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THINKING PROCESSES IN NUMERACY: INFLUENCING FACTORS, CONTENT, AND VARIETIES OF THINKING PROCESSES

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ABSTRACT

Numeracy is an important skill that enables students to understand mathematical concepts and solve problems in real-life contexts. According to the Programme for International Student Assessment (PISA), numeracy refers to the ability to use, interpret, and communicate mathematical information in everyday contexts. However, the 2022 PISA results show that Indonesia's average score in numeracy has declined compared to 2018 (OECD, 2023). This indicates that many students still struggle with the stages of thinking processes needed to solve mathematical problems correctly. This study aims to systematically examine the various factors that influence, content, and variations in students' thinking processes in numeracy. This research uses the PRISMA 2020 method by analysing 22 articles selected from the range of 2020-2024. The results showed that the most studied variations included mathematical thinking processes, mathematical literacy thinking processes, and thinking processes in solving problems. Algebra is the most researched content, because it has a framework that includes detailed stages in the thinking process, such as information identification, symbolic representation, and concept application. The most reviewed factors in the thinking process are mathematical ability and cognitive style. Students with high mathematical ability are more systematic in thinking, while students with medium and low ability tend to need scaffolding. Students with field independent cognitive style showed higher creativity than field dependent students.

Keywords : Numeracy, Mathematical Literacy, Thinking Processes.

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PRELIMINARY

Numeracy or mathematical literacy is a fundamental skill that is very important for students to acquire. This skill not only plays a role in academic contexts, but also in their daily lives. Mathematical literacy enables individuals to solve problems using mathematical concepts in a variety of real-life situations. The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines literacy as the ability to identify, understand, interpret, communicate and calculate using written and unwritten sources related to various contexts. Numeracy skills are referred to as the ability to understand and use mathematics in various contexts with the aim of being able to solve problems and being able to explain information to others using mathematics (Winata et al., 2021).

Numeracy is not just counting skills, numeracy is the ability to use mathematics in everyday situations involving thinking and reasoning skills. Therefore, individual awareness of the benefits of literacy and numeracy is an important foundation for building and developing these skills in a sustainable manner (Hadi & Suhendra, 2025).

Based on the results of the Programme for International Student Assessment (PISA) in 2022, Indonesia experienced an increase in ranking from the 2018 PISA test (Kemendikbud, 2023). However, Indonesia's average numeracy score decreased from 379 in the 2018 PISA test to 366 in the 2022 PISA test (OECD, 2023). This shows that the numeracy skills of Indonesian students still need to be improved (Fenanlampir et al., 2019). This decrease in score indicates that students still have difficulties in the thinking process when solving numeracy problems, because they have not been able to go through the stages of thinking required to arrive at appropriate solutions. Given the importance of numeracy and mathematical literacy in the development of students' competencies, understanding the thinking processes underlying these abilities is very relevant.

The difficulties students face in solving numeracy problems can be better understood by analysing their thinking processes. The thinking process plays an important role in developing numeracy skills. In line with that, Faridah (2013) stated that knowing students' thinking process in solving a mathematics problem is very important for teachers. The role of the thinking process in the development of numeracy skills includes helping the selection of the use of strategies, media and learning materials, in order to achieve maximum results from the process of developing numeracy skills and mathematical literacy. Teachers must understand the process of students processing the information received as well as acting as a guide to change the students' thinking process (Rofi'i, 2016). Therefore, the thinking process in numeracy involves various complex cognitive stages. This indicates a gap in mathematical thinking skills that needs to be analysed more deeply, especially by looking at the factors that influence the thinking process.

Previous studies have revealed the importance of literacy and numeracy in education, but the thinking process aspect of numeracy has not been explored in depth. Research conducted by Zainudin et al. (2023) focused on literacy and numeracy trends for primary school students. Pratiwi et al. (2024) highlighted the complex relationships between literacy, numeracy and mathematical logical thinking and their impact in mathematics learning. Sitopu et al. (2022) focused on the benefits and challenges of integrating mathematical literacy into the basic education curriculum. Meanwhile, Caridah et al. (2024) conducted a systematic literature review that aimed to analyse innovative

teaching strategies in literacy and numeracy in the context of achieving the Sustainable Development Goals (SDGs). Furthermore, Cevikbas et al. (2022) addressed mathematical modelling competence which is an important part of mathematical literacy. However, while these findings provide important insights, there is no previous research that specifically examines thinking processes in numeracy. Therefore, this study offers a new understanding of the variety of thinking processes used in numeracy and mathematical literacy, the factors that influence thinking processes in numeracy and mathematical literacy, and the content of the materials that are the focus of the study.

Based on the explanation above, this study aims to conduct a Systematic Literature Review (SLR) to map and review students' thinking processes in solving numeracy or mathematical literacy problems, focusing on the influencing factors, the content, and the varieties of thinking processes used. Through this literature review, it is hoped that the research results can provide a deeper understanding of the elements that contribute to improving numeracy and mathematical literacy in Indonesia.

METHODS

This Systematic Literature Review (SLR) was conducted using the PRISMA 2020 method. PRISMA 2020 is a relevant method for identifying reports, reviews, and results from specific articles with the aim of selecting significant articles for SLR content. The purpose of this research is to conduct a systematic review of the thinking process in solving numeracy problems with a focus on the influencing factors, content, and varieties of thinking processes used. This entire process followed the four steps of the PRISMA framework: identification, screening, eligibility, and inclusion.

Identification

The first step of this review is identification, the researcher uses a database that is used to search and collect relevant sources, namely Scopus and Google Scholar. These two websites serve as a secure electronic library for scientific literature that is free and accessible to students, teachers, and researchers. There are countless articles available from various publications, year ranges, and other important filters and such. In this study, the search range is limited to the last five years (2020–2024) to ensure the selected articles reflected the latest developments in numeracy research, curriculum changes, and international assessments such as PISA. This time frame also helps capture the latest perspectives on students' thinking processes in numeracy. The keywords used to search for articles in the database are shown in Table 1.

Table 1. Keywords used to search for related articles

Database	Keywords
Scopus	"Thinking processes" AND numeracy OR "Mathematical literacy"
Google Shoolar	("Thinking processes" AND numeracy OR "Mathematical literacy") ("Proses berpikir" AND numerasi OR "literasi matematis")

At this stage, 319 research documents were obtained from databases. In addition, other research documents were also obtained from certain research repositories or archives. So that at this identification stage, 319 documents were found from the database and 9 additional documents, a total of 328 documents which will then be screened.

Screening

In the Screening Stage, articles that have been identified through the literature search will go through an eligibility process to ensure only relevant and quality articles will be included in the research. The first process is duplicate screening, where similar articles found more than once on multiple databases will be identified and removed. This is important to avoid repetitive analyses and ensure data integrity. Once duplicates are removed, the remaining articles will be further evaluated based on predefined eligibility criteria, such as article type, year of publication, language, and whether the article has been peer-reviewed. These criteria are listed in Table 2 and served as a guideline to screen articles that were appropriate for the focus of the study. Articles that did not fulfil the inclusion criteria, or that were not relevant to the topic, were excluded from the process. Conversely, articles that met the criteria would proceed to the next stage of analysis. This process ensures that the data used in the research is reliable, relevant, and of high quality, which in turn will increase the validity and reliability of the research results.

Table 2. Inclusion and exclusion criteria

Category	Inclusion	exclusion
Focus	Thinking process in the context of numeracy and mathematical literacy	Not relevant to thinking process in the context of numeracy and mathematical literacy
Types	Journal article, prociding and peer-reviewed, open access	Other than Journal article and prociding, Not peer-reviewed and not open access
Participants	Various levels of education	non-school education levels
Year	2020 - 2024	Before 2020
Language	English and Bahasa	Other than English and Bahasa

At this stage, 31 duplicate documents were first removed, leaving 297 documents to be further screened based on title and abstract. Of the 297 documents screened, 194 articles

were excluded because they were irrelevant to the topic, for example, discussing general literacy without the thinking process dimension, or mathematical or document types that did not meet the standards such as non-peer-reviewed articles. The remaining 103 documents were further screened to gain access to the full text. However, 53 were excluded due to open access and relevance to the research objectives. The remaining 50 reports were further checked for eligibility through in-depth analysis of the full text. A further 21 reports were excluded whose topics were outside the scope of thinking processes in numeracy and mathematical literacy, 7 reports were excluded because they were not relevant to numeracy aspects.

Inclusion

After the Screening Stage, articles that have been screened and meet the eligibility criteria will be selected for inclusion in further analysis. At this stage, the researcher ensures that the selected articles are truly relevant to the research question and can make a significant contribution to the research objectives. These inclusion criteria include various elements that have been previously defined in Table 2, namely Relevance to the Research Topic, the selected articles should be directly related to the thinking process in the context of numeracy. In addition to evaluating the relevance of the topic, this stage also assesses the quality of the article based on peer review, clarity of methodology, and validity of data. Only articles that fulfill these criteria are further analyzed to answer the research questions in a representative and valid manner. In this process, only 22 documents met all inclusion criteria and were included in the final review. All stages are presented in Figure 1.

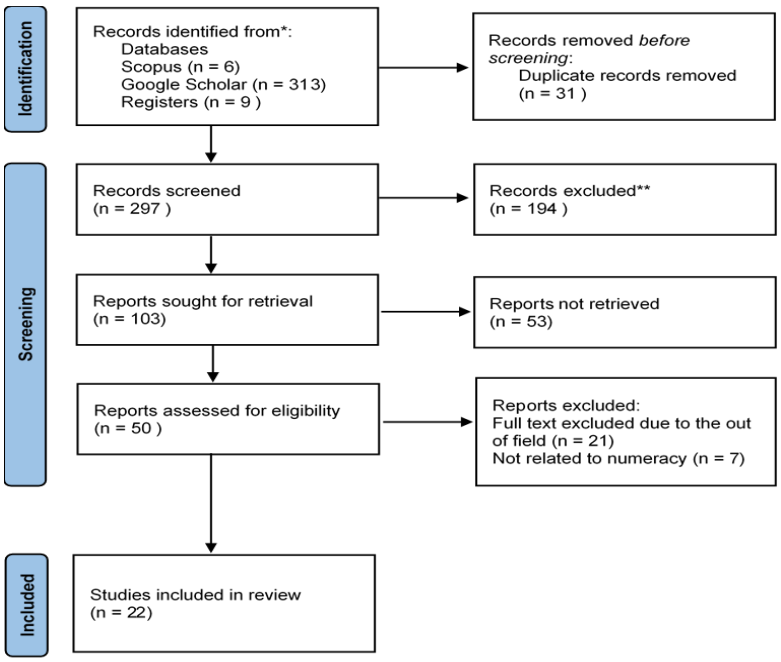

Figure.1 PRISMA Flow Chart

RESULT AND DISCUSSION

The thinking process is a series of activities to solve problems in order to find a solution to a problem (Anggreini & Dyah Asmarani, 2022). In this study what is meant by the thinking process in solving numeracy problems is a series of mental activities or cognitive strategies in understanding, analyzing, and solving problems related to the concept of numbers and mathematics in the context of everyday life and academics. Based on previous studies, the variety of thinking processes that arise in solving numeracy problems with diverse factors, and different focus content. The following is a review of the 22 articles included.

RQ1: What are the various thought processes used in solving numeracy problems?

There are different types of thinking processes used in the context of numeracy or mathematical literacy. Based on the data collected, there are several main categories of thinking processes found and examined in the included studies.

Table 3. Varieties of Thinking Processes in Numeracy

Varieties of Thinking Processes	n	Author
Algebraic Thinking Process	2	Ode Dahiana et al. (2024) Farida & Noviyanti (2023)
Mathematical Thinking Process	5	Ferdianto et al. (2022) Mukhlis et al. (2024) Hawai & Kurniasari (2021) Miftah et al. (2021) 'Athiyah et al. (2023)
Conceptual, semi-conceptual, or computational thought processes.	1	Lestariningsih et al. (2020)
Thinking process in solving problems	4	Miftah et al. (2023) Tri Candrama et al. (2023) Maryono (2020) Setiyani et al. (2024)
Computational Thinking Process	2	Azizia et al. (2023) Supiarmo et al. (2022)
Creative Thinking Process	2	Cahyati et al. (2024) Alfillaili et al. (2024)
Mathematical Literacy Thinking Process	3	Husna & Munandar (2022) Rahayu et al. (2024) Bintoro et al. (2022)
Critical Thinking Process	1	Lestari & Annizar (2020)
Combinatorics Thinking Process	1	Sekaryanti et al. (2023)
Reflective Thinking Process	1	Rupiani Pasaribu et al. (2023)

Based on Table 3, it can be seen that the variety of thinking processes in solving numeracy or mathematical literacy problems is very diverse, as studied in various previous studies. First, the algebraic thinking process is a variation of the thinking process studied in solving numeracy and mathematical literacy problems (Farida & Noviyanti, 2023; Ode

Dahiana et al., 2024). The study of students' algebraic thinking processes in solving numeracy problems concluded that in general students still use non-referential symbolic thinking and only a few have algebraic invariant or proportional and deductive thinking (Ode Dahiana et al., 2024). Furthermore, there is a mathematical thinking process discussed by researchers Ferdianto et al. (2022), Mukhlis et al. (2024), Hawai & Kurniasari (2021), Miftah et al. (2021), 'Athiyah et al. (2023). This thinking process includes developing strategies to solve problems, understanding formulas, and manipulating numbers and mathematical symbols. Conceptual, semi-conceptual, or computational thinking processes, discussed by Lestariningsih et al. (2020). Research by Miftah et al. (2023), Tri Candrama et al. (2023), Maryono (2020), and Setiyani et al. (2024) discuss the thinking process in numeracy problem solving. The computational thinking process, found in the research of Azizia et al. (2023), Supiarmo et al. (2022). Furthermore, the creative thinking process (Cahyati et al., 2024; Alfillaili et al., 2024), critical thinking process (Lestari & Annizar, 2020). The mathematical literacy thinking process includes an individual's ability to understand, use, and communicate with mathematical concepts in the context of real life (Husna & Munandar, 2022; Rahayu et al., 2024; Bintoro et al., 2022). While the combinatoric thinking process, exemplified by Sekaryanti et al. (2023), while the reflective thinking process, found in the research of Rupiani Pasaribu et al. (2023).

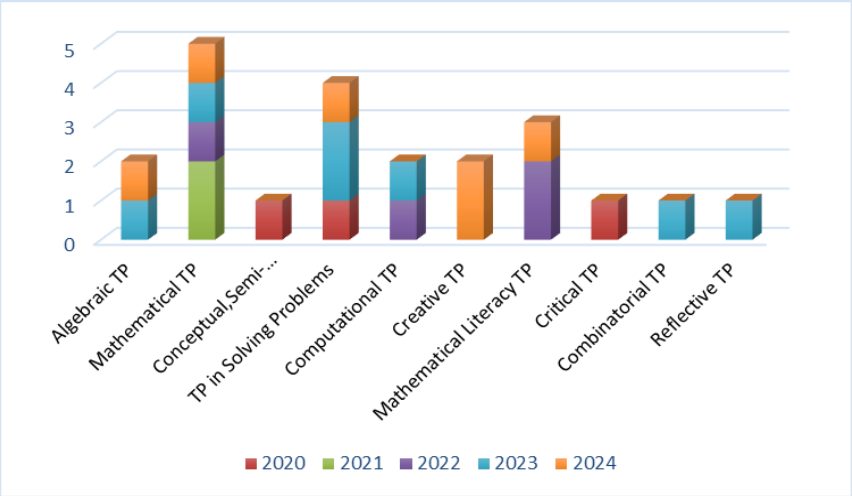

Figure 2. Diagram of varieties of thinking processes

Based on Figure 2, it can be seen that creative thinking processes dominate in 2024. Furthermore, in 2023 the problem-solving thinking process dominates and in 2022 the mathematical literacy thinking process. This shows an increased attention to thinking processes involving mathematical literacy in 2022 which may be influenced by the needs of the latest education curriculum or the demands of competency assessment. In addition,

the mathematical thinking process shows the continuity of researchers from year to year. However, computational, reflective, conceptual, semi-conceptual and critical thinking processes appeared in limited numbers, suggesting that these topics are less of a major focus of research in the context of mathematical literacy or numeracy.

Based on the analysis conducted, mathematical thinking process, problem solving thinking process, and mathematical literacy thinking process are the variations of thinking process in solving numeracy problems that have been studied the most in previous studies. The existence of other categories such as reflective and combinatoric thinking processes shows that mathematical literacy is not only limited to understanding concepts and procedures, but also includes the ability to evaluate, create and think creatively in dealing with more open and dynamic mathematical problems. Therefore, it can be concluded that to improve numeracy or mathematical literacy, an approach that involves different types of thinking processes is needed, from algebraic thinking to critical and creative thinking.

The variety of mathematical thinking processes that dominate compared to other thinking processes can be assessed through the stages and processes of mathematical thinking proposed by Mason et al. (2010). These stages include entry, attack and review, each of which includes important processes such as specialising, generalising, conjecturing and convincing. Ferdianto et al. (2022) found that all stages of students' mathematical thinking process in solving numerical problems can be passed by students with high thinking ability, while the Convincing and Generalising stages tend to be missed by students with medium and low ability. Hawai & Kurniasari's research (2021) also explained that all stages of mathematical thinking which include entry, attack, and review stages can be passed by students with high abilities without much help. However, at certain stages, such as the attack and review stages, students with moderate and low mathematical ability need scaffolding or support to be able to solve the problem correctly. This is in line with the views of Mukhlis et al. (2024) and Miftah et al. (2021) who highlighted the mathematical thinking process of students from their cognitive style. Students with impulsive cognitive styles still have difficulty achieving aspects of reflect and extend at the Review stage. Students have difficulty in making generaliations and finding alternative solutions, so they need more support in going through all stages of the mathematical thinking process.

Overall, these findings complement each other, showing that students with high ability tend to be more independent, while students with medium and low ability need scaffolding to go through more complex stages of thinking such as generalizing and

convincing (Hawai & Kurniasari, 2021). Scaffolding is given according to the subject's ability and stopped after they can think independently. High ability subjects needed scaffolding to design plans and reflect on the solution process in certain problems, while medium ability subjects needed more help in the attack and review phases to understand concepts and check calculations. In contrast, low ability subjects needed scaffolding in all phases to overcome difficulties in basic concepts and operating numbers correctly. This confirms the importance of scaffolding to support students with low mathematical ability to carry out the stages of the mathematical thinking process effectively.

RQ2: What are the factors that influence students' thinking process in solving numeracy problems?

Various factors have been identified as important in influencing students' thought processes in numeracy. The following table summarizes the research findings related to these factors, with the number of studies addressing each factor and the authors involved.

Table 4. Thinking process factors in numeracy or mathematical literacy

Factors	n	Author
Adversity Quotient (AQ)	2	Farida & Noviyanti (2023); Cahyati et al. (2024)
Mathematical Ability	5	Ferdianto et al. (2022); Husna & Munandar (2022) ; Hawai & Kurniasari (2021); Rupiani Pasaribu et al. (2023); Setiyani et al. (2024)
Gender	1	Lestariningsih et al. (2020)
Cognitive Style	4	Mukhlis et al. (2024); Miftah et al. (2021); Sekaryanti et al. (2023); Alfillaili et al. (2024)
Education Level	1	Miftah et al. (2023)
Self efficacy	1	Azizia et al. (2023)
Problem solving abilities	1	Supiarmo et al. (2022)
Self-Renewal Capacity	1	Rahayu et al. (2024)
Computational Thinking Skills	1	Lestari & Annizar (2020)
Mathematical resilience	1	'Athiyah et al. (2023)

Based on the literature collected, there are various external and internal factors that can influence students' thinking process in solving numeracy and mathematical literacy problems. First, Adversity Quotient (AQ) or the ability to overcome difficulties in the face of challenges, which plays an important role in students' thought processes (Farida & Noviyanti, 2023); Cahyati et al., 2024). Furthermore, mathematical ability is a major factor that influences students' thinking process (Ferdianto et al., 2022; Husna & Munandar, 2022 ; Hawai & Kurniasari, 2021; Rupiani Pasaribu et al., 2023; Setiyani et al., 2024). This shows that the level of basic understanding of mathematics, mastery of concepts, and skills in performing mathematical operations are directly related to students' thinking abilities in numeracy and mathematical literacy. Gender is also a factor that influences students'

thinking processes as expressed by Lestariningsih et al. (2020). Meanwhile, based on research Mukhlis et al. (2024); Miftah et al. (2021); Sekaryanti et al. (2023); Alfillaili et al. (2024) in this study, students' thinking process in terms of cognitive style.

The level of education is also one of the factors studied on students' thinking processes. This research was conducted by Miftah et al. (2023). Self-efficacy, or students' confidence in their ability to solve mathematical problems, is an important factor in the mathematical thinking process. Azizia et al. (2023). Supiarmo et al. (2022) emphasized the importance of problem solving in students' thinking process in numeracy and mathematical literacy. Self-renewal capacity or the ability to renew oneself and adjust to new situations is a factor that can support students' thinking processes (Rahayu et al., 2024). Computational thinking ability (Lestari & Annizar, 2020). Lestari & Annizar, 2020) and Mathematical resilience ('Athiyah et al., 2023) also become a review of the students' thinking process.

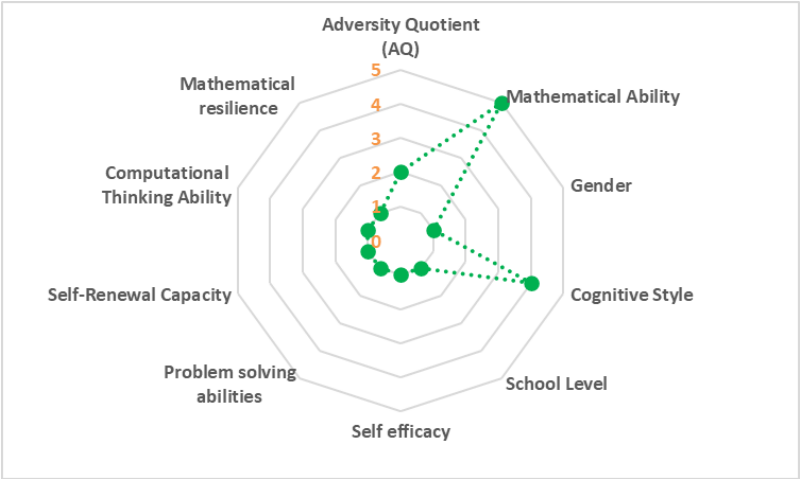

Figure. 3 Diagram of thinking process factors in numeracy

Based on the results of the analysis, there are many internal and external factors that play a role in students' thinking process to solve numeracy and mathematical literacy problems. Mathematical ability (n=5) and cognitive style (n=4) are the most studied factors. Some other factors were found less in the research, such as Adversity Quotient (AQ) (n=2), which relates to mental resilience in facing difficulties, gender, school level, self-efficacy, problem solving abilities, self-renewal capacity, computational thinking ability, and mathematical resilience (n=1). Although lower in frequency, these factors also play an important role in influencing an individual's ability to solve mathematical problems. For example, AQ and mathematical resilience help individuals to remain resilient and keep trying, while computational thinking ability supports individuals in

solving problems based on algorithms and computational logic. Therefore, while mathematical ability and cognitive style emerge as the most studied factors, other factors, too, have an important influence in supporting the thinking process in solving numeracy and mathematical literacy problems.

Based on the review of the level of mathematical ability, Setiyani et al. (2024) showed that high ability students have a deep understanding of the problem and are able to organize information well. Research Hawai & Kurniasari (2021) reinforces this finding, high ability students can go through all phases of thinking, from entry, attack, to review, with little need for scaffolding. In contrast, students with medium or low ability need more help, especially in the attack and review phases. While Ferdianto et al. (2022) showed that high ability students tend to carry out the entire mathematical thinking process, including convincing and generalization. However, students with medium and low ability were unable to perform all these stages.

Overall, these findings are complementary. High-ability students showed well-organized and step-by-step thinking processes, while medium and low-ability students needed additional support, both through practice problems and targeted scaffolding. These studies imply that a structured learning strategy, based on individualized understanding, and focused on strengthening mathematical skills, can improve students' overall thinking processes.

Based on the cognitive style of students in solving numeracy and mathematical literacy problems shows a variation in the thought process that is influenced by the cognitive style of each student. Students with field dependent cognitive style tend to follow the structure of the problem by using the same sentence in the problem, while students with field independent style are more flexible, mention information in their own language and have the ability to express information independently. Field independent students are able to produce a variety of innovative solutions and meet the indicators of creative thinking (Alfillaili et al., 2024). In research conducted by Sekaryanti et al. (2023), students with a concrete sequential thinking style solve problems in detail step by step, while students with an abstract sequential thinking style focus more on using concepts. While research Miftah et al. (2021) highlighted the differences between reflective and impulsive cognitive styles in solving mathematical literacy problems. Reflective students tend to solve problems with planned steps and do not change strategies midway. In contrast, impulsive students often do not complete the reflection stage well, especially in the reflect and ex-act phases. Thus,

these findings suggest that cognitive style plays an important role in influencing students' thought processes in numeracy and mathematical literacy.

RQ3: What is the content variation of students' thinking process in solving numeracy problems?

The content variation of students' thinking process in solving numeracy and mathematical literacy problems is algebra, geometry, number, and a combination of several topics such as number, geometry, algebra, data, and uncertainty. This variation reflects the way students apply their thought processes in dealing with different types of problems and how the content can influence their thought processes.

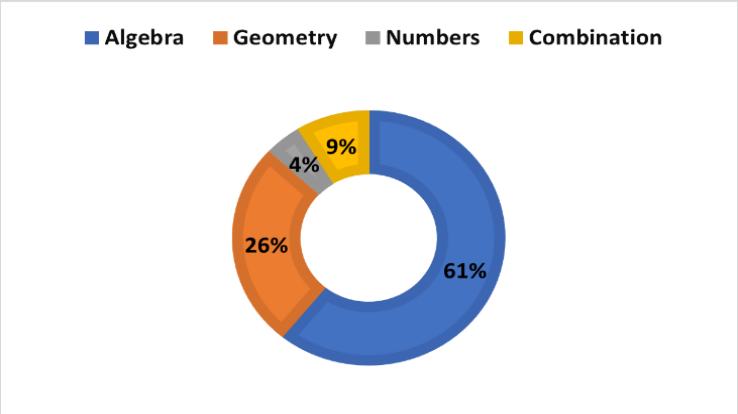

Figure 4. Diagram of content variation in numeracy thinking process

Algebra is one of the most covered topics in the collected research, with 61% of studies highlighting students' thought processes in this context. Algebra requires understanding concepts such as variables, equations, and functions, which requires students to think symbolically and abstractly. Geometry, although more focused on spatial reasoning and visualisation, still involves significant thought processes. Furthermore, in 26% of the studies that addressed geometry, students were often asked to visualise geometric shapes, calculate area, volume, or recognise symmetries and transformations. Then there were 4% of studies that discussed students' thinking processes in Number content. In addition, numeracy problems often combine several aspects of mathematics in one problem, in this case there are 9% of other studies that discuss the combination of related materials, namely a combination of number, geometry, algebra, data, and uncertainty. The thought processes involved in these types of combined problems tend to be more complex as students are expected to integrate various mathematical skills in one context.

Research on students' thinking processes in solving numeracy or mathematical literacy problems in algebraic material is more widely carried out because algebra provides a framework that reflects detailed stages in the thinking process. Bednarz, et al. in Farida, R., & Noviyanti, M. (2023) explained that solving algebra problems involves three main stages: (1) identifying relevant information by sorting useful information from those that are not, (2) representing information in mathematical form through symbols, equations, tables, or graphs, and (3) interpreting and applying concepts to find solutions, test hypotheses, or understand functional relationships. These stages are in line with the broader thinking process model. Through algebra content, students are required to follow systematic steps, starting from understanding the problem situation, transforming it into mathematical form, to producing meaningful solutions. Due to its structured and complex nature, algebra is an ideal tool to measure and explore the stages of students' thinking processes in detail, both in the ability to analyse, abstraction, and reflection.

Students' thinking processes in solving numeracy or mathematical literacy problems vary according to the content or material at hand. Various materials such as number, algebra, geometry, data, and uncertainty, each type has unique mathematical thinking characteristics and challenges. In essence, each numeracy content helps students to understand basic concepts that are integrated in everyday life, enabling them to apply mathematical knowledge in real contexts. This understanding of numeracy content is important in designing appropriate learning approaches and supporting the development of students' thinking processes in broader and more complex contexts.

Based on the findings of this study, several recommendations can be provided. For teachers, it is important to design numeracy-oriented learning that considers students' mathematical ability and cognitive styles. Algebra, which has been proven to have a clear framework of thinking stages such as information identification, symbolic representation, and concept application, can be used as key content to strengthen problem solving skills. Scaffolding and reflective activities also need to be emphasized, especially for students with medium and low ability. For schools, professional development programs related to numeracy and thinking processes are essential, accompanied by the provision of adequate learning resources and a learning environment that supports differentiated learning practices. Students can be active in solving problems, reflection on strategies, and persistence in facing mathematical challenges. High ability students should be challenged with more complex and creative tasks, while students with medium and low ability can benefit from scaffolding and collaborative learning.

CONCLUSION

Based on a systematic review of 22 articles related to students‘ thinking processes in numeracy, this study found that the variety of thinking processes, influencing factors, and content involved play a significant role in the developing students’ numeracy skills. Students' thinking processes cover a wide range of types, from algebraic thinking, mathematical literacy, to creative and reflective thinking, with mathematical thinking, mathematical literacy and problem solving as the main focus of the research. Algebraic content is most frequently used in this context because the framework includes detailed stages, such as information identification, symbolic representation and concept application, which reflect all stages of the thinking process. The factors that most influence students' thinking processes are mathematical ability and cognitive style. Students with high ability tended to show a well-organised thinking process, while students with medium and low ability needed scaffolding to fully complete the thinking stages. Cognitive style also showed a significant influence, field independent students were more creative and flexible than field dependent students. These findings suggest that there is a need for a structured learning approach that considers students' mathematical ability and cognitive style.

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