Profile of Mathematical Literacy of Prospective Teacher Students in Solving Integral Calculus Problems Seen From Learning Independence

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This study aims to determine how students' mathematical literacy is in solving math problems seen from their learning independence. The research method used in this research is descriptive qualitative. The subjects in this study were semester III students at STKIP Kusuma Negara Jakarta, with 6 students, with each category of independent learning consisting of two students. This study used researchers as key instruments, tests to measure students' mathematical literacy, interview guidelines, and a questionnaire to measure student learning independence. The results of the study show that: informants with high learning independence tend to be able to achieve all indicators of mathematical literacy. Informants with moderate learning independence tend to be able to achieve most indicators of mathematical literacy. Still, they are wrong in using language and symbolic operations, solving mathematical problems and using mathematical tools. Informants with low learning independence, on the other hand, frequently had difficulty completely interpreting the data. As a result, communication of information and problem-solving become flawed.

Keywords: mathematical literacy, independent learning, integral calculus

INTRODUCTION

The capacity for critical thought that graduates at all educational levels must have is one of the primary domains of 21st-century competency (Muntazhimah et al., 2021; Setiyani et al., 2022). Every person constantly engages in thinking, which is a cognitive process that occurs continually (Mentari et al., 2018; Setiyani et al., 2022). A scientific field that investigates numbers, measurements, geometry, algebra, calculus, arithmetic, statistics, probability, and other topics is called mathematics. Developing abilities, skills, and attitudes through thinking exercises is equivalent to learning mathematics (Mentari et al., 2018; Sani, 2016; Setiyani et al., 2022). Competence in solving mathematical problems is an important competency that prospective teachers in learning mathematics must possess. Through learning mathematics in the 2013 curriculum, students are required to have high-order thinking skills (Syamsuddin, 2019; Setiyani et al., 2022). Math skills play a major role in everyday life, and strong numeracy skills are a prerequisite in many careers (Niklas et al., 2015). Literacy is a skill that is rising to prominence in the field of education. This competency focuses on students' critical and problem-solving thinking skills (Astuti et al., 2018; Hassan et al., 2015; Rachmaningtyas et al., 2022). In solving problems, students need to have reasoning skills, design procedures and correctly use mathematical concepts according to existing problems (Suprayitno, 2019; Rachmaningtyas et al., 2022). students are required to have high-order thinking skills (Syamsuddin, 2019; Setiyani et al., 2022). Math skills play a major role in everyday life, and strong numeracy skills are a prerequisite in many careers (Niklas et al., 2015). Literacy is a competency that is becoming a trending topic in the world of education. This competency emphasizes students' thinking processes in solving and being critical of problems in everyday life (Astuti et al., 2018; Hassan et al., 2015; Rachmaningtyas et al., 2022). In solving problems, students need to have reasoning skills, design procedures and correctly use mathematical concepts according to existing problems (Suprayitno, 2019; Rachmaningtyas et al., 2022). students are required to have high-order thinking skills (Syamsuddin, 2019; Setiyani et al., 2022). Math skills play a major role in everyday life, and strong numeracy skills are a prerequisite in many careers (Niklas et al., 2015). Literacy is a competency that is becoming a trending topic in education. This competency emphasizes students' thinking processes in solving and being critical of problems in everyday life (Astuti et al., 2018; Hassan et al., 2015; Rachmaningtyas et al., 2022). 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In the field of education, the competency of literacy is quickly gaining popularity. According to Astuti et al. (2018), Hassan et al. (2015), and Rachmaningtyas et al. 2022, this competency places an emphasis on students' critical and problem-solving thinking processes. Students must have the ability to reason, develop methods, and apply mathematical concepts correctly in accordance with real-world difficulties in order to solve problems (Suprayitno, 2019; Rachmaningtyas et al., 2022).

According to recent arguments, individuals must become mathematically literate in order to process, communicate, and interpret mathematical information in a variety of contexts in order to thrive in today's modern society (OECD, 2012; Stacey & Turner, 2015; Genc & Erbas, 2019). Brownell (in Reys et al., 1998; Umbara & Suryadi, 2019) asserts that because mathematics may be seen of as a system made up of concepts, principles, and processes, the connections between these elements should be strengthened and an emphasis placed on intellect rather than memorization. But understanding mathematics is the only subject where thinking abilities may shift from tangible to abstract or vice versa. Implementing mathematical problems may be broken down into three primary stages: converting verbal issue statements into mathematical expressions, manipulating expressions, and verifying answers (Gagne, 1983; Umbara &

Suryadi, 2019). In this case, expanding the application of mathematics in daily life is necessary (Umbara & Suryadi, 2019).

According to the results of the Organization for Economic Cooperation and Development's (OECD) Program for International Students Assessment (PISA) assessment, Indonesia continues to have poor mathematical literacy levels. The capacity to translate issues from their context into mathematical language is strongly connected to mathematical literacy. In contemporary times, such as our own, mathematical literacy that is connected to mathematical thinking and problem solving is also necessary (Hayati & Kamid, 2019).

Mathematical literacy "describes the content knowledge processes, and the context that is reflected in the assessment of math problems," and this demonstrates how children do in mathematics, according to the 2015 PISA framework (OECD, 2017; Hwang & Ham, 2021). To describe, explain, and forecast occurrences, one must be able to think mathematically. Mathematical literacy represents this ability (OECD, 2017; Hwang & Ham, 2021). Students may explore the abstract world of mathematics using mathematical ideas, processes, facts, and tools. This notion of mathematical literacy emphasizes the significance of engaging children in pure mathematics activities (reasoning mathematically; OECD, 2017; Hwang & Ham, 2021). The PISA definition of mathematical literacy highlights the ability to construct issue situations, apply mathematical problems, and evaluate mathematical outcomes in a range of contexts. In other words, gaining this capability in math class requires a comprehensive experience of real-world assignments. As a result, practicing mathematics in real-world settings (such as in personal, social, professional, and scientific contexts) aids in developing mathematical literacy (Hwang & Ham, 2021).

People need to be mathematically literate in a variety of contexts because mathematical literacy entails utilizing mathematics to act in real life. Mathematically literate people must be aware of the appropriate and inappropriate uses of their knowledge to analyze situations and draw conclusions, know and use effective problem-solving techniques, and evaluate whether the results are reasonable (Genc & Erbas, 2019). Because of this, strong learning autonomy is also necessary to promote their mathematical literacy abilities. A person's vision or image of himself, which is established via experience and contact with his environment and is impacted by others who are seen to be significant, is known as learning independence.

To make students literate in mathematics, we first prepare prospective teachers (students) who are also literate in mathematics. Traditionally, college classrooms have been where lecturers teach and students are expected to listen and learn without much participation. However, over the last two decades there has been more focus on student engagement and a trend to transform college classrooms to promote dynamic student-centered learning (Stanberry & Payne, 2023). Today, the university's mission is not only to cultivate experts in various professions but also to cultivate independent lifelong learners. Over the last decade, independent learning and pedagogies that seek to encourage learner autonomy have become increasingly relevant (Hockings et al., 2018). Independent learning is a key feature of university education (Chau & Cheng, 2010). The way students use repetitive methods to control their own learning is understood as independent learning (Cukurova et al., 2018). This is due, at least in part, to the growing demand for so-called '21st-century skills' and self-learning opportunities to develop students' skills to better prepare them for the future (Kholmuratovich, 2020). One of the important conditions for the organization of the educational process in the preparation of specialists according to modern requirements is the activation of student self-educational activities (Kirschner, 2017: Kholmuratovich, 2020). The current Covid-19 pandemic has significantly impacted various aspects of life, including in the education sector. This has brought various policy changes and updates to be implemented quickly and precisely, one of which is the application of online learning through applications such as Google Classroom, Zoom, Edlink, and so on which can be used to support online learning, likewise ,STKIP, Kusuma Negara students who are also implementing online learning to support the government in reducing and breaking the chain of the spread of Covid-19. In online learning, student learning independence is very much needed (Yuliati & Saputra, 2020). Edlink, and so on, which can be used to support online learning, likewise with STKIP Kusuma Negara students who are also implementing online learning to support the government in reducing and breaking the chain of the spread of covid-19. In online learning, student learning independence is very much needed (Yuliati & Saputra, 2020). Edlink, and so on which can be used to support online learning, likewise with STKIP Kusuma Negara students are also implementing online learning to support the government in reducing and breaking the chain of the spread of covid-19. In online learning, student learning independence is very much needed (Yuliati & Saputra, 2020).

LITERATURE REVIEW

Mathematical Literacy

Five basic competencies—problem solving, communication, connection, reasoning, and mathematical representation—are outlined by the National Council of Mathematics Teachers. According to Edward et al. (2000) and Rachmaningtyas et al. (2002), the five are compiled into a mathematical literacy ability series. Researchers' conceptions of mathematical literacy vary but often overlap, ranging from informal mathematics that just requires basic arithmetic skills to formal mathematics that calls for higher order thinking abilities. While some researchers claim that mathematical literacy entails the formal application of mathematics to real-world contexts and that doing so causes a high level of mathematical knowledge and competence (e.g., Gellert, Jablonka, & Keitel, 2001; Hope, 2007; Jablonka, 2003; Pugalee, 1999), others contend that it only requires a basic understanding of mathematics to enable people to make better decisions both personally and as citizens in problem situations. According to the PISA 2000 assessment, the word "literacy" refers to the capacity to apply mathematical knowledge and abilities to real-world situations rather than only acquiring them for academic purposes. (OECD2000, P. 50). According to PISA 2000, mathematical literacy is the ability to recognize and comprehend mathematics's function in society.

For PISA 2006, mathematical literacy was redefined to refer to a person's ability to recognize and comprehend the function that mathematics serves in society, to form defensible conclusions, and to apply and engage with mathematics in ways that meet their needs as productive, compassionate, and reflective citizens. (OECD2006, P. 72) For the 2012 Framework, the definitions were once again amended (OECD2013a), however the underlying constructions have not changed in any of these updates. In response to feedback from around the world, the modifications for 2012 aimed to make the concepts underlying mathematical literacy clearer so that they could be operationalized more transparently and more clearly define the basic and expanding role of mathematics in contemporary society. The following is the 2012 PISA definition of formal mathematical literacy: The ability to develop, use, and comprehend mathematics in a variety of circumstances is known as mathematical literacy. This includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It helps individuals recognize the role that mathematics plays in the world and make the reasoned judgments and decisions necessary for constructive, engaged, and reflective citizens. (OECD2013a, P. 25) The 2012 PISA definition of formal mathematical literacy is as follows: Mathematical literacy is an individual's capacity to formulate, use, and interpret mathematics in various contexts. This includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It helps individuals recognize the role that mathematics plays in the world and make the reasoned judgments and decisions necessary for constructive, engaged, and reflective citizens. (OECD2013a, P. 25) The 2012 PISA definition of formal mathematical literacy is as follows: Mathematical literacy is an individual's capacity to formulate, use, and interpret mathematics in various contexts. This includes mathematical reasoning and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It helps individuals recognize the role that mathematics plays in the world and make the reasoned judgments and decisions necessary for constructive, engaged, and reflective citizens. (OECD2013a, P. 25) and tools to describe, explain, and predict phenomena. It helps individuals recognize the role that mathematics plays in the world and make the reasoned judgments and decisions necessary for constructive, engaged, and reflective citizens. (OECD2013a, P. 25) and tools to describe, explain, and predict phenomena. It helps individuals recognize the role that mathematics plays in the world and make the reasoned judgments and decisions necessary for constructive, engaged, and reflective citizens. (OECD2013a, P. 25)

All people, not only those in technical or scientific occupations, now require a more advanced level of mathematical literacy than in the past, according to the majority of research literature and the government consensus in support of PISA (see, for instance, Autor et al. 2003).

The 2012 definition's first clause describes mathematical literacy as an individual capacity and upholds the importance of work in context as previously stated. This demonstrates the intimate connection between mathematical literacy and mathematical modeling since the development of mathematical models, their application, interpretation, and evaluation are all crucial activities. The second statement shows that mathematical literacy involves all facets of mathematics, both through specific mathematical ideas and methods as well as more generalized mathematical thinking. The definition also emphasizes the practical purpose of mathematical literacy, which is to improve comprehension of real-world occurrences and assist good judgment in all spheres of life. This notion is not fresh. One of the studies published after the 2003 PISA results were made public (OECD2009b) quotes Josiah Quincy's writings from 1816 regarding the significance of "political arithmetic" for deliberately carrying out citizens' duties. Both Stacy (in press) and the Framework for PISA 2012 (OECD 2013a) discuss other facets of this notion.

Independent Learning

The stronger the independent learning, the more it will affect student learning independence, skills, and learning outcomes. Independent learning is an individual's perception or view of himself, which is shaped by experience and interaction with the world and is influenced by people who are considered significant (Mulyono, 2017). To study independently and feel accountable for attaining one's objectives, one must be self-aware (Hamka, D. & Vilmala, BK, 2019). The degree to which students may influence the selection of learning goals, activities, and resources and learning evaluation, is known as the independence of student learning.

Independent people are capable of making responsible decisions about what and when they wish to study. According to this viewpoint, realizing the need for change is the first crucial step before students may build their own learning strategies. Students lack desire to alter their approach or break old patterns until they notice these needs and wants shifting (Virginia, Louise, 2007). According to Johnson (2009), independent learning allows students to use their preferred multiple intelligences to develop their gifts and study in a way that suits their learning preferences and speed. Independent learning and self-understanding' go hand in hand. Students have a personality type known as "self-organizing" or "self-ordered." They take accountability for the choices they make on their own. According to (Fridani and Lestari, 2009), the concept of independence in learning suggests that independence is created as early as feasible throughout teaching and learning activities. The teacher will assume the primary function of facilitator and motivator once the concept of independence in learning is realized.

According to the description given above, learning freedom enables students to employ their preferred multiple intelligences and learning styles, advance at their speed, explore their unique interests, and further their skills.

METHODOLOGY

Research Design

This study used a qualitative descriptive research approach to describe the students' mathematical literacy development based on the autonomous learning category. Based on the category of autonomous learning, this study seeks to create a profile of mathematical literacy for potential mathematics instructors. According to Sukestiyarno (2020), the qualitative research method uses the researcher as a key tool to examine the conditions of natural objects. The data collection technique is triangulated (using interviews, observation, and documentation), the data tends to be qualitative, and the data analysis is inductive and aims to interpret or understand uniqueness, construct phenomena, and identify hypotheses. (2013) Sugiyono The natural items in issue are those that are there just as they are, unaltered by the researcher, leaving the environment mostly undisturbed before, during, and after the researcher enters them.

Sample and Data Collection

Students studying mathematics education in the third semester at STKIP Kusuma Negara Jakarta, Indonesia, provided the data for this study. 28 volunteers served as research subjects. Using a purposive sampling strategy, the 28 study participants were then divided into six research samples. A sampling strategy from data sources with specific goals is known as purposeful sampling (Sukestiyarno, 2020). Choosing samples with high, medium, and low learning independence criteria was an issue in this investigation.

Analyzing of Data

To create a profile of mathematical literacy based on learning independence, data analysis employed the descriptive analysis approach, which entails evaluating data by describing the data gathered. A learning independence questionnaire was used to gather data, and the results were classified into three categories: high, medium, and low. An arithmetic literacy exam was provided to the study participants. In-depth interviews are conducted using test results data from chosen informants. Test findings and in-depth interviews were used in the data analysis stage to group, reduce, present, and formulate hypotheses (Sukestiyarno, 2020). Compare the data on the outcomes of the mathematical literacy exam and in-depth interviews to assess the triangulation test's validity of the data.

FINDINGS/RESULTS

The data in this study included: data on students' mathematical literacy abilities, data on independent learning, and data from interviews.

This research began with collecting data on student learning independence using a questionnaire to 28 informants. Table 1 below relates to the results of the learning independence questionnaire.

TABLE 1
INFORMANTS BASED ON THE INDEPENDENT LEARNING QUESTIONNAIRE DATA

No	Informant	Score (S)	Category
1	10	$S > 72$	High
2	11	$48 \leq S \leq 72$	Medium
3	7	$S < 48$	Low

Based on the results of the analysis of the independence questionnaire from 28 students, 7 students had low independence, 11 students who had moderate independence, and ten students who had high learning independence. Then six students were taken with high, medium, and low learning independence categories, two informants each.

Profiles of mathematical literacy abilities were obtained based on test results, interviews with 6 informants, and documentation of the informants' worksheets. Seven indicators are used to measure mathematical literacy: 1. Communication. Emphasizes individual ability to present problems and solutions for others. 2. Mathematics. Emphasizes the ability to transform real-world problems into mathematical forms through mathematical modeling. 3. Representative. Emphasizes the ability to interpret various mathematical representations, both objects and mathematical situations. 4. Reasoning and arguments. Emphasizes the ability to think logically in exploring and connecting the elements of a problem and its solution. 5. Developing a strategy to solve the problem. Emphasizes the ability to choose and use various strategies in solving problems mathematically. 6. Using language and symbolic, formal, and technical operations. Emphasizes mathematical literacy skills in understanding, interpreting, manipulating, and utilizing symbolic expressions in various mathematical contexts in solving mathematical problems. 7. Using mathematical tools. Emphasizes the ability to use mathematical tools to assist mathematical activities.

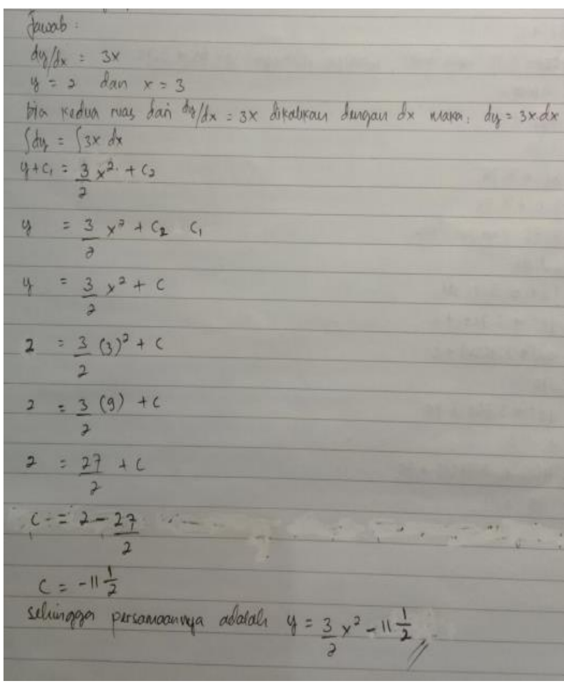
FIGURE 1
MATHEMATICAL LITERACY PROCESS TEST QUESTIONS

An xy equation of a curve that passes through (3,2) and has a slope at every point on the curve equal to three times the abscissa of that point. Determine the equation in question.

The tests and interviews with the six informants were then compared and analyzed to get an overview of the mathematical literacy profile of students as prospective teachers. The results of tests and interviews with informants are described below.

High Learning Independence Category

FIGURE 2
RESULTS OF H1 ANSWERS TO POINT 1 QUESTIONS


Jawab :
dy/dx = 3x
y = 2 dan x = 3
bila kedua ruas dari dy/dx = 3x dikalikan dengan dx maka, dy = 3x dx
$\int dy = \int 3x\,dx$
$y + C_1 = \frac{3}{2}x^2 + C_2$
$y = \frac{3}{2}x^2 + C_2 \quad C_1$
$y = \frac{3}{2}y^2 + C$
$2 = \frac{3}{2}(3)^2 + C$
$2 = \frac{3}{2}(9) + C$
$2 = \frac{27}{2} + C$
$C = 2 - \frac{27}{2}$
$C = -11\frac{1}{2}$
sehingga persamaannya adalah $y = \frac{3}{2}x^2 - 11\frac{1}{2}$

Translation
$\frac{dy}{dx} = 3x$
y=2 and x=3
if both sides of multiplied by dx then $\frac{dy}{dx} = 3xdy = 3xdx$
$\int dy = \int 3x\,dx$
$y + C_1 = \frac{3}{2}x^2 + C_2$
$y = \frac{3}{2}x^2 + C$
$2 = \frac{3}{2}(3)^2 + C$
$2 = \frac{3}{2}9 + C$
$2 = \frac{27}{2} + C$
$C = 2 - \frac{27}{2}$
$C = -11\frac{1}{2}$
so the equation is $y = \frac{3}{2}x^2 - 11\frac{1}{2}$

Based on the answers from H1, it is understandable that writing H1 has been able to write down (communicate) any information given in the problem, meaning that H1 has been able to present problems and solutions for others and has also been able to transform problems into mathematical form through mathematical modeling. The gradient is the first derivative of a function, which is three times the abscissa of the equation. H1 has also been able to perform mathematical representations by transforming data from verbal sentences into symbols representing mathematics; H1's reasoning and arguments are also good because they have thought logically in exploring and connecting problem elements and their solutions and formulating strategies to solve problems mathematically, namely to find the intended curve by using the integral,dy/dx=3x

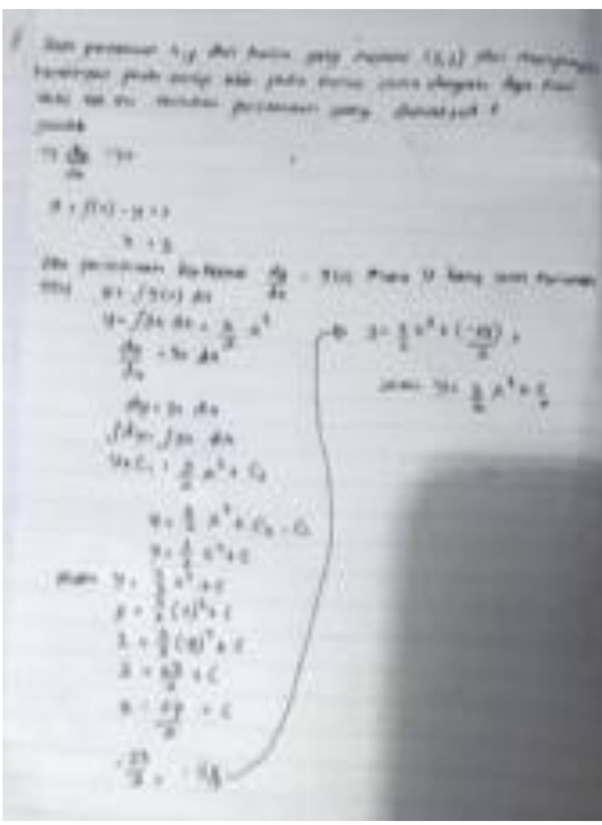
After that was confirmed through unstructured interviews, the following are the results of interviews with H1,

Researcher:	how to do the problem?
H1:	using the integral formula, ma'am,
Researcher:	why use the integral formula?
H1:	because what is known in the problem is the slope of the curve or gradient, and the gradient is the first derivative of a curve, so to find the curve means you have to integrate it mam

So based on the results of interviews and the results of student work that have been submitted previously, it is understandable that H1 has been able to present problems and solutions for others, can change problems into mathematical form through mathematical modeling, namely writing gradient curves in the form of mathematical equations where the equation of the gradient is the first derivative of a curve, namely, being able to interpret various mathematical representations, both objects and mathematical situations, thinking logically in exploring and connecting problem elements and their solutions, using strategies in solving problems mathematically, understanding, interpreting, manipulating, and utilizing symbolic expressions in solving math problems, also use mathematical tools to assist mathematical activities, in this case, is the integration technique.dy/dx=3x

Data on the results of student answers with the second high learning independence (H2) are shown in Figure 3.

FIGURE 3
RESULTS OF H2 ANSWERS TO POINT 1 QUESTION



Translation:
$\frac{dy}{dx} = 3x$
$y = f(x), y = 2\ x = 3$
If the equation is of the form then y must be anti-derivative of g(x)$\frac{dy}{dx} = g(x)$,
$y = \int g(x)\,dx$
$y = \int 3x\,dx = \frac{3}{2}x^2$
$\frac{dy}{dx} = 3x \rightarrow dy = 3xdx$
$\int dy = \int 3x\,dx$
$y + C_1 = \frac{3}{2}x^2 + C_2 \rightarrow y = \frac{3}{2}x^2 + C_2 - C_1$
$y = \frac{3}{2}x^2 + C$
So $y = \frac{3}{2}x^2 + C$
$2 = \frac{3}{2}(3)^2 + C$
$2 = \frac{27}{2} + C$
$2 - \frac{27}{2} = C$
$-\frac{23}{2} = C$
$y = \frac{3}{2}x^2 - \frac{23}{2}$

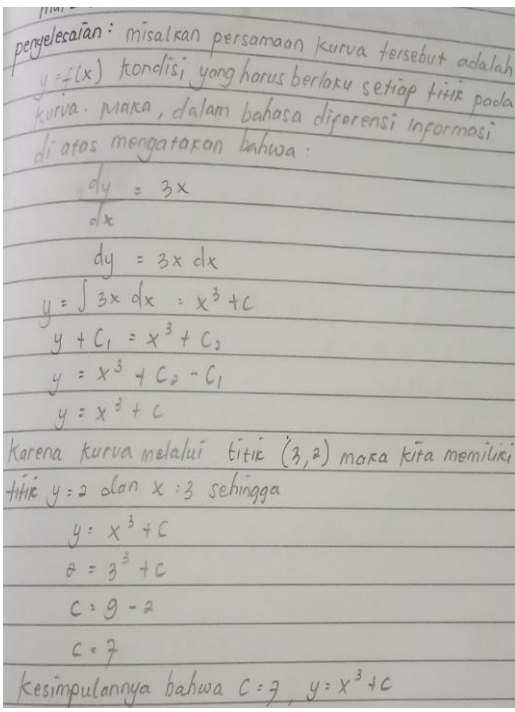
In working on question 1, it was the same as H1, that H2 had also answered the problem correctly, then an unstructured interview was conducted on H2, with the following interview results:

Researcher:	how do you do the questions given?
H2:	I am using the concept of the slope of a curve maam
Researcher:	what is the concept like?
H2:	gradient is the first derivative of a curve.

Based on the results of answers and interviews with H1 and H2, it can be understood that H1 and H2 have been able to present problems and solutions for others, able to transform problems into mathematical form through mathematical modeling, able to interpret various mathematical representations, both objects and mathematical situations, think logical in exploring and connecting problem elements and solutions, using strategies in solving mathematical problems, understanding, interpreting, manipulating, and utilizing symbolic expressions in solving mathematical problems, also using mathematical tools to assist mathematical activities.

Data on student answers with moderate learning independence 1 (M1) in question number 1 can be seen in Figure 4.

FIGURE 4
RESULTS OF M1 ANSWERS TO QUESTION 1



Translation:
Suppose the equation of the curve is y = f(x) the conditions that must apply to every point on the curve. So, in the language of difference the information above says that:
$\frac{dy}{dx} = 3x$
$dy = 3x\,dx$
$y = \int 3x\,dx = x^3 + C$
$y + C_1 = x^3 + C_2$
$y = x^3 + C_2 - C_1$
$y = x^3 + C$
Since the curve passes through the point (3,2) we have point , thus$y = 2, x = 3$
$y = x^3 + C$
$2 = 3^3 + C$
$2 = 9 + C$
$C = 9 - 2$
C = 7
The conclusion is that c = 7,$y = x^3 + C$

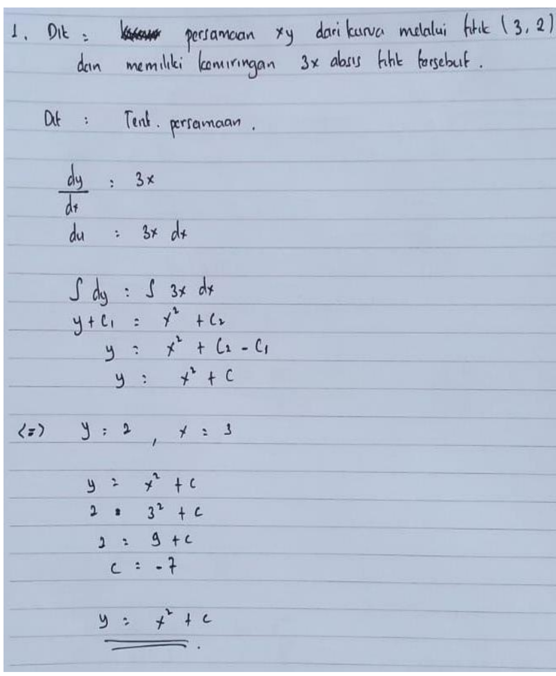
Based on the answers from M1, it is understandable that M1 has been able to write down (communicate) any information given in the problem, meaning that M1 has been able to present problems and solutions to other people and has also been able to transform problems into mathematical form through mathematical modeling. That is, the gradient is the first derivative of a function, three times the equation's abscissa. M1 has also been able to perform mathematical representations by transforming data from verbal sentences into symbols representing mathematics, the reasoning and arguments possessed by M1 are also good because they have thought logically in exploring and connecting problem elements and their solutions and formulating strategies to solve problems mathematically, namely to find the intended curve by using the integral,dy/dx=3x 3/2 x^2+Cx^2+C-23/2

Researcher: what do you do after reading the questions about the slope of a curve?
M1: from the questions read, you don't understand the problem in question
Researcher: what are the strategies used in working on the problem?
M1: following the solution steps as found on the web
Researcher: but for the slope of the curve, do you understand?
M1: gradient is the first derivative of a function, madam

Based on the results of the answers and interviews with M1, it can be understood that M1 has actually been able to interpret in analyzing the information given in the questions, and already understands the gradient concept, and in the answers, can also write the symbol of the gradient problem correctly, it's just that they haven't interpreted the information conveyed the questions and the results of the integration are also not correct, causing the results of the answers to be incorrect.

Data on the results of student answers with the second moderate learning independence (M2) are shown in Figure 5.

FIGURE 5
RESULTS OF M2 ANSWERS TO QUESTION 1



Translation:
Diket: the xy equation of the curve through the point (3,2) and has a slope of 3x the abscissa of that point.
Wanted: about equations

$\frac{dy}{dx} = 3x$

$dy = 3x\ dx$

$\int dy = \int 3x\ dx$

$y + C_1 = x^2 + C_2$

$y = x^2 + C_2 - C_1$

$y = x^2 + C$

$\leftrightarrow y = 2, x = 3$

$y = x^2 + C$

$2 = 3^2 + C$

$2 = 9 + C$

$C = -7$

$y = x^2 + C$

In working on problem number 1 regarding the application of integrals, like M1, M2 has been able to write down (communicate) any information given in the problem, meaning that M2 has been able to present problems and solutions for other people and has also been able to change the problem into the form mathematics through mathematical modeling, namely the gradient is the first derivative of a function, which is three times the abscissa of the equation. M2 has also been able to perform mathematical representations by transforming data from verbal sentences into symbols representing mathematics. The reasoning and arguments possessed by M2 are also good because they have thought logically in exploring and connecting problem elements and their solutions and formulating strategies to solve problems mathematically, dy/dx=3x 3/2 x^2+Cx^2+C-23/2

Researcher: how can you get the equation?

M2: I only remember that you said that the gradient of the first derivative of a function

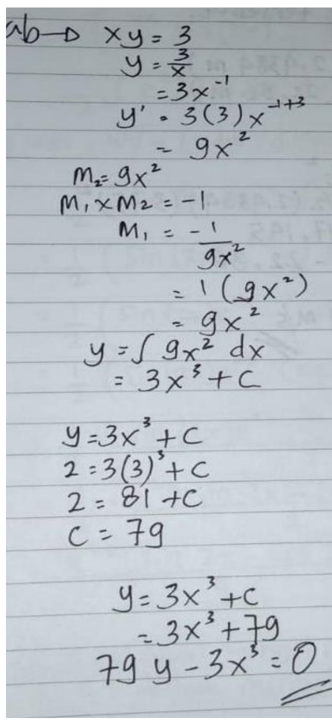
Researcher: Why did you do the integral problem with two coordinates?

M2: because I still don't understand the slope of the curve, ma'am, so I'm looking for both coordinates

Based on the results of interviews with M2, it can be understood that M2 still does not understand the slope of the curve, and also that M2 has not been able to apply integral operations correctly, so he cannot compile an appropriate solution to the given integral calculus.

Data on student answers with low learning independence 1 (L1) in question 1 is shown in Figure 6.

FIGURE 6
RESULTS OF L1 ANSWERS TO POINT 1 QUESTIONS



Translation:
$xy = 3$
$y = \frac{3}{x} = 3x^{-1}$
$y' = 3(3)\ x^{-1}+3 =$
$9x^2$
$m_2 = 9x^2$
$m_1.m_2 = -1$
$m_1 = \frac{-1}{9x^2}$
$= 1(9x^2)$
$= 9x^2$
$y = \int 9x^2 dx$
$= 3x^3 + C$
$y = 3x^3 + C$
$2 = 3(3)^3 + C$
$2 = 81 + C$
$C = 79$
$y = 3x^3 + C$
$y = 3x^3 + 79$
$79y - 3x^3 = 0$

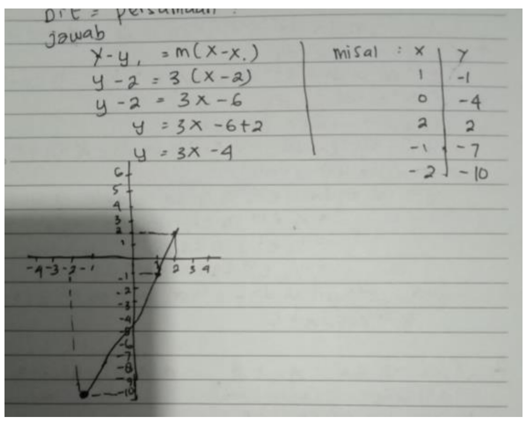
In working on question number 1 regarding the application of integrals, L1 has not been able to communicate the results of the information given to the problem, namely in the form of presenting problems and solutions for other people, because it can be seen that in the answer the informant did not write down what was known and also what was asked in the problem, L1 also have not been able to change the problem presented in the problem into a mathematical form through mathematical modeling correctly, even though L1 has written a mathematical model, it is still wrong. L1 also still cannot think logically in exploring and connecting the elements of the problem and its solution, in this problem, what is known is the gradient of the curve and there are no lines that are parallel or perpendicular, but the informant writes m1.m2 = -1. L1 has been able to devise a strategy to solve the problem, namely using integrals, but the integrated functions are still not correct, resulting in wrong results. In the problem, it was stated that the slope of the curve at each point is three times the abscissa, the curve also passes through the point (3,2) so from there the student should be able to write down the answer, it is known that the slope of the curve is dy/dx = 3x, but L1 writes xy = 3 , this happened because L1 had not been able to analyze the information presented in the form of a description or narrative resulting in an error in interpreting the information from the problem which resulted in wrong results related to the concept of the slope of the curve. Then an interview was conducted regarding question number 1 to find out how the process worked.

Researcher:	try to state what is known in the problem.
L1:	gradient of a curve and the point through which maam
Researcher:	how do you do the problem about the gradient?
L1:	with an integral, ma'am
Researcher:	what function is integrated? May be mentioned.
L1:	Wait a minute ma'am, I don't know yet ma'am
Researcher:	how do you write down the answers
L1:	I can do it according to the examples in the book, ma'am

Based on the results of the interview, it can be seen that L1 still does not understand the gradient concept presented in the problem. So based on the results of the answers and interviews, L1 has not been able to change the problem into a mathematical model.

Data on the results of the answers of students with the second low learning independence (L2), are presented in Figure 7.

FIGURE 7
RESULTS OF L2 ANSWERS TO POINT 1 QUESTIONS



In working on problem number 1 about applying integrals, L2 uses the concept of straight-line equations, and represents the situation in the problem in the form of an image.

Researcher:	on question no 1, why is your answer like that?
L2:	I still don't understand the problem ma'am
Researcher:	what strategy is used in solving the problem
L2:	I followed the solution steps as they are on the web

Based on the results of the answers and interviews, it can be said that L2 has not been able to interpret the problems given.

TABLE 2
THE PROCESS OF MATHEMATICAL LITERACY FOR EACH INFORMANT

Informant	H1	H2	M1	M2	L1	L2
Communication (Write down what is known in the problem, write down the gradient equation and determine the solution)	√	√	√	√	√	√
Mathematics (Creating equations in the form of mathematical symbols (modelling))	√	√	√	√	×	×
Representation (changing data from verbal sentences into mathematical representative symbols)	√	√	√	√	×	×
Reasoning and argument (exploring and connecting the elements of the problem and its solution)	√	√	√	√	×	×
Develop strategies to solve problems (choose and use various strategies in solving problems mathematically)	√	√	√	√	×	×
Using language and symbolic, formal and technical operations (understanding, interpreting, manipulating, and utilizing symbolic expressions in various mathematical contexts in solving mathematical problems)	√	√	×	×	×	×
Using math tools (using math tools to help with math activities)	√	√	√	√	×	×

Table 2 shows that each informant in the various categories of learning independence has a different tendency in solving math literacy questions. H1, H2, M1, and M2 use almost the same settlement pattern. In interpreting information about the gradient (slope) of a curve at a certain point, the four informants formulated a mathematical model (symbol) to represent it in the form of mathematical language. They use the differential concept to obtain the gradient equation of a curve. L1 uses the concept of a gradient but is not yet correct in spelling out the equation. L2 uses the concept of a straight line equation that knows the gradient and the point through which it passes and then represents it in the form of a straight line image. The incomplete meaning process causes errors in determining the completion steps.

TABLE 3
PROFILE OF MATHEMATICAL LITERACY BASED ON LEARNING INDEPENDENCE CATEGORIES

Informant	Tall	Currently	Low
Communication (Write down what is known in the problem, write down the gradient equation and determine the solution)	√	√	√
Mathematics (Creating equations in the form of mathematical symbols (modelling))	√	√	×
Representation (changing data from verbal sentences into mathematical representative symbols)	√	√	×
Reasoning and argument (exploring and connecting the elements of the problem and its solution)	√	√	×
Develop strategies to solve problems (choose and use various strategies in solving problems mathematically)	√	√	×
Using language and symbolic, formal and technical operations (understanding, interpreting, manipulating, and utilizing symbolic expressions in various mathematical contexts in solving mathematical problems)	√	×	×
Using math tools (using math tools to help with math activities)	√	√	×

According to learning independence, the profile of mathematical literacy varies, as seen in Table 3. The higher the independent learning category, the better at presenting problems and solutions to others, converting real-world problems into mathematical form through mathematical modeling, interpreting different mathematical representations, both objects and mathematical situations, thinking logically in exploring and connecting elements of problems and their solutions, choosing and using various strategies in solving mathematical problems, understanding, and intellectual prowess.

DISCUSSION

Differential patterns in the profile of mathematical literacy are considered to be influenced by several factors. The first stage in developing mathematical literacy is to be able to comprehend information and represent issues using mathematical language. Errors in later indices of mathematical literacy will emerge from a failure to comprehend data and model. The ability to evaluate and model knowledge holistically is often effortless for informants with high and moderate learning independence. Low-category informants, on the other hand, frequently struggle to evaluate the data as a whole. This result is in line with other studies that revealed that reading and comprehension skills have a role in mathematical literacy (OECD, 2016a).

It is believed that thinking skills are connected to the capacity to understand information. Saleh et al. (2018) state that reasoning facilitates problem comprehension and information sufficiency assessment. People that are capable of sound thinking will process information selectively (Persson et al., 2021). Understanding and application of mathematical knowledge in the context of the issues faced must go hand in hand with the capacity to comprehend information. The usage and solution of the problem will be more suitable the better understood the mathematical content is (Kolar & Hodnik, 2021; Nurwahyu et al., 2020). The communication process in various kinds of representation and problem-solving becomes incorrect when knowledge of mathematical material is inadequate. This confirms earlier research findings that incorrect perceptions of difficulties impact both the method and outcomes of problem resolution (Ansari et al., 2021). Informants with poor category learning independence experience this issue. The equation created in the low learning independence category is still incorrect, leading to errors in the integral step and the C value in the curve equation to be looked for. They are still unable to translate the slope of the curve problem into the form of a mathematical model. The planned curve equation is therefore not exact. The interpretation of the information will impact the kind of representation chosen (Napitupulu et al., 2016). Almost all informants employ visuals and mathematical symbols to provide information and create problem-solving based on their comprehension of the material in the questions. The information interpretation for informants in the low learning independence group is poor, therefore, the presentation of the type of representation is not completely accurate.

Additionally, their capacity for oral, visual, and tabular presentation. Informants who fall into the high and medium learning independence groups are more likely to be able to solve issues appropriately. However, it appears that throughout the problem-solving process, pupils in the category of moderate learning independence made a mistake when integrating the function of the derivative. However, the method and outcomes of problem solving are not completely correct in the poor learning independence group because they start with an incorrect interpretation of the data. For a systematic problem-solving process, the capacity to comprehend the information context, choose, employ strategies, and investigate is necessary. Numeracy problem-solving includes the capacity to select, apply, assess, and evaluate procedures as well as the outcomes gained (Goos et al., 2014). It also calls for the capacity to explore and know the surrounding situation (Geiger et al., 2015). The capacity to critically reason about facts and issue situations is necessary for solving numeracy challenges (Lloyd & Frith, 2013). Comparison, pattern recognition, method selection, linkages, verification, and conclusion-drawing are all processes that can be aided by reasoning (Beatty & Thompson, 2012; Bronkhorst et al., 2020; Jeannotte & Kieran, 2017; Saleh et al., 2018; Tak et al., 2021). Thus, strong thinking skills are required to enable mathematical literacy. The capacity to analyze information, communicate knowledge, and plan solutions to problems will all suffer from a lack of optimal reasoning ability. The effectiveness of developing mathematical literacy based on features of learning independence is believed to be impacted by experience and the capacity to comprehend, apply, and reason mathematical knowledge. A person is more likely to maximize experience in addressing issues that have a life context the greater their level of learning independence. The informants' experiences give them the self-assurance to write crucial information, forecast settlement phases, and choose for a more systematic settlement approach.

According to the findings of previous research, students with a high level of learning independence have several tendencies and characteristics, including good self-control, high self-confidence, high commitment to tasks, the ability to solve problems, full of initiative, and the capacity to make decisions. Because they see learning as a need, students with these characteristics or attributes typically take charge of their own learning behavior. Additionally, students with high levels of learning independence have a propensity for liking practical things and can develop their own understanding outside of what is learned from the teacher in the classroom through interaction with different outside learning resources (Mulyono, 2017).

CONCLUSION

The development of mathematical literacy is influenced by independent study. A higher category score improves the process of developing mathematical literacy in independent learning. The two primary indications of mathematical literacy progress are information interpretation and modeling. If this procedure is ineffective, it will affect the subsequent step. The act of processing information, presenting information in the form of an acceptable representation, and solving issues involves reasoning, improving mathematical content, and optimizing experience. Weak mathematical content comprehension leads to inadequate information meaning and incorrectly displayed representational formats. Then, when logic is not applied, decisions are made incorrectly. The practical application of this research is to provide future mathematics teacher students the information they need to continuously maintain and improve their learning autonomy while promoting the development of mathematical literacy. Candidates for the teaching of mathematics always prioritize experience, comprehension of the subject matter, and logic to enhance the process of mathematical literacy.

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Almost all problems that arise in daily life must be solved using a mathematical thought process. The process of mathematical literacy is required in order to solve a variety of issues that have real-world applications. Both learning and non-learning need the development and practice of mathematical literacy. Mathematical literacy requires autonomous learning in addition to content-related knowledge components. It is necessary to conduct further study on the variables that affect the development of mathematical literacy, as well as how it is applied in educational settings and to a variety of real-world issues. Other research might view it from a different aspect, notably from the dimension of learning independence, because of the significance of learning independence.

REFERENCES

Ansari, B.I., Saleh, M., Nurhaidah, & Taufiq. (2021). Exploring students' learning strategies and self-regulated learning in solving mathematical higher-order thinking problems. *European Journal of Educational Research*, *10*(2), 743–756. https://doi.org/10.12973/eu-jer.10.2.743

Astuti, N.K., Fahinu, & Masuha, J. (2018). Analisis kemampuan literasi matematika siswa kelas VIII SMP swasta di kota Kendari [Analysis of mathematical literacy ability of class VIII private junior high school students in Kendari city]. *Jurnal Penelitian Pendidikan Matematika*, *6*(1), 99–112. https://doi.org/10.36709/jppm.v6i1.7401

Beatty, E.L., & Thompson, V.A. (2012). Effects of perspective and belief on analytic reasoning in a scientific reasoning task. *Thinking and Reasoning*, *18*(4), 1–20. https://doi.org/10.1080/13546783.2012.687892

Bronkhorst, H., Roorda, G., Suhre, C., & Goedhart, M. (2020). Logical reasoning in formal and everyday reasoning tasks. *International Journal of Science and Mathematics Education*, *18*(2), 1673–1694. https://doi.org/10.1007/s10763-019-10039-8

Chau, J., & Cheng, G. (2010). Towards understanding the potential of e-portfolios for independent learning: A qualitative study. *Australasian Journal of Educational Technology*, *26*(7). https://doi.org/10.14742/ajet.1026

Cukurova, M., Bennett, J., & Abrahams, I. (2018). Students' knowledge acquisition and ability to apply knowledge into different science contexts in two different independent learning settings. *Research in Science & Technological Education*, *36*(1), 17–34. https://doi.org/10.1080/02635143.2017.1336709

Edward, A.S., Bouck, M., Howard, J., Lambdin, D., Malloy, C., & Sandefur, J. (2000). Standards for grades 6–8. In J. Ferrini-Mundy (Ed.), *Principles and standards for school mathematics* (pp.211–285). National Council of Teachers of Mathematics (NCTM). Retrieved from https://bit.ly/3kXy5R4

Fridani, L. (2009). *Ape Lestari,Inspiring Education: Kisah Inspriratis Pembelajran Anak Usia Sekolah Dasar, Bandung: Alex Media Komputindo*. ISBN 979273998X

Gagne, R.M. (1983). Some issue in psychology of mathematics instruction. *Journal for Research in Mathematics Education*, *14*(1), 7–18. doi: 10.2307/748793

Geiger, V., Goos, M., & Forgasz, H. (2015). A rich interpretation of numeracy for the 21st century: A survey of the state of the field. *ZDM - International Journal on Mathematics Education*, *47*, 531–548. https://doi.org/10.1007/s11858-015-0708-1

Gellert, U., Jablonka, E., & Keitel, C. (2001). Mathematical literacy and common sense in mathematics education: An international perspective. In B. Atweh, H. Forgasz, & B. Nebres (Eds.), *Sociocultural research on mathematics education* (pp. 57–74). Mahwah, NJ: Erlbaum.

Genc, M., & Erbas, A.K. (2019). Secondary Mathematics Teachers' Conceptions of Mathematical Literacy. *International Journal of Education in Mathematics, Science and Technology (IJEMST)*, *7*(3), 222–237.

Goos, M., Geiger, V., & Dole, S. (2014). Transforming professional practice in numeracy teaching. In Y. Li, E. A. Silver, & S. Li (Eds.), *Transforming mathematics instruction: multiple approaches and practices* (pp. 81–102). Springer. https://doi.org/10.1007/978-3-319-04993-9_6

Hamka, D., & Vilmala, B.K. (2019). Pengembangan Perangkat Pembelajaran Blended Learning Melalui Aplikasi Google Classroom Untuk Peningkatan Kemandirian Belajar Mahasiswa. *Journal of Education Informatic Technology and Science (JeITS)*, *1*(2), 145–154. Retrieved from https://ejurnal.umri.ac.id/index.php/JeITS/article/view/1439/858

Hassan, A., Maharoff, M., Abiddin, N.Z., & Ro'is, I. (2015). Teacher trainers' and trainee teachers' understanding towards the curriculum philosophy regarding soft skills embedment in the Malaysian institute of teacher education. *Policy Futures in Education*, *14*(2), 164–175. https://doi.org/10.1177/1478210315597857

Hayati, T.R., & Kamid. (2019). Analysis of Mathematical Literacy Processes in High School Students. *International Journal of Trends in Mathematics Education Research*, *2*(3), 116–119.

Hockings, C., Thomas, L., Ottaway, J., & Jones, R. (2018). Independent learning–what we do when you're not there. *Teaching in Higher Education*, *23*(2), 145–161. https://doi.org/10.1080/13562517.2017.1332031

Hope, M. (2007). Mathematical literacy. *Principal Leadership*, *7*(5), 28–31.

Hwang, J., & Ham, Y. (2021). Relationship Between Mathematical Literacy and Opportunity to Learn with Different Types of Mathematical Tasks. *Journal on Mathematics Education*, *12*(2), 199–222. http://doi.org/10.22342/jme.12.2.13625.199-222

Jablonka, E. (2003). Mathematical literacy. In A. Bishop, M. Clements, C. Keitel, J. Kilpatrick, & F.E. Leung (Eds.), *Second international handbook of mathematics education* (pp. 75–102). Dordrecht, the Netherlands: Kluwer.

Jeannotte, D., & Kieran, C. (2017). A conceptual model of mathematical reasoning for school mathematics. *Educational Studies in Mathematics*, *96*(1), 1–16. https://doi.org/10.1007/s10649-017-9761-8

Johnson, M. (2009). Evaluation of Learning Style for First Year Medical Students. *International Journal for the Scholarship of Teaching and Learning*, *3*(1), Article 20. https://doi.org/10.20429/ijsotl.2009.030120

Kholmuratovich, M.K., Mardanqulovich, A.S., Ravshanovich, J.R., Sharifovna, K.U., & Shodiyevna, B.O. (2020). Methodology of improving independent learning skills of future fine art teachers (on the example of still life in colorful paintings). *International Journal of Psychosocial Rehabilitation*, *24*(05), 285–288. https://doi.org/10.37200/V24I5/17074

Kirschner, P.A. (2017). Stop propagating the learning styles myth. *Computers & Education*, *106*, 166–171. https://doi.org/10.1016/j.compedu.2016.12.006

Kolar, V.M., & Hodnik, T. (2021). Mathematical literacy from the perspective of solving contextual problems. *European Journal of Educational Research*, *10*(1), 467–483. https://doi.org/10.12973/EU-JER.10.1.467

Lloyd, P., & Frith, V. (2013). Proportional reasoning as a threshold to numeracy at university: A framework for analysis. *Pythagoras*, *34*(2), 1–9. https://doi.org/10.4102/pythagoras.v34i2.234

McCrone, S.M., Dossey, J.A., Turner, R., & Lindquist, M.M. (2008). Learning about student‘s mathematical literacy from PISA 2003. *Mathematics Teacher*, *102*(1), 34–39. https://doi.org/10.5951/MT.102.1.0034

McCrone, S.S., & Dossey, J.A. (2007). Mathematical literacy— It‘s become fundamental. *Principal Leadership*, *7*(5), 32–37.

Mentari, N., Nindiasari, H., & Pamungkas, A.S. (2018). Analisis kemampuan berpikir reflektif siswa SMP berdasarkan gaya belajar [Analyze the reflective thinking ability of junior high school students based on learning styles]. *NUMERICAL: Jurnal Matematika Dan Pendidikan Matematika*, *2*(1), 31–42. https://doi.org/10.25217/numerical.v2i1.209

Mulyono, D. (2017). The influence of learning model and learning independence on mathematics learning outcomes by controlling students' early ability. *International Electronic Journal of Mathematics Education*, *12*(3), 689–708. https://doi.org/10.29333/iejme/642

Muntazhimah, M., Turmudi, T., & Prabawanto, S. (2021). The relation between prior knowledge and students' mathematics reflective thinking ability. *Journal of Physics: Conference Series*, *1731*, 12043. https://doi.org/10.1088/1742-6596/1731/1/012043

Napitupulu, E.E., Suryadi, D., & Kusumah, Y.S. (2016). Cultivating upper secondary students' mathematical reasoning-ability and attitude towards mathematics through problem-based learning. *Journal on Mathematics Education*, *7*(2), 117–128. https://doi.org/10.22342/jme.7.2.3542.117-128

Niklas, F., Cohrssen, C., & Tayler, C. (2016). Improving preschoolers' numerical abilities by enhancing the home numeracy environment. *Early Education and Development*, *27*(3), 372–383. https://doi.org/10.1080/10409289.2015.1076676

Nurwahyu, B., Tinungki, G.M., & Mustangin. (2020). Students' concept image and its impact on reasoning towards the concept of the derivative. *European Journal of Educational Research*, *9*(4), 1723–1734. https://doi.org/10.12973/eu-jer.9.4.1723

OECD. (2017). *PISA 2015 technical report*. Paris, France: OECD Publishing.

Organisation for Economic Co-operation and Development. (OECD). (2013a). *PISA 2012 assessment and analytical framework: Mathematics, reading, science, problem solving and financial literacy*. Paris, France: OECD Publishing.

Organization for Economic Co-operation and Development. (2016a). *Skills matter: Further results from the survey of adult skills*. OECD Publishing.

Persson, E., Andersson, D., Koppel, L., Västfjäll, D., & Tinghög, G. (2021). A preregistered replication of motivated numeracy. *Cognition*, *214*, 104768. https://doi.org/10.1016/j.cognition.2021.104768

Powell, A., & Anderson, C. (2007). Numeracy strategies for African American students: Successful partnerships. *Childhood Education*, *84*(2), 70–84. https://doi.org/10.1080/00094056.2008.10522976
Pugalee, O.K. (1999). Constructing a model of mathematical literacy. *Clearing House*, *73*(1), 19–22. https://doi.org/10.1080/00098659909599632
Rachmaningtyas, N.A., Kartowagiran, B., Sugiman, Retnawati, H., & Hassan, A. (2022). Habituation of mathematical literacy trained in junior high school. *International Journal of Educational Methodology*, *8*(2), 321–330. https://doi.org/10.12973/ijem.8.2.321
Reys, R.E., Suydam, M.N., Lindquist, M.M., & Smith, N.L. (1998). *Helping children learn mathematics*. Boston: Allyn and Bacon.
Saleh, M., Prahmana, R.C.I., Isa, M., & Murni. (2018). Improving the reasoning ability of elementary school student through the Indonesian realistic mathematics education. *Journal on Mathematics Education*, *9*(1), 41–54. https://doi.org/10.22342/jme.9.1.5049.41-54
Sani, B. (2016). Perbandingan kemampuan siswa berpikir reflektif dengan siswa berpikir intuitif di Sekolah Menengah Atas [Comparison of students' ability to think reflectively with students' intuitive thinking in high school]. *Jurnal Pendidikan Matematika Dan Sains*, *4*(2), 63–76. https://doi.org/10.21831/jpms.v4i2.12947
Setiyani, Waluya, S.B., Sukestiyarno, Y.L., & Cahyono, A.N. (2022). Mathematical reflective thinking process of prospective elementary teachers review from the disposition in numerical literacy problems. *International Journal of Educational Methodology, 8*(3), 405–420. https://doi.org/10.12973/ijem.8.3.405
Stacey, K., & Turner, R. (2015). The evolution and key concepts of the PISA mathematics frameworks. In K. Stacey, & R. Turner (Eds.), *Assessing mathematical literacy: The PISA experience* (pp. 5–34). New York, NY: Springer.
Stanberry, M.L., & Payne, W.R. (2023). Teaching undergraduate calculus at an urban HBCU through a global pandemic. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 11*(2), 340–357. https://doi.org/10.46328/ijemst.2557
Sugiyono. (2013). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*. Bandung: Alfabeta.
Sukestiyarno. (2020). *Metode Penelitian Pendidikan*. Semarang: Unnespress.
Suprayitno, T. (2019). *Pendidikan di Indonesia: Belajar dari hasil PISA 2018 [Education in Indonesia: Learning from the results of PISA 2018]*. Repositori Institusi Kementerian Pendidikan Kebudayaan, Riset dan Teknologi Republik Indonesia. Retrieved from https://bit.ly/3FxlXjv
Syamsuddin, A. (2019). Analysis of prospective teacher's mathematical problem solving based on taxonomy of reflective thinking. *Journal of Physics: Conference Series*, *1157*, 32078. https://doi.org/10.1088/1742-6596/1157/3/032078
Tak, C.C., Hutkemri, & Eu, L.K. (2021). Analysis validity and reliability of self-efficacy and metacognitive awareness instrument toward mathematical reasoning. *Turkish Journal of Computer and Mathematics Education*, *12*(9), 3332–3344. https://doi.org/https://doi.org/10.17762/turcomat.v12i9.5739.
Umbara, U., & Suryadi, D. (2019). Re-Interpretation of Mathematical Literacy Based on the Teacher's Perspective. *International Journal of Instruction*, *12*(4), 789–806. https://doi.org/10.29333/iji.2019.12450a
Yuliati, Y., & Saputra, D.S. (2020). Membangun Kemandirian Belajar Mahasiswa Melalui Blended Learning di Masa Pandemi Covid-19. *Jurnal Elementaria Edukasia*, *3*(1), 8. http://dx.doi.org/10.31949/jee.v3i1.2218