Analysis of Students' Numeracy in terms of Students' Self-Directed Learning

Wardono Wardono[1], Tri Sri Noor Asih[2], Scolastika Mariani[3], Reni Roikhatul Jannah [4]

[1,2,3,4] Mathematics Education, Universitas Negeri Semarang, Indonesia,

corresponding Email : wardono@mail.unnes.ac.id

Abstract: This research aims to describe students' numeracy in terms of their self-regulated learning. The study is a qualitative descriptive research conducted with students from grade X at SMA Negeri 3 Slawi, Tegal Regency. There were seven subjects in this research, with two students categorized as having high self-regulated learning, four with moderate self-regulated learning, and one with low self-regulated learning. Data were collected through a self-regulated learning questionnaire, numeracy test, and interviews. The questionnaire data were analyzed to determine the types of self-regulated learning exhibited by students, while the numeracy test results were based on seven components: Communication, Mathematising, Representation, and Using Mathematics Tools, Devising strategies for solving problems, Using symbolic, Reasoning, and Argument. The results showed that students' numeracy varied based on their levels of self-regulated learning. Students with high self-regulated learning were proficient in all seven numeracy components, those with moderate self-regulated learning were competent in some components such as Communication, Mathematising, Representation, and Using Mathematics Tools. However, students with low self-regulated learning were unable to perform well in all seven numeracy components.

Keywords: *Numeracy, self regulated learning, description.*

Introduction

Education is one of the ways humans consciously develop their potential to possess spiritual strength, self-control, personality, intelligence, noble character, and the skills needed for themselves, society, the nation, and the country (UU No. 20 of 2003). One way to develop one's potential is by improving the quality of human resources. Currently, education in Indonesia is actively focused on numeracy assessment and the improvement of students' character in the independent curriculum. Schools are expected to provide education that can cultivate students' characters in the Pancasila profile of the independent curriculum, one of which is independence or self-reliance in learning. Student's self-reliance in learning is significant because in carrying out daily activities, they face challenges and trials. According to Putri et al. (2022), when a student has self-reliance in learning, they will take responsibility for their own learning without being forced by the environment.

In achieving the expected learning outcomes, there are several aspects that teachers must consider, one of which is the ability to conduct effective learning processes. According to Iwamoto, Hargis, Bordner, & Chandler (2017), Schunk and Zimmerman describe self-reliant learners as individuals who actively engage in the learning environment, organize, train, and use their abilities effectively, and have positive motivational beliefs about their learning abilities. Students' lack of self-reliance in learning can result in poor initiative, discipline, confidence, and responsibility in learning. The deficiency in initiative, responsibility, discipline, and confidence in learning is believed to have an impact on the suboptimal learning process.

In addition to that, the Assessment of Minimum Competency, commonly known as AKM, is used to measure reasoning abilities using language (literacy) and mathematics (numeracy).

I. Widiyanah et al. (eds.), *Proceedings of the 8th International Conference on Education Innovation (ICEI 2024)*, Advances in Social Science, Education and Humanities Research 888,
https://doi.org/10.2991/978-2-38476-360-3_64

One component of students' learning outcomes in mathematics measured in AKM is numeracy. Numeracy is crucial for individuals facing the current era of information and knowledge. Being sensitive to numeracy prepares students to tackle real-world problems. Han et al. (2017) state that mastering numeracy gives students a sense of number and its relevance to everyday life, enabling them to compete with other nations in terms of human resources.
Referring to Abidin, et al. (2017), numeracy encompasses 7 fundamental skills, namely communication, mathematising, representation, reasoning and argument, devising strategies for solving problems, using symbolic, and using mathematics tools. The National Literacy Movement (2017) asserts that numeracy involves insights and capabilities in utilizing numerical types or symbolic language. This is closely related to the most fundamental mathematical knowledge needed to solve various problems encountered in daily life. From the description above, this research aims to examine students' numeracy in the context of their self-reliance in learning. The expected results of the study can provide valuable information as an inspirational preliminary study for teachers in developing students' numeracy through mathematics learning with an emphasis on self-regulated learning.

Literature Review

According to the OECD (2010), numeracy is the ability of students to formulate, apply, interpret mathematics in various topics and mathematical concepts, algorithms, facts, explain, and predict phenomena (Cheung, S. K., Yang, X., Dulay, K. M., & McBride, C, 2018; Hanushek, E. A., & Woessmann, L. 2008); Luyee, E. O., Roselan, F. I., & Anwardeen, N. H. , 2015; Machaba, F. M., 2018; Napoli, A. R., & Purpura, D. J., 2018; Niklas, F., Cohrssen, C., & Tayler, C. , 2016; Rogowsky, B. A., Terwilliger, C. C., Young, C. A., & Kribbs, E. E., 2018). .. . In line with Mahmud and Pratiwi (2019), numeracy is defined as students' ability to implement concepts and have operational skills in arithmetic operations. Baharuddin, M. R., Sukmawati, S., & Christy, C. (2021) mention that numeracy is the ability to use, understand, and analyze mathematics in different contexts to solve various problems in everyday life. Additionally, Nisa, A. C (2023) defines numeracy as an individual's ability to analyze and understand the manipulation of symbolic language found in daily life in their activities. Proficiency in using mathematics is necessary for good numeracy and confidence in both school learning and daily life (Tout, 2020). Educational achievement and predicting someone's job performance can be interpreted through good numeracy skills (Hanushek & Woessmann, 2008). Thus, numeracy can be understood as the ability to apply number concepts and arithmetic skills in everyday life.
Success in interpreting numeracy can develop with the ability to manage oneself, one of which is through students' self-directed learning. Desmita (2009) defines autonomy as the attitude of freedom to control one's behavior or thoughts, emotions, and efforts to overcome doubts within oneself. According to Boney (2017), numeracy is optimally supported by high levels of self-directed learning. Malta & Jessica (2016) state that with high self-directed learning, numeracy will develop maximally, and their high-level thinking skills can effectively and efficiently solve problems. Additionally, students with low self-directed learning tend to have poor numeracy skills.

Students with low self-directed learning rely solely on their peers for understanding or solving the problems they face. With limitations in problem-solving, they are not yet able to determine the method or provide appropriate reasons to solve problems. Consequently, they are unable to calculate with accurate results. According to Schunk and Zimmerman, as cited in Heris Hendriana (2018), behavior, attitudes, and strategies employed to achieve specific goals are among the influences of the self-directed learning process. The learning process demands active participation from students with self-directed learning. Charles (Yanuarto &

Qodariah, 2020) suggests that a lack of self-directedness can transform one's attitude to become more closed-off, less enthusiastic about schooling, and may lead to other bad habits.

Methodology

Research Design

This research is qualitative in nature, aiming to describe the learning conditions, particularly the state of students' numeracy proficiency based on their self-reliance in learning in the form of a description. In this research, the questionnaire technique is employed to gather primary data with the aim of assessing the level of students' self-directed learning.A questionnaire is a research tool consisting of a set of written questions or statements that respondents need to fill out according to the provided instructions (Sanjaya, 2013). The independence of students' learning is categorized using a questionnaire instrument in this study. The steps in the preparation of the self-directed learning questionnaire are as follows: (1) Formulating the questionnaire framework, (2) Composing questionnaire items based on the framework. The self-directed learning questionnaire used refers to the independence of learning, aiming to categorize each student into three categories: high self-directed learning, moderate self-directed learning, and low self-directed learning. Additionally, in this research, the researcher will administer a subjective test in the form of essay tests with the aim of measuring the extent of students' numeracy skills. Numeracy skills are not only determined by the correctness of students' calculations but also assessed based on their ability to present their answers.

Sample and Data Collection

The study was conducted at SMA Negeri 3 SLAWI in the 10th-grade academic year 2023/2024. The population in this study comprised all students in the 10th grade at SMA Negeri 3 SLAWI for the academic year 2023/2024, consisting of 10 classes from X1 to X10. Subsequently, subjects were selected using purposive sampling method. The subjects of this study are students' numeracy based on their self-reliance in learning. The determination of subjects as a source of information is based on the results of numeracy and self-reliance in learning tests, where more in-depth information is needed.

Analyzing of Data

In this study, students were given a questionnaire on self-reliance in learning based on predetermined indicators. According to the research by Eko & Kharisudin (2010), some indicators of self-reliance in learning include: 1) confidence, 2) not relying on others, 3) willing to do things independently, 4) responsibility, 5) desire for high achievement, 6) using rational consideration in giving assessments, making decisions, and solving problems, and desiring freedom, and 7) always having new ideas. Based on the theoretical review above, the researcher formulates four indicators of students' self-reliance used for the study, namely: 1) confidence, 2) responsibility, 3) initiative, and 4) discipline. Subsequently, a numeracy test was conducted on students, followed by interviews using test instruments and interview guidelines. Self-reliance questionnaires and tests were administered to the entire class. The self-reliance questionnaire consisted of 20 statements organized based on the self-reliance questionnaire grid. The student's self-reliance questionnaire was structured on a Likert scale, comprising positive and negative statements with response options "Strongly Agree (SA), Agree (A), Uncertain (U), Disagree (D), Strongly Disagree (SD)" (Likert, 1932; Sugiyono, 2016). After the questionnaire was given to students, scores of X and Y were obtained. Thus, the category of student self-reliance groups can be determined. The classification of student self-reliance groups is obtained as shown in Table 1 below.

Table 1. Classification of Self-Directed Learning

Score Classification	Score	Group

	77	High
		Medium
	61	Low

Table 2. Results of the Self-Directed Learning Assessment Scale

Self Directed Learning	**Students**
High	6
Medium	27
Low	3
Amount	**36**

Then, based on the questionnaire analysis, seven students were selected for further analysis and interviews. Seven subjects were obtained in this study, consisting of 2 students with a high self-reliance category, four students with a moderate self-reliance category, and one student with a low self-reliance category. The test instrument consists of five numeracy questions, and in this research, the researcher will provide a subjective test in the form of descriptive tests aimed at measuring the extent of students' numeracy abilities. Numeracy abilities are not only determined by the correctness of the students' calculations but also by their ability to present answers. The questions used in this test are related to sequences and series.

The test instrument is developed based on the numeracy test grid with seven components and is accompanied by a scoring rubric. The test instrument was then validated by two experts, namely mathematics education lecturers from Universitas Negeri Semarang. After completing the data collection, data analysis techniques were carried out according to the Miles & Huberman (2014) model, which includes three stages: data reduction, data display, and conclusion or verification. In the data reduction stage, self-reliance questionnaire data, numeracy test results, and interview results with students were analyzed. The grouped data will then facilitate the researcher in presenting the data. Data presentation is elaborated in the form of descriptions or narratives that explain the results of numeracy test data and interviews. In the verification stage, the conclusion, in the form of a description or portrayal of students' numeracy in terms of self-reliance, which was previously unclear, becomes clear and more detailed.

Findings/Results

In the OECD, numeracy is divided into seven components, namely "(1) communication, (2) mathematizing, (3) representation, (4) reasoning and argument, (5) devising strategies for solving problems, (6) using symbolic, formal, and technical language and operations, and (7) using mathematical tools."

Criteria in communication ability involve expressing ideas and identifying problems by providing information relevant to the issue. Mathematizing, with the criterion of being able to transform real-world problems into mathematical forms or vice versa, interpreting mathematical results or models into their original problems. Representation, with the criterion of being able to present a problem or mathematical object through selecting, interpreting, translating, and using graphics, tables, images, diagrams, formulas, equations, or concrete objects to portray the problem more clearly. In this ability, subjects can represent or read a table to solve mathematical problems.

Next, regarding the ability to devise strategies in solving problems or the ability to devise strategies for solving problems, the criteria include being able to propose formulas and choose strategies to solve a problem, identify problems, and create solution plans. The subject is capable of making accurate solution plans and solving problems sequentially, concluding

them. Using symbolic, formal, and technical language, and operations involve the ability to use mathematical symbols and perform calculations with formal symbols, such as arithmetic operations or numerical patterns. Using mathematical tools, with the criterion of being able to use tools and technology at the right time in mathematics learning, including using calculating tools to solve mathematical calculations. Reasoning and argument, with the criteria of being able to reason, provide reasons, show conclusions from a statement, explain logically, and create logical and justifiable mathematical arguments.

To ensure the validity of the data in this research, the triangulation method consists of triangulation with multiple methods and multiple sources. This technique involves utilizing the results of tests, interviews, and physical observations. The results of data validity obtained through triangulation techniques are as follows.

Description of Numeracy of Students with High Self-Regulated Learning

Subject T-01 In terms of the basic component of communication skills, Subject T-01 is able to write information or identify problems completely and correctly. During the interview with Subject T-01, the facial expression indicates confidence in providing answers, showing no confusion when questioned, and delivering coherent answers with appropriate reasoning. Overall, Subject T-01 can understand and provide answers effectively.

Regarding mathematizing abilities and the identification of everyday life problems into mathematical sentences or interpreting mathematical models in questions 1 to 5, Subject T-01 can interpret the mathematical model used to solve the problem completely and sequentially in question 1. From the student's answers to questions 1 to 5, Subject T-01 can transform information into mathematical form and solve it according to the steps made. This is further supported by the researcher's interview with Subject T-01 regarding the ability to identify all information from the problem into mathematical form. From the interview results, Subject T-01 can convert it into symbols and mathematical models. However, in question 2, the student did not write the ratio symbol but was able to solve it well. From question 1 to question 5, only in question 2 did Subject T-01 not write the ratio symbol to determine the obtained information, but in the process of mathematizing, Subject T-01 was able to solve it completely and sequentially. Thus, based on triangulation of the test results of mathematizing abilities from questions 1 to 5, Subject T-01 is valid. Subject T-01 can solve problems into mathematical symbols thoroughly and sequentially.

In question number 5, Subject T-01 is able to represent or read a table to solve mathematical problems. From the interview excerpt with Subject T-01 regarding question number 5, they can explain information from the presented table to find a solution to the problem. Additionally, in question number 1, Subject T-01 can explain the mathematical model related to the material they are currently learning, specifically the mathematical model of a system of linear equations with two variables to solve problems related to sequences and series in question number 1. Subject T-01 can effectively use calculating tools to perform accurate calculations. Therefore, Subject T-01 fulfills the abilities of Representation and Using Mathematics.

The work of Subject T-01 related to the ability of devising strategies for solving problems shows that Subject T-01 is capable of designing strategies or plans used to solve problems correctly. This is reinforced by the interview results, indicating that Subject T-01 can design strategies or steps used to solve problems correctly. Subject T-01 can provide accurate solutions by explaining the steps of the strategy used and correctly writing the formulas. Based on the work and interview results, Subject T-01 can use symbols or algebraic operations to find answers to problems correctly and sequentially. Subject T-01 can use and mention the symbols used correctly.

In the work of Subject T-01, for question number 1, they can summarize the solution to the problem completely for questions 1, 2, 3, and 5. In the answer to question number 4, Subject

T-01 provides a conclusion by simply writing the total length of the track as 260+156=416cm. Subject T-01 has not been able to write a complete conclusion for the solution to question number 4. Subject T-01 can provide conclusions and always write conclusions for every math answer, but sometimes, during class exercises, may not write if time is rushed. In question number 4, Subject T-01 only writes the total length of the track and has not concluded. Subject T-01 assumes that the total length of the track is a conclusion to their answer. Thus, Subject T-01 can provide reasons for their answers and draw conclusions from the obtained solutions. Subject T-01 can fulfill the abilities of argument and reasoning well for questions 1, 2, 3, and 5 overall.

SUBJECT T-02

During the interview, Subject T-02 felt relaxed and calm in answering questions. Subject T-02's work related to communication skills involves expressing ideas and identifying problems by providing accurate information corresponding to the issues. However, the completeness of this information is not conveyed in writing in Subject T-02's responses. In this regard, strengthened by the interview results, Subject T-02 can explain communication skills by identifying problems and providing accurate information. Subject T-02 can provide reasons for their answers. As for question number 5, Subject T-02 is not yet complete in communicating or providing information; however, in the final part of the answer, Subject T-02 can solve it correctly and sequentially.

Based on triangulation from the test results of Subject T-02 and the researcher's interview with Subject T-02, it can be said that the data of Subject T-02 regarding communication skills from questions 1 to 5 are valid. Therefore, it can be concluded that Subject T-02 is able to fulfill communication skills.

In mathematising, Subject T-02 is able to write information directly with symbols but not too comprehensively. In the part where Subject T-02 is asked, they only write the difference and 10 years without providing a clear explanation. Subject T-02 can use mathematical symbols to solve problems sequentially and completely. Subject T-02 is able to mention information from the problem correctly but not in full. After being asked, they do not write mathematical symbols because they forgot in the part that was asked. However, they can solve the problem sequentially and completely.

Based on triangulation from the test results of Subject T-02 and the researcher's interview with Subject T-02, it can be said that the data of Subject T-02 regarding mathematising skills by identifying all the information from the problem into mathematical form is valid. Regarding Representation, Subject T-02 can present information from the known table in the problem. Subject T-02 rewrites using mathematical symbols completely from U1 to U4 or the fourth week, then determines the value of b. From the interview excerpt, Subject T-02 can explain the table presented in mathematical symbols in sequences and series. Subject T-02 writes the results of the table completely, but in the story problem, Subject T-02 is less careful in reading the value of U10 that is already known and looking back for its value. In question number 1, Subject T-02 can write the mathematical model of a system of linear equations with two variables to solve the mathematical problem. In addition, from the interview excerpt, Subject T-02 can use a calculator to calculate difficult numbers according to Subject T-02. Thus, based on Subject T-02's work and interview results, they can fulfill the ability of representation by reading the known table and the ability to use mathematical tools correctly.

The work of Subject T-02 related to the ability to devise strategies for solving problems shows that Subject T-02 can solve problems completely and use formulas that are appropriate for the given problems. Subject T-02 uses the correct strategy or steps in solving the problems. From the interview excerpt, Subject T-02 can solve problems using a comprehensive strategy, but Subject T-02 reworks the value of Un, making Subject T-02 use a lengthy strategy. Nevertheless, Subject T-02 can solve it correctly and completely. From the

work results and interviews with Subject T-02, they can complete and solve all 5 problems correctly. Subject T-02 can use strategies or steps to solve problems from question number 1 to question number 5. Thus, Subject T-02 can fulfill the ability of devising strategies for solving problems.

Subject T-02, based on interview excerpts and their work results, can write or interpret symbolic language and use mathematical operations correctly. The symbols used in solving problems, as well as the formulas, are used correctly and completely. Subject T-02's writing is well-organized and neat in composing answers, using operations and symbolic language correctly and completely. Subject T-02 can interpret the symbols written in their work from question number 1 to question number 5. Thus, Subject T-02 can fulfill the ability of using symbolic language.

In the work, Subject T-02, for question number 1, mentions the conclusion of points a, b, and c as a whole. Subject T-02 states that the annual difference in visitors is 500, the first-time visitors are 5000, and the total visitors over 10 years are 72,500. For question number 2, Subject T-02 writes conclusions for each point. However, for question number 3, Subject T-02 does not write a conclusion, only the results. For questions number 4 and 5, Subject T-02 can state conclusions for those problems. Thus, Subject T-02 can provide conclusions for questions number 1, 2, 4, and 5 completely, but for question number 3, the subject does not write the conclusion. In the interview excerpt with Subject T-02, the conclusion of solution answers in mathematical problem-solving is only written when it is a word problem. However, when the question is in numerical form, the subject only writes the results. Nevertheless, from the work results and the interview, Subject T-02 can fulfill the ability of argument and reasoning.

Description of Numeracy Students with Medium Self-Regulated Learning

Subject S-01

Subject S-01's work regarding communication skills shows that they can write down ideas or information about the problems they are familiar with. In question number 1c, Subject S-01 did not write down completely related to what was asked in that information. However, for questions number 2 to 5, Subject S-01 wrote down all the information from the problems they knew. From the interview excerpt with Subject S-01, they can express ideas or information obtained from the problems well. Subject S-01 can explain in detail the reasons for the information they obtained. In the interview process, Subject S-01 appears to have great confidence in their abilities, and during their learning process, they show initiative by working in front of the class in their own way.

In the ability of mathematizing by transforming everyday life problems into mathematical sentences or models, subject S-01, in question number 1, has not yet been able to create a mathematical model to determine the values of a and b. The answer given by subject S-01 is done in a shorter way. Subject S-01 is able to change mathematical symbols and interpret them, but the solution is still incomplete. In question number 2, subject S-01 can write mathematical symbols and interpret them into the correct and complete formulas used. In questions number 3, 4, and 5, subject S-01 can write formulas and interpret mathematical symbols correctly but not completely. From the interview quotes with subject S-01, it is quite good in mathematizing skills, where subject S-01 can interpret the mathematical symbols used and the formulas in solving problems. The work of subject S-01 related to the ability to represent is not yet able to present a system of linear equations with two variables to solve the problem. The subject calculates directly in his own way. However, in question number 5, subject S-01 is able to present it in mathematical form from a table known in the problem.

In question number 1, the representation ability of subject S-01 has not been fulfilled, while in question number 5, subject S-01 is able to fulfill its representation ability. From the interview results with subject S-01, it is evident that the subject is able to represent the table into

mathematical symbols well. Subject S-01 writes information in question number 5 briefly according to what is needed to solve the problem. In question number 1, subject S-01 prefers a simpler method or takes the initiative to solve problems independently. In question number 1, subject S-01 has not been able to fulfill the representation ability well, but in question number 5, subject S-01 is able to present mathematical symbols from the representation of the table provided. Therefore, subject S-01 is quite good at fulfilling its representation ability.

Furthermore, in the interview quote, subject S-01 uses tools such as a calculator to solve mathematical calculations involving exponents and decimals to save time in solving problems. From the calculations using a calculator, subject S-01 computes with accurate results. The interview results show that subject S-01 is proficient in using tools effectively

Subject S-01, regarding the ability to devise strategies for solving problems, demonstrates quite good performance in using strategies or ideas to solve problems. However, when solving problems, subject S-01 uses their own methods based on their creativity without writing down the known formulas. In points a and b, the subject calculates using their own methods or strategies, and in point 3, subject S-01 is able to write down the formula and devise a strategy to solve the problem. Subject S-01 can explain their strategy but is unable to write down the formula when solving problems. Subject S-01 is more interested in working in their own way quickly, minimizing the time required without having to remember or memorize formulas. Overall, subject S-01 can explain quite well regarding the use of formulas or steps used in problem-solving.

From the work of subject S-01 related to the ability of Using Symbolic, they are able to write mathematical symbols well and understand what they write. However, in question number 4, subject S-01 did not write the unit for the length of the track completely; the subject only wrote the numbers. From the interview results with subject S-01, they can use mathematical symbols to solve problems. Subject S-01 can interpret the symbols written in their work and can explain them well. In question number 4, subject S-01 is not complete in solving the symbols because they forgot to write the unit for the calculated result. Thus, subject S-01 can use symbols quite well in solving mathematical problems.

From the work of subject S-01 in questions 1 to 5, they did not write conclusions for their solutions. Subject S-01 only wrote in question 1 the difference in visitors/b = 500, then the first visitor = 5000; however, subject S-01 did not provide the correct conclusion. In the work of subject S-01, they only wrote conclusions for the upward and downward lengths of the track, and subject S-01 did not provide a conclusion for the total length of the track. From the work of subject S-01 and the interview results, subject S-01 has not been able to provide a conclusion for the solutions to the problems they have worked on. From questions 1 to 5, subject S-01 did not write appropriate conclusions related to their solution results.

Subject S-02 shows a strong desire to achieve goals during the learning process, demonstrating a tendency to express opinions and frequently asking questions when confused. In terms of communication skills, Subject S-02 is able to articulate ideas or information acquired from the problem quite well. In their work, specifically in questions 1 and 4, Subject S-02 is capable of providing complete information. In question 5, Subject S-02 represents the information by rewriting the entire table. According to the interview results, Subject S-02 can express or write down ideas about mathematical problems quite well. They accurately and succinctly document information, although there are instances where Subject S-02 may not write down information, relying on their ability to calculate without revisiting the problem.

Subject S-02 demonstrates proficiency in mathematising by interpreting mathematical symbols to solve problems from question 1 to question 5. In question 1, Subject S-02 successfully translates mathematical symbols to solve the problem, employing the mathematical model of a system of linear equations with two variables to find the values of a and b or the value of U1 and the common difference in an arithmetic sequence. Subject S-02

can solve the problem accurately. However, they do not document the formulas used in solving these problems. Subject S-02 works directly or interprets numerical symbols into their formulaic expressions without writing down the formulas. In question 2, Subject S-02 does not write down the formulas with their symbols. In point b, Subject S-02 struggles to articulate or interpret the mathematical symbols correctly. Moving on to questions 3 and 4, Subject S-02 can use formulas and write down symbols correctly. In question 5, Subject S-02 directly writes down numbers from the interpreted formulas without documenting the formulas. Overall, from question 1 to question 5, Subject S-02 is somewhat incomplete in utilizing the mathematising skill to transform symbols and mathematical models to solve problems. Thus, Subject S-02 has yet to fully harness the mathematising skill.

Subject S-02 exhibits proficiency in creating mathematical models to solve problems in question 1 by presenting a correct and complete model from the system of linear equations with two variables to find the difference or the first term's value. In addressing question 5, Subject S-02 successfully transforms the information from the presented table into mathematical symbols, presenting it in its entirety. Based on interview excerpts, Subject S-02 can construct a mathematical model to solve the problem in question 1 accurately and thoroughly. For question 5, Subject S-02 translates the table results into mathematical symbols completely, rewriting the entire content. In questions 1 and 5, Subject S-02 is valid in fulfilling the representation skill correctly and comprehensively. Moving on to the use of tools, Subject S-02 effectively employs a calculator to streamline calculations, saving time and producing accurate results. Thus, Subject S-02 can meet the skills of representation and using mathematics tools in solving problems.

In the solution for question 1, regarding the skill of devising strategies for solving problems, Subject S-02 has not yet managed to articulate the formulas or plans to be used in solving the problem. However, despite this, Subject S-02 effectively solves the problem. The subject writes down the numerical values directly in the calculation process. Similarly, for question 2, Subject S-02 only writes down the numerical values in the calculations without the appropriate formulas. According to excerpts from the interview, Subject S-02 can explain the steps taken in solving the problem and accurately write down the results. Nevertheless, Subject S-02 does not document the plan or strategy to be used in solving the problem. The subject directly writes down the formulas in the provided working space but does not include them in the answer sheet.

Regarding the use of symbolic language in questions 1 to 5, Subject S-02 can write symbols based on the information given and use them in their solutions effectively, although it may be incomplete. Subject S-02 can accurately use symbols to solve problems and understands the meaning behind the symbols. However, there are instances where some symbols are overlooked, such as in question 1 with the symbol Sn, and in question 2, where the symbols used in the information are not reiterated in the formulas used to solve the problem. In questions 3 and 4, Subject S-02 demonstrates a complete use of mathematical symbols. However, there's a lack of precision in question 4 when stating the unit of length in the solution; Subject S-02 mentions meters instead of centimeters. Similarly, in question 5, Subject S-02 can only mention the symbols used in the information but does not include them in the solution or the formula. From the work and interview excerpts with Subject S-02, it's evident that they can use mathematical language and symbols quite well. However, there's room for improvement in ensuring that all symbols used in the solution are accurately and completely represented in the formulas.

Regarding the ability to argue and reason, Subject S-02 has not yet presented conclusions from the results in their solutions. In question 1a, Subject S-02 writes a conclusion by stating the difference as 500, but apart from question 1a, Subject S-02 does not provide conclusions from the solutions. Subject S-02 has not been able to give a complete and accurate conclusion.

From the work on questions 1 to 5 and the interview results, Subject S-02 has not yet demonstrated the ability to articulate conclusions from the reasoning done. Subject S-02 only writes the final results of the answers, and the conclusion in question 1a is incomplete. According to the interview, Subject S-02 explains that they are often in a hurry to conclude their answers, but in other subjects during exams, Subject S-02 sometimes includes conclusions.

Subject S-03

Subject S-03, in terms of communication skills, is capable of reading and understanding, presenting information in the form of statements in the problem by writing down what is known and what is asked quite well, but it is somewhat incomplete. In general, Subject S-03 is able to read, understand, and present information in the form of statements in the problem by writing down what is known and what is asked, but in question 5, the subject is less detailed. Additionally, from interview quotes and observations with Subject S-03, it is found that Subject S-03 is quite capable of explaining information obtained from the problem and communicating the problem-solving process, but in answering, there is a bit of hesitation and confusion in addressing mathematical problems. Therefore, it can be concluded that Subject S-03 has a fairly good level of numeracy in the communication component.

Mathematising involves the ability to transform problems described based on the real world into mathematical forms or interpret mathematical models into real-world problems. In transforming real-world contexts into mathematical forms, subject S-03 is capable of doing so. S-03 can identify everyday life problems into mathematical sentences, interpret mathematical models, and explain them in interview excerpts. However, in responding, there is no difficulty, but the response is still hesitant and shy. It can be concluded that subject S-03 has good numeracy in the mathematising component.

Representation includes the criteria of being able to present a mathematical problem or object in the form of graphs, tables, pictures, diagrams, equations, formulas, and concrete objects. In presenting a problem, subject S-03 is capable of presenting information from the table provided in the question to find a solution thoroughly and sequentially. The subject can explain information from the table to find a solution more succinctly and confidently answer questions. Additionally, in the use of calculation tools, S-03 can use mathematical calculation tools accurately. It can be concluded that subject S-03 has a very good understanding of the representation and using mathematics tools components.

Devising strategies for solving problems involves the criteria of being able to choose and design plans or strategies using mathematics to solve problems. Subject S-03 is reasonably capable of selecting the right strategy to solve problems and writing down solution formulas quite well, although somewhat incomplete. Subject S-03 is less able to convey the chosen strategy for solving the problem along with the reasons for choosing that strategy, and struggles to determine the formulas to be used in some questions. It can be concluded that subject S-03 has a fairly good understanding of the component of devising strategies for solving problems.

Using symbolic, formal, and technical language, and operations involves the criteria of being able to use mathematical content knowledge and manipulate formulas, functional relationships, and algebraic expressions. In using symbols and algebraic operations, Subject S-03 is reasonably capable of using symbols or algebraic operations to find answers to solve problems, although somewhat incomplete. Nevertheless, in the interview excerpts with Subject S-03, they can convey the solution of algebraic operations in the problem-solving process correctly but with a bit of hesitation in their delivery. It can be concluded that Subject S-03 has a fairly good understanding of the component of using symbolic, formal, and technical language.

The ability in argument and reasoning involves providing reasons for the results of their work or drawing conclusions from the solution to the problem after the process has been carried out. Subject S-03 has not yet been able to write conclusions for each mathematical answer. Additionally, in the interview, Subject S-03 is less capable of providing conclusions and explaining them for each mathematical answer, considering the final result as a conclusion. Not being accustomed to writing conclusions in every mathematical problem-solving and other subjects is one of the reasons for Subject S-03. It can be concluded that Subject S-03 has a less satisfactory understanding of the reasoning and argument component.

Subject S-04

Subjek S-04 is capable of reading and understanding, presenting information in the form of statements in the problem by correctly and completely writing what is known and what is asked. Additionally, from the interview excerpts and observations with Subject S-04, it is evident that Subject S-04 can explain the information obtained from the problem and communicate the problem-solving process, albeit with a bit of hesitation. It can be concluded that Subject S-04 has good numeracy skills in the communication component.

Matematising involves the criteria of being able to transform problems described based on the real world into mathematical form or interpret mathematical models into real-world problems. In transforming real-world context problems into mathematical form, Subject S-04 has not yet been able to identify everyday life problems in mathematical sentences or interpret mathematical models. Subject S-04 is less capable of explaining everyday life problems in mathematical sentences or interpreting mathematical models effectively. In the observation results, Subject S-04 seems a bit hesitant and faces difficulty in explaining and answering questions. It can be concluded that Subject S-04 has numeracy skills in the mathematising component that are not yet satisfactory.

Representation involves the criteria of being able to present a problem or mathematical object in the form of graphs, tables, pictures, diagrams, equations, formulas, and concrete objects. In presenting a problem, Subject S-04 can effectively present information from a table provided in the problem to find specific information in solving the problem efficiently. The subject can explain the information from the table in the problem to find a solution more concisely and confidently answer questions. Additionally, in the use of mathematical tools, Subject S-04 can use mathematical calculation tools accurately. It can be concluded that Subject S-04 excels in the representation and using mathematics tools components.

Devising strategies for solving problems involves the criteria of being able to choose and design a plan or strategy using mathematics to solve problems. Subject S-04 can choose the right strategy to solve problems and accurately and coherently write down the solution formula. The subject can effectively convey the chosen strategy for solving problems along with the reasons for choosing that strategy and clearly articulate the strategy in writing. It can be concluded that Subject S-04 excels in the devising strategies for solving problems component

Using symbolic, formal, and technical language and operations involve the ability to use mathematical content knowledge and manipulate formulas, functional relationships, and algebraic expressions. Subject S-04 can use symbols or algebraic operations in finding answers to solve problems in a coherent manner. Similarly, in the interview quotes, Subject S-04 can convey the solution to algebraic operations in the problem-solving process correctly, albeit with a slight hesitation in delivery. It can be concluded that Subject S-04 has a good understanding of the component of using symbolic, formal, and technical language.

Argument and reasoning involve providing reasons for the results of the work or drawing conclusions from the solution to the problem after the process has been done. Subject S-04 has not yet been able to write conclusions for each mathematical answer. In addition, in the interview results, Subject S-04 has not been able to provide conclusions and explain the

conclusions for each mathematical answer, assuming that the final result is a conclusion. Not being accustomed to writing conclusions in every mathematical problem or other lessons is one of the reasons for Subject S-04. It can be concluded that Subject S-04 has a less effective component in reasoning and argumentation.

Students' Numeracy with Low Self- Regulated Learning

Subject R-01

In the work results of subject R-01 related to communication skills, by writing ideas or information obtained from the problems, from question 1 to question 5, subject R-01 was only able to complete 2 questions. During the post-test, subject R-01 appeared confused and sought help from classmates. Throughout the learning process, subject R-01 was often silent, listened while bowing down. When asked, subject R-01 seemed shy, but he could move to the front of the class to help his friend present their learning activities. Subject R-01 could write information obtained from question 1, but regarding the issues being asked, subject R-01 couldn't articulate them. Subject R-01 only wrote the sentence difference/b, then directly wrote Sn. Moving on to question 2, subject R-01 could write information or ideas from the known problem. Subject R-01 wrote the obtained information completely. For answers to questions 3, 4, and 5, subject R-01 could not answer them. In the interview quotes, subject R-01 has not been able to explain ideas or information obtained well. Subject R-01 only explained what was written, but has not been able to explain in detail and still stammered. Furthermore, for questions 3 to 5, subject R-01 did not complete the work on those problems because of insufficient time and inability to work on them.

Mathematising ability involves the process of translating information into mathematical form based on what is known. In question 1, subject R-01 can write mathematical symbols in the solution, but it is incomplete. In question 2, subject R-01 can use mathematical symbols in the solution correctly and completely. From the work and interview results, subject R-01 can interpret mathematical symbols into formulas and the solution process correctly. However, in questions 3 to 5, subject R-01 did not attempt them, indicating that their mathematising ability is not yet sufficient.

In question 1, subject R-01 has not been able to represent the mathematical model to find the difference and the first visitor. In question 5, subject R-01 did not write the answer, indicating that s ubject R-01 has not been able to represent the table in mathematical form. Additionally, the use of calculation tools by subject R-01 is good. Subject R-01 recalculates their work with a calculator during the interview. In their solution, subject R-01 feels confused about the answer, and they have not been able to read the table provided in the question. Thus, subject R-01 has not been able to represent the table according to question 5. Furthermore, in the use of calculation tools, subject R-01 can use a calculator to solve questions 1 and 2.

In the ability to devise strategies for solving problems by using or writing formulas to plan strategies to solve the problems, subject R-01 has not been able to explain the strategies used to find solutions to the problems in questions 1 and 2. Subject R-01 appears confused and remains silent when asked about the steps in their work. In question 1c, subject R-01 has not been able to write the formula used correctly, while in question 2, they can write the formula correctly. However, in the interview process, subject R-01 has not been able to explain the strategies used in problem-solving. Based on the work and interview results, subject R-01 has not been able to use formulas to devise strategies for solving problems. Subject R-01 has not been able to explain the approach to solving the stated problems. Thus, subject R-01 has not fulfilled the ability to devise strategies for solving problems

From the work of subject R-01 on questions 1 to 5, they only attempted 2 questions, namely questions 1 and 2. For questions 3, 4, and 5, subject R-01 was unable to solve them. While subject R-01 can explain the meaning of symbols used in the given information, they struggle with using symbols to take actions in solving mathematical problems with the appropriate

formulas in question 1a. Furthermore, in question 1c, the subject was unable to use symbols effectively and explain the meaning of these symbols. However, in symbol writing, subject R-01 has not been able to write clearly and accurately.

In question 2, subject R-01 could write symbols but was unable to interpret the meaning of the symbols used to take action in solving the problem accurately. In the interview, subject R-01 couldn't interpret the use of symbols in solving the problem. In questions 1a and 1c, subject R-01 could explain the fifth and ninth terms and their difference symbolized by b, but in the subsequent steps, they were unable to use these symbols to solve the mathematical problem.

During the interview in question 1c, subject R-01 was unable to explain the related formula they wrote. They could mention the formula but lacked precision in interpretation. Furthermore, in question 2, subject R-01 could use symbols to solve mathematically, but they were unable to explain it well. Subject R-01 could only explain the intended value of ar by showing the formula Un. Thus, subject R-01 has not fulfilled the ability to use symbolic language effectively.

From the work of subject R-01 on questions 1 and 2 that have been attempted, subject R-01 has not been able to write or provide a conclusion from the reasons or solutions to the problems. It is evident from the answers of subject R-01 that they only write the final answers directly for questions 1 and 2, with incomplete and unclear explanations. In the initial process of solving, subject R-01 faced difficulties, resulting in their inability to draw conclusions from the problems.

Furthermore, there are no answers for questions 3, 4, and 5 in the problem-solving. From the interview quotes with subject R-01, they have not been able to draw conclusions from the solutions. This is due to a lack of understanding in the initial steps or problem-solving strategies, which ultimately affects the final results and the ability to draw conclusions. Thus, subject R-01 has not fulfilled the ability of argument and reasoning for questions 1 and 2. Additionally, for questions 3, 4, and 5, the subject has not been able to solve the problems, leading to an inability to draw conclusions from these problems.

Discussion

Numeracy demonstrated by high self-directed learners, overall, is able to fulfill all the skills. As stated in the research by Juniansyah, et al (2023), students with high self-directed learning can perform all processes well, influenced by various factors such as intelligence, concentration, motivation, and student interest. In the study by Maksum & Lestari (2020), students with confidence, discipline, initiative, and responsibility in their activities exemplify well-organized self-directed learning, contributing to an improved learning process. In terms of interest and motivation, it is the most significant factor, showing that students take the initiative to learn and seek relevant sources related to the material. According to the research by Ekananda et al. (2020), students with high self-directed learning can comprehend, plan, connect concepts to solve problems in the given questions, and draw conclusions from their answers.

Numeracy exhibited by students with moderate self-directed learning comprises various numeracy skills achieved by the four subjects S-01, S-02, S-03, and S-04. These subjects demonstrate differing abilities in solving problems related to numeracy. In terms of communication skills, all four subjects meet the indicators. Furthermore, in the mathematising ability, they can sufficiently fulfill it well, although there are shortcomings in the mathematising process. Subject S-01 exhibits a lack of mathematising ability in questions 1 and 4, while subject S-02 struggles with mathematising in questions 2 and 5. Overall, after conducting interviews, all four subjects can adequately explain their numeracy skills. However, in Devising Strategies for solving problems and Using Symbolic components, there are deficiencies in expressing answers. Regarding Reasoning and Argument, the four subjects face challenges in utilizing these skills from question 1 to question 5. This is attributed to their

unfamiliarity with drawing conclusions during the solution of everyday mathematical problems and the perceived time constraints. This aligns with Ekananda et al.'s (2020) research, stating that students with moderate self-directed learning make minor errors due to lack of precision and feeling that the allotted time is insufficient, leading them to provide incomplete responses. Additionally, Kholifasari's (2020) study indicates that students with moderate self-directed learning struggle to fulfill all numeracy skills, particularly facing difficulties in devising strategies for solving problems, including challenges with formula usage and symbolic representation.

Students in the low category tend to lack self-directed learning and are accustomed to relying on their peers' answers. They also exhibit low confidence in their abilities, feeling difficulty in learning mathematics, leading to the neglect of problem-solving efforts. According to Charles (Yanuarto & Qodariah, 2020), the absence of self-directed learning in students can result in various behavioral problems, such as shyness, lack of motivation for schooling, and poor study habits. In the initial stages of problem-solving, subjects in the low category are unable to communicate or provide accurate information, resulting in incorrect solutions in subsequent stages. Consequently, other abilities remain unfulfilled. Similarly, research by Yanuarto & Qodariyah (2020) indicates that students with low self-directed learning tend to have poor mathematical literacy or numeracy skills. Additionally, according to Juniansyah (2023) in his study, students with low self-directed learning cannot solve problems requiring planned solutions, rather than just using formulas.

Conclusion

The achievement of students' numeracy in the context of varied student learning independence. Based on the analysis of students' work and interviews conducted, it was found that students in the high and medium categories share the similarity of being able to fulfill the seven skills in numeracy. However, students in the medium category have shortcomings in the results of the given problems; they are less capable in the mathematising and reasoning and argument processes. In the interviews, students were able to explain the mathematising and reasoning and argument processes well, which were not written in their work. Meanwhile, students in the low category are unable to fulfill the seven numeracy skills accurately.

Recommendations

Providing opportunities for students to independently understand the material, allowing them to learn with confidence in solving problems and fostering self-directed learning.A suggestion for further research is to delve deeper into other affective aspects of students in relation to numeracy skills. Because numeracy skills are not only influenced by self-directed learning factors alone.

Limitations

In the questionnaire on self-directed learning and numerical test questions used, they are at the high school level. However, for the reuse of the questions, it is necessary to provide questions according to the school level. Meanwhile, for the reuse of the questionnaire, it can be used and adapted to various levels.

Ethics Statements

The study involving 10th-grade students at SMA N 3 Slawi has been reviewed and approved by the Headmaster of SMA N 3 Slawi. The permission letter is granted by Universitas Negeri Semarang and is documented in the research letter provided by SMA N 3 Slawi.

References

Abidin, Mulyati, Yunansah. (2017) PEMBELAJARAN LITERASI: Strategi Meningkatkan Kemampuan Literasi Matematika, Sains, Membaca dan Menulis. (Strategy to Improve Mathematical Literacy, Science, Reading, and Writing Skills). Jakarta: Bumi Aksara

Baharuddin, M. R., Sukmawati, S., & Christy, C. (2021). Deskripsi Kemampuan Numerasi Siswa Dalam Menyelesaikan Operasi Pecahan.(Description of Students' Numeracy Skills in Solving Fraction Operations). *Pedagogy: Jurnal Pendidikan Matematika*, *6*(2), 90-101. https://e-journal.my.id/pedagogy/article/view/1607/1258

Boney, I. T. (2017). How teaching and learning autonomy can improve the students' ability in mathematics process. Journal of Management and Learning, 4(10), 76-8. https://hal.science/hal-02421636/document

Cheung, S. K., Yang, X., Dulay, K. M., & McBride, C. (2018). Family and individual variables associated with young filipino children's numeracy interest and competence. *British Journal of Developmental Psychology*, *36*(2), 334–353. https://doi.org/10.1111/bjdp.12222

Desmita.2009. Psikologi Perkembangan Peserta Didik. (Developmental Psychology of Learners).Bandung : PT Remaja Rosdakarya

Ekananda dkk. (2020). Analisis Kemampuan Pemecahan Masalah Matematis Ditinjau dari Kemandirian Belajar Siswa. (Analysis of Mathematical Problem-Solving Skills in Terms of Students' Self-Directed Learning) Wilangan, 1(4), 367–382. http://dx.doi.org/10.56704/jirpm.v1i4.10085

Eko, Bambang & Kharisudin, Iqbal. 2010. *Improving The Autodidact Learning of Student On Kalkulus Through Cooperative Learning "Student Teams Acievement Division" By Portofolio Programed.* Jurnal penelitian pendidikan, 27(1) : 78-83. https://doi.org/10.15294/jpp.v27i1.196

Han, W., Susanto, D., Dewayani, S., Pandora, P., Hanifah, N., Miftahussururi, Nento, M. N., & Akbari, Q. S. (2017). Materi Pendukung Literasi Numerasi. In Kementerian Pendidikan dan Kebudayaan. (Supporting Material for Numeracy Literacy. In the Ministry of Education and Culture). TIM GLN Kemendikbud.

Hanushek, E. A., & Woessmann, L. (2008). The role of cognitive skills in economic development. *Journal of economic literature*, *46*(3), 607-668. Standford University

Hendriana, Heris, Euis Eti Rohaeti, dan Utari Sumarmo. 2018. Hard Skills Dan Soft Skills Matematika Siswa. Bandung: PT Refika Aditama.

Iwamoto, D, H., Hargis, J.,Bordner, R., & Chandler, P,. "Self-Regulated Learning as a Critical Attribute for Successful Teaching and Learning". International Journal for the Scholarship of Teaching and Learning*:* 11 (2)

Juniansyah, J., Mariyam, M., & Buyung, B. (2023). Kemampuan Literasi Matematis Siswa Kelas VIII Ditinjau dari Kemandirian Belajar. (Mathematical Literacy Skills of 8th Grade Students in Terms of Self-Directed Learning). *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(2), 1167-1181.

https://doi.org/10.31004/cendekia.v7i2.2224
Kemendikbud. (2017a). Materi Pendukung Literasi Numerasi. (Supporting Material for Numeracy Literacy). Jakarta: Kementrian Pendidikan dan Kebudayaan.
Kemendikbud. (2017b). Panduan Gerakan Literasi Nasional. (Guide to the National Literacy Movement). Jakarta: Kementrian Pendidikan dan Kebudayaan
Kholifasari, R., Utami, C., & Mariyam, M. (2020). Analisis kemampuan literasi matematis siswa ditinjau dari karakter kemandirian belajar materi aljabar. (Analysis of students' mathematical literacy skills in terms of the character of self-directed learning in algebraic material).*Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, *7*(2), 117-125. https://doi.org/10.31316/j.derivat.v7i2.1057
Luyee, E. O., Roselan, F. I., & Anwardeen, N. H. (2015). Suitability of the Literacy and Numeracy Screening (LINUS) 2.0 Programme in Assessing Children's Early Literacy. *Malaysian Online Journal of Educational Sciences*, *3*(2), 36–44.

Machaba, F. M. (2018). Pedagogical demands in mathematics and mathematical literacy: A case of mathematics and mathematical literacy teachers and facilitators. *Eurasia Journal of Mathematics, Science and Technology Education*, *14*(1), 95–108. https://doi.org/10.12973/ejmste/78243

Mahmud, M.R., & Pratiwi, I. M. (2019). Literasi Numerasi Siswa dalam Pemecahan Masalah Tidak Terstruktur**.** (Numeracy Literacy of Students in Solving Unstructured Problems). Kalamatika Jurnal Pendidikan Matematika, 4(1), 69-88. https://doi.org/10.22236/kalamatika.vol4nol.2019pp69-88
Maksum, A., & Lestari, I. (2020). Analisis Profil Kemandirian Belajar Mahasiswa di Perguruan Tinggi.(Analysis of the Profile of Students' Self-Directed Learning in Higher Education). Jurnal Parameter, 32(1), 75–86. https://doi.org/10.21009/parameter.321.05
Malta, I. P. & Jessica, J. H. (2016). Mathematics literacy and contributing to the learning process. Journal of Qualitative Education, 2(3), 245-254
Niklas, F., Cohrssen, C., & Tayler, C. (2016). Parents supporting learning: a non-intensive intervention supporting literacy and numeracy in the home learning environment. *International Journal of Early Years Education*, *24*(2), 121–142. https://doi.org/10.1080/09669760.2016.1155147

Nisa, A. C. (2023). Meningkatkan Kemampuan Numerasi Siswa Melalui Model Problem Based Learning Berbantu Quizizz. **(**Improving Students' Numeracy Skills Through Problem-Based Learning Assisted by Quizizz Model). *Jurnal Educatio FKIP UNMA*, *9*(1), 310-317.
OECD. (2018). Survey International Program for International Student Assessment (PISA). https://www.oecd.org/pisa/publications/PISA2018_CN_IDN.pdf (http://www.oecd.org/pisa), diakses 24 maret 2023
Putri, M., Inayah, F., & Hadiany, D. A. (2022). Analisis Kemampuan Literasi Numerasi Siswa Smp Ditinjau dari Kemandirian Belajar Matematika. (Analysis of Numeracy Literacy Skills of Junior High School Students in Terms of Self-Directed Learning in Mathematics). In *Prosiding Seminar Nasional Pendidikan Matematika (SNPM)* (Vol. 3, No. 1, pp. 196-207)
Rogowsky, B. A., Terwilliger, C. C., Young, C. A., & Kribbs, E. E. (2018). Playful learning with technology: the effect of computer-assisted instruction on literacy and numeracy skills of preschoolers. *International Journal of Play*, *7*(1), 60–80. https://doi.org/10.1080/21594937.2017.1348324

Sugiyono. (2015). Metode Penelitian Pendidikan (Pendekatan Kuantitatif, Kualitatif, dan R&D). *(*Research Methods in Education (Quantitative, Qualitative, and R&D Approaches)).Bandung: Alfabeta.

Tout, D. (2020). *Critical Connections Between Numeracy and Mathematics.* State of Victoria (Department of Education and Training) 2020

Yanuarto, W. N., & Qodariah, L. N. (2020). Deskripsi Literasi Matematis Siswa SMP Ditinjau dari Kemandirian Belajar. (Description of Junior High School Students' Mathematical Literacy in Terms of Self-Directed Learning). *MATH LOCUS: Jurnal Riset dan Inovasi Pendidikan Matematika*, *1*(2), 41-53.