M A T H L I N E
JURNAL MATEMATIKA DAN PENDIDIKAN MATEMATIKA
ISSN 2502-5872 (Print)
ISSN 2622-3627 (Elektronik)

Volume 8 Number 2, May 2023, 641-660

ANALYSIS OF MATHEMATICAL REASONING ABILITY IN TERMS OF MATHEMATICAL SELF-EFFICACY OF MAN 2 PEKANBARU STUDENTS

Masrianti Fadillah[1*], Maimunah Maimunah[2], Nahor Murani Hutapea[3]
[1,2,3]Departement of Mathematics Education, Universitas Riau, Riau Province, Indonesia

*Correspondence: masrianti.fadillah6967@grad.unri.ac.id

ABSTRACT
The mathematical reasoning ability of each student is very important to be able to make them use reasoning in patterns and traits, and perform mathematical tricks to produce valid generalizations, proofs, and statements. The activity of generalizing, proving, and making valid statements requires self-confidence. Confidence is in the form of Self-Efficacy and becomes an internal factor related to mathematical reasoning abilities. describing mathematical reasoning abilities in terms of students' mathematical self-efficacy is the aim of this study using a descriptive qualitative approach. Data collection techniques were questionnaires to measure students' self-efficacy, written tests to measure students' mathematical reasoning abilities, and interviews. The research subjects were 30 students of class XII MAN 2 Pekanbaru. The results of the study found that: (1) 26.67% of students with high mathematical reasoning abilities were accompanied by high or moderate self-efficacy; (2) 56.67% of students with moderate mathematical reasoning abilities are accompanied by high, medium, or low self-efficacy; (3) 16.67% of students with low mathematical reasoning ability are accompanied by moderate or low self-efficacy; (4) 43.33% of students can perform calculations based on certain rules; (5) 76.67% of students can do direct proof; and (6) 75.83% of students can provide valid arguments. It can be concluded that the level of mathematical reasoning ability is not always on the same level as students' self-efficacy, but the best mathematical reasoning ability is always followed by good self-efficacy. So, students' self-efficacy needs to be increased to be able to apply better mathematical reasoning abilities.
Keywords: Analysis of Mathematical Reasoning Abilities, Student Self-Efficacy, Limits of Algebraic Functions

How to Cite: Fadillah, M., Maimunah, M., & Hutapea, N. M. (2023). Analysis Of Mathematical Reasoning Ability in Terms of Mathematical Self-Efficacy of MAN 2 Pekanbaru Students. *Mathline: Jurnal Matematika dan Pendidikan Matematika, 8*(2), 641-660. http://doi.org/10.31943/mathline.v8i2.443

PRELIMINARY

In The 2013 curriculum and the independent curriculum, it is stated that learning mathematics aims to form students' mindsets and mathematical reasoning. Patterns of thinking and mathematical reasoning are part of students' ability to reason. Mathematical reasoning ability can be interpreted as the ability to think by establishing strategies and systematic steps in solving mathematical problems and finally obtaining a valid conclusion based on mathematical concepts that have been found when solving non-routine mathematical problems (Umaroh et al., 2020). The Regulation of the Minister of National Education No. 22 of 2006 also lists the goals of learning mathematics, which include applying mathematical reasoning to patterns and properties, performing mathematical

operations to conclude, gather data, or defend mathematical hypotheses and assertions (Adetia & Adirakasiwi, 2022).

Researchers' observational data and interviews with students and math teachers revealed that students' mathematical reasoning skills could not be fully developed while learning mathematics and that students continued to struggle or hesitate to provide sound arguments or provide direct proof using specific formulas when responding to questions about math that were not commonplace. In addition to mathematics' abstract character, this challenge is brought on by students' mistrust of their mathematical prowess. Due to this circumstance, students experience anxiety when presenting concrete evidence and strong arguments to support their explanations for how to solve a specific math problem. Low student self-efficacy is a result of internal issues, including the students' lack of confidence and fear. Self-efficacy is defined as an individual's self-confidence in his inherent skills and abilities, which have an impact on his success in the learning process. (Adetia & Adirakasiwi, 2022). Mathematics self-efficacy, which is related to studying mathematics, can be defined as a student's self-confidence in the mathematical skills he possesses and has an impact on whether or not he participates successfully in the learning process. Similar claims have been made about how students' self-efficacy can help them accomplish their goals and become one of the factors influencing their learning outcomes in mathematics (Rizkiah et al., 2022 ; Nuraisyah & Izzati, 2020 ; Ririk et al., 2018).

Thus, the self-efficacy that students develop in their mathematical abilities can impact whether they achieve the intended learning outcomes of students in the form of success or failure in learning mathematics (Utami & Wutsqa, 2017). Self-efficacy will have a significant influence on deciding the appropriateness and correctness of students' reasoning (Umaroh et al., 2020). Mathematical self-efficacy also makes a positive contribution and plays an important role in the mathematics learning achievements that can be achieved by students (Simatupang et al., 2020). This is because one of the psychological factors that substantially determines students' performance in completing math tasks is the self-efficacy that students develop based on their mathematical prowess (Jatisunda, 2017).

When students have high categories of mathematical self-efficacy, they will be more motivated to be able to achieve the goals of learning mathematics, and when facing challenges in the form of math assignments, they will choose to survive and try (Hartati et al., 2021). As a result of this significant influence, mathematical reasoning abilities and students' mathematical self-efficacy have a linear relationship. It is well recognized that each student's motivation and approach to task completion varies, and this is related to how

confident they feel about their abilities. Ningsih & Hayati (2020) argued that the differences in self-efficacy for each student were found in three dimensions, namely: (1) Magnitude or level of difficulty of the task. Students have different assessments and attitudes in dealing with mathematical tasks. (2) Generality is closely related to the broad field of behavior. Where a person feels confident in his abilities based on previous experience, (3) strength, regarding the student's self-confidence about the extent to which he believes he can complete the task properly and optimally.

Mathematical reasoning skills and mathematical self-efficacy appear to be closely related, according to several earlier research. The results show that there is a positive association between the two variables: mathematical reasoning ability increases as student self-efficacy increases (Aprisal & Arifin, 2020). Another conclusion indicates that students' learning outcomes in mathematics are positively correlated with their level of self-efficacy in completing math tasks and setting math goals for developing attitudes and reasoning is consistent with the findings (Disai et al., 2018). Mathematical self-efficacy in students plays a significant role as one of the aspects and factors that affect the success of learning mathematics in achieving the objectives of mathematical learning, namely the formation of the thinking and reasoning students need to be able to apply during math learning, sign the existence of a positive relationship produced by the ability to think mathematically and mathematic self-efficacy.

The major goal of this study is to determine the relationship between students' mathematical self-efficacy and their capacity for mathematical reasoning. In research (‘Aini, 2020) it is said that students with high mathematical reasoning abilities have moderate self-efficacy, students with moderate mathematical reasoning abilities have high self-efficacy and students with low mathematical reasoning abilities have low self-efficacy when tested on integer material. In this study, the authors will measure students' mathematical reasoning abilities using algebraic limit function material and review them with student self-efficacy accompanied by searching data through interviews at each level of students' mathematical reasoning abilities. The interviews were aimed at knowing students' self-efficacy verbally in giving opinions on learning mathematics and their own perceived mathematical abilities. later the results of self-efficacy measurements and research interviews will be able to describe students' mathematical reasoning abilities in terms of self-efficacy compared to ability level categories and the interview results found.

METHODS

This research is descriptive qualitative research using case studies and aims to describe students' mathematical reasoning skills in terms of their mathematical self-efficacy. The subjects in this study were 30 students of Class XII MAN 2 Pekanbaru. Data collection techniques in this study were carried out by testing mathematical reasoning abilities, filling out students' mathematical self-efficacy questionnaires, and conducting interviews with 15 students consisting of students with high, medium, and low mathematical reasoning abilities. The first research instrument used was a mathematical reasoning ability test sheet in which the six items had been tested to be valid and reliable, the test results can be seen in Table 1. Instrument Prerequisite Test.

Table 1. Instrument Prerequisite Test

No.	Validity		Reliability		Difference Power	Difficulty Level
	Results	Criteria	Results	Criteria		
1	Valid	Very High	Reliabel	High	Very Good	Difficult
2	Valid	Enough			Pretty Good	Easy
3	Valid	Enough			Pretty Good	Currently
4	Valid	High			Pretty Good	Currently
5	Valid	Enough			Good	Currently
6	Valid	Very High			Very Good	Difficult

Based on Table 1. So, all items are feasible to use and contain questions on the limits of algebraic functions which consist of three indicators of mathematical reasoning ability, namely: perform calculations based on certain rules or formulas; perform direct proof; and develop valid arguments (Hendriana et al, 2017). The second instrument used in this study was a student mathematics self-efficacy questionnaire consisting of 24 statement items, of which there were 12 positive statement items and 12 negative statement items. The dimensions of the students measured are (1) Magnitude with indicators of Difficult in solving problems and Enthusiastic and trying to solve difficult problems; (2) Strength with indicators of Convinced of having good math skills and having the hope of getting good math results with the abilities they have; and last (3) Generalization with indicators Believe it takes a lot of practice to get even better results and Making experience the basis for increasing confidence (Sartika, 2019). The student mathematics self-efficacy questionnaire used has also been tested to be valid and reliable.

The analysis was carried out in this study by analyzing the results of student answers to mathematical reasoning ability questions about the limit of algebraic functions

using the assessment guidelines as presented in Table 2. Mathematical Reasoning Assessment Criteria, as follows.

Table 2. Mathematical Reasoning Assessment Criteria

Skor	Indicator of Mathematical Reasoning
4	Substantially correct and complete answer
3	The Answer contains one significant error or omission
2	Partly correct answers with one or more significant errors or omissions
1	Some answers are incomplete but contain at least one valid argument
0	Incorrect answer based on process or argument, or no response at all

Source: (Sulistiawati et al., 2015)

The items in the Mathematics Self-Efficacy questionnaire that students have filled in will also be analyzed based on the scoring guidelines presented in Table 3. Criteria for Scoring Student Mathematics Self-Efficacy, are as follows.

Table 3. Criteria for Scoring Student Mathematics Self-Efficacy

Score	Positive Statement	Negative Statement
4	Strongly Agree	Strongly Disagree
3	Agree	Disagree
2	Disagree	Agree
1	Strongly Disagree	Strongly Agree

The scores that students get will be summed up, compared to the total score, and multiplied by 100 to get the final score. The final score that has been obtained and processed will then be grouped according to the category of students' mathematical reasoning ability or the category of students' mathematical self-efficacy, as presented in Table 4. The Category of Students' Mathematical Reasoning Ability & Mathematical Self-Efficacy is the following.

Table 4. The Category of Students' Mathematical Reasoning Ability & Mathematical Self-Efficacy

Interval	Category
The Final value ≥ Mean + SD	High
Mean – SD ≤ The Final value < Mean + SD	Medium
The Final value ≤ Mean + SD	Low

Categorization of Mathematical Reasoning Ability and Mathematical Self-Efficacy Students aim to be classified based on their level of mathematical reasoning ability and their mathematical self-efficacy (Sartika, 2019). Thus, it will be seen how the level of students' mathematical reasoning abilities relates to their mathematical self-efficacy.

To complete this research, the last data collection technique to support the results of this research conducted by the author is to conduct interviews with students regarding their views on mathematics learning and mathematics self-efficacy that they feel according to

their own experiences and perceptions. Relevant research will also be published along with the results of the analysis that the author found to provide a clear description related to the analysis of students' mathematical reasoning abilities in terms of their mathematical self-efficacy.

RESULT AND DISCUSSION

Based on the results of students' answers to 6 items of mathematical reasoning ability on the limited material of algebraic functions given, it is known that students have diverse mathematical reasoning abilities, which are presented in Table 5. The Results of the Mathematical Reasoning Ability Analysis are below.

Table 5. Results of Mathematical Reasoning Ability Analysis

Interval	Frequency	Percentage	Category
The Final value ≥ or = 81.67	8	26.67%	High
48.89 ≤ The Final value < 81.69	17	56.67%	Medium
The Final value < 48.89	5	16.67%	Low

In the data presented in Table 5, the results of the mathematical reasoning ability analysis related to the limited problem of algebraic functions show that the test was given to 30 students of class XII MAN 2 Pekanbaru. The results of the mathematical reasoning ability test classify students in the high, medium, or low category of mathematical reasoning ability. It was found that the majority of the mathematical reasoning ability of Class XII MAN 2 Pekanbaru students was in the category of moderate mathematical reasoning ability, consisting of 17 students with a percentage of 56.67%. 8 out of 30 students, or 26.67%, have mathematical reasoning skills in the high category, and 5 students, or 16.67%, have low mathematical reasoning skills. The results of the analysis based on the mathematical reasoning indicators contained in the mathematical reasoning ability test instrument using algebraic function limit questions are presented in Figure 1. The results of the analysis of Mathematical Reasoning Ability Indicators are as follows.

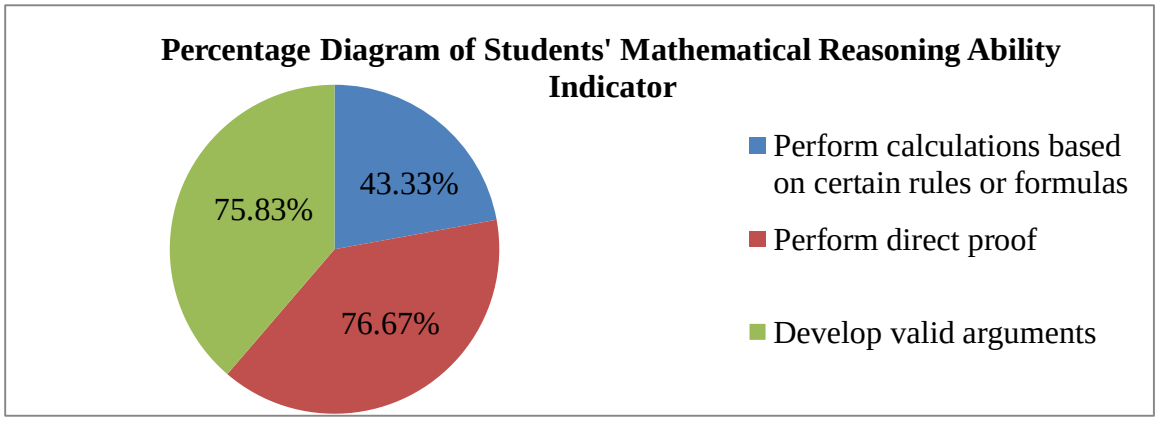


Figure 1. The Results Of The Analysis Of Mathematical Reasoning Ability Indicators

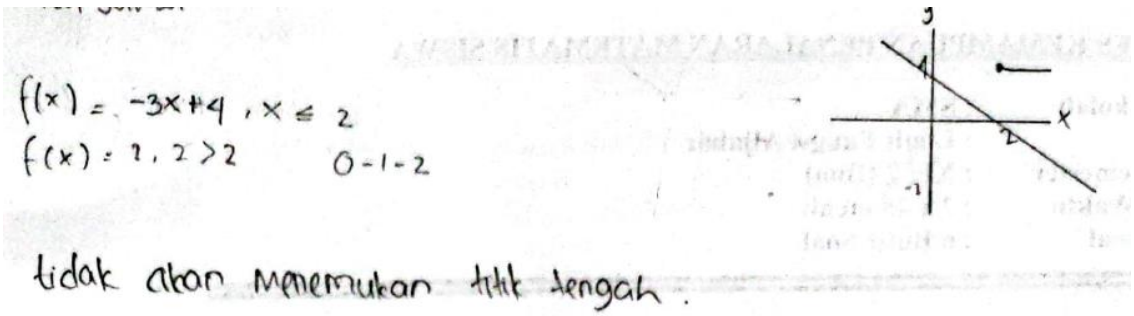
Based on Figure 1. Analysis Results of Mathematical Reasoning Ability Indicators, it is known that the indicator of carrying out mathematical calculations based on certain rules or formulas has a percentage of 43.33%. This percentage is the lowest indicator percentage of the other 2 indicators of mathematical reasoning ability, namely that students can do proof and compile valid arguments. These results conclude that most students still have difficulty solving limit problems of algebraic functions related to calculations using certain formulas or rules, so the popular score in this category is 0, which means that the answers students present are empty or not filled in at all.

In the second indicator based on Figure 1. Results of Analysis of Mathematical Reasoning Ability Indicators, namely carrying out direct proof, it is found that 76.77% of students have succeeded in carrying out direct proof. Especially in question number 2, most students got a perfect score of 4. In this second indicator, it can be said that many students are skilled in mathematical reasoning ability to do direct proof related to the limit problem of algebraic functions. The direct proof that students do is shown through the presentation of graphs, derivation of formulas, and comparing one rule with other mathematical rules to get a final mathematical decision.

As for the third indicator, it was found that 75.83% of students had also succeeded in composing valid arguments. However, in the two questions containing the indicator of constructing valid arguments, most students only got a score of 3 and did not achieve a perfect score. This means that all students have difficulty being able to compile valid arguments correctly without making the slightest mistake.

In Figure 1. The results of the Analysis of Mathematical Reasoning Ability Indicators presented when viewed from the percentage of scores obtained by students as a whole have a percentage score from lowest to highest of 17.8% for score 0, 3.9% for score 1, 8.3% for score 2, 39.4% for score 3, and 30.6% for score 4. The results of such data

explain that there are still many students who find it difficult when applying mathematical reasoning skills, especially in indicators of performing mathematical calculations using certain rules or formulas, and some students still have obstacles to carrying out proof directly or in proposing a valid argument to draw a final mathematical conclusion. The difficulties interpreted by students are, of course, different for each indicator of mathematical reasoning ability. The results of the analysis of the application of indicators of students' mathematical reasoning ability can be analyzed from the way students answer mathematical reasoning ability questions on the material of limit algebraic functions in difficult and easy categories presented in the following figures.



English Version:

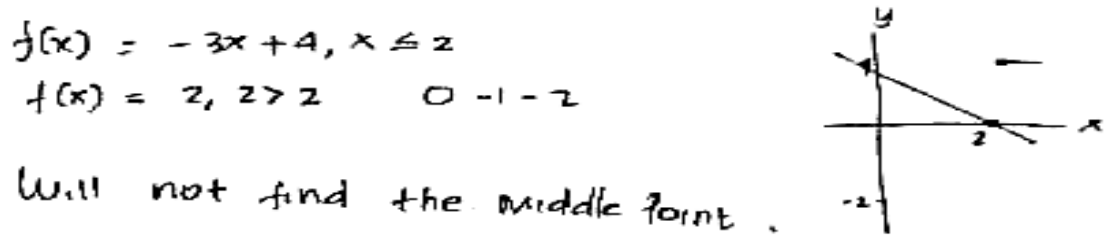


Figure 2. Answers of Students with High Reasoning Ability on Difficult Problems

In Figure 2. Answers of Students with High Mathematical Reasoning Ability on Difficult Problems, it can be seen that students with high mathematical reasoning abilities try to answer the questions by providing valid arguments accompanied by direct evidence. Direct proof is given in order to gain confidence in the correctness of the answers given by students and shows that they are right in solving problems. Based on the results of the interviews, it is known that students are trying to analyze the meaning of the problem and solve it using the knowledge they have previously found, even though the problem is a difficult limit of an algebraic function.

The results of the answers of students with moderate mathematical reasoning ability on difficult problems are presented in Figure 3. below.

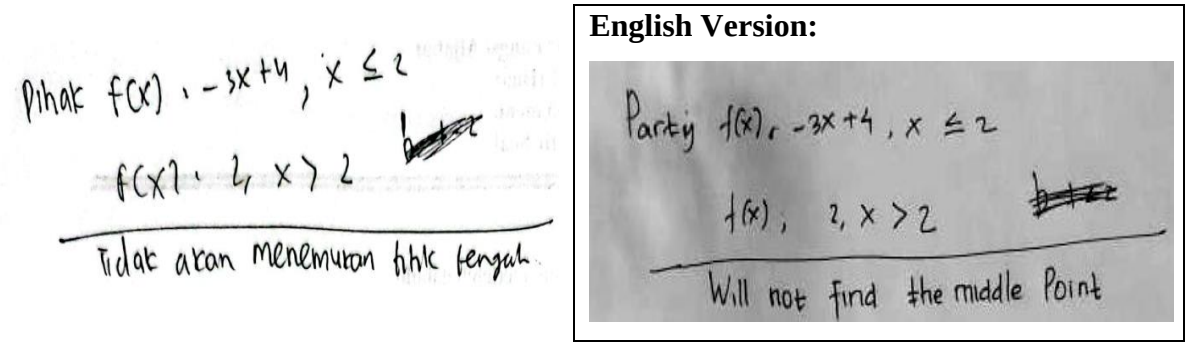


Figure 3. Answers Moderate Reasoning Ability on Difficult Problems

Figure 3. Answers of Students with Moderate Mathematical Reasoning Ability on Difficult Questions demonstrate how students who are capable of using mathematics to reason are attempting to respond to the limit of algebraic functions given by using the knowledge and understanding they have acquired along with an underlying justification. The student answers presented also do not provide direct evidence that underlies their argument. In student answers, there are also streaks in several parts, which can be interpreted as a form of student doubt in answering the given limit of algebraic functions. The doubts felt by the students were justified by the students themselves based on the interview results. In the interview, students with moderate mathematical reasoning ability stated that they had difficulty in stating some answers to the limit problem of algebraic functions due to uncertainty about the formula or argument they gave. The difficulty of proving directly the answer to the limit problem of algebraic functions is also based on the level of difficulty presented by the problem. This makes students unsure of their mathematical abilities and think they need to hone their mathematical skills again by practicing many problems. The difficulty level of the problem fortunately does not make students with moderate mathematical reasoning ability give up, most of them argue that such problems require them to think harder and should not be left blank but must be answered based on their abilities and analysis that they can do.

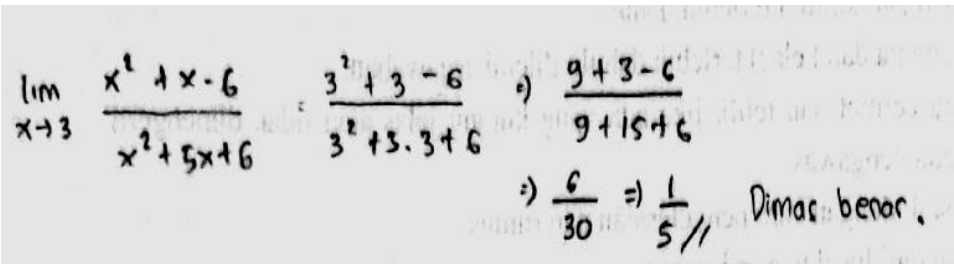
Students who have low mathematical reasoning ability also have characteristics in solving mathematical reasoning problems regarding the given algebraic function limit material. The following are presented the answers of students with low mathematical reasoning ability in answering difficult questions as in Figure 4.

English Version:

2(Yes, It's like that)

Figure 4. Answers of Students with Low Reasoning Ability on Difficult Problems

Based on Figure 4. Answers of Students with Low Mathematical Reasoning Ability on Difficult Problems. It can be seen that students answer as best they can. Students with low mathematical reasoning do not try to find the right or best solution using direct proof or by providing valid arguments supported by certain formulas so that the answers they give are acceptable. Some answers from students with low mathematical reasoning ability also look empty or deliberately ignore difficult problems related to the limited material of algebraic functions. Based on the results of the interview, it is known that the reason students deliberately leave blank answers is because of the difficulty of the problems given and their ignorance of how to answer them, such as formulas or how to solve them. The students also feel too dizzy to think about the solution, even though there is still working time provided. In the end, students with low mathematical reasoning ability only fill in the answers to difficult problems in a makeshift manner, seem haphazard, or choose not to work on them at all. It is evident that in the difficult problem of the limit of algebraic functions presented, many students' answer sheets are filled in blank and only present the numbering of the problem without containing any mathematical problem-solving.



English Version:

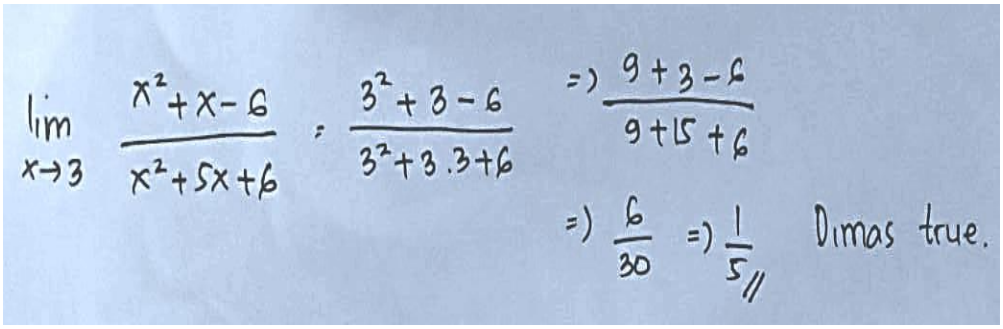
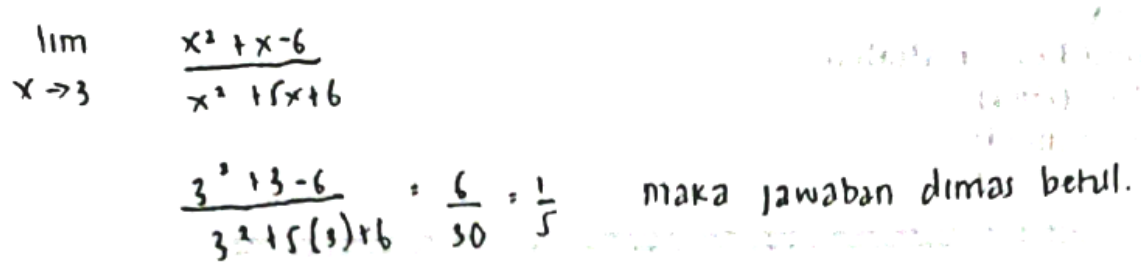


Figure 5. Answers with High Mathematical Reasoning Ability on Easy Problems

Analyzing Figure 5. Student Answers with High Mathematical Reasoning Ability on Easy Problems concludes that students whose mathematical reasoning ability is high when answering easy questions are correct and get a score of 4. Students whose mathematical reasoning ability is high in answering easy questions are carried out by fulfilling each indicator of mathematical reasoning ability, namely performing calculations with certain formula rules, in this case, the limit of algebraic functions, and providing valid arguments accompanied by direct proof. No problems or obstacles were felt when determining how to solve this easy algebraic function limit problem by students with high mathematical reasoning ability. The results of observations and interviews also found that students were confident in the answers they gave and had no problem explaining the origin of the answer to reach a valid conclusion.



English Version:

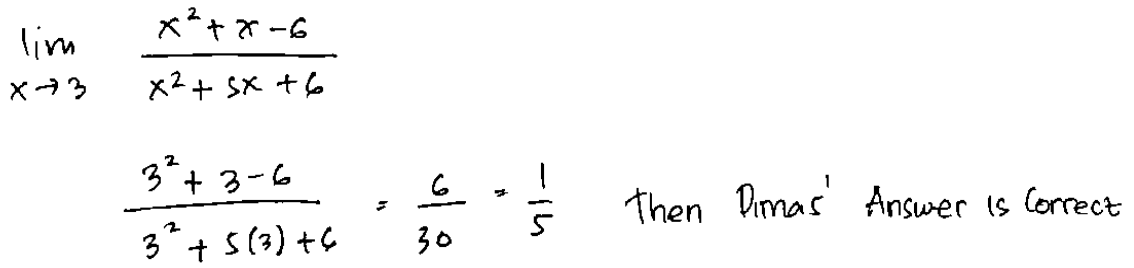


Figure 6. Answers of Students with Moderate Reasoning Ability on Easy Problems

Analyzing the results of students' answers with moderate mathematical reasoning abilities on easy questions as presented in Figure 6. shows that the answers given by students are not much different from those given by students who have high mathematical reasoning ability. Students with moderate mathematical reasoning ability have also been able to perform calculations with certain formula rules, in this case, the limit of algebraic functions, and provide valid arguments accompanied by direct proof. It's just that in this answer, students tend to skip some calculation steps or jump over the operation stages. The interview results also found that students with moderate mathematical reasoning ability did not find obstacles in solving easy algebraic function limit problems. After understanding

the meaning of the question, they can immediately answer it by first linking it to the knowledge they have regarding the limit of algebraic functions.

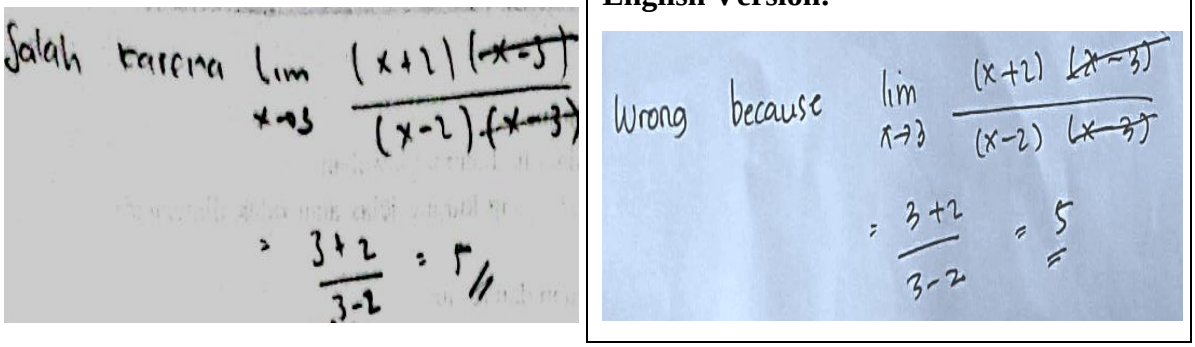


Figure 7. Answers of Students with Low Reasoning Ability on Easy Problems

The results of the answers of students with low category mathematical reasoning ability on easy questions with limited algebraic function material and presented in Figure 7. obtained a score of 1. This is because the arguments given by students are not valid and students are wrong in using certain formulas or rules for the limit of algebraic functions. These errors make it difficult for students with low mathematical reasoning ability to provide direct proof. This difficulty is felt by students with low mathematical reasoning ability because of the concept of limit that they have not understood and the many limit rules that make them dizzy and lazy to think about it. The interview results also found student's statements in the form of their dislike for mathematics because of things like this, namely the answers they gave were always wrong.

The results of the analysis of student's answers to the limit problem of algebraic functions to measure students' mathematical reasoning skills can be concluded that students' mathematical reasoning skills still experience obstacles and difficulties in realizing them. The obstacles and difficulties experienced by students include the level of difficulty of the problem, the inability to answer by finding the right formula, doubts in providing valid arguments, and not being able to do direct proof. Difficult problems have the effect of different attitudes displayed by students, namely being enthusiastic or giving up to work on and find solutions to their mathematical problems. Doubts in providing valid arguments relate to students' lack of confidence in their mathematical abilities. This uncertainty makes some students ignore difficult problems in the limit of mathematical algebraic functions and get low results. Students' doubts in answering, lack of effort to solve problems, and ignoring difficult problems are internal factors that affect students' mathematical reasoning skills regarding students' mathematical Self-Efficacy. Based on the

Self-Efficacy questionnaire items that students have answered, the following results are obtained.

Table 6. Results Of Self-Efficacy Analysis Of Students' Mathematics

Interval	Frequency	Percentage	Category
The Final value ≥ 77.44	5	16.67%	High
59.25 ≤ The Final value < 77.44	19	63.33%	Sedang
The Final value < 59.25	6	20%	Low

Based on Table 6. Results of Student Self-Efficacy Analysis can be seen that only 16.67% or 5 out of 30 students have high mathematics selfefficacy. The rest, 63.33% or 19 students have moderate math Self-Efficacy, and 20% or 6 students have low math Self-Efficacy. In simple terms, it can be concluded that the majority of students in class XII MAN 2 Pekanbaru have a moderate level of mathematics Self-Efficacy. The results of the analysis of students' mathematics Self-Efficacy indicators are presented in Table 7.

Table 7. Results of Analysis of Students' Mathematics Self-Efficacy Indicators

Dimensions	Indicators	Percentage	Average
Magnitude	Difficult in solving problems	45%	50.84%
	Enthusiastic and trying to solve difficult problems	56.67%	
Strength	Convinced of having good math skills	39.17%	44.17%
	have the hope of getting good math results with the abilities they have	49.17%	
Generalization	Believe it takes a lot of practice to get even better results	63.33%	62.08%
	Making experience the basis for increasing confidence	60.83%	

Based on Table 7. Results of the Analysis of Student's Mathematical Self-Efficacy Indicators found that the Magnitude dimension has a percentage of 45% related to students' recognition of the difficulty in doing math tasks, and 56.67% of students will be enthusiastic and think hard in solving difficult or easy math tasks. The average for the Magnitude dimension is 50.84%. In the Strength dimension, 39.17% of students believe they have good enough math skills and 49.17% of students have hopes that their math skills will make them able to solve math problems even better, so the average in the strength dimension is 44.17%. In the Generalization dimension, it was found that 63.33% of students believed that they would get better results when they often practiced and studied harder, and 60.83% of students believed that the practice and study they had done so far helped improve their mathematics skills.

However, based on interviews, there were also comments from students who felt that they were not good at math at all, so whether they studied or not they would have the

same low results. Their attitude toward learning mathematics as a result exhibits hesitation, discontent, and laziness. This statement was also confirmed by the mathematics teacher who taught them. This statement is in contrast to students who are known to be smart and are recognized by mathematics teachers as having good mathematical abilities; namely, learning mathematics that they do at school and practicing it at home will help them improve their math skills. Even these students are not afraid to present themselves and confidently give the mathematical solution proposed by the teacher. They also do not hesitate to discuss difficulties and obstacles during mathematics learning with the mathematics teacher so that they can understand learning better.

Thus, it can be realized that students' mathematical self-efficacy affects how they behave and act when faced with math problems and how they generate and optimize their mathematical abilities, including exploring their reasoning power. Analyzing students' mathematical reasoning abilities and reviewing them with students' mathematical self-efficacy found a comparison as presented in Table 8. Analysis of criteria for mathematical reasoning abilities and students' mathematical self-efficacy. The following.

Table 8. Analysis of criteria for mathematical reasoning abilities and self-efficacy

Mathematical Reasoning Ability	*Self-Efficacy*	Frequency	Total
High	High	3	8
	Medium	5	
Medium	High	2	17
	Medium	13	
	Low	2	
Low	Medium	1	5
	Low	4	
Total		**30 Students**	

In Table 8. Analysis of Criteria for Mathematical Reasoning Ability and Students' Mathematical Self-Efficacy, it can be seen that students with high mathematical reasoning abilities totaled 8 students, with 3 students having high category mathematical self-efficacy and 5 students having moderate mathematical self-efficacy. Another result is that students with high mathematical reasoning abilities do not have low mathematical self-efficacy. This is because students' high mathematical reasoning abilities give them good confidence in their mathematical abilities. So the mathematical self-efficacy possessed by students with high mathematical reasoning abilities gives birth to motivation, tenacity, persistence, and an attitude of never giving up on solving math problems. This statement is justified by (AR, et al., 2022) who have shown that studying student self-efficacy is essential,

particularly while learning mathematics, to prevent pupils from ignoring issues they perceive to be difficult.

Table 8. Analysis of Criteria for Mathematical Reasoning Ability and Student Self-Efficacy also presents that of the 17 students with medium mathematical reasoning abilities, 2 have high mathematical self-efficacy, 13 are in the medium category, and 2 are in a low category. In simple terms, it can be concluded that 17 Students with medium mathematical reasoning skills often have medium mathematical self-efficacy. This concludes that the student's mathematical reasoning abilities that they display are in tune with the mathematical self-efficacy they have. In other words, students with medium mathematical ability to reasoning perpetually struggle and needed to develop their mathematical reasoning skills so that they no longer experience doubts or worries while completing some mathematical activities that need high-level thinking.

As for analyzing the mathematical reasoning abilities of low-category students by reviewing students' mathematical self-efficacy from Table 8. Analysis of Criteria for Mathematical Reasoning Ability and Students' Mathematical Self-Efficacy found that 5 students had mathematical reasoning abilities in the low category, including having moderate mathematical self-efficacy as much as 1 student and having low category mathematics self-efficacy for 4 people. It can be concluded that students with low mathematical reasoning abilities also tend to have low mathematical self-efficacy. This creates fear in students and lowers their self-confidence when facing problems related to mathematics (Tatiriah et al., 2017). Therefore, it is not surprising to hear that some students continue to avoid and even seem to ignore learning mathematics. They lack the desire and enthusiasm to learn mathematics as a result of their low mathematical reasoning abilities. Because their self-efficacy is also low, students do not take advantage of the teacher's help, namely asking the teacher when they have difficulty learning mathematics. They feel it won't help either because their math results are still low. Consequently, some of these children decide to do their homework by surfing the internet or copying the results of their peers.

Analyzing students' mathematical reasoning abilities and reviewing students' mathematical self-efficacy shows that each student's mathematical reasoning abilities produce and are built with different mathematical self-efficacy. As it is known, students with high reasoning abilities have high or moderate mathematical self-efficacy. Students with moderate mathematical reasoning abilities have high, medium, or low categories of mathematical self-efficacy. As for students who have low-category mathematical reasoning

abilities, they have moderate or low-category mathematical self-efficacy. This means that not all students who have high mathematical reasoning abilities also have high mathematical self-efficacy, as found by other researchers. Therefore, mathematical self-efficacy is not always a reference for the level of mathematical reasoning ability because there are students who have low mathematical self-efficacy but have good mathematical reasoning abilities (Nurussalamah & Marlina, 2022).

Based on the previous statement, mathematical self-efficacy is not always a reference for concluding the level of mathematical reasoning ability, but mathematical self-efficacy still influences the level of students' mathematical reasoning ability. The effect is that it can raise and train students' mathematical reasoning abilities. This influence is felt in how students behave and try to overcome difficult situations, such as math assignments (Zakiyah et al., 2018). For students with high categories of Self-efficacy mathematics will result in the emergence of self-confidence in the abilities that exist within them to be able to do something to achieve success. In contrast, students with low math self-efficacy will have the perception that they are not able to do all the tasks that exist during the process of learning mathematics (Monika & Adman, 2017). The proof is that students with high mathematical self-efficacy are in the high category or have good learning outcomes and mathematical reasoning abilities. This is because students who can optimize self-efficacy in themselves will try more optimally to deal with difficulties when learning mathematics, which requires a lot of effort, perseverance, and calmness to complete the task (‘Aini, 2020).

Students who have high Self-Efficacy will better prepare themselves to study well to obtain good learning outcomes as well (Wahdaniah et al., 2017). When compared to students with low self-efficacy, who have comprehension difficulties or cannot find the proper formula for mathematical modeling, students with high self-efficacy are better able to comprehend problems thoroughly and plan and apply problem-solving strategies effectively (Imaroh et al., 2021). Thus, one of the elements that have a significant impact on math behavior is mathematics self-efficacy. This behavior affects students' perspectives on studying mathematics and develops their mathematical skills (Auliya & Munasiah, 2016). It is not unexpected that kids who have high levels of self-efficacy also have high levels of confidence in their aptitude for mathematics. This notion developed as a result of their perception that completing math issues presented challenge for them. They can because they pay attention to the teacher's explanation and repeat the activity at home. When students run into challenges with math, they don't afraid about asking the teacher for

help. They have a strong conviction that mathematics always finds a solution to its issues. These results prove Somakim's statement, that is, that students who have good self-efficacy will have independence, work hard, and always try not to give up easily when solving a math problem (Auliya & Munasiah, 2016).

Students with self-efficacy are in the middle category when solving difficult questions, and they don't give up easily but create a feeling that they need to study harder to hone their abilities. The self-efficacy that they have requires them to find other strategies for improving their abilities, meaning that mathematical self-efficacy can be linked to the ability to set strategies for solving problems (Kurnia et al., 2018).

Students with low self-efficacy have displeasure with the math assignments given. They tend to leave out difficult math problems. Many students with low math self-efficacy say that their math results are not satisfactory enough, even though they have studied before. They also feel that they are not good at math. Such attitudes and feelings make their self-efficacy low compared to their abilities and cause students to develop an attitude of indifference and reluctance to learn (Wahyuningtyas & Febrianingsih, 2018). According to the findings of student interviews, many students feel that mathematics is the most difficult subject to understand because it requires strong thinking. In addition, it can be seen that the majority of children perceive mathematics as a challenging and frightening topic (Muhsana & Diana, 2022). However, the ability to trust in oneself to finish answering difficult math problems is something that pupils should have (Rahmawati et al., 2021).

Such belief can renew and maximize students' mathematical abilities. As mentioned, self-efficacy is a strong factor in influencing students' mathematics learning outcomes (Ningsih & Hayati, 2020). This statement is relevant to the results of research conducted by Lestari and friends that the presence of mathematical self-efficacy in students of IT IQRA High School Bengkulu City, SMA Negeri 11 Bengkulu City, and Idhata High School Bengkulu City has a direct effect on students' mathematical reasoning abilities (Lestari et al., 2022). Mathematical reasoning abilities will also increase when students' self-efficacy is increased, so they will not avoid doing math assignments (Hadiat & Karyati, 2019). This can be proven by the data found that 8 students with high mathematical reasoning abilities have high or moderate Self-Efficacy, meaning that difficulties in the problem will be encouraged to find a solution strategy. Meanwhile, 5 students who have a low dominant category of mathematical reasoning ability have low self-efficacy, which results in them losing motivation and confidence in their ability to find solutions to solving math tasks.

The results of this study are different from the research conducted (‘Aini, 2020) which found that high mathematical reasoning abilities have moderate self-efficacy, moderate mathematical reasoning abilities have high self-efficacy, and low mathematical reasoning abilities have low self-efficacy. Comparing the results of Aini's research with the results of this study it was found that (1) the majority of students with high mathematical reasoning abilities had moderate self-efficacy due to the opinion that there was still a lot of mathematical material that they did not understand well, (2) the majority of students with low mathematical reasoning abilities also have low math self-efficacy, and (3) students with high mathematical reasoning abilities have high or moderate self-efficacy, in this study, the majority have moderate math self-efficacy.

CONCLUSION

Based on the analysis carried out oin this study, it was found that: (1) the mathematical reasoning ability of students in class XII MAN 2 Pekanbaru the majority category is medium or equal; (2) students with high mathematical reasoning abilities have high or medium mathematical self-efficacy; (3) students with mathematic reasoning abilities are likely to have medium-sized mathematical self-efficacy; and (4) students who have low-category mathematical reasoning abilities tend to have low mathematical self-efficacy.

Thus, the student's mathematical reasoning ability is not necessarily equal to the self-efficacy of mathematics that the student possesses, due to different experiences and environments, but for students who have a good ability to mathematically reason along with having good mathematical self-efficacy. This research is limited to mathematical reasoning abilities in terms of students' mathematical self-efficacy. many other affective assessments can be measured as a review of students' mathematical reasoning abilities, such as self-anxiety, fear, and others that can be used as further research so that students' mathematical reasoning abilities can be measured even better as an effort to help maximize students' abilities.

REFERENCES

‘Aini, L. Q. (2020). Analisis Kemampuan Penalaran Matematis Siswa Ditinjau Dari Self-Efficacy Siswa SMP Kelas VII. *JURNAL E-DuMath*, *6*(1), 30–39. https://doi.org/10.52657/je.v6i1.1162

Adetia, R., & Adirakasiwi, A. G. (2022). Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Self-Efficacy Siswa. *Jurnal Educatio FKIP UNMA*, *8*(2), 526–536.

https://doi.org/10.31949/educatio.v8i2.2036

Aprisal, A., & Arifin, S. (2020). Kemampuan Penalaran Matematika Dan Self-Efficacy Siswa SMP. *Delta: Jurnal Ilmiah Pendidikan Matematika*, *8*(1), 31-40. https://doi.org/10.31941/delta.v8i1.945

AR, R. A., Arifin, S., & Aprianti, A. (2022). Pengaruh Kemampuan Penalaran Matematis dan Self-Efficacy Terhadap Hasil Belajar Matematika Siswa. *Jurnal Eduscience*, 9(3), 759-771. https://jurnal.ulb.ac.id/index.php/eduscience/article/view/3436/2770

Auliya, R. N. (2016). Hubungan Antara Self-Efficacy, Kecemasan Matematika, Dan Pemahaman Matematis. Pasundan Journal of Mathematics Education Jurnal Pendidikan Matematika, 6(2), 81-90. https://doi.org/10.23969/pjme.v6i2.2655

Disai, W. I., Dariyo, A., & Basaria, D. (2018). Hubungan Antara Kecemasan Matematika Dan Self-Efficacy Dengan Hasil Belajar Matematika Siswa Sma X Kota Palangka Raya. *Jurnal Muara Ilmu Sosial, Humaniora, dan Seni*, *1*(2), 556-568. https://doi.org/10.24912/jmishumsen.v1i2.799

Hadiat, H. L., & Karyati, K. (2019). Hubungan Kemampuan Koneksi Matematika, Rasa Ingin Tahu Dan Self-Efficacy Dengan Kemampuan Penalaran Matematika. *Jurnal Riset Pendidikan Matematika*, *6*(2), 200–210. https://doi.org/10.21831/jrpm.v6i2.26552

Hartati, I., Suciati, I., & Wahyuni, D. S. (2021). Pengaruh Efikasi Diri Terhadap Hasil Belajar Matematika Meta Analisis. *Guru Tua: Jurnal Pendidikan Dan Pembelajaran, 4(2),* 49-56. https://doi.org/10.31970/gurutua.v4i2.74

Hendriana, H., Rohaeti, E. E., & Sumarmo, U. (2017). *Hard Skill dan Soft Skills Matematik Siswa*. PT Refika Aditama.

Imaroh, A., Umah, U., & Asriningsih, T. M. (2021). Analisis Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Self-Efficacy Siswa Pada Materi Sistem Persamaan Linear Tiga Variabel. JPMI (Jurnal Pembelajaran Matematika Inovatif), 4(4), 843-856. http://dx.doi.org/10.22460/jpmi.v4i4.p%25p

Jatisunda, M. G. (2017). Hubungan Self-Efficacy Siswa SMP dengan Kemampuan Pemecahan Masalah Matematis. *Jurnal THEOREMS (The Original Research of Mathematics)*, *1*(2), 24–30. http://dx.doi.org/10.31949/th.v1i2.375

Kurnia, R. D. M., Mulyani, I., Rohaeti, E. E., & Fitrianna, A. Y. (2018). Hubungan Antara Kemandirian Belajar dan Self Efficacy Terhadap Kemampuan Komunikasi Matematis Siswa SMK. *JIPMat*, *3*(1), 59–64. https://doi.org/10.26877/jipmat.v3i1.2183

Lestari, G. P., & Haji, S. (2022). Pengaruh Self Efficacy, Disposisi Matematis, dan Koneksi Matematis Terhadap Kemampuan Penalaran Matematis Peserta Didik. *Didactical Mathematics*, 4(2), 399-412. https://doi.org/10.31949/dm.v4i2.3538

Monika, M., & Adman, A. (2017). Peran Efikasi Diri Dan Motivasi Belajar Dalam Meningkatkan Hasil Belajar Siswa Sekolah Menengah Kejuruan. *Jurnal Pendidikan Manajemen Perkantoran*, *2*(2), 219-226. https://doi.org/10.17509/jpm.v2i2.8111

Muhsana, N., & Diana, H. A. (2022). Pengaruh Kecemasan Matematika Terhadap Kemampuan Penalaran Matematis Berbasis Soal Pisa. *Jurnal Pendidikan Matematika Universitas Lampung*, *10*(1), 41–52. https://doi.org/10.23960/mtk/v10i1.pp41-52

Ningsih, W. F., & Hayati, I. R. (2020). Dampak efikasi diri terhadap proses dan hasil belajar matematika. *Journal on Teacher Education*, *1*(2), 26–32. https://journal.universitaspahlawan.ac.id/index.php/jote/article/view/514

Nuraisyah, M., & Izzati, N. (2020). Self - Efficacy pada Hasil Belajar Peserta Didik Materi Bentuk Aljabar Madrasah Tsanawiyah Tanjungpinang. *Jurnal Pendidikan Matematika RAFA*, *6*(2), 100–108. https://doi.org/10.19109/jpmrafa.v6i2.5453

Nurussalamah, A., & Marlina, R. (2022). Kemampuan Penalaran Matematis Siswa Ditinjau Dari Self-Efficacy Pada Materi Relasi dan Fungsi. JPMI (Jurnal

Pembelajaran Matematika Inovatif), 5(5), 1255-1268. https://doi.org/10.22460/jpmi.v5i5.1255-1268

Rahmawati, A., Lukman, H. S., & Setiani, A. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Ditinjau dari Tingkat Self-Efficacy. *EQUALS: Jurnal Ilmiah Pendidikan Matematika*, *4*(2), 79–90. https://doi.org/10.46918/equals.v4i2.979

Ririk, N., Sulistyaningsih, M., & Kumesan, S. L. (2022). Pengaruh Kepercayaan Diri dan Kecemasan Matematika Terhadap Hasil Belajar Siswa Di SMP Negeri 2 Tondano. *ADIBA: JOURNAL OF EDUCATION*, 2(3), 441-451. https://adisampublisher.org/index.php/adiba/article/view/165/167

Rizkiah, I., Sarjana, P., & Negeri, U. (2022). Hubungan Antara Kemampuan Penalaran Matematis dan Self-Efficacy Pada Materi Teorema Pythagoras. *Delta : Jurnal Ilmiah Pendidikan Matematika*, *10*(2), 355–366. http://dx.doi.org/10.31941/delta.v10i2.1806

Sartika, E.S. (2019). Peningkatan Kemampuan Pemacahan Masalah Matematis dan Keyakinan Diri Siswa Melalui Model Pembelajaran Investigasi Kelompok di SMA Negeri 2 Bangkinang Kota. [*Skripsi*, Universitas Islam Riau]. https://alumni.uir.ac.id/online/detail/156411172/620101bd4f6b8

Simatupang, R., Napitupulu, E., & Asmin, A. (2020). Analisis Kemampuan Pemecahan Masalah Matematis Dan Self-Efficacy Siswa Pada Pembelajaran Problem Based Learning. *Paradikma: Jurnal Pendidikan Matematika*, *13*(1), 29–39. https://doi.org/10.24114/paradikma.v13i1.22944

Sulistiawati, S., Suryadi, D., & Fatimah, S. (2015). Desain Didaktis Penalaran Matematis untuk Mengatasi Kesulitan Belajar Siswa SMP pada Luas dan Volume Limas. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *6*(2), 135-146. https://doi.org/10.15294/kreano.v6i2.4833

Tatiriah, Cahyono, E., & Kadir. (2017). Peningkatan Kemampuan Penalaran Matematik dan Self Efficacy Siswa SMA melalui Penerapan Pendekatan Problem Posing. *Jurnal Pendidikan Matematika*, *8*(2), 129–139. https://dx.doi.org/10.36709/jpm.v8i2.5981

Umaroh, S., Yuhana, Y., & Hendrayana, A. (2020). Pengaruh Self-Efficacy Dan Kecemasan Matematika Terhadap Kemampuan Penalaran Matematis Siswa Smp. *Wilangan: Jurnal Inovasi dan Riset Pendidikan Matematika*, 1(1), 1-15. http://dx.doi.org/10.56704/jirpm.v1i1.7971

Utami, R. W., & Wutsqa, D. U. (2017). Analisis kemampuan pemecahan masalah matematika dan self-efficacy siswa SMP negeri di Kabupaten Ciamis. *Jurnal Riset Pendidikan Matematika*, *4*(2), 166-175. https://doi.org/10.21831/jrpm.v4i2.14897

Wahdaniah, W., Rahman, U., & Sulateri, S. (2017). Pengaruh Efikasi Diri, Harga Diri Dan Motivasi Terhadap Hasil Belajar Matematika Peserta Didik Kelas X SMA Negeri 1 Bulupoddo Kab. Sinjai. *MaPan*, *5*(1), 68–81. https://doi.org/10.24252/mapan.2017v5n1a5

Wahyuningtyas, N., & Febrianingsih, L. (2018). Pengaruh Self Efficacy Dan Motivasi Terhadap Hasil Belajar Matematika Siswa. *JP2M (Jurnal Pendidikan Dan Pembelajaran Matematika)*, *4*(1), 38-46. https://doi.org/10.29100/jp2m.v4i1.1777

Zakiyah, S., Imania, S. H., Rahayu, G., & Hidayat, W. (2018). Analisis Kemampuan Pemecahan Masalah Dan Penalaran Matematik Serta Self-Efficacy Siswa SMA. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *1*(4), 647-656. https://doi.org/10.22460/jpmi.v1i4.p647-656