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# Adversity Resilience and Self-Regulation on Students' Mathematical Competence in Elementary Schools

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***ABSTRAK***

*Terdapat berbagai masalah dalam pembelajaran matematika di kalangan siswa. Salah satu masalah utama adalah adanya pandangan yang berbeda-beda di antara individu terkait dengan kesulitan mata pelajaran matematika. Penelitian ini bertujuan untuk menganalisis resiliensi dan regulasi diri terhadap kompetensi matematika siswa. Jenis penelitian ini adalah penelitian survei kausal dengan teknik analisis SEM (Structural Equation Modeling). Sampel penelitian sebanyak 153 siswa yang ditentukan dengan rumus slovin dan dipilih secara acak. Data resiliensi dan regulasi diri dikumpulkan melalui angket, sedangkan data kompetensi matematika dikumpulkan melalui tes. Data dianalisis dengan analisis SEM. Hasil temuan yaitu resiliensi dan regulasi diri berpengaruh terhadap kompetensi matematika. Resiliensi berpengaruh positif terhadap kompetensi matematika siswa. Regulasi diri berpengaruh positif terhadap kompetensi matematika siswa. Resiliensi berpengaruh positif terhadap regulasi diri siswa. Kesimpulan penelitian ini yaitu ketahanmalangan dan regulasi diri berpengaruh terhadap kompetensi matematika siswa. Implikasi penelitian dapat memberikan kontribusi terhadap pembelajaran matematika yaitu pentingnya upaya peningkatan kompetensi matematika melalui peningkatan penguasaan tindakan yang tepat akan berdampak pada pencapaian kompetensi matematika siswa yang lebih optimal.*

**ABSTRACT**

There are various problems among students when learning mathematics. One of the main problems is that individuals have different views regarding the difficulty of mathematics subjects. This research aims to analyze the resilience and self-regulation of students' mathematical competence. This type of research is causal survey research with SEM (Structural Equation Modeling) analysis techniques. The research sample consisted of 153 students, determined using the Slovin formula and selected randomly. Resilience and self-regulation data were collected through questionnaires, while mathematics competency data were collected through tests. Data were analyzed using SEM analysis. The findings show that resilience and self-regulation influence mathematical competence. Resilience has a positive effect on students' mathematical competence. Self-regulation has a positive impact on students' mathematical competence. Resilience has a positive effect on students' self-regulation. This research concludes that resilience and self-regulation influence students' mathematical competence. The research implications can contribute to mathematics learning, namely the importance of increasing mathematical competence through growing mastery for appropriate actions, which will impact achieving more optimal mathematical competence in students.

## 1. INTRODUCTION

The learning process is an effort made to change the behavior and attitudes of individuals through interaction with their environment. Over time, this process has become the education system's main foundation, aiming to provide good and optimal learning outcomes to each student. The success of a student is often measured by the level of his knowledge, which is expected to create individuals who are intelligent, innovative, creative, and have good character. Education is the main means in this learning process, becoming a container that forms and hones the potential of each individual. The purpose of education is not only limited to increasing knowledge but also includes the development of critical thinking skills, creativity, and moral character (Muktamar, 2023; Sumandya & Widana, 2022). This process involves interaction between teachers and students, as well as interaction between students and their

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classmates. The learning environment plays an important role in shaping students' character and personality (Primayana et al., 2019). Students are expected to gain significant knowledge through the educational process. This knowledge is the basis for developing individual abilities and potential. Ideally, good learning outcomes will positively impact the students, society, and the nation. Education is directed at creating individuals who can contribute maximally to the development and progress of the country (Yaniariza et al., 2022). The importance of the learning process in achieving educational goals must be addressed. This process includes transferring knowledge from teacher to student and forming character and positive attitudes. Students are expected to develop interpersonal skills, adaptability, and a sense of responsibility towards themselves and their environment. Therefore, teachers are key in guiding students toward achieving learning goals. The success of an education system can be measured by the effectiveness of the learning process implemented in it. Teachers must be able to identify students' learning styles and present learning materials using appropriate methods (Magdalena & Luthfiyah, 2020). Learning must also be designed to motivate students to participate and actively develop an interest in the subject matter (Mega & Faisal Madani, 2023; Wibowo et al., 2022). Teacher creativity is needed in packaging information into an interesting form of learning, which is very necessary. However, the learning process is not solely the responsibility of the teacher. Students also have an active role in responding to the learning process. They need to be motivated and aware of the importance of education for their future. Student involvement in learning includes cognitive, emotional, and social aspects. Thus, the learning process becomes a collaboration between teachers and students to achieve optimal results. Creating a conducive learning environment is also a determining factor in the success of the learning process. An environment that supports creativity and innovation and creates a sense of security and comfort for students will contribute positively to their motivation and interest in learning (Lisnawati et al., 2023). Therefore, the role of schools and all elements of education in creating a good learning atmosphere should be addressed.

Achievement of educational goals can be met from knowledge competencies in each material load, one of which is mathematical knowledge competency. Competence is the ability of individuals to carry out work or tasks in a field (Ayu et al., 2023; Septiana et al., 2023). Knowledge has been known to gain new understanding, learning, and experience (Juniantari et al., 2023). Mathematics is an exact science that influences and can improve an individual's thinking ability to solve problems and apply them in everyday life (Fadhilah et al., 2020; Panduwinata et al., 2023). So mathematical knowledge competence is a combination of knowledge and skills mastered by someone built to develop and improve thinking skills, behavioral patterns, or actions carried out by someone as well as possible. It is important to realize that studying mathematics requires high accuracy to get the correct results. In this context, mathematics is not just an ordinary subject; it reflects a person's intelligence. However, the reality shows various problems among students in learning mathematics. One of the main problems is the existence of different views among individuals regarding the difficulty of this subject. As a discipline, most students often consider mathematics challenging. Some may have difficulty understanding complex mathematical concepts, while others may feel that mathematics is difficult. These differences in views can arise due to differences in each individual's thinking and learning styles. However, along with the difficulties that some students may face, it must be recognized that mathematics should be able to be used as a fun subject. Making mathematics interesting and challenging is the key to changing students' views on this subject. Mathematics should not only be understood as a collection of theories and formulas but as a life skill that can be applied in various everyday situations (Maulida, 2023).

The solution to overcome these problems is to make mathematics interesting. It is not an easy task, but it is very important. Teachers have a significant role in creating inspiring and fun mathematics learning. By presenting creative and interactive teaching methods, teachers can help students see mathematics as an interesting challenge rather than just a burden to overcome. In addition, the use of technology in mathematics learning can also make a big contribution to making the material more interesting. Software applications, simulations, and math games can help students to understand mathematical concepts more visually and interactively. This motivates students and opens up opportunities to understand the real-world applications of the mathematical concepts they are learning. The importance of making mathematics more applicable must be addressed. Relating mathematical material to real-world situations can help students see the relevance and usefulness of their learning concepts. This will improve their understanding of mathematics and motivate them to learn more. Effective mathematics education must also consider the differences in students' learning styles. Every individual has a different way of learning, and an inclusive learning approach can help reach all students regardless of the level of difficulty they experience. Providing additional support, whether through personal tutoring or additional learning resources, can help students better cope with their difficulties. In this regard, collaboration between teachers, students, and parents is essential. Teachers can act as facilitators who guide students to find learning methods that suit their needs (Jumrawarsi & Suhaili, 2020;

Sari et al., 2023). On the other hand, students need to actively communicate with teachers regarding the obstacles or difficulties they face in understanding mathematics material. Parents also have a role in providing moral support and motivation to their children to stay motivated in learning mathematics. By realizing the importance of making mathematics a positive learning experience, it can be expected that students will not only master mathematical concepts well but also be able to apply them in everyday life. Effective mathematics education not only creates students proficient in calculations and formulas but also forms individuals with logical, critical, and applicable thinking in living their lives.

Most individuals assume that to gain knowledge, a person must have a high (IQ) and also have (EQ) because both play a role (Hari, 2020). In addition, other factors affect students' mathematical knowledge. These factors include resilience and self-regulation. Resilience is the soul of an individual because, with resilience, a person can survive in facing all the problems in his life and assess that problems are opportunities, not obstacles (Suhendri & Ningsih, 2018; Winaya, 2021). Students' resilience makes them strong in all obstacles they encounter in learning. So, resilience is generally an individual's ability to face difficulties, misfortunes, and unwanted circumstances. However, each person's resilience varies in learning and can affect the individual's knowledge competence. In education, student knowledge is influenced by one factor, namely resilience, because resilience is a fighting attitude that a person has (Dewi & Antara, 2021; Hari, 2020). The work and life of a person who becomes successful is influenced by resilience. Self-regulation is needed if it relates to how to face difficulties because how an individual positions himself to achieve goals is called self-regulation. Self-regulation that students have can help students control emotions, thoughts, and actions to achieve goals. Students who know themselves and know how to learn well are said to be able to regulate themselves (Hari, 2020). With individuals' self-regulation, individuals become more planned and focused in taking steps to start something, which can be made easier in its implementation (Qistia et al., 2019; Sagitarini et al., 2023). The self-regulation process also continues until the goal is achieved. Both factors play a role in learning mathematics. If students are resilient in learning, they will focus on regulating their emotions and behavior to achieve goals in mathematical knowledge. Previous research findings stated that resilience and self-regulation influence students' mathematical knowledge competence (Hari, 2020). Resilience and self-regulation positively and significantly impact mathematics learning outcomes (Sagitarini et al., 2023). Adversity resilience directly and significantly affects mathematics learning achievement, so if a student has a high level of mental resilience, they are likely to achieve better mathematics learning achievement. Meanwhile, self-regulation also directly and significantly affects mathematics learning achievement. Students' ability to organize and manage themselves well can improve their mathematics learning achievement. Previous studies' results have shown an influence between adversity resilience and self-regulation on students' mathematical knowledge competence. The similarities between the research results and the research carried out are the assessment of independent variables, namely adversity resilience, and self-regulation, while the differences are that the research subjects used fifth-grade elementary school students, and the analysis technique used multiple linear regression techniques. This study analyzes the influence of adversity resilience and self-regulation on students' mathematical competence.

## 2. METHOD

The research method used in this study is a causal survey method with SEM (Structural Equation Modeling) analysis techniques. This study aims to analyze complex relationships between variables. The analysis aims to determine the relationship between factors that influence mathematical competence according to previous facts without providing a treatment to control the variables that have been owned by the research subjects fairly. The population taken in this study were all public elementary schools in Gugus III, North Kuta, North Kuta District. After knowing the population, the research sample was taken using the proportional sampling technique. The selection of proportional sampling was carried out randomly with a lottery system after determining the minimum number of samples needed to represent the population. The study was conducted at seven public elementary schools included in Gugus III North Kuta in North Kuta District, Badung Regency, namely SDN 1 Kerobokan, SDN 2 Kerobokan SDN, 3 Kerobokan, SDN 4 Kerobokan, SDN 1 Kerobokan Kaja SDN 2 Kerobokan Kaja and SDN 3 Kerobokan Kaja. The data collection methods used in collecting research data are test and non-test techniques. The test technique is used to collect research data on the mathematics competency variable in the form of 10 essay questions, each scored in a weighting of 1-5. The non-test technique used in this study is using a questionnaire. The questionnaire is used to collect research data from the variables of resilience and self-regulation. Test the instrument before use to determine its quality so that it is suitable for use. Testing for non-test instruments in the form of questionnaires is carried out through content validity tests, internal stability tests, and reliability tests.

In contrast, the mathematics test instrument is carried out through content validity tests, internal stability tests, discriminatory power tests, difficulty level tests, and reliability tests. Content validity is a stage of internal validity testing through testing the feasibility or relevance of the instrument content with rational analysis by the assessment. Internal Stability Test is a stage of external validity testing. Validity testing is a test carried out to determine the level of accuracy or precision of a test used to measure what is intended to be measured. Reliability testing refers to the consistency of scores or answers obtained or given by respondents (testees) from one test implementation time and another. Discriminatory power is a measurement of the ability of a question item to distinguish students who have mastered the competency from those who have not. The difficulty level test is a test of each question item to determine the difficulty of the question based on the number of respondents who answer correctly. A good question is a question that could be more challenging and easier. The results of the content validity test are known for all items in the self-regulation resilience questionnaire, and the mathematics test instrument can be used in the external instrument trial stage with each content validity test value of 1.00 and is classified as very high. The results of the internal stability test are known for the resilience questionnaire. All statement items are declared valid, 30 statement items, the self-regulation questionnaire, six statement items are declared invalid, and the number of statement items for the self-regulation instrument is declared valid is 30 statement items. The mathematics test is obtained that all question items are declared valid, namely ten questions. The reliability test results are known for the resilience and self-regulation questionnaires, which obtained results of 0.94 and are classified as reliable with a very high category. The mathematics test obtained results of 0.81 and is classified as reliable with a very high category. The results of the discrimination power test obtained all the math test questions are classified as very good classification. The math test question difficulty level test results are known to be four items in the easy category, four in the medium category, and two in the difficult category. The instrument grid is presented in Table 1, Table 2, and Table 3.

**Table 1.** Mathematical Knowledge Instrument

| Element | Learning Outcomes |
|---|---|
| Analyzing various Numbers, Algebra, Measurement, Geometry, and Data Analysis and Probability. | Students can demonstrate an intuitive understanding of numbers (number sense)<br>Students can fill in unknown values in a mathematical sentence related to addition, subtraction, multiplication, and division of whole numbers.<br>Students can determine the circumference and area of various flat shapes (triangles, quadrilaterals, and polygons)<br>Students can construct and decompose spatial shapes (cubes, cuboids, and their combinations)<br>Students can sort, compare, present, and analyze many objects and measurement data. |

**Table 2.** Disaster Resilience Instruments

| Dimension | Indicator |
|---|---|
| Control | Dapat mengkondisikan keadaan yang menimbulkan kesulitan |
| Origin and ownership | Pengendalian diri yang tinggiterhadap kesulitan |
| | Memiliki semangat dalammenghadapi kesulitan |
| Reach | Dapat menemukan asal – usul kesulitan dan mencari sebab dari kesulitan tersebut |
| | Berani mengakui bertanggung dan atas jawab masalah yang dilakukan |
| | Dapat membatasi jangkauankesulitan dalam kehidupan |
| | Tetap berdaya dan Tidak Kewalahan |
| Control | Menunjukkan daya tahan terhadap masalah |
| | Optimis dan selalu memiliki Keyakinan |

**Table 3.** Self-Regulatory Instrument

| Dimension | Indicator |
|---|---|
| Metacognitive | Having a plan |
| | Having a goal |
| | Being able to organize yourself |
| | Being able to evaluate yourself |
| Motivation | Having a passion and desire to succeed |
| Behavior | Ownership and Environmental Management |

The data in the study were analyzed using descriptive statistical analysis and SEM (Structural Equation Modeling) analysis using the Lisrel program. Descriptive data analysis in the form of calculating data centralization measures, namely mean (M), median (Me), mode (Mo), and standard deviation (SDi), which are processed to be presented in the form of a frequency distribution table. SEM (Structural Equation Modeling) analysis is based on evaluating the existence of interdependent relationships between variables (Putri et al., 2021). SEM is a statistical tool that simultaneously analyzes latent variables, indicators, and measurement errors (Puspitasari & Jannah, 2021). SEM is included in multivariate dependency statistics that allows the analysis of one or more independent variables with one or more dependent variables. This study uses SEM, which is based on evaluating the existence of interdependent relationships between research variables. In analyzing SEM using Lisrel, assumptions that underlie its use are needed, namely the Normality Test and the Classical Assumption Test (Normality and Linearity Assumptions, Outliers Assumptions, and Multicollinearity Assumptions). After testing the assumptions, the next step is the SEM analysis modified by Gunarto (2018) and Sujarweni (2018). The steps of SEM analysis are Formulating Hypotheses, Making SEM Diagrams, Model Identification, Model Estimation, Model Evaluation, and Interpretation.

## 3. RESULT AND DISCUSSION

### Result

The study results showed that the Y3 dimension was at the highest level, with an average value of 3.57. Respondents viewed Mathematics Competence (Y) primarily from the Y3 dimension. The average Mathematics Competence (Y) average of 3.50 is in the high category. This indicates that respondents consider Mathematics Competence (Y) to be high. Analysis of the mathematics competency variable (Y) description in Table 4.

**Table 4.** Descriptive Analysis of Mathematics Competence Variables (Y)

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| Y1 | 153 | 2 | 5 | 3.49 | 0.70 |
| Y2 | 153 | 2 | 5 | 3.45 | 0.71 |
| **Y3** | **153** | **2** | **5** | **3.57** | **0.80** |
| Y4 | 153 | 2 | 5 | 3.48 | 0.71 |
| **Average** | | | | **3.50** | |

The analysis of the resilience variable (X1) description shows that the X3 dimension is at the highest level, with an average value of 3.61. This means that respondents view Resilience (X1) primarily from Dimension X3. The overall average value of Resilience (X1) of 3.58 is in the high category, indicating that respondents consider resilience (X1) high. The analysis of the resilience variable (X1) description is in Table 5.

**Table 5.** Descriptive Analysis of the Disaster Resilience Variable (X1)

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| X1 | 153 | 2 | 5 | 3.59 | 0.69 |
| X2 | 153 | 2 | 5 | 3.56 | 0.74 |
| **X3** | **153** | **2** | **5** | **3.61** | **0.68** |
| X4 | 153 | 2 | 5 | 3.58 | 0.69 |
| **Average** | | | | **3.58** | |

Analysis of the self-regulation variable (X2) description shows that dimensions X5 and X6 are at the highest level, with an average value of 3.59. This means respondents see Self-Regulation (X2) primarily from Dimensions X5 and X6. The overall average Self-Regulation (X2) value of 3.58 is high. This indicates that respondents consider self-regulation (X2) to be high. Analysis of the self-regulation variable (X2) description in Table 6. Before the hypothesis test, a prerequisite test was conducted, including the Classical Assumption Test, the Outliers Assumption Test, the Normality Test, and the Multicollinearity Test. The outlier analysis in Table 7 showed no pl and p2 values below 0.001. Thus, it can be concluded that the data can be carried out at the next stage. The results of the normality test analysis of the data used in the study in Table 8 show that the data has no value greater than ± 2.58, so the data is normal. The

results of the multicollinearity test analysis in Table 9 showed no multicollinearity among the independent variables. Thus, it can be concluded that there is no multicollinearity between resilience and self-regulation.

**Table 6.** Descriptive Analysis of Self-Regulation Variables (X2)

| Descriptive Statistics | | | | | |
|---|---|---|---|---|---|
| | **N** | **Minimum** | **Maximum** | **Mean** | **Std. Deviation** |
| X5 | 153 | 2 | 5 | 3.59 | 0.69 |
| X6 | 153 | 2 | 5 | 3.59 | 0.70 |
| X7 | 153 | 2 | 5 | 3.58 | 0.71 |
| **Average** | | | | **3.58** | |

**Table 7.** Outliers Evaluation Results

| Observation number | Mahalanobis d-squared | p1 | p2 |
|---|---|---|---|
| 110 | 39,516 | 0,000 | 0,007 |
| 152 | 35,966 | 0,000 | 0,000 |
| 11 | 35,858 | 0,000 | 0,000 |
| 82 | 35,434 | 0,000 | 0,000 |
| 70 | 35,231 | 0,000 | 0,000 |
| 30 | 34,467 | 0,000 | 0,000 |
| 69 | 33,287 | 0,000 | 0,000 |
| 80 | 32,319 | 0,001 | 0,000 |
| 67 | 32,132 | 0,001 | 0,000 |
| 64 | 30,059 | 0,002 | 0,000 |
| 9 | 26,822 | 0,005 | 0,000 |
| . | . | . | . |
| . | . | . | . |
| . | . | . | . |
| 124 | 7,273 | 0,777 | 1,000 |

**Table 8.** Normality Test Results

| Variable | min | max | Skew | c.r. | kurtosis | c.r. |
|---|---|---|---|---|---|---|
| Y4 | 2.000 | 5.000 | -.256 | -1.295 | -.309 | -.781 |
| Y3 | 2.000 | 5.000 | -.415 | -2.095 | -.255 | -.643 |
| Y2 | 2.000 | 5.000 | -.021 | -.106 | -.321 | -.809 |
| Y1 | 2.000 | 5.000 | -.157 | -.792 | -.406 | -1.026 |
| X5 | 2.000 | 5.000 | -.329 | -1.662 | -.370 | -.934 |
| X6 | 2.000 | 5.000 | -.431 | -2.176 | -.225 | -.568 |
| X7 | 2.000 | 5.000 | -.270 | -1.362 | -.432 | -1.091 |
| X4 | 2.000 | 5.000 | -.053 | -.267 | -.308 | -.777 |
| X3 | 2.000 | 5.000 | -.370 | -1.867 | -.094 | -.238 |
| X2 | 2.000 | 5.000 | -.235 | -1.188 | -.310 | -.784 |
| X1 | 2.000 | 5.000 | -.162 | -.818 | -.373 | -.941 |
| **Multivariate** | | | | | **53.840** | **19.690** |

**Table 9.** Multicollinearity Test Results

| No. | Variable | *Tolerance Score* | VIF Score | Description |
|---|---|---|---|---|
| 1 | Resilience | 0,964 | 1,037 | No multicollinearity |
| 2 | Self-Regulation | 0,964 | 1,037 | No multicollinearity |

The first hypothesis test in Table 10 obtained a parameter estimate value of 0.478. The results of the test of the relationship between Resilience (X1) and Mathematical Competence (Y) showed a probability value (P) = 0.000 and a C.R value of 5.613. Based on these results, the first hypothesis is accepted, so it can be interpreted that there is a significant and positive influence between Resilience (X1) and Mathematical Competence (Y). The positive estimate coefficient indicates a positive relationship between the two, meaning that higher Resilience (X1) results in higher Mathematical Competence (Y) and

vice versa. The second hypothesis test in Table 10 obtained a parameter estimate value of 0.353. The results of the test of the relationship between Self-Regulation (X2) and Mathematical Competence (Y) showed a probability value (P) = 0.000 and a C.R value of 4.191. Based on these results, the second hypothesis is accepted, so it can be interpreted that there is a significant and positive influence between Self-Regulation (X2) and Mathematical Competence (Y). The positive estimated coefficient indicates a positive relationship between the two, meaning that higher Self-Regulation (X2) results in higher Mathematical Competence (Y) and vice versa. The third hypothesis test in Table 10 obtained a parameter estimate value of 0.867. The results of the test of the relationship between Resilience (X1) Affecting Self-Regulation (X2) showed a probability value (P) = 0.000 and a C.R value of 12.884. Based on these results, the third hypothesis is accepted, so it can be interpreted that there is a significant and positive influence between Resilience (X1) and Affecting Self-Regulation (X2). The positive estimated coefficient indicates a positive relationship between the two, meaning that higher Resilience (X1) results in higher Self-Regulation (X2) and vice versa.

**Table 10.** Direct Effect Hypothesis Testing

| Hypothesis | Independent Variable | Dependent Variable | Path Coefficient | | | |
|---|---|---|---|---|---|---|
| | | | Std'ize | C.R. | *P-value* | Description |
| $H_1$ | Adversity Resilience (X1) | Mathematics Competence (Y) | 0.478 | 5.613 | *** | significant |
| $H_2$ | Self-Regulation (X2) | Mathematics Competence (Y) | 0.353 | 4.191 | *** | significant |
| $H_3$ | Adversity Resilience (X1) | Self-Regulation (X2) | 0.867 | 12.884 | *** | significant |

**Discussion**

The first finding shows that resilience and mathematical competence have a significant and positive influence. There are several significant and positive influences between resilience and mathematical competence. First, resilience includes psychological aspects that enable students to face challenges better (Dewi & Antara, 2021; Nurtanto et al., 2020). Students with a high level of resilience tend to be more confident and do not give up easily when faced with difficulties understanding complex mathematical concepts. Second, resilience can also strengthen motivation to learn mathematics(Caesarani et al., 2022). Students with good resilience will have an internal drive to continue learning and trying to understand the mathematics material (Kartika et al., 2021; Wati, 2022). Mistakes are opportunities to learn and improve, not obstacles that stop their journey in developing mathematical competence. Third, resilience can improve students' ability to cope with stress and pressure when facing exams or math assignments (Sagitarini et al., 2023). Students with strong resilience can manage their emotions well and be more focused and calm when facing mathematics evaluation situations (Sri et al., 2021). Fourth, resilience can also strengthen students' social relationships in the context of learning (Wiguna, 2020). Students who can interact positively with classmates and teachers tend to have a supportive learning environment where they can help each other and collaborate in understanding difficult math concepts (Sulaiman et al., 2021). Fifth, resilience can help students develop more flexible and creative thinking patterns in solving mathematical problems (Wijayanti & Suendarti, 2020).

They are more open to various learning approaches and strategies so they can optimize their cognitive potential in mastering mathematical competence. Overall, resilience significantly impacts students' mathematical competence, involving psychological and motivational skills, coping with stress, social relationships, and creative thinking skills. Improving resilience can improve mathematics learning outcomes and develop students' cognitive skills. The second finding shows that self-regulation and mathematical competence have a significant and positive influence. The significant and positive influence between self-regulation and mathematical competence is due to several aspects. First, the ability to regulate oneself, including time management and task planning, can improve the effectiveness of learning mathematics (Fatimah et al., 2023). Students who manage their time well can pay sufficient attention to learning mathematics, allocate time for practice, and avoid procrastination, thus helping to gain a deeper understanding of mathematical concepts (Septian et al., 2020). Second, self-regulation includes controlling emotions and motivation (Putrie, 2021; Zielińska et al., 2022). Students who manage math-related stress or anxiety are more motivated to learn (Kharisma & Safitri, 2023). Students with a strong internal drive to achieve their mathematics goals are likelier to persist in facing difficulties and develop better mathematics competence. Third, self-regulation also includes monitoring and evaluating learning progress (Harahap,

2023). Students who can critically assess their understanding of mathematical concepts will be better able to identify areas that require additional attention (Mega & Faisal Madani, 2023).

Effective monitoring can change their learning strategies and direct their efforts to improvement areas. Fourth, the ability to self-regulate also includes good study habits. Students with good self-regulation tend to be more consistent in carrying out their study routines, such as doing exercises, reading study materials, and seeking help when needed (DLT et al., 2022). This consistency can result in gradual improvements in mathematical competence over time. Fifth, self-regulation can increase students' persistence in facing mathematical challenges (Hasmalena et al., 2023; Lestari et al., 2023; Zielińska et al., 2022). Students who can motivate themselves and have the ability to stay focused on their academic goals tend to have an easier time getting through the difficulties of understanding complex mathematical concepts (Panduwinata et al., 2023). To improve mathematical competence, developing self-regulation becomes an important aspect of learning strategies. Promoting self-regulation skills through educational approaches can contribute positively to students' achievement in mathematics. The third finding shows that resilience and self-regulation have a significant and positive influence. The significant and positive influence between resilience and self-regulation is due to several aspects. First, resilience can provide a strong psychological basis for someone to develop effective self-regulation (Ayu et al., 2023; Lestari et al., 2023). Students with high levels of resilience tend to better cope with pressure and stress, allowing them to focus better on academic tasks, including self-regulation in learning (Ramadhani et al., 2023). Second, resilience to adversity can strengthen intrinsic motivation, a key component of self-regulation (Pratiwi & Sinaga, 2022). Students with good resilience have an internal drive to achieve their goals, including academic goals such as improving math skills. This motivation can catalyze better self-regulation, such as managing time and monitoring learning progress (Qistia et al., 2019). Third, resilience helps form adaptive mindsets (Wijayanti & Suendarti, 2020).

Students with high resilience tend to have more flexible attitudes towards challenges and failure (Mubarok, 2023; Nabillah & Abadi, 2020; Pratiwi & Sinaga, 2022). This can help them develop adaptive self-regulation, where they can continuously learn from experience and evaluate and improve their learning strategies. Fourth, resilience can affect students' ability to adapt to changing learning environments (Suhendri & Ningsih, 2018; Winaya, 2021). Students who are resilient to adversity may be more open to changes in teaching methods, assessments, or classroom environments, which may strengthen their self-regulatory abilities to adapt to new demands (Tuz Sa'diyah et al., 2021). Fifth, resilience to adversity can also strengthen the social aspects of self-regulation (Dewi & Antara, 2021; Manurung et al., 2021). Students who are resilient to adversity tend to have better social relationships, which can positively impact their self-regulation (Terry, 2020). Through interactions with peers and social support, students can better understand effective self-regulation strategies and provide mutual encouragement to achieve academic goals (Hasmalena et al., 2023).

Thus, resilience and self-regulation mutually reinforce each other, creating a supportive learning environment and enhancing students' ability to cope with mathematics tasks and other academic challenges. Enhancement of resilience can be a key factor in promoting the development of positive and sustainable self-regulation. The findings of this study contribute significantly to understanding the relationship between resilience and self-regulation and students' mathematics competence. The implications of these findings for the development of related scientific fields are the increasing awareness of the importance of psychological and motivational factors in mathematics learning. In this context, this study highlights that resilience and self-regulation are important in strengthening students' mathematics competence. First, the findings show that resilience positively impacts mathematics competence through students' psychological, motivational, and coping skills with stress, social relationships, and creative thinking skills. This suggests that psychological and motivational factors play a significant role in mathematics learning, influencing students' academic achievement. Thus, this study broadens understanding of non-academic factors influencing mathematics learning outcomes. Second, the findings also highlight the importance of self-regulation in enhancing students' mathematics competence. Self-regulation plays a key role in managing time, emotions, and motivation, monitoring learning progress, developing good study habits, and increasing persistence in facing mathematics challenges. By emphasizing the importance of self-regulation in mathematics learning, this study leads to a better understanding of how students can develop effective learning strategies to improve their academic achievement. This study also has limitations that need to be considered. One of the main limitations is that this study may have limitations in the generalizability of the results because it focuses on a specific sample or population. In addition, this study may need to identify other factors that may influence students' mathematics competence in depth. Based on these limitations, there are several recommendations for future research. First, further research can expand the scope of the sample to include various learning contexts and student backgrounds. This can help gain a more comprehensive understanding of the

relationship between resilience, self-regulation, and mathematics competence. In addition, future research can also use a mixed methods approach to combine quantitative and qualitative data to gain a deeper understanding of the mechanisms underlying the relationship between these variables. Thus, these recommendations can help broaden and deepen our understanding of the factors influencing students' mathematics learning and achievement.

## 4. CONCLUSION

The study results indicate that resilience and self-regulation affect students' mathematical competence, there is a significant and positive effect between resilience and students' mathematical competence, and there is a significant and positive effect between self-regulation and students' mathematical competence. In the learning process in the classroom, teachers should consider factors that affect students' mathematical problem-solving abilities, such as resilience and self-regulation. For learning to be effective, classroom learning activities should encourage increased resilience and self-regulation because their increase also contributes to increased students' mathematical problem-solving abilities.

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