

Literature Study: The Role of Resilience on Students' Mathematics Learning Achievement

Rista Faradila¹, Andi Kusumayanti², A. Sriyanti³, Lisnasari Andi Mattoliang⁴

^{1,2,3,4} Universitas Islam Negeri Alauddin Makassar

Email: a.sriyanti@uin-alauddin.ac.id

ABSTRACT

This study examines the influence of mathematical resilience on mathematics learning achievement by conducting a literature review of 30 articles, covering 12 international journals and 18 national journals, published between 2018 and 2025. The analysis shows that mathematical resilience has a direct impact through persistence, adaptation, and problem-solving, and an indirect impact through motivation, self-regulation, and social support. Students with high resilience can maintain concentration, innovation, and perseverance when facing learning challenges, both in person and online, while strengthening critical thinking, collaboration, and innovation skills. Support in learning and social interactions has been shown to strengthen mental resilience, thus influencing mathematics achievement. This research highlights the importance of enhancing resilience through reflective, collaborative, problem-solving approaches and pedagogical interventions based on teacher support, the environment, and interactive media. Strengthening mathematical resilience not only promotes academic achievement but also shapes students who are strong, creative, and able to adapt to both academic and everyday life challenges.

Keywords: *Mathematical Resilience, Learning Achievement, Self-Regulation, Collaboration, Problem Solving*

1) INTRODUCTION

Mathematics is a fundamental science that plays a crucial role in developing students' logical, analytical, and systematic thinking skills. By studying mathematics, students are equipped with critical thinking skills and logical problem-solving skills. Minister of Education and Culture Regulation No. 58 of 2014 emphasizes that mathematics plays a role in improving scientific thinking skills and serves as a foundation for the advancement of science and technology. However, in reality, a number of students still face challenges in understanding mathematical concepts due to various factors, both cognitive and non-cognitive (Diri, 2023; Iman, 2019). Therefore, mathematics must pay attention to the affective aspects that support students' enthusiasm and commitment to overcome learning difficulties.

Difficulties in learning mathematics are not only related to cognitive abilities but also to students' mental resilience when facing academic challenges. Students often face pressure, fear of failure, or loss

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of enthusiasm when faced with complex questions. In this context, resilience is a crucial element that helps students persist and recover from adversity. (Hidayatul et al., 2020) revealed that mathematical resilience is a person's ability to remain positive and adapt despite facing challenges in learning mathematics. These results are supported by research (Maarif et al., 2023) and (Mahardika et al., 2023) which suggest that students with high resilience are more likely to view failure as an opportunity to learn, rather than an obstacle. Thus, resilience is a link between thinking skills and success in learning mathematics.

The relationship between resilience and mathematics learning outcomes has been proven by various previous studies. (Diri, 2023) stated that resilience has a significant impact on student learning outcomes, especially studies supported by strong self-regulation and motivation to study. (Hadi et al., 2025) found that academic resilience and learning discipline are key factors influencing student achievement in mathematics. (Demir, 2023) also stated that mental resilience and academic persistence have a positive relationship with students' mathematics achievement in secondary school. Therefore, students who possess emotional and mental strength usually achieve better learning outcomes than those who give up easily.

Besides functioning as mental resilience, resilience is also closely related to advanced thinking skills such as critical thinking and problem-solving. (Betaviana et al., 2024) revealed a positive relationship between critical thinking, collaboration, and resilience with mathematics learning achievement at SMP N 1 Pleret. On the other hand, (Nurfitri & Jusra, 2021) emphasized that students with high resilience can be more effective in finding different strategies to solve complex mathematical problems. (Mahardika et al., 2023) also revealed that resilience encourages students to be more innovative and adaptive in their thinking. Thus, resilience not only strengthens the emotional dimension but also improves the quality of students' thinking in understanding mathematics.

Furthermore, social and environmental factors play a crucial role in building student resilience. (Rachmawati & Saefudin, 2025) found that students in remote areas with limited online learning facilities still demonstrated good learning outcomes due to their high levels of resilience. (Nabilah et al., 2024) revealed that family support and a positive learning environment can improve students' ability to overcome academic challenges. Therefore, resilience can be enhanced through positive social interactions and environmental support that facilitates the learning process.

At higher levels of learning, resilience plays a significant role in achieving student academic success. (Retariandalas, 2023) revealed that students with high levels of resilience exhibit positive mathematical dispositions, such as curiosity, responsibility, and perseverance. Furthermore, (Maarif et al., 2023) emphasized that mathematical resilience is an affective aspect that must be improved to support critical thinking skills and academic resilience. This demonstrates that improving resilience is not only important for elementary and middle school students, but also crucial for college students facing more complex academic challenges. Therefore, resilience development must be ongoing at every level of learning.

Despite this, the application of the concept of resilience in mathematics learning remains suboptimal. Many research institutions focus on cognitive achievement without incorporating strategies to strengthen students' character and resilience (Iman, 2019; Mahardika et al., 2023). Hidayatul et al., 2020 (Hidayatul et al., 2020) recommend that teachers use learning methods that support increased self-confidence, such as providing appropriate challenges and engaging in self-reflection after completing assignments. These strategies can strengthen students' motivation and ability to recover from setbacks. Therefore, strengthening resilience through learning strategies is a crucial factor in creating meaningful mathematics learning experiences.

Based on the explanation above, it can be concluded that resilience plays a significant role in improving students' mathematics learning achievement. Resilience enables students to transform academic stress into positive drivers that strengthen motivation and resilience. Therefore, additional research exploring the role of resilience in mathematics learning contexts is needed so that strategies to strengthen students' character can be effectively integrated into the learning process. Therefore, this research study is crucial for deepening understanding of the role of resilience in mathematics learning achievement and providing guidance for continuously improving the quality of learning.

2) METHODS

This research employs a literature review method, an approach that emphasizes the analysis of various reading sources to gain a comprehensive theoretical understanding of the topic under study. This literature review was chosen because it provides a solid conceptual foundation for the role of resilience in influencing mathematics learning outcomes without the need for field data collection

(Ansori, 2020; Diri, 2023). This approach facilitates researchers in critically evaluating previous research findings and identifying general patterns that can be used as a basis for strengthening theory.

The first stage of this literature review was to identify academic sources related to the topic under study. Researchers explored 30 national and international journals published between 2018 and 2025, including 12 international journals and 18 national journals, with a particular focus on the themes of resilience, motivation, and achievement in mathematics learning. The search process was conducted through databases such as Google Scholar, DOAJ, and ScienceDirect, using the keywords "student resilience," "mathematical resilience," and "mathematics learning achievement" (Betaviana et al., 2024). This stage is crucial to ensure that the literature used has a significant and up-to-date relevance to the research topic.

After collecting the literature, the next step was to select and classify the sources according to their relevance to the research. The selected articles were then grouped into three main categories: literature discussing the concept of resilience in learning, literature analyzing mathematics learning achievement, and literature investigating the relationship between (Hadi et al., 2025; Maarif et al., 2023). This classification aimed to provide a more focused analysis and systematically demonstrate the relationships between variables.

Next, the researchers conducted a descriptive qualitative analysis of the selected sources. The analysis was conducted by reading thoroughly, identifying key ideas, and interpreting the relationships between the results of previous studies (Frungongban, 2023; Nurfitri & Jusra, 2021). This approach not only describes the findings but also interprets their meaning in the context of improving mathematics learning achievement. Therefore, the analysis results are not merely a summary, but a synthesis of various mutually supporting academic perspectives.

By following these steps, this literature review approach is expected to yield a comprehensive conceptual overview of the role of resilience in shaping students' mathematics learning achievement. Through a comprehensive analysis of previous research findings, this study not only offers a theoretical basis for further research but also strengthens our understanding of the significance of resilience in the context of modern mathematics learning (Betaviana et al., 2024; Maarif et al., 2023).

3) RESULTS AND DISCUSSION

In this study, researchers reviewed various research findings from within and outside the country related to resilience and student mathematics achievement. This study aims to gain a comprehensive

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understanding of the role of resilience in supporting academic success, particularly in mathematics learning. The literature sources described are derived from registered scientific publications, both nationally and internationally, published between 2018 and 2025.

The search results yielded 30 scientific articles meeting the inclusion criteria, consisting of 12 international journals and 18 national journals. Each study was assigned a unique code (I01–I12 for international journals and N01–N18 for national journals) to facilitate discussion and mapping of analytical results in the discussion section.

This table is expected to provide a comprehensive overview of research progress on the role of resilience in student mathematics achievement and serve as a foundation for further discussion.

Table 1: *Summary of National and International Research on Resilience and Students' Mathematics Achievement (2018–2025)*

Code	Title	Authors	Findings
I01	Factors Related to the Mathematics Achievement of Resilient and Nonresilient Students with Different Genders in Top Performing Asian Countries.	(Başarılarıyla & Faktörler, 2025)	In high-achieving Asian countries, students with academic resilience performed better in mathematics; the effect was consistent across both genders.
I02	The Development of the Mathematical Resilience Scale: Validity and Reliability Study.	(Atahan & Uyangör, 2024)	This study designed a Mathematical Resilience Scale with four main dimensions, namely values, struggle, growth mindset, and social support, which were proven to be valid and reliable ($\alpha = 0.704$) to measure the level of

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			mathematical resilience of high school students.
I03	Investigation of the effects of secondary school students' psychological resilience and academic grit levels on mathematics achievement.	(Demir, 2023)	Mental resilience and persistence in learning play a significant role in improving students' math scores in secondary school; this relationship is stronger among female students.
I04	Mathematical Resilience: how Students Survived in Learning Mathematics Online During the Covid-19 Pandemic.	(Pulungan et al., 2022)	Students with high resilience remain engaged and flexible in the online math learning process; technical/facility constraints can be overcome with mental resilience.
I05	The relationship between classroom support and mathematical resilience.	(Hamidy et al., 2024)	Teacher support has a positive influence on the Value and Struggle dimensions of mathematical resilience; peer support has a positive impact on Value but a negative impact on Growth.
I06	Predictive Analysis: Academic Resilience as a Determinant of Mathematics Achievement among Senior Secondary	(Duru et al., 2024)	Academic resilience significantly predicts mathematics achievement; gender variable has no effect.

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	School Students in Nigeria.		
I07	The interplay between ego-resiliency, math anxiety and working memory in math achievement. (Doz et al., 2024)		Ego-resiliency has an indirect positive impact on mathematics achievement through the anxiety and working memory pathways; confirming that individual resilience is crucial in the mathematics learning process.
I08	Middle School Students' Mathematical Resilience and Perceptions of Mathematics: A Cluster Analysis Approach. (Kilmen, 2022)		Two clusters were found: one group with a profile of high resilience + positive perception + high achievement; one with the opposite.
I09	Academic Resilience and its Relation to Academic Achievement for Moroccan University Students During the Covid-19 Pandemic. (Amzil, 2023)		Academic resilience was higher among high-achieving students; gender and study level were not significant.
I10	Resilience in mathematics education research: a systematic review. (Xenofontos & Mouroutsou, 2023)		Mathematical resilience is conceptualized as “overcoming disadvantage + high performance” and “part

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	review of empirical studies.		of mathematical identity”; interventions and instruments are still limited.
I11	The Impact of Resilience on Students’ Academic AchievementI: Case Study of Secondary School Students	(Fru-ngongban, 2023)	Resilience has a direct effect on academic achievement; students who are able to adapt to stress perform better.
I12	The Impact of Resilience on Students’ Academic Achievement: Case Study Of Secondary School Students	(Nabilah et al., 2024)	Resilience and family environment play an important role in mathematics learning outcomes; family support enhances the effect of resilience on learning motivation.
N01	Analisis Kemampuan Resiliensi Dalam Meningkatkan Kemampuan Koneksi Matematis Siswa.	(Ansori, 2020)	Mathematical resilience helps students connect old and new concepts in solving complex problems; highly resilient students have better mathematical connection skills.
N02	Kemampuan Resiliensi Matematis Dalam Pembelajaran	(Maarif et al., 2023)	Systematic reviews reveal that mathematical resilience involves aspects of resilience, self-confidence, and cognitive

	Matematika: Systematic Literatur Review.		adaptation; there is still a need for learning approaches that develop resilience from an early age.
N03	Pengaruh Kemampuan Resiliensi dan Minat Belajar di Tengah Pandemi Covid-19 Terhadap Kemampuan Pemahaman Konsep Matematis Siswa SMA Islam Al-Azhar Kelapa Gading Jakarta.	(Rianto et al., 2022)	Studies show that resilience and learning interest significantly influence students' understanding of mathematical concepts during online learning due to the pandemic.
N04	Kajian Pustaka: Resiliensi dalam Pembelajaran Matematika	(Azizah & Abadi, 2022)	The literature review concludes that resilience in learning mathematics (mathematical resilience) is a crucial attitude that helps students overcome anxiety and obstacles in learning mathematics.
N05	Pengaruh Resiliensi Matematis dan Minat Belajar terhadap Kemampuan Pemecahan Masalah Matematis Siswa SMP	(Barat, 2025)	Simultaneously, resilience and interest in learning have a significant positive influence (50.4%) on the ability to solve mathematical problems.

	Se-Kabupaten Bangka Barat.		
N06	Pengaruh Resiliensi Matematis dan Lingkungan Belajar terhadap Hasil Belajar Matematika Siswa SMP	(Hadra et al., 2025)	A study at SMP Negeri 29 Samarinda showed that mathematical resilience and learning conditions influenced mathematics learning outcomes.
N07	Identifikasi Resiliensi Matematis Siswa Kelas X pada Pembelajaran Matematika.	(Sirri et al., 2024)	The data shows that only 11.21% of class X students have high mathematical resilience, while 69.82% are at a moderate level and 18.96% are low, indicating the need for improvement.
N08	Analisis Kemampuan Representasi Matematis Peserta Didik Sekolah Dasar Ditinjau dari Resiliensi Matematis.	(Lestari et al., 2024)	Students who have high mathematical resilience can fulfill all indicators of mathematical representation (visual, verbal, symbolic), while students with low resilience are not yet able to fulfill them.
N09	Systematic Literature Review: Identifikasi Kemampuan Berpikir Aljabar dan Resiliensi Matematis pada	(Kurniawan et al., 2023)	This study shows that studies between 2017-2023 on algebraic thinking skills and mathematical resilience were mostly conducted at the junior high school level with the topic

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	Pembelajaran Matematika.		of geometry, and that the relationship between algebraic thinking and mathematical resilience is starting to attract attention, but research that empirically combines both variables is still very limited.
N10	Kemampuan Pemecahan Masalah dan Resiliensi Matematis melalui Tinjauan Pustaka Sistematis.	(Z et al., 2025)	This research indicates that mathematical resilience plays a crucial role in improving students' problem-solving skills. Students who demonstrate high levels of resilience tend to be more resilient, innovative, and reflective when facing mathematical problems. Creative and participatory learning is recommended to strengthen these two aspects.
N11	Resiliensi Matematis Ditinjau dari Self- Efficacy Siswa.	(Nuraeni & Kusuma, 2018)	These results confirm that increasing academic self-confidence is an effective way to strengthen resilience and achievement in learning mathematics.
N12	Resiliensi matematika siswa dalam		Students in remote areas demonstrate strong resilience

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	pembelajaran daring (e-learning): studi kasus pembelajaran matematika siswa di sekolah daerah terpencil dan wilayah pegunungan di DI Yogyakarta, Indonesia.	(Rachmawati & Saefudin, 2025)	due to their familiarity with limited facilities. This resilience allows them to continue achieving good academic results despite network and facility limitations.
N13	Resiliensi dan Disposisi Matematis Mahasiswa Pendidikan Matematika	(Retariandalas, 2023)	A significant positive relationship was found between students' mathematical resilience and disposition, which influences logical thinking ability and academic persistence.
N14	Hubungan Kemampuan Berpikir Kritis, Kolaborasi dan Resiliensi Matematis dengan Prestasi Belajar Matematika di Kelas VII SMP N 1 Pleret	(Betaviana et al., 2024)	There is a significant relationship between critical thinking, collaboration, and resilience with mathematics achievement; collaboration strengthens the effect of resilience on learning outcomes.
N15	Pengaruh regulasi diri, resiliensi, dan motivasi belajar terhadap prestasi belajar	(Diri, 2023)	Resilience and self-regulation jointly predict mathematics achievement; students with good self-regulation and high resilience show greater

	matematika peserta didik		improvements in mathematics scores.
N16	Pengaruh motivasi belajar dan resiliensi matematis terhadap kemampuan pemecahan masalah matematis pada materi perbandingan	(Mahardika et al., 2023)	Learning motivation and mathematical resilience simultaneously have a positive effect on mathematical problem-solving ability; in particular, students with high motivation and high resilience achieve the best problem-solving results.
N17	Analisis Kemampuan Pemecahan Masalah Matematis Peserta Didik Ditinjau dari Resiliensi Matematis dan Gender	(Nurfitri & Jusra, 2021)	Mathematical resilience mediated the relationship between gender and problem-solving ability; female students showed greater increases in resilience after the reflective intervention.
N18	Pengaruh Kemampuan Resiliensi Matematis Terhadap Hasil Belajar Matematika	(Iman, 2019)	Mathematical resilience skills have a significant contribution to improving learning outcomes; the higher a student's mental resilience, the better their math test results.

Based on a synthesis of 30 articles from 12 international journals and 18 national journals published between 2018 and 2025, a comprehensive understanding of the contribution of

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mathematical resilience to mathematics learning achievement was obtained. All available literature indicates that resilience is a key psychological factor influencing students' academic achievement, both directly through persistence and the ability to face challenges, and indirectly through learning motivation, self-regulation, and social support.

In general, international research indicates that mathematical resilience is not only related to the ability to overcome learning challenges but also closely correlates with students' perspectives on mathematics, mathematics anxiety, working memory, and adaptability to online learning. Students with high levels of resilience tend to be better able to maintain concentration, complete tasks more efficiently, and demonstrate better academic achievement. Furthermore, several studies confirm that resilience serves as a mediator between psychological conditions such as fear of failure or mathematics anxiety and mathematics achievement. This point emphasizes that mental resilience is not merely an emotional aspect but also an element of the cognitive process that supports deeper mastery of mathematical concepts.

The synthesis also indicates a consistent pattern that mathematical resilience is strongly related to high levels of self-efficacy, intrinsic motivation, and self-regulation. Students who can control their emotions and independently develop learning strategies demonstrate greater resilience in solving math problems, even under highly stressful conditions. Various studies have shown that resilience not only supports students in maintaining academic performance but also enhances creativity and critical thinking skills. At one level, resilience also serves to improve social relationships, such as collaboration within study groups, thereby enriching the process of collectively constructing mathematical knowledge.

Furthermore, this synthesis indicates that resilience is reciprocally related to mathematics learning achievement. As learning outcomes improve, students' self-confidence and mental resilience typically strengthen; conversely, strong resilience supports students in increasing their adaptability, overcoming learning obstacles, and calming anxiety that can interfere with mathematical thinking. In other words, resilience plays a significant role in the development of sustainable academic character.

Meanwhile, local literature emphasizes the contribution of resilience to various mathematical abilities such as problem-solving, representation, mathematical connections, and algebraic thinking. National research also shows that resilience can develop through external factors such as teacher support, a supportive classroom environment, positive social interactions, and participatory and

reflective learning methods. During the pandemic, the role of resilience became increasingly apparent when students with high resilience were able to maintain the quality of their learning despite challenges related to network connectivity, devices, and the learning environment. This suggests that resilience serves as a support mechanism, enabling students to adapt to unstable academic conditions.

From all the research findings, it can be concluded that enhancing mathematical resilience should be a crucial element in designing mathematics learning. Problem-based learning strategies, collaborative methods, introspection, the use of interactive media, and emotional support from teachers and the environment have proven effective in enhancing students' academic resilience. Planned interventions not only improve mathematics learning outcomes but also shape students' character to be strong, innovative, and able to adapt to academic and everyday life challenges. Therefore, mathematical resilience can be seen as a crucial element that not only predicts learning success but also improves the quality of the learning process as a whole.

4) CONCLUSIONS

Based on a comprehensive literature review of 30 national and international articles, it can be concluded that mathematical resilience plays a crucial role in students' mathematics achievement. Resilience functions as a multidimensional factor that influences academic success both directly and indirectly. The direct pathway is seen through perseverance, adaptability, and problem-solving skills, while the indirect pathway involves aspects such as self-confidence, motivation, self-regulation, and social support.

Students with high levels of resilience tend to be able to maintain focus, perseverance, and creativity when facing learning difficulties, both in face-to-face and online learning. Resilience not only strengthens mental resilience but also enhances higher-order thinking skills, including critical thinking, problem-solving, innovation, and collaboration. Social interactions and the learning environment have been shown to play a crucial role in building resilience, where support from teachers, peers, and family, along with a conducive learning environment, strengthens students' ability to face academic challenges.

Furthermore, resilience serves as a link between thinking skills and learning success and can mediate the influence of other factors such as motivation, self-regulation, and gender. Resilience and academic achievement have a reciprocal relationship, where mentally and emotionally strong students

are better able to understand concepts, think logically, and withstand academic pressure, while improved academic achievement also strengthens students' mental resilience.

Developing resilience should be a focus in mathematics learning design through reflective, collaborative, problem-solving strategies, and the use of interactive media, with pedagogical support from teachers and the environment. This approach not only improves academic achievement but also develops resilient, creative, and adaptive students who are able to face the challenges of mathematics and everyday life. Therefore, mathematical resilience is a crucial component that must be systematically strengthened in mathematics education to support optimal learning achievement and student character development.

Acknowledgment

The writer conveys his sincere thanks and appreciation to Ms. Andi Kusumayanti, S.Pd., M.Pd., Ms. A. Sriyanti, S.Pd., M.Pd., and Ms. Andi Lisna Mattoliang, S.Pd., M.Pd., as co-authors and educators from the Mathematics Education Study Program, Faculty of Tarbiyah and Teacher Training, Alauddin State Islamic University (UIN) Makassar, for their mentorship, advice, and significant scientific input during the creation of this article. The scholarly assistance and valuable insights from these co-authors established an essential basis for the quality and enhancement of this research.

The author extends his appreciation to his peers in the Mathematics Education Department of the Faculty of Mathematics and Mathematics Education at Alauddin State Islamic University (UIN) Makassar for their assistance, discussions, and teamwork, which enabled the successful completion of this research and the drafting of this paper. Additionally, the author expresses gratitude to all the researchers and sources referenced in this study, guaranteeing the effective completion of this research.

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Paper presented at The 2nd ICONETT, 2025
Faculty of Teacher Training and Education
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