Absis: Mathematics Education Journal
Vol. 7, No. 2, November 2025, pp. 100-107
ISSN 2686-0104 (print), 2686-0090 (online)
http://journal.univetbantara.ac.id/index.php/absis/index

Differentiated Learning in the Independent Curriculum to Enhance Mathematical Connection and Resilience of State Junior High School Students in East Kalimantan Province

Abdul Razak [a,1*], Rumainur [a,2]

[a] Faculty of Education and Teacher Learning, UIN Sultan Aji Muhammad Idris Samarinda, Samarinda 75123, Indonesia
[1] razakabdul180290@gmai.com
* corresponding author

Received 04 December 2025; Accepted 29 December 2025; Published 31 December 2025

ABSTRACT

This quasi-experimental study aims to analyze the effectiveness of differentiated learning within the Merdeka Curriculum in enhancing the mathematical connection and resilience of junior high school students in East Kalimantan Province. The research employed a pretest-posttest control group design, involving purposively selected eighth-grade students from several public schools. Data was collected through a mathematical connection test, a resilience questionnaire, and learning process observations. The results indicate that differentiated learning significantly improved students' mathematical connection and resilience compared to conventional instruction. The experimental group's average mathematical connection score increased from a low to a high category, with notable improvements in their ability to relate mathematical concepts to daily life and other mathematical ideas. Furthermore, students demonstrated significantly enhanced mathematical resilience, particularly in perseverance, problem-solving persistence, and adaptability to challenges. Key success factors included needs-based lesson planning, active student engagement, and motivating reflective practices.In conclusion, Differentiated instruction is effective in significantly increasing the mathematical resilience of eighth-grade students in East Kalimantan, with a significant value of 0.000 < 0.05. Differentiated instruction is effective in significantly increasing the mathematical connection of eighth-grade students in East Kalimantan, with a significance value of 0.000 < 0.05.Differentiated instruction is effective in simultaneously and significantly increasing both the mathematical resilience and mathematical connection of eighth-grade students in East Kalimantan, with a significance value of 0.000 < 0.05. It is recommended that teachers adopt differentiated strategies more widely to support inclusive, meaningful learning and develop student competencies in the era of independent learning.

KEYWORDS

Differentiated instruction
Merdeka Curriculum
Mathematical connection
Mathematica resilience
Junior High School
East Kalimantan

1. Introduction

The potential and characteristics of every student are highly diverse and unique. Each student arrives at school with their own individuality and distinct background. This diversity encompasses different learning styles (e.g., auditory, visual, and kinesthetic), varying academic abilities (high, medium, and low), differing paces of understanding lessons (fast, average, or slow), learning orientations (mastery, performance-approach, performance-avoidance), levels of motivation (high, medium, low), degrees of self-efficacy (high, medium, low), and specific interests in subjects, among other factors, Ade Sintia Wulandari (2022).

Consequently, a key demand for modern educators is to shift their teaching patterns to accommodate student characteristics and interests. Teachers must engage in continuous reflection to achieve better educational outcomes. One pedagogical approach that addresses this need is differentiated instruction. Afilin (2023) suggests that differentiated learning is an effort to adapt the classroom learning process to the individual learning needs of each student. This adaptation relates to student interests, learning profiles, and motivation to achieve better learning outcomes. Similarly, Puspitasari & Walujo (2020) state that differentiated learning holds the view that every student should be allowed to learn according to their own abilities. According to Tomlinson (2017), differentiated instruction is the process of tailoring teaching to meet student needs, which can involve differentiating the process, content, or product. As Purba et al. (2021) note, the current importance of implementing differentiated learning is grounded in several philosophical, sociological, and legal foundations.

The National Council of Teachers of Mathematics (NCTM, 2000) outlines five key standard skills in the mathematics curriculum: problem-solving, communication, reasoning, connections, and representation. These standards play a significant role in mathematics curriculum development (Maulyda, 2020). Based on NCTM's learning objectives, students must be able to understand and learn mathematical connection skills to solve mathematical problems (Nuryanto & Yuliardi, 2023).

Mathematical connection refers to the relationship or linkage within the field of mathematics itself, both between mathematical concepts and between mathematics and everyday life (Yuliani et al., 2018; Isfayani et al., 2018). Adirakasiwi (2018) further explains this as internal and external linkage. As Sugiman (2008) states, one goal of mathematics education is to develop mathematical connection ability. This ability involves recognizing relationships between mathematical concepts, as well as connections between mathematics and contexts outside of mathematics. By possessing this ability, students not only understand the utility of mathematics but also see how mathematical topics are interrelated. The NCTM (2000) connection standards focus on students' abilities to: (1) identify and use connections among mathematical ideas; (2) understand how mathematical ideas interconnect and build to produce a coherent whole; and (3) recognize and apply mathematics in contexts outside of mathematics.

Despite its importance, research indicates that students' mathematical connection abilities remain low. A study by Ruspiani (cited in Zuyyina et al., 2018) found that students' ability to make mathematical connections was weak, particularly in linking different mathematical topics. Zuyyina et al. (2018) similarly found that junior high school students' mathematical connection abilities in circle-related topics were low. Kusuma's research (cited in Fajri, 2015) also reported that the level of mathematical connection ability among junior high school students was still low. These findings indicate that many students lack adequate connection skills. As Nuryanto & Yuliardi (2023) explain, this inability is reflected in students' failure to make connections between previously learned concepts and newly acquired ones, which weakens their overall mathematical connection (Atmaja et al., 2020). Many students still do not know how to apply mathematics to other subjects and daily life, or understand the relationship between mathematics and non-mathematical subjects.

In addition to connection skills, mathematical resilience is another critical area of research. Hafiz et al. (2020) define mathematical resilience as a positive attitude that encourages students to persevere when facing difficulties in problem-solving. Sari et al. (2023) found that the mathematical resilience of students taught with a Problem-Based Learning (PBL) model differed from those receiving adapted traditional instruction, with PBL students demonstrating higher resilience indicators. Factors causing low mathematical resilience include a lack of student self-confidence and a pessimistic attitude during mathematics learning, especially when confronted with very difficult problems. This aligns with Setiawan et al. (2022), who state that when students encounter challenging mathematical problems, they tend to give up quickly and stop trying to solve them, thus avoiding the task. Conversely, Kurniawan & Agoestanto (2023) assert that students with high mathematical resilience are better able to overcome challenges and obstacles in learning mathematics.

To enhance mathematical connection and resilience, educators require innovative teaching approaches. An approach is needed that makes the learning process more active and accommodates all student interests and talents to their fullest potential, according to their individual characteristics, thereby allowing their inherent potential to develop optimally. Therefore, teachers must be able to recognize the diverse characteristics of their students to conduct more effective and efficient learning activities. A suitable learning approach in mathematics is essential to make the process more impactful and meaningful for students. Based on this rationale, the researcher is interested in examining the topic: "Differentiated Learning in the Merdeka Curriculum to Enhance Students' Mathematical Connection and Resilience in Public Junior High Schools in East Kalimantan".

2. Method

This study aimed to analyze the effectiveness of differentiated learning within the Merdeka Curriculum in enhancing the mathematical connection and resilience of public junior high school students in East Kalimantan Province. Data collection techniques used were observation, mathematical connection tests, and resilience questionnaires. Data analysis used multivariate tests.

A quasi-experimental method with a pretest-posttest control group design was employed. The sample consisted of eighth-grade students selected purposively from several public junior high schools. The school was selected because it has implemented differentiated learning and is also a driving school. The research was conducted at the following schools: SMP Negeri 5 Tanah Grogot Paser, SMP Negeri 7 Bontang, SMP Negeri 3 Teluk Bayur Berau, SMP Negeri 6 Balikpapan, SMP Negeri 8 Balikpapan, and SMP Negeri 14 Balikpapan.

Data were collected using a mathematical connection test, a mathematical resilience questionnaire, and observations of the learning process. The data were then analyzed using multivariate analysis, which was preceded by prerequisite tests for normality and homogeneity.

3. RESULTS AND DISCUSSION

3.1. Research Results

Multivariate prerequisite tests are crucial to ensure the validity of the multivariate statistical analysis results. Prior to multivariate testing, prerequisite tests are performed, namely normality and homogeneity tests.

3.2. Normality Test

The results of the Kolmogorov-Smirnov normality test for the post-test data of both the control and experimental groups are presented in Table 1. The significance values for both mathematical resilience and connection were greater than 0.05, in the experiment obtained 0.124 and 0.145 while the control was 0.117 and 0.167. indicating that the data for both groups are normally distributed.

Table 1. Normality Test Result

	Kelas	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Resiliensi Matematis	Eksperimen	,088	181	,124	,969	181	,452
	Kontrol	,088	179	,117	,969	179	,582
Koneksi Matematis	Eksperimen	,088	181	,145	,969	181	,472
	Kontrol	,088	179	,167	,969	179	,813

[a] Sample of a Table footnote. *(Table footnote)*

3.3. Homogeneity Test

The results show that the significance (sig.) value for mathematical resilience is 0.238, and for mathematical connection, it is 0.106. Since both values are greater than 0.05, the null hypothesis (H_0) is accepted, and the alternative hypothesis (H_1) is rejected. This can be interpreted as follows:

a) The variance of mathematical resilience between the experimental and control classes is homogeneous.
b) The variance of the mathematical connection between the experimental and control classes is also homogeneous.

Table 2. Homogeneity Test Results

	F	df1	df2	Sig.
Resiliensi Matematis	2,381	1	358	,238
Koneksi Matematis	2,851	1	358	,106

From the Box's M test, the value is 7.175 with a significance level of 0.078. Since the significance value (0.078) is greater than 0.05, the null hypothesis (H_0) is accepted, and the alternative hypothesis (H_1) is rejected. This means that the covariance matrices of the dependent variables are homogeneous.

Absis: Mathematics Education Journal
Vol. 7, No. 2, November 2025, pp. 100-107

Box's Test of Equality of Covariance Matrices[a]

Box's M	7.175
F	2.274
df1	3
df2	127371.356
Sig.	.078

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Kelas

Fig. 1. Example of a figure caption. *(figure caption)*

3.4. Hypothesis Test

Table 3. Multivariate Tests

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.994	3864.101[b]	2.000	45.000	.000	.994
	Wilks' Lambda	.006	3864.101[b]	2.000	45.000	.000	.994
	Hotelling's Trace	171.738	3864.101[b]	2.000	45.000	.000	.994
	Roy's Largest Root	171.738	3864.101[b]	2.000	45.000	.000	.994
Kelas	Pillai's Trace	.462	19.352[b]	2.000	45.000	.000	.462
	Wilks' Lambda	.538	19.352[b]	2.000	45.000	.000	.462
	Hotelling's Trace	.860	19.352[b]	2.000	45.000	.000	.462
	Roy's Largest Root	.860	19.352[b]	2.000	45.000	.000	.462

a. Design: Intercept + Kelas

b. Exact statistic

The statistical test resulted in a significant value of 0.000. Based on the MANOVA criteria, where a sig. value < 0.05 leads to rejecting H_0 and accepting H_1 it can be concluded that the independent variable (differentiated learning) has a significant effect on the dependent variables (mathematical resilience and mathematical connection).

3.5. Discussion

The figure below displays the pre-test and post-test scores for mathematical resilience and mathematical connection, comparing the experimental and control groups. The results are detailed as follows:

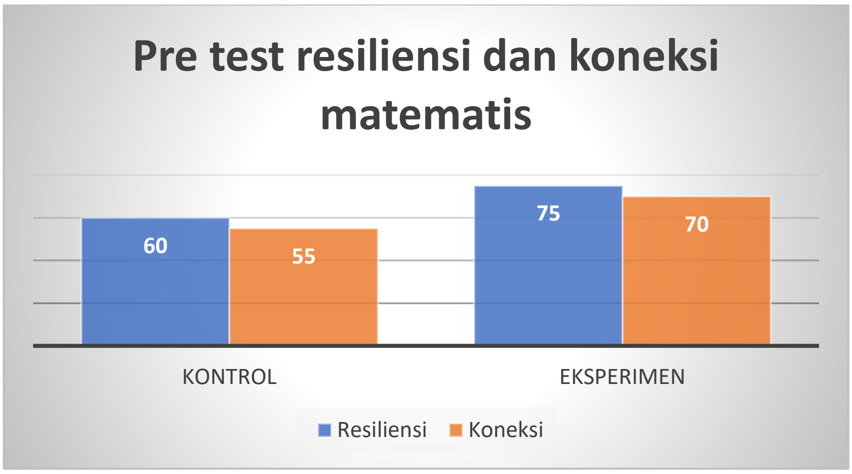

Fig 1. pre-test scores

Mathematical Resilience:

3.5.1. The control group had an average score of 60.

3.5.2. The experimental group achieved a significantly higher average score of 75.

Mathematical Connection:

3.5.1. The control group obtained an average score of 55.

3.5.2. The experimental group again demonstrated superior performance, with an average score of 70.

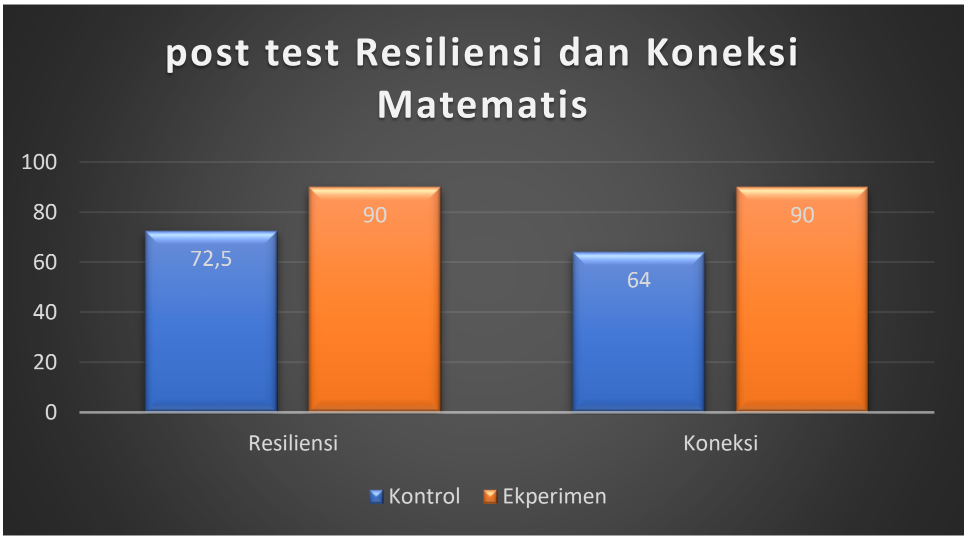

Fig 2. post-test scores

The graph below illustrates the post-test results for mathematical resilience and mathematical connection, comparing the experimental and control groups.

Mathematical Resilience:

3.5.1. The control group had an average score of 72.5.

3.5.2. The experimental group achieved a significantly higher average score of 90.

3.5.3. This indicates that the differentiated learning intervention had a positive impact on enhancing students' mathematical resilience.

Mathematical Connection:

3.5.1. The control group obtained an average score of 64.

3.5.2. The experimental group again demonstrated superior performance, with an average score of 90.

3.5.3. This difference further confirms the success of the differentiated learning approach in improving students' mathematical connections.

The data clearly demonstrates the superior performance of the experimental group over the control group in both mathematical resilience and mathematical connection. This provides strong evidence for the significant contribution of differentiated learning in enhancing both of these variables. Differentiated instruction proved highly effective in fostering mathematical resilience. Its core strength lies in tailoring teaching strategies to individual student needs, interests, and readiness levels. By providing challenges within each student's Zone of Proximal Development (ZPD), where tasks are optimally difficult to promote growth without causing frustration (Tomlinson, 2001), the approach builds the self-confidence essential for resilience. The flexibility of this method also enables teachers to provide individualized support, helping students overcome specific learning obstacles and persist in problem-solving (Santangelo & Tomlinson, 2009).

Furthermore, by offering students choices in their learning methods or tasks, differentiated instruction enhances intrinsic motivation. According to Deci and Ryan (1985), this intrinsic

 Absis: Mathematics Education Journal
Vol. 7, No. 2, November 2025, pp. 100-107

motivation directly strengthens a student's capacity to endure academic challenges. The relevance of the material is another critical factor; by connecting mathematical problems to students' real-life experiences, teachers make the subject matter meaningful, which in turn fosters greater persistence (Hattie, 2009). Additionally, the supportive learning environment cultivated through differentiated instruction, characterized by adjusted task difficulty and positive feedback, helps reduce mathematics anxiety, making students feel safer and more confident (Boaler, 2016). Ultimately, by providing meaningful and supportive learning experiences, differentiated learning serves as a powerful strategy for building robust mathematical resilience.

Beyond resilience, differentiated learning also had a profound positive impact on students' mathematical connections. This approach encourages a deep, conceptual understanding by actively linking mathematical topics to other disciplines and real-world situations. For example, contextually relevant tasks, such as using real-world case studies to calculate the area of a field, help students see the practical utility of mathematics. Hattie (2009) emphasizes the importance of such context-based learning for strengthening conceptual understanding.

The strategy of offering students choices in how they learn, be it through visual, verbal, or practical approaches, allows them to grasp concepts in the way most suitable for them, thereby facilitating connections between different mathematical ideas (Tomlinson, 2001). Differentiated learning also fosters discussion and collaboration, which are crucial for helping students link diverse mathematical ideas. Through group discussions, students share perspectives, think critically, and develop a more profound, integrated understanding (Boaler, 2016).

Moreover, the use of multiple instructional strategies, such as diagrams, simulations, and project-based problem-solving, helps students integrate new knowledge with their existing mental frameworks, thereby reinforcing mathematical connections (NCTM, 2000). Encouraging students to reflect on their learning, for instance by discussing the relationships between concepts or their real-life applications, further consolidates and deepens their understanding (Santangelo & Tomlinson, 2009).

In conclusion, through its multifaceted and student-centered strategies, differentiated learning effectively enhances students' mathematical connections. It not only provides relevance but also helps students develop a profound, interconnected understanding of mathematics and its applications, thereby equipping them with the skills to navigate future learning challenges successfully.

4. Conclusion

Provide a statement of what is expected, as stated in the "Introduction" chapter can ultimately result in the "Results and Discussion" chapter, so there is compatibility. Moreover, it can also be added the prospect of the development of research results and application prospects of further studies into the next (based on results and discussion). Based on the data analysis and discussion, the following conclusions can be drawn:

4.1.1. Differentiated instruction is effective in significantly increasing the mathematical resilience of eighth-grade students in East Kalimantan, with a significant value of 0.000 < 0.05.

4.1.2. Differentiated instruction is effective in significantly increasing the mathematical connection of eighth-grade students in East Kalimantan, with a significance value of 0.000 < 0.05.

4.1.3. Differentiated instruction is effective in simultaneously and significantly increasing both the mathematical resilience and mathematical connection of eighth-grade students in East Kalimantan, with a significance value of 0.000 < 0.05.

Suggestions

This study recommends that teachers more frequently adopt and implement differentiated instruction strategies in their classrooms to support inclusive and meaningful learning. Such practices are crucial for fostering student competencies in the era of the independent learning curriculum. School administrators and policy makers are also encouraged to facilitate professional development for teachers to master differentiated instruction techniques.

References

Ade Sintia Wulandari. (2022). Literature Review: Pendekatan Berdiferensiasi Solusi Pembelajaran dalam Keberagaman. Jurnal Pendidikan Mipa, 12(3), 682–689. https://doi.org/10.37630/jpm.v12i3.620

Afilin, K. M. (2023). Menggunakan Model Pjbl Untuk Meningkatkan Hasil Belajar Matematika. Jurnal DIKDAS BANTARA, 6(1), 36–46.

Atmaja, A., Rohman, M. S., & Utami, W. B. (2020). Analisis kemampuan koneksi matematika dalam mengerjakan soal cerita. Jurnal Inovasi Pendidikan Matematika (JIPM), 2(2), 77–91. https://doi.org/10.37729/jipm.v2i2.6581

Breaux, E., & Magee, M. B. (2013). How the best teachers differentiate instruction. How the Best Teachers Differentiate Instruction, 1–166. https://doi.org/10.4324/9781315855257

Boaler, J. (2016). Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching. Jossey-Bass.

Deci, E. L., & Ryan, R. M. (1985). Intrinsic Motivation and Self-Determination in Human Behavior. Springer Science & Business Media.

Fajri, N. (2015). Korelasi Antara Kemampuan Koneksi Dan Komunikasi Matematis Siswa Dengan Menggunakan Pendekatan Contextual Teaching And Learning(CTL). One Education, 2(1), 51–60.

Flores, C. D., & García-García, J. (2017). Conexiones intramatemáticas y extramatemáticas que se producen al resolver problemas de cálculo en contexto: Un estudio de casos en el nivel superior. Bolema - Mathematics Education Bulletin, 31(57), 158–180. https://doi.org/10.1590/1980-4415v31n57a08

Hafiz, M., Darhim, & Dahlan, J. A. (2020). Comparison of mathematical literacy enhancement between students with problem-based learning and guided discovery learning model. Journal of Physics: Conference Series, 1521(3). https://doi.org/10.1088/1742-6596/1521/3/032075

Hattie, J. (2009). Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement. Routledge.

Hutauruk, A. J. B., & Priatna, N. (2017). Mathematical Resilience of Mathematics Education Students. Journal of Physics: Conference Series, 895(1). https://doi.org/10.1088/1742-6596/895/1/012067

Intan Kamelia Mohtar, E. . P. S. (2022). Penerapan Model Pembelajaran ARIAS untuk Meningkatkan Koneksi Matematis Siswa Intan. 5(1), 83–88.

Johnston-wilder, S. (2017). Johnston-Wilder , S . Lee , C ., Garton , E ., Goodlad , S ., Brindley , J . 2013 Developing Coaches for Mathematical Resilience , the proceeding of ICERI. January 2013.

Kenedi, A. K., Helsa, Y., Ariani, Y., Zainil, M., & Hendri, S. (2019). Mathematical connection of elementary school students to solve mathematical problems. Journal on Mathematics Education, 10(1), 69–79. https://doi.org/10.22342/jme.10.1.5416.69-80

Kurniawan, M. R., & Agoestanto, A. (2023). Systematic Literature Review: Identifikasi Kemampuan Berpikir Aljabar dan Resiliensi Matematis pada Pembelajaran Matematika. Jurnal Cendekia : Jurnal Pendidikan Matematika, 7(3), 2208–2221. https://doi.org/10.31004/cendekia.v7i3.2442

Maulyda, M. A. (2020). PARADIGMA PEMBELAJARAN MATEMATIKA BERBASIS NCTM (Issue January).

Mota, A. I., Oliveira, H., & Henriques, A. (2016). Developing mathematical resilience: Students' voice about the use of ICT in classroom. Electronic Journal of Research in Educational Psychology, 14(1), 67–88. https://doi.org/10.14204/ejrep.38.15041

Muliana, M., Azura, C., & Rohantizani, R. (2022). Penerapan Model Pembelajaran Problem Based Learning Untuk Meningkatkan Kemampuan Koneksi Matematis Siswa. Jurnal Dedikasi Pendidikan, 6(2), 503–514. https://doi.org/10.30601/dedikasi.v6i2.3084

Nuryanto, Y., & Yuliardi, R. (2023). Efektivitas Model Pembelajaran Problem Based Learning Berbasis STEM Terhadap Kemampuan Koneksi Matematis Siswa. Indo-MathEdu Intellectuals Journal, 4(2), 179–192. https://doi.org/10.54373/imeij.v4i2.147

Purba, M., Purnamasari, N., Soetantyo, S., Suwarma, I. R., & Susanti, E. I. (2021). Prinsip Pengembangan Pembelajaran Berdiferensiasi (Differentiated Instruction).

Puspitasari, V., & Walujo, D. A. (2020). Model Diferensiasi Menggunakan Book Creator Untuk. 8(4), 310–319.

Santangelo, T., & Tomlinson, C. A. (2009). The Application of Differentiated Instruction in Postsecondary Environments: Benefits, Challenges, and Future Directions. International Journal of Teaching and Learning in Higher Education, 20(3), 307–323.

Sari, P. M., Syahputra, H., & Fauzi, K. A. (2023). Pengembangan Perangkat Pembelajaran Kooperatif Type Course Review Horay dan Media Geogebra untuk Meningkatkan Kemampuan Berpikir Spasial dan Resiliensi Matematika Siswa Kelas VIII. Jurnal Cendekia : Jurnal Pendidikan Matematika, 7(2), 1647–1658. https://doi.org/10.31004/cendekia.v7i2.2426

Setiawan, A., Sukestiyarno, Y., & Junaedi, I. (2022). Pengaruh Resiliensi Matematis Terhadap Literasi Matematik Peserta Didik Ma Nudia Semarang. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 11(3), 2431. https://doi.org/10.24127/ajpm.v11i3.5441

Sugiman. (2008). Koneksi Matematik Dalam Pembelajaran Matematika Di Sekolah Menengah Pertama. Pythagoras : Jurnal Pendidikan Matematika, 4(1), 56–66.

Tomlinson, C. A. (2017). The Rationale for Differentiating Instruction in Academically Diverse Classrooms. DIFFERENTIATE INSTRUCTION : In Academically Diverse Classooms, 12–18. http://www.ascd.org/ASCD/pdf/siteASCD/publications/books/HowtoDifferentiateInstructioninAcademicallyDiverseClassrooms-3rdEd.pdf

Yuliani, R., Praja, E. S., & Noto, M. S. (2018). Pengaruh Model Pembelajaran Missouri Mathematics Project Terhadap Kemampuan Koneksi Matematis dan Kemandirian Belajar Siswa SMP. Jurnal Elemen, 4(2), 131. https://doi.org/10.29408/jel.v4i2.478

Zanthy, L. S. (2018). Kontribusi Resiliensi Matematis Terhadap Kemampuan Akademik Mahasiswa Pada Mata Kuliah Statistika Matematika. Mosharafa: Jurnal Pendidikan Matematika, 7(1), 85–94. https://doi.org/10.31980/mosharafa.v7i1.344

Zuyyina, H., Wijaya, T. T., P, H. M., & Senjawati, E. (2018). Kemampuan Koneksi Matematis Siswa Smp Pada Materi Lingkaran. SOSIOHUMANIORA: Jurnal Ilmiah Ilmu Sosial Dan Humaniora, 4(2), 79–90. https://doi.org/10.30738/sosio.v4i2.2546