BIS EDUCATION
Volume 2 2026 | DOI: 10.31603/bised.638
7th Borobudur International Symposium on Humanities and Social Science (BIS-HSS) 2025
UNIMMA PRESS
Universitas Muhammadiyah Magelang

Numeracy profile viewed from the level of mathematical resilience in mathematics in context

Ayu Fitri[1*], Wahyudin[1], and Turmudi[1]

[1] Universitas Pendidikan Indonesia, Bandung, Indonesia
[*]Corresponding author's email: ayufitri@upi.edu

Abstract

This research aims to describe the profile of students' numeracy based on the level of mathematical resilience (MR) in Mathematics in Context (MiC) learning. The approach used was descriptive qualitative with six students as subjects, each representing the high, medium, and low MR categories. Data was obtained through a numeracy test, which includes four indicators: Communication and Interpretation, Problem and Formulation, Basic Numeracy Skills, and Application in Context. The research results show that students with high MR can fulfill all numeracy indicators consistently and precisely. Students with moderate MR show quite good abilities in data interpretation and basic skills but are not yet stable in formulating problems and applying mathematics in more complex contexts. Meanwhile, students with low MR only master basic operations and have difficulty understanding the context, choosing appropriate operations, and building problem modeling. This research confirms that differences in MR levels influence variations in students' numeracy, so strengthening mathematical resilience is needed to support optimal numeracy improvement.

Keywords

Numeracy, Mathematical resilience, Mathematics in context, Elementary school, Mathematics

Introduction

Numeracy has increasingly become a central concern in contemporary education research due to its critical role in enabling individuals to interpret quantitative information, reason mathematically, and make informed decisions in real-life situations. In the context of the twenty-first century, numeracy is no longer viewed merely as computational proficiency, but as a multidimensional competence involving understanding, interpretation, communication, and application of mathematics in meaningful contexts. This shift has positioned numeracy as a foundational skill for active participation in data-driven societies and has raised concerns regarding students' preparedness to engage with complex quantitative demands (Cockcroft, 1982; OECD, 2016; Gal et al., 2020).

Published:
May 04, 2026

Selection and Peer-review under the responsibility of the 7th BIS-HSS 2025 Committee

Despite strong policy emphasis on numeracy, international and national assessments consistently report that many students, particularly at the elementary level, demonstrate limited numeracy competence. These findings suggest that a significant proportion of students struggle not only with mathematical procedures but also with interpreting contextual problems, making sense of representations, and applying mathematical reasoning in everyday situations. Such conditions indicate a persistent problem within the field of mathematics education: the gap between formal mathematics instruction and students' ability to use mathematics functionally beyond the classroom (OECD, 2019).

To address this issue, a substantial body of research has explored instructional approaches designed to strengthen students' numeracy through contextualization. One prominent approach is *Mathematics in Context* (MiC), which emphasizes the use of real-world situations as a starting point for learning and supports students' gradual progression from informal reasoning to formal mathematical representations. Previous studies have reported that MiC contributes positively to students' conceptual understanding, problem-solving abilities, and contextual numeracy, as mathematical ideas are learned as tools for making sense of realistic situations rather than as isolated procedures (Gravemeijer, 1994; Romberg & Shafer, 2003; Yang et al., 2010).

Within this line of research, numeracy has been conceptualized through several core indicators, including basic numerical skills, the ability to formulate and model problems, communication and interpretation of mathematical information, and the application of mathematical reasoning in real-life contexts. Empirical findings suggest that contextual learning environments such as MiC are particularly effective in supporting these indicators, especially those related to interpretation and application, which are often weak in traditional mathematics instruction (Marr & Hagston, 2007; Bolstad, 2020).

However, existing studies on numeracy development have predominantly focused on cognitive outcomes and instructional effectiveness, with relatively limited attention to students' affective dispositions toward mathematics. Recent literature in mathematics education highlights that students' engagement with challenging numeracy tasks is also shaped by affective factors, one of which is *mathematical resilience*. Mathematical resilience refers to students' capacity to persist, remain engaged, and respond positively when encountering difficulties in mathematics learning, underpinned by beliefs about the value of mathematics, acceptance of struggle, growth-oriented mindsets, and persistence (Johnston-Wilder & Lee, 2010; Kooken et al., 2013).

Research has shown that students with higher levels of mathematical resilience are more likely to persevere in solving complex problems, explore alternative strategies, and regulate their emotions during learning, whereas students with lower resilience tend to disengage when facing difficulty. These characteristics suggest that mathematical resilience plays a critical role in how students engage with numeracy tasks, particularly those embedded in contextual and non-routine situations (Johnston-Wilder et al., 2015; Rokhmah et al., 2019).

Nevertheless, a closer examination of the literature reveals that numeracy and mathematical resilience are often investigated as separate constructs. Studies on numeracy typically emphasize instructional design and achievement outcomes, while research on mathematical resilience largely concentrates on attitudes and dispositions without directly examining how these dispositions manifest in students' numeracy performance. Consequently, limited attention has been given to how different levels of mathematical resilience relate to variations in students' numeracy profiles, especially within contextual learning environments such as MiC (Rahayu et al., 2020).

This lack of integrated analysis points to an important gap in the field: the need to understand how students with different levels of mathematical resilience demonstrate distinct patterns of numeracy competence. In particular, there is insufficient empirical evidence describing how indicators of numeracy such as problem formulation, interpretation, communication, and contextual application are manifested by students with high, medium, and low mathematical resilience at the elementary school level. Addressing this gap is essential for developing more adaptive and inclusive numeracy instruction that accounts for both cognitive and affective dimensions of learning (Gal et al., 2020).

In response to this gap, the present study proposes an integrative perspective by examining students' numeracy profiles through the lens of mathematical resilience within a *Mathematics in Context* learning environment. By linking indicators of numeracy with levels of mathematical resilience, this study offers a conceptual contribution that extends beyond measuring achievement to understanding how students engage with and respond to contextual numeracy tasks in different ways.

Accordingly, the purpose of this study is to describe the numeracy profiles of elementary school students based on their levels of mathematical resilience high, medium, and low within *Mathematics in Context* learning. Through this approach, the study aims to provide empirical insights that inform the design of contextual numeracy instruction and contribute to a more comprehensive understanding of the interplay between cognitive competence and affective resilience in mathematics education.

Method

This study employed a descriptive qualitative approach supported by quantitative data to examine students' numeracy profiles viewed from different levels of mathematical resilience within *Mathematics in Context* (MiC) learning. This approach was selected because the primary objective of the study was to describe and interpret variations in students' numeracy abilities based on their levels of mathematical resilience, rather than to test causal relationships or the effectiveness of a specific intervention. Accordingly, the analysis focused on understanding students' numeracy characteristics and problem-solving processes in depth.

The study was conducted with fifth-grade students at a public elementary school in Karawang Regency, Indonesia. Participants were selected using purposive sampling, based on the consideration that the selected class implemented contextual mathematics learning and allowed *Mathematics in Context* instruction to be carried out optimally. All students in the class participated in the study and were subsequently classified into high, medium, and low mathematical resilience groups based on their questionnaire scores.

Mathematics in Context learning served as the instructional context of the study. Mathematical concepts were introduced through real-life situations familiar to students, such as buying and selling activities, time measurement, quantity comparison, and simple calculations embedded in everyday contexts. Students were encouraged to construct mathematical understanding through discussion, exploration, and reflection, emphasizing progressive mathematization from concrete situations to more formal representations. The MiC procedures applied in this study followed well-established practices reported in the literature, enabling replication by future researchers.

The research instruments consisted of a numeracy test and a mathematical resilience questionnaire. The numeracy test comprised open-ended contextual problems designed to elicit students' thinking processes across key numeracy indicators, including basic numerical skills, problem formulation and modeling, communication and interpretation of mathematical information, and the application of mathematical reasoning in real-life contexts. The mathematical resilience questionnaire was used to identify students' levels of resilience based on indicators of valuing mathematics, acceptance of struggle as part of learning, belief in the growth of mathematical ability through effort, and persistence with emotional regulation when facing mathematical challenges.

Data collection was carried out in a structured sequence. After participating in *Mathematics in Context* learning according to the designed instructional scenario, students completed the numeracy test to provide data on their numeracy abilities. Subsequently, students completed the mathematical resilience questionnaire to determine their respective resilience levels. All data were collected under natural classroom conditions without additional experimental treatment, ensuring that the results reflected students' authentic responses and abilities.

Data analysis was conducted in stages and aligned with the research objectives. Questionnaire data were analyzed quantitatively to categorize students into high, medium, and low mathematical resilience groups. Students' responses to the numeracy test were then analyzed using descriptive qualitative analysis based on the predefined numeracy indicators. This process aimed to identify patterns, characteristics, and differences in numeracy profiles across the three levels of mathematical resilience. The findings were subsequently presented as descriptive profiles and served as the basis for further discussion in relation to relevant theories and previous research.

Results

The results of this study describe students' numeracy profiles and mathematical resilience profiles within *Mathematics in Context* learning. Based on the mathematical resilience questionnaire, students were classified into three levels: high, medium, and low mathematical resilience. Each level showed distinct characteristics related to students' beliefs, persistence, and responses to mathematical challenges.

Table 1. Students' mathematical resilience profiles

Level of Mathematical Resilience	Value (Belief in Mathematics)	Struggle (Response to Difficulty)	Growth (Belief in Improvement)	Persistence (Engagement and Effort)
High	Views mathematics as useful and meaningful	Accepts difficulty as a normal part of learning	Strong belief that ability improves through effort	Persists, remains engaged, and controls emotions when facing challenges
Medium	Recognizes the importance of mathematics but inconsistently	Attempts to cope with difficulty but easily hesitates	Believes improvement is possible but lacks confidence	Shows effort initially but may stop when tasks become complex
Low	Views mathematics as difficult and less meaningful	Avoids or gives up when encountering difficulty	Believes mathematical ability is fixed	Quickly disengages and shows low persistence

The Table 1 shows that students with high mathematical resilience demonstrated positive beliefs toward mathematics, accepted struggle as part of learning, and consistently persisted in solving challenging tasks. Students with medium resilience showed partial positive attitudes but were less consistent in maintaining effort. In contrast, students with low resilience exhibited avoidance behaviors and low persistence when encountering mathematical difficulties.

Based on this classification, students' responses to the numeracy test were analyzed to identify their numeracy profiles across four indicators: basic numerical skills, problem formulation, communication and interpretation, and application in context. Table 2 summarizes students' numeracy profiles according to their levels of mathematical resilience.

The results indicate a consistent pattern: students with higher mathematical resilience demonstrated more comprehensive numeracy performance across all indicators, while students with lower resilience exhibited fragmented understanding and limited engagement in numeracy tasks. High-resilience students showed persistence and flexibility in problem-solving, medium-resilience students demonstrated partial understanding, and low-resilience students often disengaged when facing difficulty.

Table 2. Students' numeracy profiles based on levels of mathematical resilience

Level of Mathematical Resilience	Basic Numerical Skills	Problem Formulation	Communication and Interpretation	Application in Context
High	Accurate and efficient; minimal computational errors	Able to identify relevant information and construct appropriate models	Clear interpretation and coherent explanations	Effectively applies mathematical reasoning to real-life situations
Medium	Generally accurate with occasional errors	Identifies main information but models are sometimes incomplete	Partial interpretation; explanations tend to be procedural	Applies mathematics mainly in familiar contexts
Low	Frequent errors in basic operations	Difficulty identifying relevant information and formulating models	Misinterpretation or absence of explanation	Limited or no application in contextual situations

Discussion

The findings of this study demonstrate that students' numeracy profiles in *Mathematics in Context* learning vary systematically according to their levels of mathematical resilience. Students with high mathematical resilience exhibited comprehensive numeracy performance across all indicators, including basic numerical skills, problem formulation, communication and interpretation, and application in real-life contexts. This result indicates that mathematical resilience supports sustained engagement with contextual numeracy tasks, particularly those requiring interpretation, reasoning, and decision-making beyond routine procedures.

The strong numeracy performance of students with high mathematical resilience can be explained by their positive beliefs about mathematics and their acceptance of struggle as a natural part of learning. These characteristics align with the conceptualization of mathematical resilience as a disposition that enables learners to persist, regulate emotions, and remain cognitively engaged when facing mathematical challenges (Johnston-Wilder & Lee, 2010; Kooken et al., 2013). Within *Mathematics in Context* learning, which emphasizes progressive mathematization from real-world situations, such persistence allows students to explore, revise, and refine their mathematical reasoning until meaningful solutions are achieved.

Students with medium mathematical resilience demonstrated a transitional numeracy profile. While they generally showed adequate basic numerical skills and were able to identify relevant information in contextual problems, their performance was weaker in communication, interpretation, and contextual application. This finding suggests that moderate resilience may support task completion at a procedural level but may not be sufficient to sustain deeper conceptual engagement and reflective reasoning. Similar patterns have been reported in previous studies, which indicate that students with

moderate affective dispositions often rely on procedural strategies and provide limited explanations when confronted with complex or non-routine problems (Rahayu et al., 2020).

In contrast, students with low mathematical resilience exhibited fragmented numeracy profiles characterized by frequent computational errors, difficulties in problem formulation, and limited application of mathematical reasoning in contextual situations. Their tendency to disengage when encountering difficulty highlights the critical role of affective factors in numeracy development. As noted in prior research, students with low resilience often perceive mathematical difficulty as a signal of failure rather than as an opportunity for learning, which restricts their willingness to persist and explore alternative strategies (Rokhmah et al., 2019). In the context of *Mathematics in Context* learning, such disengagement may prevent students from benefiting fully from contextual problem-solving activities that require active sense-making.

The alignment between students' mathematical resilience profiles and their numeracy profiles underscores the interdependence between cognitive and affective dimensions of learning mathematics. Numeracy, as a multidimensional competence involving interpretation, communication, and application, requires not only conceptual understanding but also the capacity to tolerate uncertainty and persist through challenging situations (Gal et al., 2020). The present findings support this view by showing that higher levels of resilience are associated with more complete and coherent numeracy performance, particularly in indicators that demand sustained reasoning and contextual interpretation.

From an instructional perspective, these findings reinforce the importance of integrating resilience-supportive strategies into contextual numeracy instruction. While *Mathematics in Context* provides meaningful learning opportunities through real-life problems, its effectiveness depends on students' readiness to engage with difficulty and ambiguity. Supporting students in developing positive beliefs about mathematics, normalizing struggle, and encouraging persistence may enhance the impact of contextual learning approaches, especially for students with low and medium levels of mathematical resilience.

In terms of theoretical contribution, this study extends existing research by offering an integrated analysis of numeracy and mathematical resilience. Rather than examining these constructs in isolation, the study demonstrates how differences in resilience levels are reflected in distinct numeracy profiles within the same instructional context. This integrative perspective contributes to a more comprehensive understanding of numeracy development and highlights the need to consider affective dispositions as an essential component of numeracy research.

Overall, the discussion of findings suggests that improving students' numeracy competence requires attention not only to instructional design but also to the cultivation of mathematical resilience. Future research may build on these findings by

exploring instructional interventions that explicitly combine contextual numeracy tasks with resilience-building strategies, as well as by examining how these relationships evolve across different grade levels and learning contexts.

Conclusion

This study investigated elementary school students' numeracy profiles viewed from different levels of mathematical resilience within *Mathematics in Context* learning and found that numeracy competence is closely related to students' capacity to persist, interpret, and apply mathematical reasoning in contextual situations. Students with higher levels of mathematical resilience demonstrated more coherent and comprehensive numeracy profiles, particularly in indicators involving interpretation, communication, and real-life application, whereas students with lower resilience showed fragmented understanding and limited engagement with contextual numeracy tasks. These findings indicate that numeracy development is not solely a cognitive endeavour but emerges from the interaction between mathematical understanding and affective dispositions toward learning mathematics. By integrating numeracy and mathematical resilience within a contextual learning framework, this study contributes to a more holistic perspective on numeracy development and advances current knowledge by highlighting the role of resilience in shaping students' engagement with contextual mathematics. The results suggest that effective numeracy instruction should combine meaningful contextual tasks with deliberate support for students' mathematical resilience, and future research is encouraged to explore instructional designs that explicitly integrate resilience-building strategies across diverse learning contexts and grade levels.

References

1. Balatti, J., Black, S., & Falk, I. (2006). Reframing adult literacy and numeracy courses: A social practice perspective. National Centre for Vocational Education Research.
2. Bolstad, R. (2020). Numeracy: A critical skill for the future. New Zealand Council for Educational Research.
3. Cockcroft, W. H. (1982). Mathematics counts. Her Majesty's Stationery Office.
4. Gal, I., Grotlüschen, A., Tout, D., & Kaiser, G. (2020). Numeracy, adult education, and vulnerable adults: A critical view. ZDM–Mathematics Education, 52(3), 377–394. https://doi.org/10.1007/s11858-020-01155-9
5. Gravemeijer, K. (1994). Developing realistic mathematics education. Utrecht University.
6. Johnston-Wilder, S., & Lee, C. (2010). Developing mathematical resilience. Proceedings of the British Society for Research into Learning Mathematics, 30(3), 38–43.
7. Johnston-Wilder, S., Lee, C., Brindley, J., & Smith, L. (2015). Developing mathematical resilience in school students. Routledge.
8. Kooken, J., Welsh, M. E., McCoach, D. B., Johnston-Wilder, S., & Lee, C. (2013). Development and validation of the Mathematical Resilience Scale. Measurement and Evaluation in Counseling and Development, 46(4), 306–322. https://doi.org/10.1177/0748175613497032
9. Marr, B., & Hagston, J. (2007). Numeracy in practice. Australian Primary Mathematics Classroom, 12(1), 14–18.
10. OECD. (2016). PISA 2015 assessment and analytical framework: Mathematics, reading, science, problem solving and financial literacy. OECD Publishing. https://doi.org/10.1787/9789264255425-en
11. OECD. (2019). OECD future of education and skills 2030. OECD Publishing.

12. O'Donoghue, J. (2002). Numeracy and mathematics. Irish Mathematical Society Bulletin, 50, 47–55.
13. Rahayu, S., Kartono, & Isnarto. (2020). Students' mathematical resilience in solving contextual mathematics problems. Journal of Mathematics Education, 11(2), 123–134.
14. Rokhmah, A., Wardono, & Isnarto. (2019). Mathematical resilience: Is it affecting students' mathematics achievement? Journal of Mathematics Education, 10(2), 151–164.
15. Romberg, T. A., & Shafer, M. C. (2003). Mathematics in Context: A connected curriculum. Educational Studies in Mathematics, 54(2–3), 259–277. https://doi.org/10.1023/A:1026052226979
16. Romberg, T. A., Shafer, M. C., & Webb, N. L. (2005). The impact of Mathematics in Context on student achievement. Wisconsin Center for Education Research.
17. Yang, D. C., Reys, R. E., & Wu, L. L. (2010). Comparing mathematics curricula: A study of Mathematics in Context. International Journal of Science and Mathematics Education, 8(4), 627–646. https://doi.org/10.1007/s10763-009-9161-3