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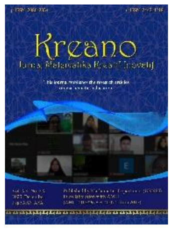

Analysis of Students' Mathematical Communication Skills in Terms of Student Resilience at BAN KALISA School Thailand

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Abstract

This study aims to analyze students' mathematical communication skills based on their level of academic resilience in solving fraction-based word problems at Ban Kalisa School, Thailand. A descriptive qualitative approach was employed involving 20 fifth-grade students selected through purposive sampling. Data were collected using a resilience questionnaire, a mathematical communication test, and semi-structured interviews, and analyzed through data reduction, data display, and triangulation. The results show that 55% of students were classified as having moderate resilience, 35% high resilience, and 10% low resilience. Students with high resilience achieved the highest communication performance and demonstrated systematic problem-solving procedures, clear reasoning, and accurate use of mathematical symbols. In contrast, students with moderate resilience were able to obtain correct answers but provided limited explanations, while low-resilience students showed difficulties in both conceptual understanding and communication, often presenting incomplete procedures. These findings indicate that academic resilience significantly influences students' mathematical communication skills, particularly in terms of persistence, clarity of explanation, and the ability to articulate reasoning. Therefore, resilience should be considered an essential factor in supporting the development of effective mathematical communication.

Keywords: Ability; Mathematical Communication; Resilience

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Abstrak

Penelitian ini bertujuan untuk menganalisis kemampuan komunikasi matematis siswa berdasarkan tingkat resiliensi akademik dalam menyelesaikan soal cerita berbasis pecahan di Ban Kalisa School, Thailand. Penelitian ini menggunakan pendekatan deskriptif kualitatif dengan melibatkan 20 siswa kelas V yang dipilih melalui teknik purposive sampling. Data dikumpulkan melalui angket resiliensi, tes komunikasi matematis, dan wawancara semi-terstruktur, kemudian dianalisis melalui reduksi data, penyajian data, dan triangulasi. Hasil penelitian menunjukkan bahwa 55% siswa memiliki resiliensi sedang, 35% resiliensi tinggi, dan 10% resiliensi rendah. Siswa dengan resiliensi tinggi menunjukkan kemampuan komunikasi matematis yang lebih baik, ditandai dengan penyajian langkah penyelesaian yang sistematis, penalaran yang jelas, serta penggunaan simbol matematika yang tepat. Sementara itu, siswa dengan resiliensi sedang mampu memperoleh jawaban yang benar namun kurang dalam memberikan penjelasan, sedangkan siswa dengan resiliensi rendah mengalami kesulitan baik dalam pemahaman konsep maupun komunikasi matematis, serta cenderung memberikan prosedur yang tidak lengkap. Temuan ini menunjukkan bahwa resiliensi akademik berperan penting dalam memengaruhi kemampuan komunikasi matematis siswa, terutama dalam aspek ketekunan, kejelasan penjelasan, dan kemampuan mengungkapkan proses berpikir. Oleh karena itu, resiliensi perlu menjadi perhatian dalam upaya meningkatkan kemampuan komunikasi matematis siswa.

INTRODUCTION

The capacity to communicate mathematically stands as one of the core competencies that students are expected to acquire during their formal education (Intan et al., 2021). This ability encompasses far more than arithmetical accuracy; it requires learners to articulate their reasoning coherently, represent ideas symbolically, and construct logical arguments within mathematical discourse (Fitriani et al., 2021). Given that many mathematical tasks are presented as word problems or contextual scenarios, the integration of language and mathematics becomes particularly salient (Lubis et al., 2024). Scholars have framed mathematical communication as the capacity to express and interpret quantitative ideas through numerals, symbols, diagrams, graphs, and verbal language (Alfiana & Dewi, 2021; Wida et al., 2022). Schoen further characterised this skill as the ability to challenge and elucidate novel problem-solving approaches (Danuri & Choirunisa, 2023), arguing that without it, students cannot reliably reach correct solutions (Rizal et al., 2021). Mathematical communication also serves as the primary vehicle through which students explore ideas collaboratively, evaluate each other's reasoning, and build collective understanding (Arina & Nuraeni, 2022).

In contemporary mathematics education, mathematical communication is increasingly recognised as a fundamental component of mathematical literacy and higher-order thinking skills. Students who are able to express mathematical reasoning clearly tend to demonstrate deeper conceptual understanding and improved problem-solving abilities (Mulbar et al., 2022; Priatna et al., 2022). Moreover, global educational practices emphasise the integration of communication skills through innovative learning approaches such as project-based learning, contextual learning, and technology-assisted instruction (Pratiwi et al., 2020; Susilawati, 2021; Yuningsih et al., 2021). These approaches provide students with opportunities to represent ideas in multiple forms and engage in meaningful mathematical discussions.

Despite its acknowledged centrality, large-scale assessments reveal persistent shortfalls in student communication competency. Indonesia's average PISA mathematics score declined from 379 in 2018 to 366 in 2023, reflecting systemic difficulties that extend beyond computational skill to include the communicative dimension

(Heri et al., 2024). These findings align with classroom-level observations suggesting that students often arrive at correct answers yet struggle to articulate the procedures or concepts underpinning their solutions. Such fragmentation in mathematical understanding signals the need to examine not only cognitive but also affective contributors to communication performance (Suhenda & Munandar, 2023).

At the classroom level, students frequently experience difficulties in communicating mathematical ideas, including limited ability to explain reasoning, misuse of mathematical symbols, and lack of confidence in expressing their thoughts (Puspa et al., 2023; Wandari & Anggara, 2021). This indicates that improving mathematical communication requires not only strengthening conceptual understanding but also addressing students' affective conditions during learning.

Within the affective domain, resilience has attracted growing scholarly attention as a determinant of mathematical learning outcomes. Defined as the capacity to recover and persist following adversity or difficulty, resilience equips students to confront demanding tasks with sustained effort rather than avoidance (Meilani & Meiliasari, 2024).

Recent international research highlights that academic resilience plays a crucial role in sustaining students' engagement and performance, particularly in challenging subjects such as mathematics. Resilient students are more likely to persist, remain motivated, and apply adaptive strategies when facing difficulties (Steel et al., 2024; Sun & Liu, 2023). Furthermore, resilience is strongly influenced by external factors, including teacher support and learning environments. Guo et al. (2026) found that teacher academic support significantly enhances students' resilience through increased engagement, while Wang et al. (2025) emphasise that supportive learning environments foster students' ability to overcome academic challenges.

In the specific context of mathematics, this trait encompasses willingness to engage with challenging content, confidence in one's own capability, collaborative orientation with peers, and command of the mathematical register required to express ideas precisely (Fatimah & Fitriani, 2021). Resilient learners are less likely to disengage when confronted with difficulty and more likely to develop and test alternative strategies (Ansori, 2020; Retariandalas & Pujiati, 2023). Academic resilience, as distinct from general psychological resilience, specifically denotes the ability to restore effective functioning after a setback in learning (Meiranti & Sutoyo, 2020), and has been associated with improved self-efficacy and achievement outcomes (Syihabudin et al., 2024).

In addition, resilience is not solely an individual trait but is also shaped by instructional practices and teacher characteristics. Bykova & Chirkina (2020) demonstrate that teacher-related factors, such as instructional quality and emotional support, significantly influence students' academic resilience. This suggests that classroom environments play a critical role in fostering resilience alongside cognitive development.

The interplay between resilience and mathematical communication has begun to receive empirical attention. Purwati & Mailanufi (2022) found that approximately 13.33% of the variance in communication tendency could be accounted for by mathematical resilience, indicating a meaningful, if partial, relationship. (Lubis et al., 2024) similarly observed that students with stronger resilience profiles demonstrated deeper conceptual understanding in a cross-national setting. Chairuddin et al. (2024) argue that resilience functions as a motivational substrate that determines how students approach the communicative challenges embedded in mathematical problem-solving. Arifin (2020) operationalises this relationship directly, defining mathematical resilience as the disposition to persist through the communicative difficulties inherent in problem-solving context. Mustika et al. (2024) further links positive disposition and tenacity to enhanced problem-resolution rates, while Ulhasna et al. (2024) call for systematic assessment of resilience within instructional contexts.

However, previous studies tend to examine mathematical communication and resilience separately, and only limited research has investigated their relationship simultaneously, particularly at the primary school level (Fernandes et al., 2025). Additionally, most studies are conducted in secondary or higher education contexts, leaving a gap in understanding how these variables interact among younger learners.

Another important gap lies in the limited number of studies conducted in multicultural and cross-national contexts. Learning environments such as Ban Kalisa School in Thailand, where students may face linguistic and cultural differences, present unique challenges that can influence both resilience and mathematical communication. These contextual factors remain underexplored in existing literature.

Contextual observations at Ban Kalisa School, Narathiwat, Thailand, indicate that a substantial proportion of learners harbour negative preconceptions about mathematics, describing it as intimidating and unapproachable. These attitudes manifest in reluctance to engage with problem-solving tasks, cognitive avoidance, and rapid disengagement when difficulties arise (Gehlawat & Pandey, 2024).

This condition highlights the urgency of examining not only students' mathematical communication skills but also the underlying affective factors that influence these skills (Hutapea et al., 2024). Without sufficient resilience, students are less likely to persist in solving problems, reflect on their reasoning, and communicate their ideas effectively, which may hinder their overall mathematical performance (Sumliyah et al., 2026).

Therefore, this study is important as it addresses both cognitive and affective dimensions of learning by analysing the relationship between mathematical communication and academic resilience in a primary school context.

When students lack the resilience to persist through such difficulties, their capacity to construct and communicate mathematical reasoning is correspondingly constrained. Coordinated effort among teachers, students, and institutional stakeholders is therefore required to cultivate the resilient dispositions that underpin effective mathematical communication (Siswantari et al., 2025).

The present study responds to this gap by analysing the mathematical communication skills of Grade V students at Ban Kalisa School in relation to their resilience classification. Specifically, this study aims to: (1) analyse students' mathematical communication skills; (2) classify students based on their level of academic resilience; and (3) examine how different levels of resilience influence students' ability to communicate mathematical ideas in solving fraction-based word problems. The findings of this study are expected to contribute theoretically by enriching the literature on the interaction between cognitive and affective factors in mathematics education, and practically by providing recommendations for teachers to design learning strategies that foster both resilience and mathematical communication skills.

METHOD

This study adopted a descriptive qualitative approach, chosen for its suitability in capturing the depth and diversity of individual student responses (Yin, 2016). The research was conducted at Ban Kalisa School, Narathiwat, Thailand, with Grade V students during the academic semester. A purposive sampling procedure yielded a sample of twenty students whose characteristics including prior performance variability and teacher-assessed engagement levels aligned with the research objectives.The participants were aged between 10–11 years and represented diverse academic abilities. The analytical framework integrated data reduction, data display, conclusion-drawing, and triangulation to ensure interpretive rigour (Rofiah et al., 2021).

Three instruments were employed. First, a 25-item Likert-format resilience questionnaire assessed four dimensions: (a) perceived importance of mathematics, (b) intrinsic motivation to persist despite difficulty, (c) self-efficacy in mathematical learning, and (d) tenacity and positive orientation in the face of setbacks. The questionnaire used a 5-point Likert scale ranging from strongly disagree to strongly agree. Second, a five-item story-problem test operationalised five mathematical communication indicators relevant to fraction content: systematic step-by-step presentation, conceptual justification, correct symbolic notation, clarity of final answers, and provision of supplementary explanations. The test was administered under supervised classroom conditions within a specified time allocation. Third, semi-structured interviews were conducted with selected students to probe how resilience influenced their approach to communication challenges. Both instruments were validated by a Ban Kalisa School mathematics teacher and a mathematics education lecturer from Universitas Muhammadiyah Tapanuli Selatan. This validation process ensured content validity. The questionnaire demonstrated acceptable reliability based on internal consistency measures.

Table 1. Resilience Questionnaire Indicators

No	Resilience Indicator
1	Belief that mathematics is important and worthwhile
2	Strong intrinsic motivation to study mathematics, even when encountering unpleasant challenges
3	Self-confidence in one's ability to learn and master mathematics through understanding, strategy creation, tool use, and accumulated experience
4	Emotional fortitude in facing hardship, refusing to give up, and maintaining a positive response to learning mathematics

Student resilience scores were categorised as shown in Table 2. Following questionnaire administration, three students from each resilience tier were selected as focal interview participants to enable in-depth cross-group comparison. Data collection was conducted sequentially, starting with the questionnaire, followed by the test, and ending with interviews. All interview data were recorded, transcribed, and triangulated against test responses and observational notes. Data analysis involved coding responses based on mathematical communication indicators, presenting them in descriptive and tabular forms, and comparing patterns across resilience levels. Method triangulation was applied to ensure data credibility.

Table 2. Resilience Score Categories

Score Range	Resilience Level
$x > 77$	High
$66 \leq x < 77$	Moderate
$x \leq 66$	Low

Ethical considerations were addressed by obtaining permission from the school, ensuring voluntary participation, and maintaining the confidentiality of all participants.

RESULT AND DISCUSSION

Results

Table 3 presents the resilience distribution across the twenty Grade V participants at Ban Kalisa School. The majority of students fell within the moderate resilience category, comprising eleven individuals or 55% of the sample. Seven students (35%) were classified as high-resilience learners, while only two (10%) registered low resilience scores. This distribution suggests that while most students possessed a functional level of persistence, a noteworthy minority demonstrated the heightened tenacity and self-assurance characteristic of the high-resilience profile.

This distribution also indicates that most students have not yet reached optimal resilience levels, as only a small proportion demonstrated high resilience. Furthermore, the presence of low-resilience students highlights the need for targeted instructional support, particularly in fostering persistence and confidence when solving mathematical problems.

Table 3. Resilience Score Distribution

Score Range	Resilience Level	Number of Students	Percentage
$\boldsymbol{x \leq 66}$	Low	2	10%
$\boldsymbol{66 \leq x < 77}$	Moderate	11	55%
$\boldsymbol{x > 77}$	High	7	35%

To examine how these resilience profiles corresponded with communication performance, the five-item story-problem test was administered and scored against the communication indicators listed in Table 4. Three focal students were then selected to represent each tier: RT (high resilience, PR = 83%, test score = 100), RS (moderate resilience, PR = 72%, score = 80), and RR (low resilience, PR = 62%, score = 40).

The data in Table 5 reveal a clear pattern in which higher resilience is associated with better mathematical communication performance. Students with high resilience achieved the highest scores, while those with lower resilience showed decreased performance, indicating a proportional relationship between resilience and communication ability.

Table 4. Mathematical Communication Test Indicators

Item	Communication Indicator	Sub-Indicator
1	Presenting solution steps clearly and systematically	Arranging computation steps sequentially and logically when finding LCM prior to fraction operations
2	Explaining the concept or	Providing a rationale for why the denominator must be

	principle applied	equalised in fraction operations
3	Using mathematical notation and symbols correctly	Writing symbols and mathematical expressions accurately, particularly in fraction operations
4	Presenting answers clearly and legibly	Writing the final answer neatly with denominator equalisation shown before the operation
5	Adding supplementary notes to clarify the process	Including an explanation of fraction simplification steps to enhance comprehensibility

Table 5. Focal Student Data

Category	Student ID	Resilience score (%)	Test Score
High	RT	83%	100
Moderate	RS	72%	80
Low	RR	62%	40

High-Resilience Students

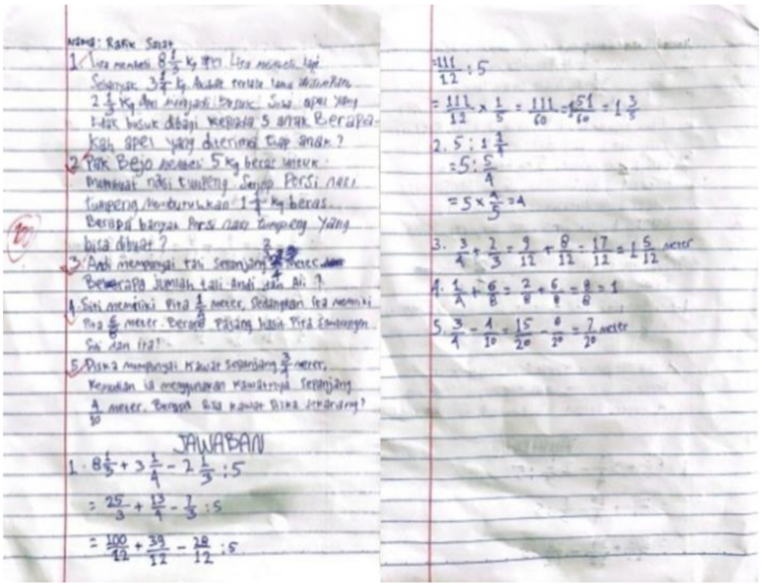


Figure 1. Answer of a Student with High Resilience

Student RT consistently demonstrated strong mathematical communication across all five items. This indicates that high-resilience students not only understand mathematical procedures but are also able to regulate their thinking processes and communicate them effectively, reflecting strong metacognitive ability. On Item 1, the student presented a thorough and logically ordered procedure for identifying the lowest common multiple (LCM) before executing the fraction operation, accompanied by an explicit explanation of the rationale for denominator equalisation. Item 2 responses showed a systematic, stepwise approach in which every arithmetic move was accompanied by a stated justification. For Item 3, conceptual understanding was particularly evident: the student articulated clearly why equalising denominators is a prerequisite for addition, with all symbolic notation rendered correctly and arranged coherently. Items 4 and 5 were characterised by structured, report-style responses that included supplementary notes on simplification procedures and denominator alignment. Although arithmetic outcomes were uniformly accurate, there remained limited scope to further strengthen the explicitness of final-answer derivations.

Interview data reinforced these observations. RT expressed confidence in approaching unfamiliar problems by decomposing them into smaller sub-tasks and revisiting foundational concepts when initial strategies proved insufficient. The student articulated a clear personal standard for mathematical communication-responses, in this student's view, should be sequentially organised, unambiguous, and accompanied by logical justification at each step. To sustain improvement, RT reported habitual practices including self-explanation, supplementary reference consultation, and deliberate refinement of written procedures. This profile aligns with Ansori's (2020) characterisation of mathematically resilient learners as individuals who actively deploy adaptive strategies and maintain engagement across cycles of difficulty.

Moderate-Resilience Students

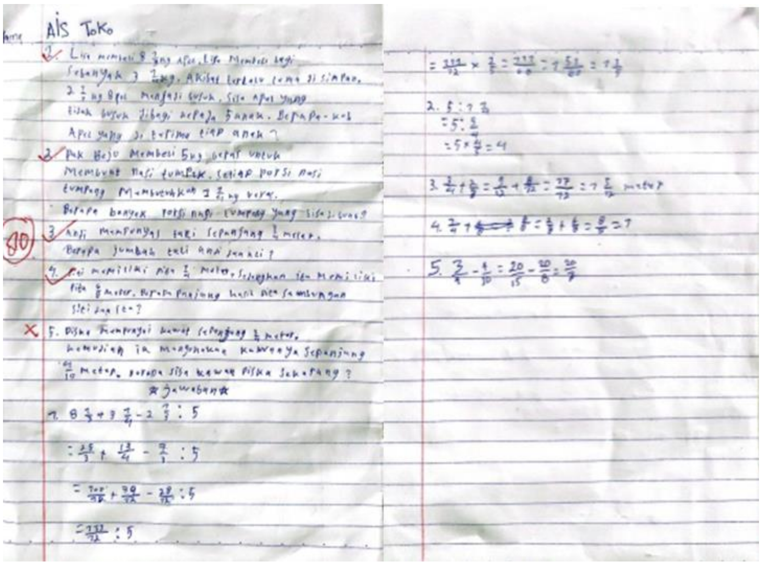
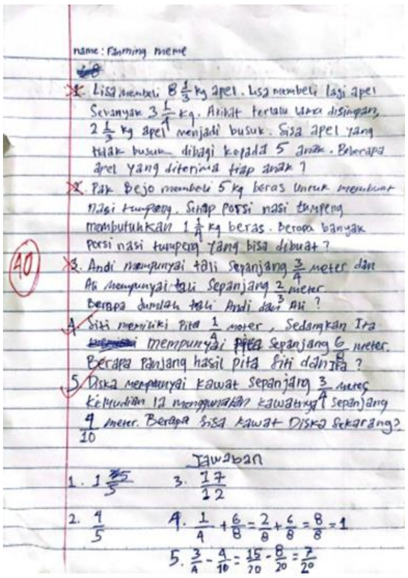


Figure 2. Answer of a Student with Moderate Resilience

Student RS produced largely correct answers but with uneven communicative quality. This suggests that the limitation of moderate-resilience students lies not in their mathematical ability, but in their ability to articulate reasoning explicitly. On Item 1, solutions were accurate yet explanatory commentary was sparse, consisting primarily of numerical steps without explicit reference to the underlying reasoning. Item 2 responses, though correct, revealed hesitation: the student completed calculations successfully but omitted the conceptual justification required by the indicator. Similarly, Items 3 and 4 contained the correct answer but lacked the supplementary denominational notes that would have made the logic fully transparent. For Item 5, the student arrived at the correct result but did not elaborate the simplification pathway, leaving important procedural steps implicit.

Interview evidence indicated that RS could perform the mathematics adequately but struggled to verbalise the reasoning process. The student was aware of procedural steps but lacked confidence in asserting or defending them in either spoken or written form. These findings echo Retariandalas & Pujiati (2023), who note that moderate-resilience students tend to achieve procedural correctness while remaining constrained in metacommunicative articulation. Pedagogical strategies that emphasise peer discussion, concrete manipulatives, and guided argumentation construction are likely to be most effective for this group (Lubis et al., 2024), as they would provide the scaffolding needed for students to translate implicit understanding into explicit communication.

Low-Resilience Students


name : Fanming meme

1. Lisa membeli $8\frac{1}{3}$ kg apel. Lisa membeli lagi apel sebanyak $3\frac{1}{4}$ kg. Akibat terlalu lama disimpan, $2\frac{1}{3}$ kg apel menjadi busuk. Sisa apel yang tidak busuk dibagi kepada 5 anak. Berapa apel yang diterima tiap anak?
2. Pak Bejo membeli 5 kg beras untuk membuat nasi tumpeng. Setiap porsi nasi tumpeng membutuhkan $1\frac{1}{4}$ kg beras. Berapa banyak porsi nasi tumpeng yang bisa dibuat?
3. Andi mempunyai tali sepanjang $\frac{3}{4}$ meter dan Ali mempunyai tali sepanjang $\frac{2}{3}$ meter. Berapa jumlah tali Andi dan Ali?
4. Siti memiliki pita $\frac{1}{4}$ meter, sedangkan Ira mempunyai pita sepanjang $\frac{6}{8}$ meter. Berapa panjang hasil pita Siti dan Ira?
5. Diska mempunyai kawat sepanjang $\frac{3}{4}$ meter kemudian ia menggunakan kawatnya sepanjang $\frac{4}{10}$ meter. Berapa sisa kawat Diska sekarang?

40

Jawaban

1. $1\frac{5}{5}$
2. $\frac{4}{5}$
3. $\frac{17}{12}$
4. $\frac{1}{4}+\frac{6}{8}=\frac{2}{8}+\frac{6}{8}=\frac{8}{8}=1$
5. $\frac{3}{4}-\frac{4}{10}=\frac{15}{20}-\frac{8}{20}=\frac{7}{20}$

Figure 3. Answer of a Student with Low Resilience

Student RR exhibited pronounced communicative difficulties throughout the test. This pattern indicates that low resilience affects not only conceptual understanding but also learning behaviour, particularly in terms of persistence and willingness to engage with challenging problems. Item 1 responses contained minimal procedural detail and, while the final numerical value was occasionally correct, the absence of any stated reasoning made it impossible to determine whether the answer reflected understanding or coincidental calculation. Items 2 and 3 revealed misunderstanding of the fraction addition procedure: the student did not consistently equalise denominators and made systematic errors in symbolic representation. On Item 4, confusion in the equalisation process propagated into an incorrect final answer, and the step sequence was disorganised. Item 5 responses contained fundamental errors in fraction subtraction, suggesting that core conceptual knowledge had not been consolidated.

Interview responses from RR confirmed a pattern of low self-efficacy, avoidance of challenging items, and rapid discouragement when errors occurred. The student acknowledged difficulty with foundational concepts and expressed reluctance to ask for help. This profile is consistent with Rifdah and Cahya's (2020) observation that low-resilience students seldom self-correct and tend to abandon tasks prematurely. Meiranti and Sutoyo (2020) similarly note that without academic resilience, students cannot restore productive engagement after experiencing setbacks. Targeted interventions for this group should include graduated task difficulty, visual aids, constructive feedback cycles, and small-group practice structures designed to rebuild confidence progressively.

Table 6. Communication Skill by Resilience Level

Communication Indicator	Student	Items Successfully Addressed
Presenting solution steps clearly and systematically	RT, RS	1, 1
Explaining the concept or principle applied	RT, RS	2, 3, 2
Using correct mathematical notation and symbols	RT, RS	4, 5, 4
Presenting answers clearly and legibly	RT	All items
Adding supplementary explanatory notes	RT	Selected items

Note:
RT = high resilience; RS = moderate resilience; and RR = low resilience.

Overall, the findings demonstrate three distinct learner profiles: high-resilience students who are reflective and communicative, moderate-resilience students who are procedurally competent but less expressive, and low-resilience students who struggle both cognitively and motivationally. This classification indicates that mathematical communication is influenced not only by knowledge but also by students' resilience levels.

Discussion

These findings suggest that resilience plays a crucial role as a bridge between cognitive understanding and communication ability. Students with higher resilience tend to persist longer, reflect more deeply, and express their reasoning more clearly, while those with lower resilience are more likely to disengage and provide minimal explanations.

The findings confirm a positive association between student resilience and mathematical communication quality. High-resilience learners not only produced accurate computations but also demonstrated the metacognitive transparency and structural organisation that define proficient communication. Their capacity to accept critique, maintain argumentative coherence, and connect procedural steps to conceptual principles reflects the characteristics described by Ansori (2020) and Fatimah and Fitriani (2021) for mathematically resilient learners. The willingness of high-resilience students to revisit concepts and attempt alternative approaches further aligns with Lubis et al.'s (2024) finding that resilience supports adaptive strategy use in novel problem contexts.

Moderate-resilience students occupied an instructionally significant transitional zone. Their procedural competence was generally adequate, yet the absence of explicit justification and supplementary elaboration restricted the communicative value of their responses. This pattern mirrors the findings of Purwati et al. (2022), who identified a meaningful but incomplete overlap between resilience and communicative proficiency. Students in this group appear to possess latent communicative capacity that remains underdeveloped due to insufficient confidence and limited practice in verbalising mathematical reasoning. Structured opportunities for peer explanation and reflective writing are likely to catalyse growth in this population (Dewi & Nuraeni, 2022).

Low-resilience students presented the most substantial communicative barriers. Their difficulties were not exclusively procedural; rather, they reflected a broader disengagement from the communicative register of mathematics — the language of justification, notation, and systematic exposition. This disengagement is consistent with Azizah and Abadi's (2022) argument that resilience constitutes a motivational prerequisite for communicative engagement in mathematics. Without resilience, students lack the sustained attention and risk tolerance required to produce and revise mathematical explanations. The implication for pedagogy is that content instruction alone is insufficient; fostering resilience must be treated as a co-equal instructional objective alongside mathematical content knowledge.

Implication

These findings carry practical implications for mathematics teachers and curriculum developers, particularly in multicultural or cross-national contexts such as Ban Kalisa School. Differentiated instruction that explicitly addresses the affective dimensions of learning—including resilience-building activities, growth-mindset framing, and emotionally supportive feedback—should be integrated into standard lesson planning. Visual aids, manipulatives, and small-group learning structures can reduce the affective barriers that prevent low-resilience students from engaging with communicative tasks. Professional development programmes for teachers should include strategies for recognising and responding to resilience-related learning challenges.

Limitation

This study is bounded by several constraints. The sample size of twenty students limits the generalisability of findings beyond the immediate context. The cross-sectional design prevents causal inference regarding the direction of the resilience–communication relationship. Additionally, the reliance on story-problem format restricts the assessment to one communicative genre, and students' performance may vary across other types of mathematical tasks. Future research employing larger samples, longitudinal designs, and varied task formats would strengthen the evidence base for the claims advanced here.

CONCLUSION

Based on the results of the study on the analysis of students' mathematical communication skills in relation to their resilience at Ban Kalisa School, it can be concluded that there are varying levels of student resilience that correspond to their mathematical communication abilities. The findings reveal a clear pattern in which students with higher resilience demonstrate more structured, coherent, and conceptually grounded mathematical communication compared to those with moderate and low resilience.

Students with high resilience demonstrate better communication skills compared to those with moderate and low resilience. High-resilience students are able to explain problem-solving procedures systematically, justify their reasoning, and use appropriate mathematical representations, indicating strong metacognitive awareness. In contrast, moderate-resilience students generally achieve correct answers but tend to provide limited explanations, suggesting that their difficulty lies in articulating reasoning rather than understanding concepts. Meanwhile, low-resilience students exhibit weaknesses in both conceptual understanding and communication, often providing incomplete procedures and showing low persistence when facing difficulties.

Of the total students studied, 55% had moderate resilience, 35% had high resilience, and 10% had low resilience. This distribution indicates that most students have not yet reached optimal resilience levels to fully support effective mathematical communication. Therefore, this study concludes that mathematical communication skills are not solely influenced by cognitive aspects but are strongly affected by students' resilience, particularly in terms of persistence, confidence, and willingness to engage in explaining mathematical ideas.

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