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The Muffled Echoes of Reflection: Mapping the Fading Resonance of Mathematics Reflective Thinking Among Anxious Students

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ABSTRACT

Mathematical reflective thinking allows students to examine and reconstruct the steps they take when solving problems. Yet psychological factors, especially mathematics anxiety, can disrupt this mental process by causing cognitive interference. This study describes and maps how high school students in Jakarta engage in reflective thinking while solving contextual trigonometric problems, considering three levels of mathematics anxiety: high, medium, and low. The research used a descriptive qualitative approach and involved six students chosen through purposive sampling. Data came from a mathematics anxiety scale, a reflective thinking ability test, and in-depth interviews conducted with the think-aloud technique. Data analysis used a thematic approach grounded in Surbeck's three phases of reflective thinking: Reacting, Comparing, and Contemplating. Among students with high anxiety, the findings point to a pattern of "fading resonance": the voice of logic becomes muffled as reflective thinking progressively weakens, particularly when students must sustain deeper evaluation under increased cognitive demands. Low-anxiety students, by contrast, show complete and systematic reflective resonance across all three stages. The results indicate that students' psychological characteristics are a primary factor distinguishing the quality of their mathematical reflection, which calls for instructional strategies that can reduce emotional barriers.

Keywords: Mathematical Reflective Thinking, Mathematics Anxiety, Trigonometry, High School Students

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1. INTRODUCTION

At its foundation, mathematics is a systematic discipline that develops logical, analytical, and critical thinking (Damastuti et al., 2023; Isran et al., 2025). Problem-solving therefore stands at the center of the learning proces (Charolina, 2025; Munawwarah et al., 2024). In mathematics education, though, the emphasis has increasingly moved beyond procedural fluency and memorization toward higher-order thinking skills (*HOTS*) (Gradini et al., 2025; Muntazhimah et al., 2022). Mathematical reflective thinking is one part of HOTS. It involves a structured cognitive process in which students intentionally examine, assess, and reconstruct their reasoning, connecting what they already know with unfamiliar challenges (Sari et al., 2025; Setiyani et al., 2025). Through this kind of reflection, students can approach complex problems with greater focus and reduce misconceptions (Muntazhimah et al., 2022).

Despite its importance, reflective thinking is often neglected in education because so much attention is placed on final answers (Setiyani et al., 2024). As a result, students may lack the ability to assess the steps they take when solving problems (Mugnianingsih et al., 2022; Situmorang, 2025). The results of the Programme for International Student Assessment (PISA) 2022 in Indonesia, for example, show that a significant majority of students continue to struggle with even simple mathematical problems requiring them to apply concepts to real-world situations (Masito et al., 2024; Putriani et al., 2025). Many students find mathematics burdensome and confusing, seeing it as a difficult subject dominated by abstract formulas (Budhathoki et al., 2022; Cañeda et al., 2024). The difficulty becomes especially apparent in complex areas such as trigonometry, often perceived as a "labyrinth" of formulas that students struggle to apply in different formats (Latibjonovich, 2022; Reza et al., 2026).

Numerous earlier research has evidenced that students not only faced challenges memorizing and implementing the formulas in trigonometry, but also the conceptual interpretation of mathematical concepts and flexible reasoning. For example, studies concluded that students could be hindered by challenges relating to understanding the information provided in trigonometric questions, angle comparison, and the appropriate trigonometry applied to them for completing a question (Nurmeidina & Rafidiyah, 2019). In a similar study of students' understanding of ratio and trigonometric ratio, the difficulty in visual conceptualisation of angles can restrict students' flexibility to work with trig relations, which suggests students were more likely to possess an instrumental understanding than relational understanding (Yiğit Koyunkaya, 2016). In other contemporary studies, it was noted that high school students faced difficulties in truly grasping concepts and ideas behind some of the contextual ideas, such as an angle of elevation, which thus led to students facing difficulties in identifying proper procedures to be used in solving the questions (Obeng et al., 2024). However, such problems are crucially meaningful in the light of Mathematical Reflective Thinking since, to solve non-routine trigonometric problems, students not only need to recognize the useful information, but also to make comparisons of potential methods, appraise the correctness of reasoning, and reexamine answers. Previous research has demonstrated a positive relationship between students' reflective thinking in problem solving and their mathematical achievement, as well as between reflective thinking and mathematical problem-solving ability (Syadid & Sutiarso, 2021; Toraman et al., 2020). Therefore, difficulties in interpreting and evaluating trigonometric information may constrain the reflective processes necessary for successful mathematical problem-solving and achievement. Much less research has been conducted on how these reflective processes operate at varying levels of mathematics anxiety, especially when students are working on contextual trigonometry problems. This gap highlights the importance of investigating the nature of the processes, in addition to the correctness of the solutions, that an affective variable like mathematics anxiety might be associated with.

Effectiveness of the reflective thinking process does not reflect a mere mental process but encompasses various psychological filters (Gómez et al., 2025; Ugli, 2025). Amongst the many emotional filters, mathematics anxiety is a psychological filter that frequently hinders mathematical progress (Joy et al., 2025). In accordance with the cognitive interference theory, anxiety symptoms produce negative thoughts such as worry and self-evaluative rumination and consume the limited working memory capacity available for the mathematical problem (Brockbank & Feldon, 2024; Cécillon et al., 2024). Resultant emotional dysregulation produces a 'mental block' where students' logical 'voice' or resonance is muffled, and inhibits their ability to initiate or sustain a reflective cycle of thinking (J. Liu et al., 2026). While consciousness of cognitive dissonance or 'confusion' can facilitate deeper reflection, high anxiety produces confusion as a form of mathematical incapacity and thwarted reflective thinking, resulting in avoidance or premature surrender (Joy et al., 2025; J. Liu et al., 2026).

The relationship between psychological factors such as the Adversity Quotient (AQ) or resilience and mathematics achievement has been long explored in the extant literature (Ginting, 2024; Mustafa & Andriani Yunus, 2025; Nurdin et al., 2026; Peng et al., 2025). Literature findings indicate that resilient high or climber students consistently yield an excellent cycle of reflective thinking, compared to resilient low or climber students who conceptually have a mediocre cycle, or non-resilient, quitter students who have an absent cycle of reflective thinking. However, most of these studies utilize quantitative path analyses or broad behavioral categorizations. There is a lack of qualitative research that specifically "maps" the internal dynamics and thematic "fading" of reflective resonance in high-pressure urban environments like Jakarta, particularly within the abstract domain of trigonometry.

This is a novel contribution of this study in that it is not only about the scores, but the mapping of the flow of reflective thinking in the context of anxiety for the whole spectrum. It is hoped that by using the reacting, comparing, and contemplating stages of reflective thinking, this study could pinpoint the exact moment when the logic resonance begins to fade to the anxious student. The innovation lies in reconstructing the "muffled echoes" of student responses to identify in what stages of mathematical reflection anxiety kills certain aspects of mathematical reflection. It is expected that this study will provide a general map of tenth-graders' reflective thinking process and to serve as a reference for Jakarta teachers on the steps to develop a diagnostic intervention, which not only leads to cognitive remediation but also provides psychological safety. Therefore, the aim of this study is to investigate and describe the dynamics of high school students' mathematical reflective thinking when solving contextual trigonometry problems, viewed through the lens of their mathematics anxiety levels.

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2. RESEARCH METHOD

In this research, a qualitative descriptive method and a case study design are used. The purpose of this method is to explore and map the pattern of mathematical reflective thinking among students (Damastuti et al., 2023; Munawwarah et al., 2024). This design is selected as it allows for an in-depth, detailed investigation of students' mental processes in a natural setting without manipulating the variables (Fatimah et al., 2025).

Participants

The research was conducted in a Senior High School located in Jakarta, Indonesia. The research participants were selected by applying Purposive sampling methodology. Purposive sampling is a sampling technique where the researchers intentionally select the participants based on certain criteria to suit the purpose of the research (Situmorang, 2025). The initial group of students was given the Mathematics Anxiety Scale (MAS) to identify the levels of mathematics anxiety of the students. Then, the researcher selected six students from the initial group of students as the research subjects: two students of high mathematics anxiety, two students of medium mathematics anxiety, and two students of low mathematics anxiety (Charolina, 2025). Such small number of subject selection is in line with case study research, which emphasizes the variety of cases rather than the generalizability of the findings (Herlina et al., 2025).

Research Instruments

In this qualitative study, researcher is the main instrument, assisted by some supplemental instruments (Nasution et al., 2025):

1. Mathematics Anxiety Scale (MAS): An adapted questionnaire to group students among the three spectrums of anxiety (Acharya et al., 2026).
2. Trigonometric Reflective Thinking Test: A written test that comprises contextual non-routine problems, aimed to bring out the three phases of reflective thinking: *reacting, comparing,* and *contemplating* (Zakiyah & Muntazhimah, 2025).
3. Interview Guidelines: a semi-structured interview used to explore more in depth the students' thinking process, employing a think-aloud protocol (Muntazhimah et al., 2023).

Based on Charolina (2025) and Munawwarah et al. (2024). Two experts in Mathematics education validated every instrument in both of them before administering them to any data. They evaluated the items and instructions to ensure they are understandable by users, the fit of the indicators between the instruments designed for each of the constructs, the appropriateness of the trigonometric problems related to the three sub-stages of reflection: *Reacting, Comparing, and Contemplating*, and the compatibility of the tools for the participants to comprehend. Using the responses from both experts to modify their text and presentation and to put indicators aligned from each instrument.

Research Procedure

The chronological course of this research followed four distinct stages:

- Preparation Stage: Developing the theoretical framework, designing instruments, and conducting expert validation.
- Anxiety Categorization: Administering the MAS questionnaire to the student to identify and select the six representative subjects.
- Data Collection Stage: Subjects completed the mathematical reflective thinking trigonometric test while engaging in think-aloud protocols. The subjects were then engaged in in-depth semi-structured interviews to clarify the ambiguities presented in their written responses.

Analysis and Synthesis Stage: Interpreting and analyzing the data gathered to formulate the pattern of reflective thinking at each level of anxiety.

Data Analysis and Validity

The data analysis process utilizes the interactive model as proposed by Miles and Huberman with three intertwined processes, namely data reduction, data display, and drawing and verifying conclusions (Haqiqiyah & Putri, 2025; Muntazhimah et al., 2023). The data reduction process involved selecting the data and coding them according to the three stages of reflection outlined by Surbeck. Coding

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included searching for evidence on students' responses, thinking aloud scripts, and responses during the interview sessions based on the three phases of reflective thinking: Reacting (interpreting the problem for the first time), Comparing (relating current and previously learned information, and comparing strategies and solutions), and Contemplating (providing deeper evidence and thinking back about a solution and solution strategy). The coded data were then displayed in verbal and matrix narratives that are used to trace and compare students' coherence of reflection from one math anxiety level to another. To ensure the trustworthiness of the findings, methodological triangulation was done through inter-corroborating the evidence from all the research methods- mathematics anxiety questionnaire, written test, thinking aloud procedures, and interviews (Hanson-DeFusco, 2023). The study also included member checking, in which the researcher's findings were given back to students to see whether their original meaning was being accurately represented.

3. RESULTS AND DISCUSSION

This research modeled the mathematical reflective thinking processes of six senior high school students in Jakarta on the solution of contextual trigonometry problems. The six research subjects were differentiated into low, medium, and high MAS anxiety spectrum according to the data from the Mathematics Anxiety Scale (MAS). The results are depicted by a resonance metaphor to show the mental processes in the act of reflective thinking.

A. Mapping the Reflective Spectrums: Profiles of Reflective Resonance

The responses from the students show clear evidence that there is a great variation in the extent to which the students have been reflecting mathematically within the phases of *Reacting, Comparing,* and *Contemplating*.

A.1 The Clear Resonance: Low Anxiety Student Profile (Students 1 & 2)

The following contextual problem was given to the students: On a certain day, two members of the school flag-raising team were told by their coach to get a new rope in order to operate the pulley of the newly installed flagpole. Since the flagpole had already been erected and could not be laid horizontally, direct measurement of its height was impossible. To determine its height, one student, whose height was known to be 1.5 meters, stood 8 meters away from the pole and measured the angle of elevation to the top of the flagpole as 45°. The coach informed them that the rope length required was twice the height of the flagpole plus an additional 2 meters for knots and fastening. The rope costs IDR 12,000 per meter, and the coach provided IDR 300,000.

a. Determine the height of the flagpole.
b. Determine whether the money provided by the coach is sufficient, excessive, or insufficient. Explain your reasoning.
c. If the coach uses the remaining money to purchase additional rope, how many meters of rope can be purchased?

The answer sheets of Students 1 and 2 are presented in Figure 1.

Students in this group showed the most complete and explicit thinking resonance. In the *Reacting* phase, they were able to develop the mathematical model in terms of the original trigonometric context. A remarkable case emerged from Student 2, where resonance was sharpened at the *Comparing* phase. Student 2 used the geometric property of the isosceles right triangle (45°-45°-90°) based on prior knowledge to determine the pole height directly without having to memorize tangent formulas repeatedly. In the *Contemplating* phase, they were definitive with their response and ended their thinking with a reflective statement, which is "jadi pas (it fits perfectly)", reflective of strong metacognition to check for consistency.

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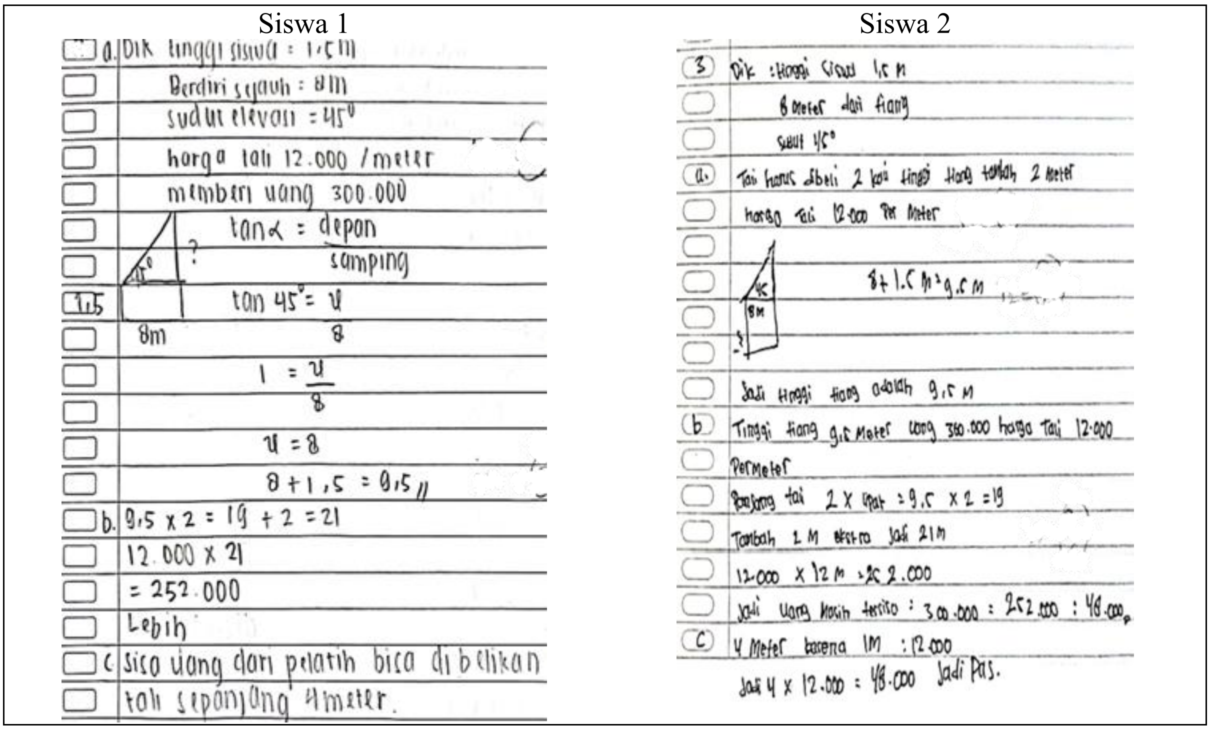

Figure 1. The First and Second Students' Answers

A.2 The Distorted Signal: Medium-Anxiety Student Profile (Students 3 & 4)

Within this group, students' ability to engage in the reflective thinking process was assessed by examining their responses to the question: Toni needs to save his pet cat, which is stranded on the roof of a house, with the aid of a ladder. The cat is positioned 7m above the ground, and the ladder must be placed such that an angle of 30 with the ground is achieved for safety purposes.

a. If Toni's ladder is 8 meters long, determine whether it is sufficient to rescue the cat. Explain your reasoning.
b. What is the minimum ladder length required to reach the cat?
c. If Toni's ladder is either too short or longer than necessary, determine the deficiency or excess length.

The answer sheets of Students 3 and 4 illustrate the reflective thinking processes they employed, as presented in Figure 2.

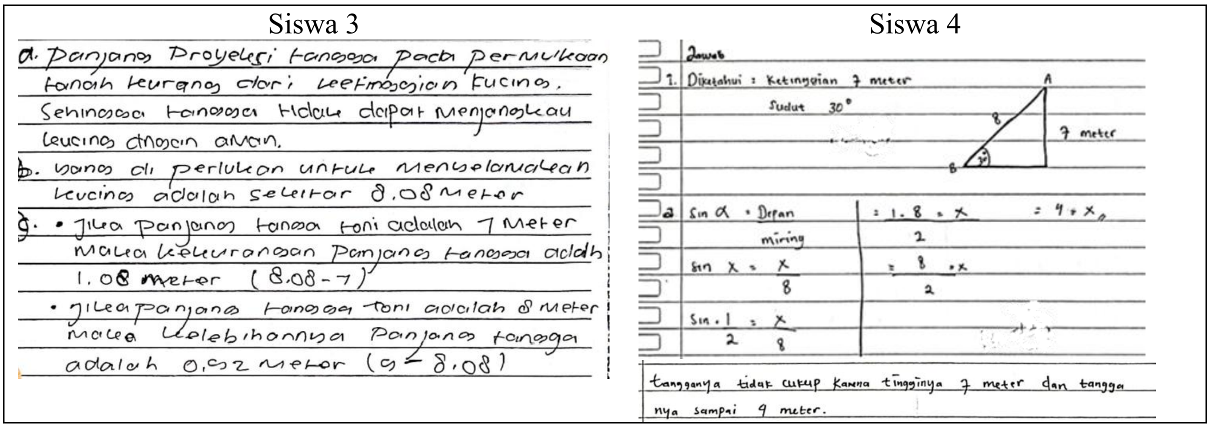

Figure 2. The Third and Fourth Students' Answers

Following figure 2, students in this spectrum resonated up to about the midpoint and then started to become distorted. While the *Reacting* phase was traversed during the phases of understanding the problem and identifying the model, the "signal" was lost when the strategy was entered. For example, Student 3 sought to utilize all available information but did not reconsider the selected strategy. During the *Contemplating* phase, the reflective "signal" was cut; students often became comfortable with the

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final numeric answer without performing an in-depth "check" for errors in procedure and reached an ineffective.

A.3 The Fading Echo: High-Anxiety Student Profile (Students 5 & 6)

Students were Students were provided with the following problem: Dani took part in a traditional pole climbing game in Sawit Village. After a long climb, he managed to get himself to the top of a 6m pole and wanted to throw down some prizes to his friends Budi and Dedi. On the look forward, Dani saw Budi at an angle of depression of 45 and on the looking sideways, he saw Dedi at an angle of depression of 30.

a. Assuming that a stronger throw results in a greater distance, determine whether Dani must throw harder toward Budi or Dedi.

Figure 3 illustrates the reflective thinking processes exhibited by Students 5 and 6.

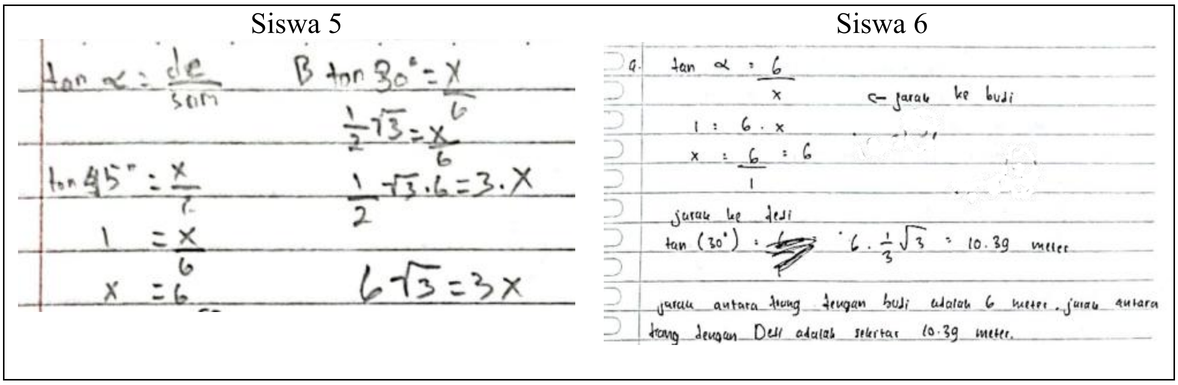

Figure 3. The Fifth and Sixth Students' Answers

In this group, the reflective thinking resonance was linearly diminished until a state of "cognitive silence". During the Reacting stage, Student 5 could only understand superficial content. She could calculate the number using the tangent formula, but failed to analyze this result, which could help to address contextual questions. Student 6 failed in calculation from the beginning, but continued solving the problem without one clear direction of attention. The resonance was depressed almost to the extent of disappearance in the Comparing stage because students experienced "cognitive blocking" and thus lacked the drive to push to more demanding strategies. During the Contemplating stage, there was basically no reflection.

B. Discussion: Why Does the Resonance Fade?

The findings reveal that reflective thinking does not just exist as one particular cognitive framework but that it is a process where students psychological circumstances severely filter this cognitive process, which explains the disappearance of reflection (fading resonance) by indicating that the reflection process appears blocked at the critical junction that shifts the cognitive processes of simple understanding into a more advanced level of evaluation, and that Mathematics Anxiety seems to suppress a logical process.

B.1 Cognitive Interference and Working Memory Paralysis

The findings reveal that not only was reflective thinking not a standalone cognitive structure, but it was very much filtered by students' psychological status. Indeed, the fading resonance we observed demonstrates a degradation of transitions from an initial understanding and evaluation process, implying that math anxiety may hamper the continuity of logical thinking during the complex phases of thinking.

These findings are coherent with prior works that demonstrate that cognitive interference is one of the potential pathways that may lead to the impact of math anxiety on students' mathematical performance. For example, Suárez-Pellicioni et al. (2016) found that math anxiety is related to working memory and attentional control and showed that this might be mediated by the quality of working memory and attentional control. More recently, Finell et al. (2022) provided, on the basis of meta-analytic evidence, that working memory is significant in the relation between math anxiety and

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mathematics performance. These findings provide a possible cognitive explanation for the fading resonance observed in the present study. When students experience anxiety while solving complex trigonometric problems, cognitive resources may be diverted toward managing anxiety and uncertainty, making it more difficult to sustain the evaluative processes required to move from initial understanding toward deeper reflection.

In the present study, this interpretation is highly relevant since our work is on reflective thinking.

Therefore, the results demonstrate that lower- vs. higher-anxiety students didn't differ in the initiation of the reasoning process, but in the ability to sustain the thinking across the other stages of thinking, namely Reacting, Comparing, and Contemplating. That is, lower-anxiety students were more capable of maintaining their reasoning and checking for strategy consistency, while the higher-anxiety students were struggling during the evaluation and reflection phase when facing difficulties and non-routine challenges. Consequently, fading resonance doesn't imply that the students do not reason anymore, but implies that the continuum of the thought may fade over time; the length and the depth of reasoning decline.

Moreover, as noted in previous studies, this cognitive pathway should not be interpreted as fatalistic. Indeed, as pointed out in Caviola et al. (2017) work about the effects of math anxiety, stress, and time pressure on strategies in mathematics, while the psychological conditions like anxiety and stress can have a detrimental impact on strategizing and working cognitive mechanisms, research findings are not fully concordant with respect to the explanation that underlies this. It is not the case here since we haven't collected any measures on working memory, so we should refer to this phenomenon as a likely pathway. All things considered, the present study suggests math anxiety acts as a filter on students who engage in a continuous thinking process when math requires deeper reasoning processes.

We also show how this potential interference shows up in the actual course of the reflective reasoning: resonance remains for a while, starts to decrease in the comparison and evaluation phase, and fades out of sight by the time students begin to contemplate. "Fading resonance" in this context refers to whether students get the right solution, or to what extent their reflective thought process could sustain as math becomes more challenging.

B.2 Urban Pressures and the Silent Reflection

We may attempt to interpret students' moderate and high anxiety responses in the context of earlier research exploring student beliefs about the role of social pressure and pressures associated with performance on tasks. In the present study, Students 3 and 4 both reported Moderate anxiety, and although they began working on mathematical reasoning, when evaluating their approach and response, their ability to maintain reflection faltered. Students 5 and 6, who both reported High anxiety, were even less able to sustain reflective thinking, especially when they expressed doubt and the fear that they would make an error. There is evidence to support the claims made in relation to the influence of external pressure on students who suffer mathematics anxiety; Hwang & Lee (2019), in their research of 439 middle school students, demonstrated a positive relation between parental pressure for academics and their levels of math anxiety. The study further concluded that parental support would moderate the relationship between academic pressure and math anxiety, yet the moderation pattern is differentiated by gender (parents' support moderating the relationship positively for the boys and negatively for the girls), thus suggesting external demands are more mentally taxing under conditions of lacking psychological support and of external demands which are perceived as pressures.

Peer pressures could also have an effect on how cognitive responses impact student behaviour when responding to mathematics problems. Competitive conditions resulted in an increase in state anxiety; one of an experimental study conducted by Liu et al. (2024) found reduced performance and attention in competitive conditions. These findings can be integrated to inform the interpretation of the effect in the present work since both result from the fading of reflective activity, and the high anxiety may similarly see the cognitive resources shifted to deal with the anxiety, which will hinder the evaluation process. There is evidence to suggest that in conditions of pressure there is an interference in strategic activity and the appearance of concern words at the expense of mental resources needed to solve math problems (Caviola et al. 2017). Nevertheless, Caviola and others stressed that the evidence is far from consistent: pressure can impact differently, according to external and individual influences.

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Notably, external pressure does not always operate in an anxiety-provoking way. The study of (Hollenstein et al., 2024) utilized longitudinal data from 509 students and 28 teachers, indicating that teacher expectations predicted increases in math achievement and math self-concept and decreases in math anxiety. This research offers a crucial caveat to this interpretation: it is not necessarily external expectations themselves that are anxiety-provoking, but how individual students appraise their expectations. When students perceive teacher expectations and parental pressure as supportive and challenging, these demands may be positively motivating; conversely, when these demands are perceived as threatening and evaluative, anxiety may increase, and interference will likely emerge.

Taken in tandem, these lines of research show that the path to mathematics anxiety under duress is not a directly causal one, but a more intricate link. Here, the fact that the three anxiety groups performed differently from each other shows us that an individual student's psychological reaction to struggling mathematically may either give it prominence in her/his mind (leading to reflection) or give it salience as threatening and anxiety-provoking (leading to withdrawal). Although neither parental pressure nor teacher expectations nor competition from peers were directly tested in the present study, these findings parallel previous research indicating that the anticipation of performance and social demands contributes to mathematical anxiety and engagement. Therefore, "silent reflection," as described in highly anxious students, should be framed as more than math ignorance, but also as a potential by-product of an interaction of cognitive demands and students' psychological appraisal of those challenges.

B.3 Mathematics Anxiety as a Gatekeeper of Logic Resonance

This provides support for viewing Mathematics Anxiety as a barrier which prevents reflective thinking from realizing its potential at its deepest level. It is suggested that student psychological traits at the time of engagement with the problems were a significant variable. In particular, low-anxiety students appeared more persistent, persevering, and self-regulated when engaging with difficult mathematics, in particular displaying a more regulated, calm approach and utilizing self-coaching during the assessment.

In contrast, the psychological traits that the high-Mathematics Anxiety cohort identified at the beginning of the learning journey during trigonometry- confusion, rather than being an impetus to reflect- led to a failure of mathematical reasoning persistence. Their limited persistence when facing non-routine challenges caused their reflective resonance to fade systematically. Evidence exists in the literature to interpret these differential findings by using the concept of mathematical resilience. For example, Gokhool et al. (2022) found that mathematics anxiety may lead to maladaptive behavior to cope with challenges such as avoidance and postponement of assistance, reducing perseverance in mathematics. More recently, evidence from Hodds (2026) provided that an effective Mathematics Anxiety and mathematical resilience intervention reduced levels of Mathematics Anxiety and enhanced student Mathematics achievement. These findings are reflected in the current analysis, where high levels of mathematics anxiety are associated with reduced persistence in evaluation of strategies leading to failure to attain the Contemplating level of reflective thinking.

Although it is perhaps intuitive to suggest that mathematical resilience and maths anxiety might be inversely related overall, this should not be read as general or automatic. For example, Casinillo et al. (2022), found no significant relationship between mathematical resilience and maths anxiety in senior high school students ($p = .4725$), indicating that resilience alone might not reduce anxiety and that other affective and contextual factors might also shape students' experience of mathematics. This finding offers a useful caveat to the present results. Instead of signifying that maths anxiety directly predicts ability to be reflective, anxiety may instead modulate a student's ability to persist, control affect and maintain engagement in times of mathematical struggle.

This is arguably what can be most readily observed in the transition from Comparing to Contemplating. t was the low anxiety students who were more able to 'hang on in there' whilst comparing strategies and checking for consistency of answers. High anxiety students on the other hand appeared more inclined to opt out of closer scrutiny as soon as it becomes somewhat unclear or difficult. So, while mathematical resilience offers an appealing explanatory framework in this respect it is important to note that it was not directly measured in the present study. Thus, the "gate keeping" function attributed to maths anxiety should perhaps be framed as a qualitative interpretation of how this anxiety might restrict the extensiveness or continuity of reflective practice.

C. Visualization of Reflective Resonance Flow

The flowchart of the dynamics of mathematical reflective thinking resonance based on mathematics anxiety level below is used to clarify this mapping. It shows where the flow of reflective resonance would be stopped at various levels of mathematics anxiety. The flow of reflective thinking goes through three stages of Reacting Comparing Contemplating.

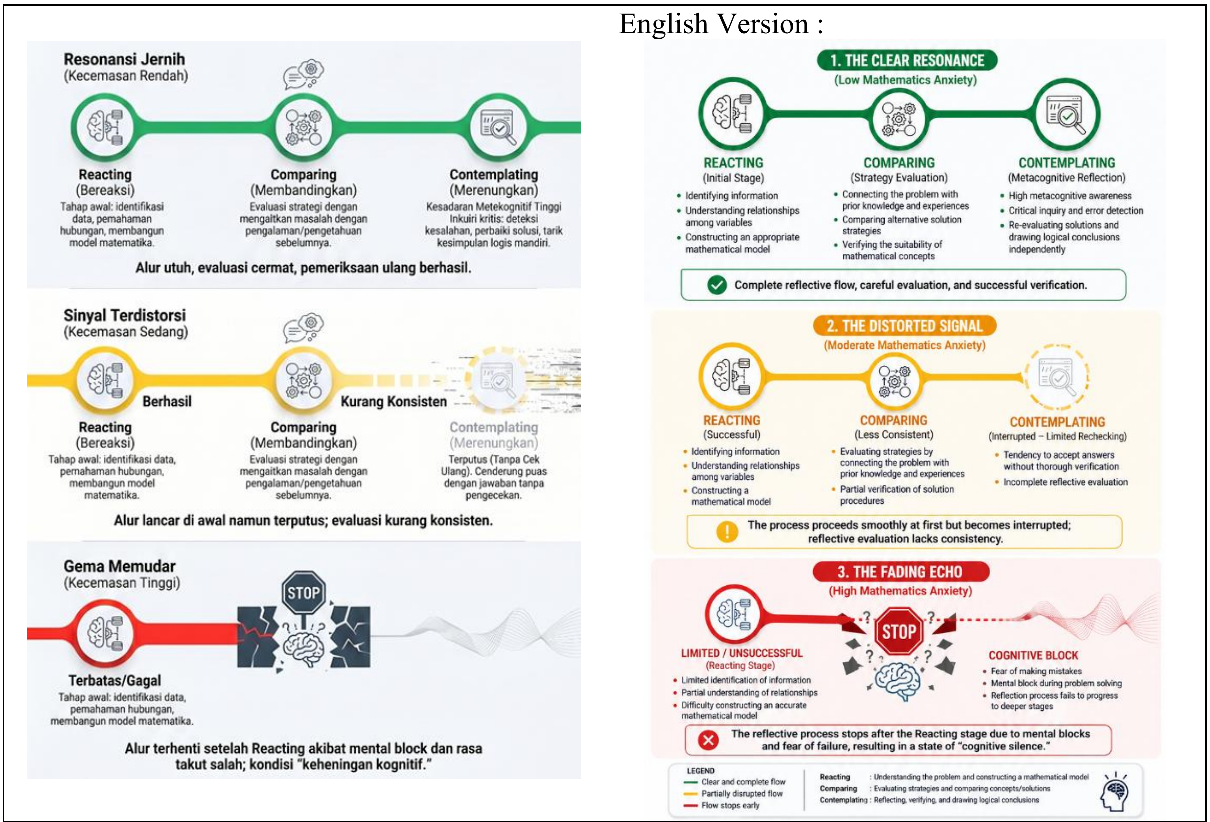

Figure 4. Dynamics of Mathematical Reflective Thinking Resonance Based on Mathematics Anxiety Levels

Figure 4 shows the trends of mathematical reflective thinking resonance in relation to mathematics anxiety levels. Compared to the students with low anxiety, the students with low reflects relatively weak but stable reflective process, which indicated a progressive development of the resonance of thinking from *Reacting, Comparing, and to Contemplating*, respectively. The students with moderate reflects a similar process, but the resonance of thinking is less stable as the students faced more challenges gradually when transitioning to the deeper contemplative stage. The students with high mathematics anxiety show relatively strong variance in the resonance of thinking and a sharp decrease in the process of continuous development of resonance of thinking when progressing to the Contemplating stage. The students tend to be cognitively confused and less persistent toward non-routine trigonometry problems. To conclude, the figure shows that the increase in mathematics anxiety will be simultaneously associated with a stepwise break in the flow and depth in reflective thinking to the Contemplating stage.

4. CONCLUSION

This study shows strong support for the original premise expressed in the introduction: that mathematical reflective thinking is not just a matter of any mathematical architecture but is heavily filtered by the students' psychological processes. Results seem to substantiate that the "resonance" of mathematical logic is muffled by mathematics anxiety, which appears to be the biggest gatekeeper in reflective success. The findings indicate that students with low mathematics anxiety demonstrate relatively stable reflective resonance across Reacting, Comparing, and Contemplating, whereas students with high anxiety exhibit a systematic “fading resonance,” in which the voice of logic becomes increasingly muffled as reflective engagement weakens. Intrusive thoughts and emotional interference may constrain the continuity of reflection, particularly during the transition from initial problem framing to deeper evaluative reflection. This pattern may be related to increased demands on working-memory resources, although working memory was not directly measured in the present study.

This study makes a novel contribution with a "thematic map" of the nature of cognitive decay in high-pressure urban settings such as Jakarta, in which the state of confusion is ultimately productive only if the student has enough psychological capacity (that is, emotional regulation and psychological safety) to use it. A policy implication would be that mathematics instruction in Jakarta should move away from the unhelpful generic remedial approach to mathematics toward a more diagnostic one that focuses on both psychological safety and emotional regulation as well as content mastery.

For future research, a promising avenue would be to create and test several "reflective scaffolds" for the anxious student to reinitiate the "thinking pulse" when it begins to fade. Moreover, conducting this kind of investigation with larger samples and other abstract mathematical topics besides trigonometry would also strengthen the applicability of the "fading resonance" model for emotion and higher-order cognition.

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