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Preservice teacher's enactment of growth mindset in mathematics instruction: a qualitative study from classroom interaction

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Abstract. *This qualitative study investigates how a preservice teacher enacts growth mindset principles during mathematics instruction, with a particular focus on teaching correlation concepts in a secondary classroom setting. The data were collected from detailed classroom interaction transcripts and analyzed using a thematic analysis approach to identify recurring instructional patterns. The findings reveal four major themes: (1) the use of scaffolding as a representation of growth-oriented pedagogy that supports students' understanding, (2) the normalization of errors as a natural and valuable part of the learning process, (3) an emphasis on learning processes rather than merely focusing on final outcomes, and (4) strategic and adaptive responses to students' difficulties, confusion, and disengagement during lessons. However, the study also uncovers instances of a false growth mindset, particularly when teachers tend to minimize errors without providing sufficient conceptual clarification. These findings indicate that although preservice teachers begin to demonstrate growth mindset practices, a deeper and more critical pedagogical understanding is still necessary to prevent misinterpretation. This study contributes to the broader discussion on effectively integrating growth mindset principles into teacher education, especially within mathematics learning contexts.*

Keywords: *Growth Mindset, Preservice Teacher, Mathematics Education, Qualitative Study, Classroom Interaction*

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Introduction

Growth mindset, introduced by Carol Dweck, has become a central discourse in contemporary education, particularly in promoting students' resilience, motivation, and engagement in learning. Growth mindset refers to the belief that intelligence and abilities are not fixed traits but can be developed through effort, effective strategies, and feedback (Mohamoud, 2024; Rege et al., 2021). In mathematics education, this perspective is especially relevant, as students often experience anxiety, fear of failure, and a tendency to perceive mathematical ability as innate rather than developed (Xie et al., 2022; X. Xu et al., 2022).

Previous research has consistently shown that students who adopt a growth mindset are more likely to persist in challenging tasks, engage in deeper problem-solving processes, and demonstrate higher achievement (Zhao et al., 2024). However, the successful implementation of growth

mindset in classrooms does not solely depend on students' beliefs; it is largely shaped by how teachers design instruction, respond to errors, and facilitate learning interactions (Hecht, 2023). Teachers play a crucial role in translating growth mindset from a theoretical construct into observable pedagogical practices (Laine & Tirri, 2023).

Despite its widespread popularity, recent studies have raised concerns about the misinterpretation of growth mindset in educational practice (Barger et al., 2022; Memari et al., 2024; Rissanen et al., 2021). One critical issue is the emergence of what is often referred to as false growth mindset, where teachers emphasize effort and encouragement without providing adequate conceptual guidance or maintaining academic rigor. In such cases, statements like "all answers are acceptable" or "effort alone is enough" may inadvertently hinder students' understanding rather than support it, for example when praise focuses on effort without progress or when students are given motivational messages without effective strategies and support (Canning et al., 2024; Hao et al., 2025; Vaughn et al., 2021; Zarrinabadi et al., 2021). This indicates that implementing growth mindset requires more than positive language; it demands a careful balance between emotional support (e.g., encouragement, normalization of struggle) and cognitive challenge through rigorous expectations, strategy instruction, feedback, and purposeful challenges aligned with growth mindset principles (Canning et al., 2024; Kroeper et al., 2022).

In the context of teacher education, this issue becomes even more significant (Aina et al., 2023; Laine & Tirri, 2023; Orland-barak & Wang, 2020; Rege et al., 2021). Preservice teachers are often introduced to growth mindset as a theoretical concept, yet they may struggle to enact it effectively in real classroom situations (Chew & Cerbin, 2020). Their teaching practices may reflect partial or surface-level understanding, particularly when dealing with student errors, disengagement, or conceptual difficulties (Aina et al., 2023; Chew & Cerbin, 2020; Rissanen et al., 2021). As a result, examining how preservice teachers implement growth mindset in authentic teaching contexts is essential to bridge the gap between theory and practice (Mariano-dolesh & Collantes, 2022).

This study focuses on the enactment of growth mindset by a preservice mathematics teacher during classroom instruction. Mathematics learning provides a critical context for this investigation, as it inherently involves reasoning, problem-solving, and dealing with errors—elements that are closely مرتبط with growth mindset principles. By analyzing classroom interaction transcripts, this study seeks to uncover how growth mindset is manifested through instructional discourse, including questioning strategies, feedback, and responses to student challenges. Specifically, this study addresses the following research question: How does a preservice teacher enact growth mindset principles during mathematics instruction, and to what extent does this enactment reflect authentic or false growth mindset? By answering this question, the study aims to contribute to the literature in two ways. First, it provides empirical evidence of how growth mindset is operationalized in real classroom interactions, rather than relying solely on self-reported beliefs. Second, it offers a critical perspective on the complexities and potential misinterpretations of growth mindset in teaching practice. These insights are expected to inform teacher education programs in designing more effective approaches to developing pedagogical competence that integrates both motivational and cognitive dimensions of learning.

Method

This study employed a qualitative research design with a classroom discourse analysis orientation to explore how a preservice teacher enacted growth mindset principle during mathematics instruction. The research was conducted from February to March 2026 at SMAN 2 Malang, Indonesia, during the teaching practicum period. The participant of this study was a preservice mathematics teacher (pseudonym: Anita) who was assigned to teach correlation concepts in a secondary classroom setting. The data were collected through classroom observation in the form of teaching transcripts, which captured naturally occurring interactions

between the teacher and students. The transcription process was conducted verbatim to ensure the authenticity and richness of the data, including verbal responses, instructional prompts, and spontaneous student reactions. These transcripts served as the primary data source for examining how growth mindset was manifested in real-time pedagogical practices.

The data were analyzed using thematic analysis following Braun and Clarke (2006). The analysis involved iterative stages, including data familiarization, initial coding, category development, and theme construction (W. Xu, 2020). During the coding process, meaningful units of classroom interaction were identified and assigned inductive codes that captured the teacher's instructional moves and responses to students. The initial coding generated several recurring codes such as *prompting reasoning*, *guiding re-evaluation*, *reducing fear of mistakes*, *emphasizing effort*, *encouraging collaboration*, and *accepting incomplete responses* (Minguela & Onrubia, 2022). These codes were then grouped into broader categories based on their functional roles in classroom discourse, including guided thinking support, psychological safety, process-oriented instruction, adaptive pedagogical responses, and overgeneralized feedback (Salmon & Barrera, 2021).

Subsequently, these categories were synthesized into overarching themes that represent the enactment of growth mindset in teaching practice, namely scaffolding as growth-oriented pedagogy, normalizing errors as part of learning, emphasis on learning process over correctness, and responding to student challenges (Yu et al., 2022). Additionally, a critical interpretive theme, identified as false growth mindset, emerged from patterns of overgeneralized encouragement without sufficient conceptual clarification (Rissanen et al., 2019). To ensure analytical rigor, the coding process involved repeated comparison across data excerpts to maintain consistency and coherence between codes, categories, and themes (Mohamoud, 2024).

To provide a transparent account of the analytical process, a detailed codebook was developed to capture the range of instructional moves and responses demonstrated by the preservice teacher. The codebook presents the operational definitions of each code along with representative excerpts from the classroom transcripts (Roberts et al., 2019). This allows readers to understand how specific segments of data were interpreted and systematically categorized during the analysis (Linneberg, Mai Skjott & Korsgaard, 2019).

Table 1. Codebook of Growth Mindset Enactment

Code	Definition	Transcript
Prompting reasoning	Teacher asks students to explain or justify their answers	*"Why do you think it is categorized as weak?"*
Guiding re-evaluation	Teacher encourages students to reconsider their answers	*"Try to look at the data again…"*
Encouraging participation	Teacher invites students to respond despite uncertainty	*"It's okay if you are not sure, just try."*
Reducing fear of mistakes	Teacher normalizes errors as part of learning	*"If it's incorrect, we will fix it together."*
Overgeneralized encouragement	Teacher suggests all answers are acceptable without distinction	*"There are no wrong answers here."*
Emphasizing effort	Teacher highlights effort and persistence	*"Everything takes a process."*
Process-oriented instruction	Teacher prioritizes understanding steps over memorization	*"Focus on understanding the steps."*
Encouraging active reasoning	Teacher promotes thinking without reliance on tools	*"Try solving it without a calculator."*
Reframing difficulty	Teacher presents challenges as manageable	*"Try working with your friends."*
Encouraging	Teacher suggests group work as a	*"Work together so it feels*

collaboration	strategy	*easier."*
Motivating disengagement	Teacher responds to lack of motivation	*"Let's try first, you might enjoy it."*
Accepting incomplete responses	Teacher accepts answers without further clarification	*"It's okay, at least you tried."*

Theme	Description	Categories
Scaffolding as Growth-Oriented Pedagogy	Teacher supports students' thinking through guided questioning	Guided Thinking Support
Normalizing Errors as Learning	Teacher creates a safe environment for making mistakes	Psychological Safety
Emphasis on Learning Process	Teacher prioritizes effort and understanding	Process-Oriented Teaching
Responding to Student Challenges	Teacher adapts strategies to address difficulty and disengagement	Adaptive Pedagogical Response
False Growth Mindset	Overemphasis on encouragement without conceptual correction	Overgeneralized Feedback

Following the initial coding process, the identified codes were further examined and grouped into broader categories based on their functional similarities in classroom interaction (Lochmiller, 2021). This categorization aimed to organize the codes into more meaningful analytical units that reflect patterns of pedagogical practice and teacher responses within the learning process (Hennessy et al., 2020).

Table 2. Categories and Associated Codes

The categories derived from the coding process were subsequently synthesized into overarching themes that represent the core patterns of growth mindset enactment in teaching practice (Naeem et al., 2024). These themes provide a higher-level interpretation of the data, illustrating how specific instructional actions and responses collectively form meaningful dimensions of growth-oriented pedagogy (Laine & Tirri, 2023).

Table 3. Theme Construction

Category	Codes Included
Guided Thinking Support	Prompting reasoning; Guiding re-evaluation
Psychological Safety	Encouraging participation; Reducing fear of mistakes
Process-Oriented Teaching	Emphasizing effort; Process-oriented instruction; Encouraging active reasoning
Adaptive Pedagogical Response	Reframing difficulty; Encouraging collaboration; Motivating disengagement
Overgeneralized Feedback	Overgeneralized encouragement; Accepting incomplete responses

Result

The findings of this study are grounded in selected excerpts from classroom interaction transcripts, illustrating how the preservice teacher enacted growth mindset principles during

mathematics instruction. The analysis is organized into four major themes, each supported by representative transcript excerpts.

Scaffolding as Growth-Oriented Pedagogy

The preservice teacher consistently used questioning strategies to scaffold students' thinking rather than directly providing answers. This is reflected in the following excerpt:

"Try to look at the data again… do you think this is a strong or weak correlation?"
"Why do you think so? Can you explain your reasoning?"

These interactions indicate *prompting reasoning* and *encouraging justification*. The teacher guided students to re-evaluate the data and articulate their thinking, fostering active cognitive engagement. This approach reflects a growth-oriented pedagogical stance in which understanding is constructed through guided effort rather than direct instruction.

The findings obtained from the research have to be supported by sufficient data. The research results and the discovery must be the answers, or the research hypothesis stated previously in the introduction part. The result section consists of a description of the results of the data analysis to answer the research question(s). The result should summarize (scientific) findings rather than providing data in detail. Please highlight the differences between your results or findings and the previous publications by other researchers. This section should be explained in several subsections with a detailed explanation of the findings. Tables and Figures are presented center, as shown below and cited in the manuscript.

Normalizing Errors as Part of Learning

The teacher explicitly created a safe space for students to make mistakes, as shown in the following excerpt:

"If it's incorrect, we will fix it together… it's okay if your answer is not right yet."

This reflects *reducing fear of mistakes* and *building psychological safety*. Students appeared more willing to participate and share their ideas without hesitation. However, another excerpt reveals a potential overgeneralization:

"There are no wrong answers here."

While intended to encourage participation, this statement reflects *overgeneralized encouragement*, which may lead to conceptual ambiguity if not followed by clarification.

Emphasis on Process over Correctness

The teacher consistently emphasized effort and learning processes rather than immediate correctness:

"Everything takes a process… at first you may not understand, but you will improve over time."
"You don't need to memorize it, what matters is understanding the steps."

These statements represent *emphasizing effort* and *process-oriented instruction*. The teacher encouraged students to focus on understanding rather than memorization. In addition, the teacher stated:

"Try to solve it without using a calculator first, so you can understand the process."

This reflects *encouraging active reasoning*, reinforcing students' engagement with mathematical thinking.

Responding to Student Challenges and Disengagement

The teacher demonstrated adaptive responses when students expressed difficulty or reluctance:

Student: "*Miss, this is difficult… I can't do it.*"
Teacher: *"Try working with your friends, it will feel easier."*

This interaction reflects *reframing difficulty* and *encouraging collaboration*, positioning challenges as manageable rather than fixed.
In another instance:

Student: *"Miss, I feel lazy…"*

Teacher: *"Usually working in groups makes it more enjoyable, let's try first."*

This indicates *motivating disengaged students*, showing the teacher's effort to re-engage students through social learning strategies.

Emergence of False Growth Mindset

Despite the presence of growth-oriented practices, several excerpts indicate partial or misinterpreted enactment:

"It's okay, at least you tried."

"All answers can be accepted."

These statements reflect *accepting incomplete responses* and *overgeneralized praise*. While they promote effort, they are not consistently followed by conceptual correction, which may limit students' understanding.

Discussion

This study reveals that the preservice teacher demonstrated emerging enactments of growth mindset through classroom discourse, particularly in the use of scaffolding, encouragement of participation, and emphasis on learning processes (Handa, 2023). These findings are consistent with the theoretical framework of Carol Dweck, who posits that students' abilities can be developed through effort, strategy, and supportive feedback (Dweck, 2006); (Padır, 2023). However, the findings also indicate that the enactment of growth mindset is not yet fully developed, as evidenced by the presence of overgeneralized encouragement and limited conceptual correction, which is consistent with research showing that teachers' classroom practices do not automatically align with growth-mindset ideals and that targeted interventions are needed to motivate teachers to adopt specific growth mindset–supportive communication practices in their discourse (Hecht, 2023).

First, the teacher's use of questioning strategies reflects a form of scaffolding that aligns with growth-oriented pedagogy. By prompting students to explain their reasoning and revisit their answers, the teacher positioned learning as an active cognitive process (Chin, 2007); (Salmon & Barrera, 2021); (Wang, 2025). This supports previous research suggesting that growth mindset is not merely a belief but must be enacted through instructional practices that promote student thinking and agency (Laine & Tirri, 2023; Jorif & Burleigh, 2020; Mendoza & Yan, 2025). The findings suggest that the preservice teacher has begun to shift from a transmission-oriented approach toward a more constructivist orientation, where knowledge is co-constructed through dialogue and active participation (Chand, 2023); (Mishra, 2023);(Saleem & Deeba, 2021); (Barros et al., 2026).

Second, the normalization of errors as part of learning contributed to a psychologically safe classroom environment. Students appeared more willing to participate and express their ideas without fear of being judged, which is consistent with studies showing that positive error climates and constructive error-handling increase students' participation, interaction, and willingness to take the risk of being wrong (Khasawneh et al., 2023); (Kalaç & Konyalioğlu, 2025); (Dresel et al., 2025). This aligns with research indicating that reducing mathematics anxiety and fear of failure is essential for mathematical learning, because anxiety interferes with learning processes and leads students to disengage or avoid participation (Tomasetto et al., 2020). However, the findings also reveal a critical nuance: the teacher occasionally framed all responses as acceptable without distinguishing between correct and incorrect reasoning. While this may increase participation, it risks reinforcing misconceptions if students' errors are not explicitly analyzed

and addressed, given evidence that productive use of errors requires identifying and working with misconceptions rather than ignoring or superficially treating them (Hoth et al., 2022); (Tore et al., 2023); (Kabadas, 2024).

This tension highlights the distinction between authentic growth mindset and what has been described in the literature as *false growth mindset*. Authentic growth mindset involves acknowledging effort while still maintaining high expectations for understanding and accuracy (X. Xu et al., 2022);(Dong et al., 2023). In contrast, false growth mindset may manifest as excessive praise or unconditional acceptance of responses without guiding students toward improvement, reflecting an overemphasis on effort without adequate strategic support (Sonja & Kirsi, 2025); (Calingasan & Plata, 2022). In this study, statements such as "all answers can be accepted" illustrate this misinterpretation. This finding is significant, as it suggests that preservice teachers may internalize the language of growth mindset without fully understanding its pedagogical implications, a pattern consistent with research on false growth mindsets and misalignment between professed beliefs and actual practices (Waid, 2018).

Third, the emphasis on process over correctness reflects a key principle of growth mindset, where learning is viewed as gradual and effort dependent (Oraple et al., 2025). The teacher encouraged students to focus on understanding steps rather than memorizing formulas, which is particularly relevant in mathematics education (Jonsson et al., 2020); (Repuya & Esterninos, 2022). This process-oriented approach supports the development of deeper conceptual understanding and aligns with research emphasizing the importance of reasoning in mathematical learning (Hidayat, 2022); (Mukuka et al., 2023).

In addition, the teacher's adaptive responses to student difficulties demonstrate an emerging ability to reframe challenges as opportunities for growth. By encouraging collaboration and providing alternative strategies, the teacher avoided labeling students as incapable and instead emphasized that difficulties can be addressed through effort and support, mirroring teaching behaviors that signal to students that "everyone can learn" and that struggle merits additional support and attention rather than frustration (Bardach et al., 2024).This aligns with the core idea of a growth mindset that intelligence is not fixed but can be developed through appropriate strategies, effort, and help from others (Dweck, 2006).

Despite these strengths, the findings indicate that the preservice teacher's enactment of growth mindset remains partial and occasionally inconsistent (Barger et al., 2022). The tendency to prioritize emotional support over conceptual accuracy suggests a need for more explicit training in integrating growth mindset with rigorous mathematical instruction (Cutler, 2020). Growth mindset should not only foster motivation but also support the development of accurate and meaningful understanding (Tassell, 2020).

Overall, this study contributes to the growing body of literature by demonstrating that the implementation of growth mindset in classroom practice is complex and requires more than verbal encouragement (Hecht, 2023). It involves a delicate balance between supporting students emotionally and challenging them cognitively (Rissanen et al., 2019). For teacher education programs, these findings highlight the importance of providing preservice teachers with concrete pedagogical models that illustrate how growth mindset can be enacted authentically in subject-specific contexts, particularly in mathematics learning (Yu et al., 2022).

Conclusion

This study concludes that the preservice teacher demonstrated emerging enactments of growth mindset in mathematics instruction through scaffolding practices, the normalization of errors, process-oriented teaching, and adaptive responses to student difficulties. These practices contributed to creating a more supportive and participatory classroom environment, where students were encouraged to engage, take risks, and view learning as a gradual process.

However, the findings also reveal that the implementation of growth mindset was not yet

fully developed. Instances of overgeneralized encouragement and the acceptance of incomplete responses without sufficient conceptual clarification indicate the presence of false growth mindset. This suggests that while the preservice teacher has begun to adopt the language and surface practices of growth mindset, a deeper pedagogical understanding is still needed to balance emotional support with cognitive rigor.

This study highlights that enacting growth mindset in classroom practice is a complex process that requires not only positive reinforcement but also structured guidance to ensure meaningful learning. Therefore, teacher education programs should provide more explicit training on how to integrate growth mindset principles with subject-specific pedagogy, particularly in mathematics, to support both students' motivation and conceptual understanding.

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