International Journal of Innovative Research and Scientific Studies, 9(11) 2026, pages: 39-48

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com



Mindset transformation of pre-service mathematics teachers: A phenomenological study of growth mindset during the teaching practicum in partner schools

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Abstract

This study aims to describe the essence of the lived experience of growth mindset transformation among pre-service mathematics teachers during their teaching practicum in partner schools. A qualitative transcendental phenomenological design based on Moustakas' model was employed. Ten participants were purposively selected from 58 mathematics-track pre-service teachers placed in junior and senior secondary partner schools. Data from in-depth interviews and reflective journals were analyzed through epoche, horizontalization, clustering of meaning, textural-structural description, and essence description. Participants' experiences followed a similar trajectory: an initial adaptational shock from the clash between idealistic expectations and classroom realities; a reflective turning point mediated by mentor-teacher feedback and self-evaluation; adaptive mathematics-teaching strategies; and a professional identity oriented toward lifelong learning. Crisis triggers and pathways differed between individuals. Within this small, single-context sample, growth mindset transformation appears as a structurally similar yet individually varied process. Teacher-preparation programs may strengthen pre-service teachers' mental resilience through mentor-teacher feedback and structured reflection.

Keywords: Growth mindset, Mathematics education, Phenomenology, Pre-service teachers, Teacher professional identity, Teaching practicum.

DOI: 10.53894/ijirss.v9i11.11984
Funding: This study received no specific financial support.
History: Received: 28 August 2026 / **Revised:** 19 October 2026 / **Accepted:** 23 October 2026 / **Published:** 16 November 2026
Copyright: © 2026 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Institutional Review Board Statement: Ethical review and approval were waived for this study, as it was conducted as independent faculty research rather than an institutionally funded or grant-based project, and therefore did not fall under the categories of research subject to mandatory ethics committee review under the institution's policy at the time of data collection. Nonetheless, all procedures adhered to core ethical principles for research involving human subjects, including informed consent, voluntary participation with the right to withdraw, and confidentiality and anonymity of participant identities (replaced with pseudonymous codes P1-P10 throughout this report), with interview recordings and transcripts securely stored and accessible only to the research team.
Acknowledgment: The authors would like to thank the Faculty of Teacher Training and Education, Universitas Halu Oleo, and all participating pre-service teachers and partner schools in Kendari for their cooperation. The authors also thank Candra Wijaya Kusuma and Muhammad Sigit Aidit Sugiarto for their assistance during data collection.
Publisher: Innovative Research Publishing

1. Introduction

Education in the world is changing in the 21st century, and to respond to the dynamics of contemporary learning, educators need to be more than just providers of material. The teaching profession is a difficult area of psychological adaptation. Teachers need to be psychologically sustainable and ready for continuous learning. Modern educational psychology indicates that the success of an educator depends on his or her cognitive orientation toward challenges, especially if he or she has a growth mindset, which helps resilience and long-term professional performance [1]. Recent reviews of the literature on teacher mindset research [2] support this pattern.

This crucial transition to professionalism is tested when pre-service teacher trainees participate in the teaching practicum at partner schools. Here the messy realities of the classroom sometimes run afoul of the idealized pedagogical notions learned in the lecture halls of academia. Research on teacher education consistently shows that pre-service teachers experience psychological shocks (cultural shock) from school institutional bureaucracy [3, 4] in addition to the usual challenges of managing classroom behavior and dynamics. This adaptive pressure often leads to academic anxiety, self-doubt and frustration, jeopardizing the integrity of their early professional development.

Under this adaptive pressure and the contradiction with the reality of the field, a person's cognitive reaction will be the determining factor between change and inertia. People with a fixed mindset are likely to see criticism from mentor teachers or poor classroom management as evidence that they are still weak. Nevertheless, empirical studies across the globe have demonstrated that teachers with a growth mindset have higher levels of self-efficacy, psychological well-being, and reflective ability to transform challenges into useful learning methods [5, 6]. Thus, cultivating a growth mindset is not only a protective factor, but an essential component of pre-service teachers' mental resilience in managing the partner-school environment [7].

Though quantitative methods have been extensively used to explore the significance of growth mindset for academicians and educators, there is a lack of holistic research that addresses the actual lived experiences of pre-service teachers during the chaotic practicum. Most macro-level research does not explore the individual's experience of subjective meaning and cognitive transformation at the individual level [8]. To close this research gap, qualitative phenomenological method is required to find the structure of consciousness and the lived dynamics of pre-service teachers. Given the theoretical and empirical arguments above, this study attempts to analyze this mentality transition nature comprehensively.

In view of this background, the study addresses the following research issues: RQ1: Pre-service teachers' growth mindset shifts during their teaching practicum in partner schools. What is the essence of their life experience? RQ2: What are the psychological shocks and challenges faced by pre-service teachers at the initial stage of the practicum including the challenges of classroom management and adaptation to school culture? RQ3: How do pre-service teachers deal with these difficulties, especially in differentiating developmental space (growth mentality) and self-limitation (fixed mindset)? RQ4: How do pre-service teachers navigate instructional barriers in partner schools as evidenced by specific behaviors of a growth mindset? RQ5: How do pre-service teachers subjectively interpret the development of their professional teacher identities in the turbulence of the practicum?

This study will contribute empirically to the theory of mindset transformation during the career-transition phase of educators through a phenomenological lens, and to the body of knowledge in educational psychology, especially regarding a growth mindset in the formation of beginning-teacher professionalism. The results are intended to serve as a guide for mentor teachers and supervising lecturers in giving feedback that leads to growth, a reflective tool for pre-service teachers to understand the psychological dynamics of the practicum, and a means to help teacher education institutions develop teacher-preparation curricula that improve pre-service teachers' mental resilience.

2. Theoretical Framework

2.1. Growth Mindset

The concept of growth mindset was originally formulated by Carol Dweck based on a series of cognitive psychology experiments investigating people's implicit beliefs about the malleability of ability and intellect [9]. Two opposing cognitive orientations are identified: a growth mindset, which holds that ability can be gradually developed through effort, appropriate learning strategies and guidance from others, and a fixed mindset, which views ability as a static, essentially unchangeable trait [1].

People with a growth-mindset see failure as a natural part of learning and a way to get feedback for personal improvement, not as a sign of permanent inability. In contrast, people with a fixed mindset are more likely to avoid challenges, give up easily when faced with a difficulty, and perceive criticism as a challenge to their worth. A large-scale national trial found that interventions that improved a growth mindset increased students' academic achievement, in particular for groups that were previously at risk of low attainment [6].

Recent experimental evidence indicates that pre-service teachers with a growth mindset report higher teaching self-efficacy and more adaptive instructional intentions than their fixed-mindset counterparts [10]. In the teaching profession, a positive link has been identified between teachers' growth mindset and their self-efficacy and psychological well-being [5]. Teachers who believe that they can always improve in teaching are more able to handle pressure at work and to accept professional criticism. One of the most crucial skills for educators in the twenty-first century is mental resilience and motivation for lifelong learning, both of which have been demonstrated to be positively influenced by growth-mindset reinforcement in academic environments [7].

2.2. Teacher Professional Education Programs and the Teaching Practicum

The teacher professional education program is a graduate program that prepares students to become professional educators, regardless of their prior educational background, by providing them with pedagogical, personal, social and professional skills. A key feature of the curriculum is the teaching practicum, where students apply the pedagogical theory learned in lecture halls to the real classroom environment of partner schools.

The practicum is the link that connects the student to the professional educator roles. At this stage, pre-service teachers are expected to manage classrooms independently, design and deliver lessons, and adapt to the institutional culture and governance of the school. The quality of field experience during teacher preparation is critical for instructional readiness and professional retention of beginning teachers in the early years of their careers [4] highlighting initial training as the critical time at which teacher professional identity begins to develop [11].

The practicum is often considered the most important phase in the formation of the professional identities of pre-service teachers, as it is the point where academic idealism and field reality converge. The successful passage of this stage is determined not only by the technical proficiency in teaching techniques, but also by the psychological readiness and the cognitive orientation in working with the difficulties encountered during the practice in partner schools. Recent data from the Indonesian and international contexts [12, 13] show that self-efficacy and coping skills gained during school-based internships are among the most influential predictors of pre-service teachers' readiness for the profession.

2.3. Adaptation Crisis and Classroom Management among Pre-Service Teachers

Teacher-education research shows that pre-service teachers are subject to psychological shock, or "culture shock," when they first encounter the partner-school setting. A meta-analysis of teacher self-efficacy and personality [3] revealed that classroom management skills are one of the best predictors of teaching effectiveness and the most common source of anxiety for new teachers. This is especially true for would-be math teachers whose anxiety of classroom management has been linked to academic self-efficacy as well as lack of enthusiasm for teaching [14]. Pre-service teachers often experience such cognitive dissonance because of the gap between the idealized classroom-management theory they are taught at university and the complexity of the real classroom, with its variety of student personalities, behavioral resistance, and institutional bureaucratic pressure. This adaptive pressure, in the absence of adequate reflective support, can create self-doubt, academic anxiety and even burnout symptoms at the very beginning of a teaching career [4]. This risk is consistent with recent findings linking social-emotional competencies and self-efficacy of early-career teachers to burnout trajectories [15]. This is the very condition that makes the growth-mindset orientation necessary for research. The pre-service teacher's interpretation of failure and criticism at this stage of crisis will largely determine their professional development in the future.

3. Methodology

3.1. Research Design

The study used qualitative approach with phenomenological research design to explore in depth the lived experiences of participants and to find the structure of consciousness of the participants [8]. The study is based on van Manen [16] notion of educational lived experience (tact) and Moustakas [17] transcendental tradition of phenomenology.

3.2. Participants

Participants were selected by purposive sampling based on the criterion of information-rich cases [18]. The eligibility criteria for participants were as follows: (a) enrollment to the Mathematics track as active pre-service teachers; (b) completion or ongoing completion of the practicum in a partner school for at least one semester; (c) having gone through a major crisis or challenge (e.g., classroom control difficulties or school culture shock) resulting in a change in perspective; and (d) a total number of five to ten participants according to the data saturation principle [19].

Ten subjects (P1–P10) were purposefully selected from a pool of 58 pre-service teachers on the mathematics track, according to the criterion of information-rich-cases (completeness and depth of interview answers, clarity of the adaptation-crisis point, and narrative coherence of the mindset transformation). The results are able to capture heterogeneity in classroom management crises and coping pathways while maintaining a constant field of study, as all ten subjects teach mathematics at junior and senior secondary levels in their various partner schools. The real identities of the participants were substituted by codes P1 to P10 in compliance with the confidentiality principle as defined in Section 3.5. Table 1 shows the profiles of the 10 selected individuals.

Table 1.
Profile of selected participants.

Code	Prior teaching experience	Partner school	Brief characteristics
P1	None	Junior secondary school, Kendari	Female; faced diverse student characteristics in the classroom
P2	None	Secondary school, Kendari	Male; faced a noisy class with low learning focus
P3	None	Junior secondary school, Kendari	Female; first teaching experience, school-culture adaptation
P4	None	Secondary school, Kendari	Female; faced a less conducive classroom during field practice
P5	None	Senior secondary school, Kendari	Male; faced difficulty explaining abstract concepts
P6	None	Junior secondary school, Kendari	Female; managed a large class (36 students); explicit talent-doubt crisis
P7	Private tutoring experience	Junior secondary school, Kendari	Female; fatigue-based (not talent-based) crisis
P8	None	Junior secondary school, Kendari	Female; faced passive students during group discussion
P9	None	Secondary school, Kendari	Male; deep reflection on talent-doubt; most varied strategies among subjects
P10	None	Secondary school, Kendari	Male; faced unfocused students; gradual doubt-to-confidence transition

3.3. Data Collection

Data were collected through in-depth interviews with the use of a semi-structured guide to naturally elicit personal narratives [20] and written reflective journals, which were used to record participants' spontaneous emotional and cognitive dynamics when facing challenges in the partner school [21]. These approaches align with recent research supporting reflective journaling as a useful tool for pre-service teachers' professional development [22]. Interviews lasted sixty–ninety minutes, were audio recorded (with permission), and were transcribed verbatim. The same basic questions were used to guide both the written reflective diaries and the follow-up in-depth interviews, enabling cross-referencing of participants' spoken and written reports in the analysis. Table 2 presents the four guiding themes and an example question used to elicit each theme in data collection.

Table 2.
Theme and example of interview/reflective-journal question.

Theme	Example of an Interview/Reflective-Journal Question
Theme 1: Initial Adaptational Shock and Reality Clash	What did you feel when you first faced the reality of teaching in your partner-school classroom? Please describe the situation and your reaction (Item 3).
Theme 2: Cognitive Turmoil and Reflective Turning Point	Did you ever doubt your own ability or talent to become a teacher when facing that difficulty? What made you begin to see the situation differently (Items 5-7)?
Theme 3: Behavioral Manifestation and Strategic Adaptation	What concrete steps or strategies did you try in order to address the challenges you faced in the classroom (Item 8)?
Theme 4: Synthesis of Professional Teacher Identity	Looking back on this whole experience, what does becoming a teacher now mean to you, and what have you learned about yourself as a future professional educator (Items 10-12)?

3.4. Data Analysis

The data analysis process involved a series of systematic steps of Moustakas [17]: (1) epoche (bracketing), which refers to the suspension of the researchers' own assumptions or preconceptions about the subject matter [23]; (2) horizonalization, which involves reviewing transcripts and marking significant statements; (3) clustering of meaning, which involves grouping statements into thematic meaning clusters; (4) textural and structural description, which describes what participants experienced and how it happened; and (5) essence description, which summarizing the universal essence of the mindset-transformation phenomenon.

The coding process followed the guidelines of qualitative thematic analysis [24] to ensure analytical reliability and transparency: open coding was used to extract meaning units from the raw transcripts, axial coding was used to group related codes, and selective coding was used to identify the final thematic units of analysis. Table 3 shows an example of this coding procedure.

Table 3.
Illustrative excerpt of the data-coding process.

No.	Data excerpt (abridged)	Open code	Category (axial)	Theme (selective)
1	P1: "...the classroom situation did not match what I had hoped for" (Item 3)	Disappointment at unmet expectations	Negative initial emotional response	Initial Adaptational Shock
2	P5: "...I briefly thought whether I was really not talented to become a teacher" (Item 5)	Self-doubt about talent/capacity	Self-attribution of failure	Initial Adaptational Shock
3	P1: "...seeing every obstacle as an opportunity to know my own shortcomings" (Item 7)	Reframing obstacles into learning opportunities	Constructive self-evaluation	Reflective Turning Point
4	P2: "...my mindset shifted" after mentor-teacher feedback (Item 7)	Perspective shift triggered by feedback	External mediation role (mentor teacher)	Reflective Turning Point
5	P4: "...activities that are simpler, more engaging, and actively involve students" (Item 8)	Modification of teaching strategy	Instructional-method adaptation	Behavioral Manifestation
6	P5: "...examples that are simpler and closer to students' daily lives" (Item 8)	Contextualization of teaching material	Instructional-method adaptation	Behavioral Manifestation
7	P4: "...not about being perfect right away, but continuing to learn" (Item 10)	Acceptance of continuous learning process	Reorientation of professional values	Professional Identity Synthesis
8	P2: "...must uphold professional ethics and have good moral character" (Item 11)	Emphasis on ethics and exemplary conduct	Reorientation of professional values	Professional Identity Synthesis

3.5. Trustworthiness

Credibility, transferability, dependability, and confirmability were the four qualitative criteria used to ensure reliability.

We sought credibility through source triangulation (in-depth interviews and reflective journals), investigator triangulation (inter-coder agreement), and member checking, where we checked transcripts and thematic interpretations with participants to ensure that they reflected participants' intended meaning [8]. Member checking was conducted with all ten participants (P1–P10) between July 2 and 4, 2026. All participants fully agreed with the researchers' thematic interpretations of all four topics, with no further correction notes. Inter-coder triangulation was carried out on July 5, 2026, with the lead investigator and one member of the study team as a second coder. The results indicated 100% percentage agreement (20 of 20 data units). This level of agreement is very high and should be interpreted proportionally as the second coder was part of the same study team and not an external, fully independent rater, as discussed in greater detail in Section 5. Table 4 presents the results of member-checking for each of the ten subjects.

Transferability was explored through the rich description of the context, setting and characteristics of the participants to allow the readers to assess the applicability of the findings in other, similar contexts. Reliability was established through an audit trail that systematically documented each step of the research process, from raw transcripts and field notes to the phases of Moustakas [17] analysis. Confirmability was assured from the beginning and throughout the study by use of the epoche (bracketing) method [23] to ensure that the interpretations were based on the perspectives of the participants and not the researcher.

Table 4.
Summary of member-checking results.

Code	Verification date	Member-checking result (4 themes)	Participant note
P1	2 July 2026	Confirmed (4/4 themes)	No corrections
P2	2 July 2026	Confirmed (4/4 themes)	No corrections
P3	2 July 2026	Confirmed (4/4 themes)	No corrections
P4	3 July 2026	Confirmed (4/4 themes)	No corrections
P5	3 July 2026	Confirmed (4/4 themes)	No corrections
P6	4 July 2026	Confirmed (4/4 themes)	No corrections
P7	4 July 2026	Confirmed (4/4 themes)	No corrections
P8	4 July 2026	Confirmed (4/4 themes)	No corrections
P9	4 July 2026	Confirmed (4/4 themes)	No corrections
P10	4 July 2026	Confirmed (4/4 themes)	No corrections

3.6. Research Ethics

The ethical principles of human-subjects research considered in conducting this study were as follows: (1) informed consent, where each participant was fully informed of the study's purpose, procedures, and data usage before providing

written consent; (2) voluntary participation and the right to withdraw at any time without penalty; (3) confidentiality and anonymity, where participants' real identities were kept confidential and replaced with pseudonyms in reporting; and (4) secure data storage, where interview recordings, transcripts, and reflective journals were kept in a secure location and only the research team had access to them for academic purposes.

4. Results and Discussion

The results of the study are structured into four major themes based on the horizontalization of the transcripts of all ten subjects and the clustering of meaning units, which are aligned with the stages of the subjects' mental transformation: (1) Initial Adaptational Shock and Reality Clash, (2) Cognitive Turmoil and Reflective Turning Point, (3) Behavioral Manifestation and Strategic Adaptation, and (4) Synthesis of Professional Teacher Identity.

4.1. Theme 1: Initial Adaptational Shock and Reality Clash

From the beginning of the practicum, all participants had noticed a difference between the real complexity of the partner-school classroom and the idealized expectations that had been constructed during the study. The mismatch made them feel anxious, confused, anxious and self-conscious about their potential as pre-service teachers.

> *"I felt afraid, confused, and sad—even a little disappointed in myself—because the classroom situation did not match what I had hoped for."*
> P1, Item 3
> *"At that time, I briefly thought that perhaps I was not yet capable of becoming a good teacher."*
> P3, Item 5
> *"It happened, especially when facing a class that was hard to control and lessons that did not go as planned."*
> P5, Item 5
> *"I had reminded them several times, but after a few minutes the class became noisy again. At that moment I felt quite pressured and very exhausted."*
> P6, Item 3
> *"I felt anxious and frustrated because my efforts seemed insufficient. I also briefly doubted my own ability—whether I could manage a class well."*
> P7, Item 3
> *"I felt quite nervous, worried, and somewhat lacking in confidence because the situation did not entirely match the plan I had prepared."*
> P9, Item 3

Textural analysis revealed that all 10 pre-service math teachers had genuine difficulty with concentration and the management of the diversity of student traits, which naturally resulted in negative emotions such as concern, disappointment and anxiety. Structurally, these difficulties temporarily triggered a fixed-mindset tendency, where the first difficulty was seen as evidence for personal inability. The doubt of their own suitability for the profession by P3 and P5 is best exemplified by this. This is consistent with previous research that has identified the most common cause of concern for new teachers as their ability to manage the classroom [3]. Significantly, this shock was not limited to the novice teacher: P7 revealed that previous experience in teaching (as a private tutor) did not eliminate the shock but redirected the focus of the shock, from uncertainty of theoretical mastery to difficulty of theory application in the real complexity of classroom dynamics; P6 and P10 showed that the intensity of shock can vary widely even among subjects teaching the same subject matter. It implies that classroom management anxiety is moderated by individual teaching experience history and school-level context (junior versus senior secondary) rather than subject-matter difficulty alone.

4.2. Theme 2: Cognitive Turmoil and Reflective Turning Point

The turning point for all of the subjects came when they had to choose between giving in to self-doubt or reinterpreting the difficult experience as an integral part of learning.

> *"...seeing every obstacle as an opportunity to know my own shortcomings."*
> P1, Item 7
> *"...I began to see the situation from a different point of view... my mindset shifted."*
> P2, Item 7
> *"I realized that the difficulty I faced does not mean I am not talented to become a teacher, but rather that it is part of my process of growth."*
> P8, Item 5
> *"What I felt was not 'I am not talented,' but 'I ran out of energy.' There is a big difference between the two."*
> P7, Item 5
> *"I began to realize that teaching ability is not only about talent, but also a skill that can continually be learned and developed through experience."*
> P9, Item 5
> *"I began to understand that I am not incapable—I am simply not yet accustomed, and I am still learning to adapt."*
> P6, Item 6

In each of the ten disciplines, the cognitive upheaval always revolved around one basic question: Is the difficulty encountered a sign of a lack of aptitude or a typical aspect of learning? This re-framing was articulated most clearly in P8 and P6, in line with the trend identified in P5 . P7 provides one particularly significant nuance that makes "lacking talent" stand apart from "running out of energy." This subtle metacognitive difference between stable-internal attribute (talent) and unstable-internal attribute (fatigue) enriches Weiner's attribution-theory framework [25] in terms of the development of a growth mindset among pre-service math teachers. The formation of a growth-mindset does not need to be a direct rejection of the talent-doubt, but rather the more subtle process of metacognitive differentiation between different internal causes of difficulty. This distinction was reiterated, although the subjects had the same background in subject-matter, emphasizing the fact that this cognitive turning point is more a matter of individual disposition and previous experience than of the specific demands of teaching mathematics. Instead of interpreting exhaustion as a sign of incapacity, P7 coped with the burden using time management and social support.

4.3. Theme 3: Behavioral Manifestation and Strategic Adaptation

The adaptive strategies developed throughout the ten courses show a general shift away from strict adherence to an original lesson plan and toward a more responsive approach sensitive to actual classroom conditions.

"...more varied instructional media, simplified instructions, and reorganized group arrangements."
P1, Item 8
"...establishing classroom agreements before instruction begins" as a preventive strategy.
P2, Item 8
"...simpler explanations and examples that are closer to students' everyday lives, with more opportunities for discussion and questions."
P5, Item 8
"I tried using a paper-ball toss game to determine which group would present first."
P6, Item 8
"I immediately designed alternative strategies for the next session. When the class felt noisy, I used ice-breakers or varied my tone of voice."
P7, Item 8
"I clarified instructions, provided demonstrations before practice, and gave direct feedback during the activity."
P10, Item 8

The ten courses covered the same material, but were very different in their approaches to originality and concentration. P6 had the most creative set of large-class management strategies, including icebreakers, rotating group roles, and a paper-ball toss game to direct the energy of engaged students to activities relevant to their learning. P7 reflected a dual reflection system, which was consistent with her previous teaching experience through a systematic, evaluation-based approach. The system consisted of an informal personal journal and group discussions with fellow pre-service teachers and the mentor teacher. To directly address the specific pedagogical needs of teaching mathematics, P5 and a number of other disciplines are placing a great emphasis on contextualizing abstract mathematical ideas into situations more relatable to the lives of students. This variety indicates that the behavioral expression of growth mindset is not only subject-dependent but also contextual, influenced by the interaction of individual disposition, classroom environment, and available support resources (mentor teachers, other pre-service teachers).

4.4. Theme 4: Synthesis of Professional Teacher Identity

When asked to reflect on the overall importance of their practicum experience, the subjects came to a common understanding of what it meant to become a teacher.

Teaching ability "is not shaped by theory alone, but through real experience"—an epistemological shift from an academic-theoretical to an experiential view of the profession.
P1, Item 10
"Becoming a teacher is not about being perfect right away, but about continuing to learn and improve oneself."
P4, Item 10
"Becoming a teacher does not mean always being perfect, but having the willingness to keep learning and improving."
P8, Item 10
"I am tougher than I thought, and being a good teacher is about the process, not perfection."
P7, Item 10
"I may not yet be a perfect teacher, but I believe that as long as I am willing to keep learning, I can grow into a professional educator."
P9, Item 11
"Through experience, reflection, and mentor-teacher feedback, I began to understand that every difficulty carries its own lesson."
P10, Item 12

The common thread that runs through the professional-identity synthesis of all 10 disciplines is the assumption that becoming a teacher is a process rather than an accomplishment at a single point in time. Whereas P9 pointed to the

complexity of the professional position beyond the simple material delivery, P7 presented the most structurally articulated synthesis that outlined five basic values (lifelong learner, failure as part of the process, empathy, community support, and professional calling). In accordance with the principle of individual variation in phenomenological analysis [17] the essence of the pre-service teachers' growth mindset is structurally invariant, but narrative plural. This individual variation of the same essence of the subjects' articulation, from the emphasis on resilience (P7), acceptance of imperfection (P8), role complexity (P9), to a personal doubt-to-confidence transformation narrative (P6, P10) , is consistent with recent structural evidence that the professional identity formation of pre-service teachers is mediated by personal commitment and self-image rather than one single uniform pathway [26].

4.5. The Invariant Essence and Trajectory Visualization

The essence of this phenomena can be expressed as follows by synthesizing the above findings into one invariant-essence statement that includes the lived experience of all 10 mathematics pre-service teacher subjects:

> *"The growth mindset transformation of pre-service teachers during the practicum originates from cognitive vulnerability caused by the clash between idealized expectations and classroom reality, is mediated by mentor-teacher feedback and active self-reflection, and culminates in the recognition that instructional difficulty is not an indicator of permanent failure but rather formative material for the growth of a professional teacher identity oriented toward lifelong learning."*

The above results are combined to create a trajectory diagram (Figure 1), which also visualizes the changes in the thinking orientation of the 10 subjects during the four periods of the practicum. The horizontal axis illustrates the four phases of the practicum: (1) Initial Adaptational Shock, (2) Reflective Turning Point, (3) Strategic Adaptation, and (4) End of Practicum/Professional Identity. The vertical axis displays mindset orientation as two qualitative points (fixed mindset at bottom, growth mindset at top). Each point is a qualitative representation of the thinking orientation of the subjects as determined from the textural-structural analysis above. The points were left intentionally without a numerical scale so as not to imply the accuracy of a quantitative instrument.

In the diagram we observe three different patterns: According to the result of Theme 1, both subjects experienced shock mostly related to the existential concern about their qualification for the profession, all subjects started the practicum in a region leaning toward a fixed mindset, with P3 and P5 closest to the fixed-mindset pole. Second, the steepest increase (inflection point) appears between the Initial Shock and Reflective Turning Point phases across all trajectories, suggesting that the turning point is the most critical point in the whole transformation process. Third, although the starting points were different, all ten trajectories ended up in the growth-mindset area at the end of the practicum, reinforcing the invariant-essence conclusion that all ten pre-service math teachers experienced the same critical transformation regardless of the differences in individual crisis type or school level.

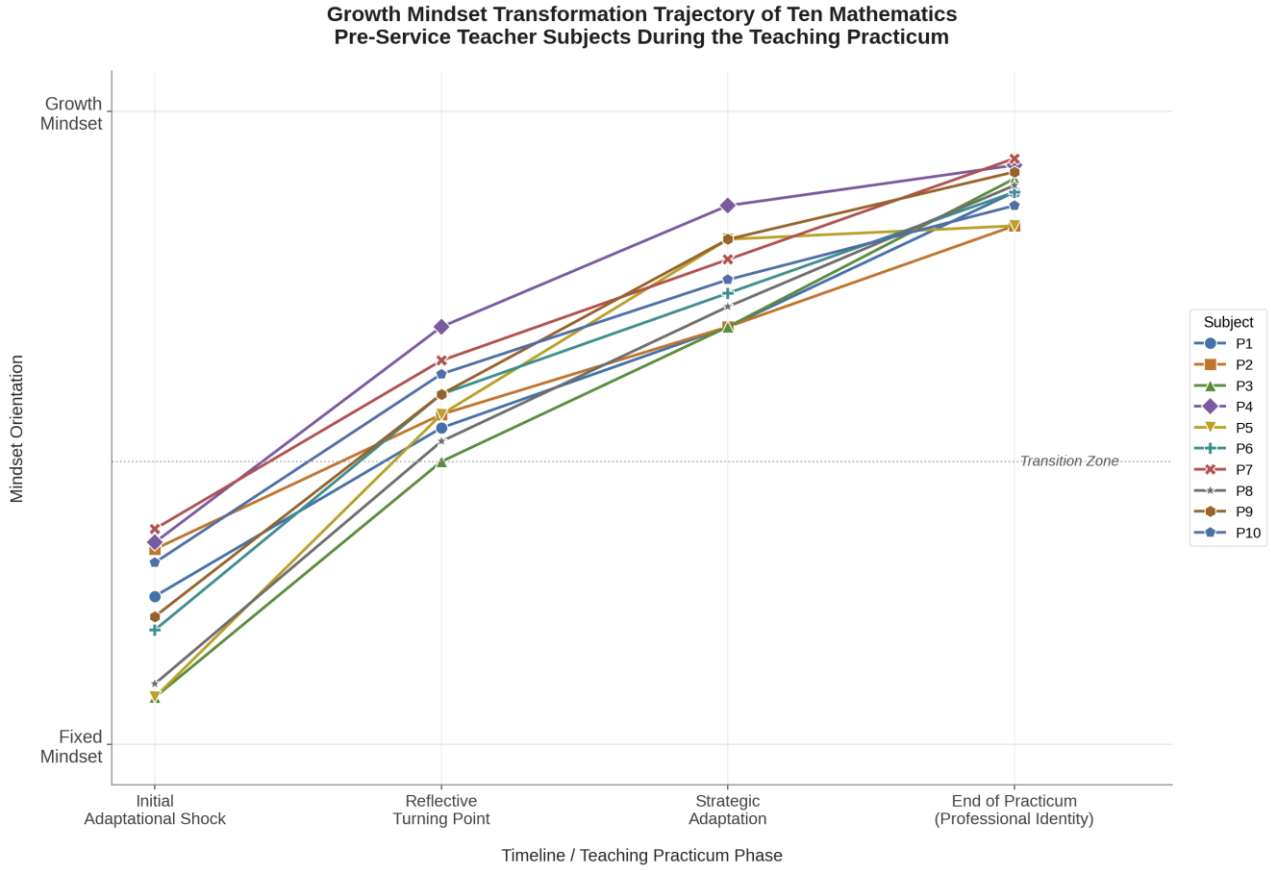


Figure 1.
Qualitative trajectory of growth mindset transformation across ten Mathematics pre-service teacher subjects during the teaching practicum.
Source: Researchers' textural-structural analysis of interview data.

5. Conclusion

This phenomenological study describes the lived experience of pre-service math teachers' growth mindset transformation during the practicum. The lived experience of growth mindset transformation was found to follow a structurally consistent path for the ten subjects, i.e. the process begins with an initial adaptational shock, then a reflective turning point mediated by the feedback and self-evaluation from the mentor-teacher, then shows itself in adaptive teaching strategies, and ends with the crystallization of a professional identity that is centered on lifelong learning. Likewise, a variety of psychological challenges, depending on the individual and classroom setting, elicited an emotional response of anxiety, disappointment, and self-doubt at the beginning of the practicum. Some of the challenges were diverse student characteristics, hard to focus in classes, being a first time teacher, and struggling to explain abstract mathematical concepts. Subjects responded to these challenges by a cognitive and introspective process that combined independent self-evaluation with external help from mentor-teachers in different proportions. Concrete manifestations of the growth mindset appeared in the form of modifications of teaching strategies that were tailored to the circumstances of the classroom of each subject, showing that the mindset shift was not limited to the cognitive level but was adaptively translated into tangible pedagogical action. After experiencing the turbulence of the practicum, the subjective meanings of the subjects converged to a common essence: becoming a teacher is a continuous learning process that shapes a resilient and adaptable professional identity, instead of a state of immediate perfection. As stated in the invariant-essence statement in Section 4.5, the growth mindset transformation of pre-service math teachers during the practicum is a psychological phenomenon that is structurally invariant in its pattern and direction, but variable in its crisis triggers and pathways of attainment.

As with any qualitative phenomenological study, there are some limitations to this research that must be openly disclosed. First, in terms of the number and variety of the subjects, ten subjects of one academic discipline (mathematics) at one university (Universitas Halu Oleo) were selected in this study because of the richness of their narratives. The results are not meant for statistical generalization to the wider pre-service teacher community, although transferability to similar circumstances is possible as discussed in Section 3. Rather, they convey the spirit of the experiences of these 10 subjects. Second, inter-coder triangulation was not fully independent; the second coder was a member of the research team and already familiar with the theoretical framework and context of the study while reaching 100% agreement. Such a high agreement is likely due to common background knowledge rather than purely objective, blind verification. Future research should include a truly external coder who is not involved in the research process. Third, a longitudinal design would offer a more dynamic look at the transformation process. This study employed a cross-sectional design, gathering data at one point in time after the practicum ended, capturing retrospective reflection rather than real-time developmental change.

These limitations are significant for readers to consider in relation to the scope and applicability of the findings and inform the recommendations that follow. However, they do not detract from the validity of the findings in terms of the orientation of qualitative phenomenological inquiry to depth of meaning rather than to statistical generalization. Teacher preparation programs should make the explicit reinforcement of a growth mindset in their curricula, not just as conceptual content, but through structured reflective activities (e.g., guided practicum journals) that can accelerate students' reflective turning point. Given the critical mediating effect of mentor-teacher feedback demonstrated in this study, supervising lecturers and mentor teachers are advised to provide evaluation that is process-oriented rather than outcome-oriented only. Pre-service teachers are encouraged to engage in regular self-reflection activities such as reflective journals or peer discussion, to facilitate reframing of challenges experienced during the practicum. In addition to the use of a truly independent second coder, future researchers are encouraged to expand the scope of inquiry to include subjects from more diverse study fields and partner-school contexts (including underserved or remote regions), and to explore longitudinal designs that follow the continuity of growth mindset beyond the practicum to the first year of professional teaching. Finally the results of this study are presented to participants and readers in general as a reminder that challenges faced during the course of becoming an educator are an integral part to the development of a strong professional identity and not an indication of irreversible failure.

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