Journal of Philosophy and Research in Islamic Mathematics Education
J-PRIMa
Vol. 2, No. 1, 2026, pp 24–36 e-ISSN:
https://doi.org/10.33474/j-prima.v2i1.25346
online at: https://riset.unisma.ac.id/index.php/j-prima/article/view/25346/

Integrating beliefs, pedagogical identity, and practice: a systematic literature review of pre-service mathematics teachers' instructional frameworks.

Tiara Mastura Nafisa[1], Risma Ardhelisa Aulyafani[2] , Wahyu Kartikawati[3], Syelvira Nova Zulfaidany[4], Risna Nuraini[5], Yaroidah Maharani[6], Indah Ayu Lestari[7]
[1,2,3,4,5,6,7] SMA Negeri 9 Kota Malang, Indonesia
*Correspondence: tiamasturaa@gmail.com[1]

Received: 24-02-2026; Revised: 20-03-2026; Accepted: 08-04-2026

Abstract. *This research is motivated by the gap between the theory acquired in college and the reality of practice in the field, as well as the influence of beliefs and identity of a prospective mathematics teacher. This study aims to analyze the relationship between these three aspects in shaping the professionalism of prospective mathematics teachers. The method used is a phenomenological approach with a Systematic Literature Review of various studies related to prospective mathematics teachers. Data were collected through a literature study analyzed using a prism diagram to identify patterns of relationships between beliefs, pedagogical identity, and theory-practice gap. The results show that beliefs act as a primary filter in determining learning decisions, while pedagogical identity develops through a process of transformation from a student perspective to a professional educator. Furthermore, a gap was found between theory and practice that often gives rise to identity crises in pre-service teachers, mainly due to the influence of previous observational experiences and school environmental pressures. However, practical experience also serves as a reflective space that allows for a more mature reconstruction of identity. Therefore, a strong integration between beliefs, pedagogical identity, and practice, supported by critical reflection and active engagement, is key to developing professional and adaptive mathematics teachers*

Keywords*: Beliefs, Pedagogical Identity, Practice, Pre-service Mathematics Teacher.*

How to cite: Nafisa, T. M., Aulyafani, R. A., Aulyafani, R. A., Kartikawati, W., Zulfaidany, S. N., Nuraini, R., Maharani, Y., & Lestari, I. A. (2026). Integrating beliefs, pedagogical identity, and practice : a systematic literature review of pre-service mathematics teachers' instructional frameworks. *Journal of Philosophy and Research in Islamic Mathematics Education (J-PRIMa)*, *2*(1), 24–36. https://doi.org/10.33474/j-prima.v2i1.25346

Introduction

The development of 21st-century education indicates that critical thinking, problem-solving, and numeracy literacy have become the core competencies students must possess to face increasingly complex global challenges. These skills are essential not only for academic success but also for individual readiness in navigating a workforce and daily life that demand analytical and adaptive capabilities. Furthermore, international reports such as the Programme for International Student Assessment (PISA) reveal that student mathematics performance remains a significant challenge in many countries, including Indonesia, which consistently ranks in the lower-middle proficiency category. This condition indicates a gap between pedagogical expectations and the reality of student achievement on the ground, underscoring that the quality of mathematics instruction heavily depends on the quality of teachers as the

primary actors in the educational process. Recent research suggests that the effectiveness of mathematics learning is influenced not only by content mastery but also by the psychological and professional dimensions of the teacher (Alsina & Pincheira, 2025). Consequently, enhancing teacher quality is the key to improving the overall quality of mathematics education.

As the demands on mathematics teachers increase, the required competencies have become more complex and multidimensional. Teachers are expected not only to possess the cognitive ability to understand the subject matter but also to manage affective, reflective, and social aspects within the learning process. This includes understanding student characteristics, building positive interactions, and engaging in reflection on their teaching practices. Recent studies emphasize that teaching practice is the result of interactions between a teacher's knowledge, beliefs, and professional identity (Yang et al., 2020). This interaction suggests that successful instruction is determined not just by what a teacher knows, but by how they interpret their role in the learning process. Therefore, understanding internal factors such as beliefs and identity is crucial for improving future learning quality. Thus, teacher competency development must consider these internal aspects that holistically influence teaching practice.

In the context of mathematics education, teacher beliefs are among the most influential factors in classroom practice. A teacher's beliefs about the nature of mathematics, how it is learned, and the roles of teachers and students determine the instructional approach used. Systematic studies show that teacher beliefs regarding the nature of mathematics and student learning directly influence the instructional strategies employed in the classroom (Muhtarom et al., 2020). Teachers with procedural beliefs tend to implement teacher-centered instruction, such as lecturing and routine drills, whereas conceptual beliefs encourage constructivist or student-centered approaches that emphasize conceptual understanding (Li et al., 2022). These differing approaches significantly impact student learning experiences and outcomes. This indicates that beliefs are not merely perceptions but a core aspect that must be addressed in instruction. Accordingly, teacher beliefs play a strategic role in determining the quality and direction of mathematics education.

In addition to beliefs, professional identity is an essential aspect influencing teaching practice. Teacher identity is defined as the way teachers perceive themselves in their professional roles, shaped through experience, social interaction, and reflection (Kavrayici, 2020). This identity encompasses how teachers understand their responsibilities, their core values, and how they interact with their professional environment. Recent studies indicate that teacher identity is dynamic and evolves throughout a professional career, particularly during the initial stages of teacher education when individuals begin to build an understanding of their profession (Zhao & Zhang, 2017). This development is influenced by various experiences, both inside and outside the classroom, as well as interactions with mentors, students, and peers. Therefore, professional identity serves as a vital foundation for shaping effective and reflective teaching practices.

Furthermore, Lutovac (2020) demonstrates that beliefs and identity have a mutually influential relationship in shaping a teacher's professional practice. Beliefs shape an individual's perspective on the profession and learning, while professional identity reinforces or even alters these beliefs through lived experiences in teaching practice. This relationship is dynamic and continuous, evolving alongside a teacher's professional experience. In mathematics education, this connection is particularly critical as both factors simultaneously influence classroom practice and pedagogical decision-making (Vidal & Kuckuck, 2025). The interaction between beliefs and identity can also explain why teachers exhibit different teaching styles despite being in similar contexts. Thus, understanding the relationship between beliefs and identity is key to a more comprehensive understanding of teaching practice.

The pre-service teacher education stage, such as the *PPG Prajabatan* program, is a crucial phase in the formation of beliefs and professional identity. At this stage, prospective

teachers begin to integrate theoretical knowledge from their coursework with practical field experience. These programs are designed to bridge the gap between pedagogical theory and teaching practice through activities such as microteaching and field placements. However, research indicates that this process is not always seamless, as pre-service teachers bring initial beliefs formed during their own prior learning experiences (Lo, 2021). These initial beliefs are often robust and influence how they receive and implement new knowledge. Consequently, the pre-service phase is a critical period that determines the professional development trajectory of prospective teachers.

One of the primary issues in teacher education is the theory-practice gap. This gap arises when the pedagogical concepts studied cannot be directly applied to the complex and dynamic reality of the classroom. Studies show that many pre-service teachers struggle to translate pedagogical theory into real-world classroom situations, particularly in mathematics, which demands deep conceptual understanding (Bjerke & Nolan, 2023). This condition often leads to confusion and a lack of confidence among prospective teachers in fulfilling their roles. Such a gap results in lower professional readiness and compromised instructional quality. Thus, overcoming the theory-practice gap remains a major challenge in teacher education.

In this context, the teaching practicum (PPG) is an essential element in bridging the divide between theory and practice. Through direct classroom experience, pre-service teachers have the opportunity to test, reflect on, and develop their understanding of learning. Research indicates that field experiences can be a turning point in reconstructing the beliefs and identities of prospective teachers. Interaction with students, mentors, and the school environment helps shape a more realistic understanding of the teaching profession (Lee, 2021). These experiences also assist prospective teachers in developing skills to adapt to various learning situations. Therefore, field practice plays a strategic role in establishing the professional readiness of pre-service teachers.

Nevertheless, research findings regarding changes in beliefs and identity during teacher education still show inconsistencies. Some studies have found that beliefs can change significantly through intensive and reflective practical experiences (Woltron & Götz, 2025). Conversely, deeply rooted beliefs in pre-service teachers can create a rigid identity, leading to resistance toward collaboration and the implementation of new instructional models, thereby closing opportunities for professional change (Keiler, 2018). These differing findings suggest that changes in beliefs are influenced by various factors, including the quality of the practical experience and the reflective support provided. Moreover, most research still examines beliefs, identity, and practice in isolation rather than integratively within a single analytical framework. Therefore, a more comprehensive study is needed to understand the holistic relationship between these three aspects.

Based on the aforementioned context, there is an urgent need for a comprehensive study that integrates beliefs, identity, and the transition from theory to practice for pre-service mathematics teachers. This study utilizes a Systematic Literature Review (SLR) approach to identify relationship patterns, research gaps, and future development directions based on existing literature. This approach allows for a systematic and evidence-based synthesis of the topics studied. Academically, this research is expected to enrich the literature on mathematics teacher education, particularly in understanding the dynamics of beliefs and identity. Practically, it aims to provide recommendations for the development of *PPG Prajabatan* programs to more effectively foster professional teachers who are reflective and adaptive. Ultimately, this research is intended to provide significant theoretical and practical contributions to the field of mathematics education.

Method

This study employed the Systematic Literature Review (SLR) method, which focused

on examining empirical studies related to beliefs, pedagogical identity, and the gap between theory and practice of teaching and learning among pre-service teachers. This method was chosen because it allows the author to conduct a comprehensive review by systematically identifying, evaluating, and synthesizing relevant research findings (Kitchenham, 2004). In its implementation, systematic observation requires specific criteria in selecting the literature to be reviewed (Mukuka & Alex, 2024). The SLR approach in this study is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

Selection Process

The data sources for this study were obtained from the Scopus database. The literature search was conducted using a combination of keywords with the Boolean operators: TITLE-ABS-KEY ("pre-service teacher" OR "student teacher" OR "PPG") AND ("mathematics education") AND ("beliefs" OR "teacher identity" OR "metacognition") AND ("teaching practice" OR "classroom experience") AND PUBYEAR > 2014 AND PUBYEAR < 2027, resulting in 741 articles.

The registered articles were then filtered by adding the keyword "teacher development", resulting in 186 articles. The authors then narrowed the scope of the information sources by excluding several keywords that were less relevant to the research objectives, containing: "Literature Review", "Systematic Review", "Primary School Teachers", "Primary School", "Early Childhood Teacher Education", "Early Childhood Education", and "Secondary Education" leaving a total of 101 articles. The exclusion criteria were considered based on the research needs. Since the focus of this study is to examine prospective teachers, especially those who were prospected of teaching at the high school level, several keywords referring to early childhood, primary, and secondary school teachers were excluded. This study also requires empirical data, not the results of a literature review, hence, keywords referring to literature reviews were also excluded.

Of the 101 articles remaining, the author assessed their eligibility by evaluating the quality of the selected articles based on several aspects, such as the clarity of the research objectives, the appropriateness of the methods, and their relevance to the research focus. Articles that did not meet the quality standards were excluded from the analysis process. At this stage, the author also eliminated several articles that were not open access. After conducting the review process, the author obtained 20 articles eligible for systematic review. This literature source selection process is illustrated in the PRISMA flowchart in Figure 1.

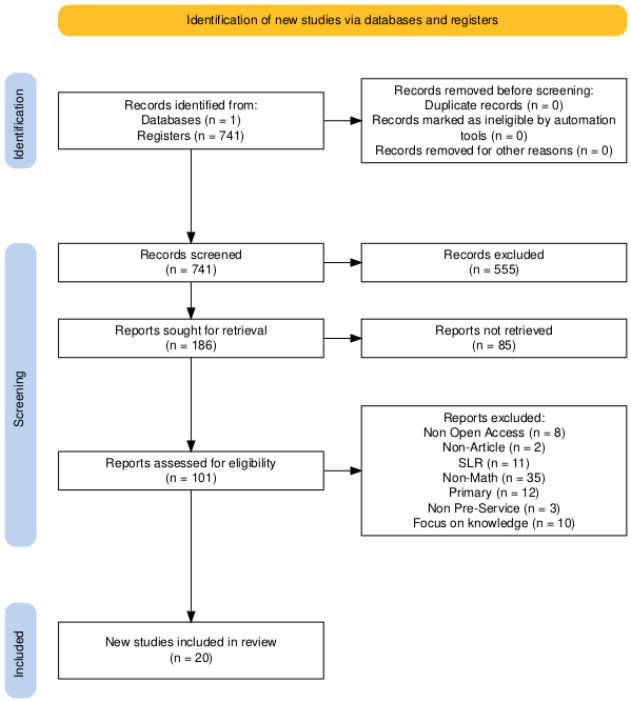

Figure 1. PRISMA Flowchart

Data Extraction

The information from articles that passed the selection were then systematically extracted using a data extraction table. This table was designed to organize key information from each article, thereby facilitating the analysis process. The components in the data extraction table include: author's name and year of publication, focus, research method, and research findings. The data extraction process was conducted by thoroughly reading each article, then identifying and recording relevant information in accordance with the research focus, consisting of belief, pedagogical identity, and the gap between theory and practice. The results of the data extraction are presented in Table 1.

Table 1. Data Extraction

No	Author	Year	Focus	Methods	Findings
1	Lutovac & Kaasila	2022	Beliefs	Qualitative	Failure in mathematics is a subjective, autobiographical experience shaped by a discrepancy between a student's performance and their self-identity, which significantly influences how pre-service teachers perceive their own competence and their future professional roles.
2	Grigaliuniene & Lehtinen	2025	Beliefs	Quantitative	Mathematics teachers' overall self-efficacy significantly increases with career experience, their confidence in their subject knowledge remains relatively high and consistent from the very start of their professional

No	Author	Year	Focus	Methods	Findings
					journey.
3	Fonseca	2021	Pedagogical Identity	Qualitative	Engaging future teachers in reflective mathematical problem-solving not only deepens their technical knowledge and use of heuristics but also triggers a spontaneous shift where they begin to integrate their personal learning experiences with their future pedagogical practice
4	Lutovac, et.al.	2023	Beliefs	Qualitative	A pre-service teacher's fixed mindset can cause them to interpret critical feedback as a personal threat to their innate ability, creating a defensive barrier that prevents them from using supervisory guidance for professional development.
5	Kusaeri & Aditomo	2019	Beliefs	Quantitative	Indonesian pre-service math teachers value critical thinking skills and prefer constructivist instruction, they often lack a commitment to critical dispositions and feel underprepared to teach these skills, with their formal teacher education showing little influence on these core pedagogical beliefs.
6	Alsina & Mul	2019	Pedagogical Identity	Qualitative	Transforming pre-service teachers' professional competence and integrating sustainability requires a reflective learning model where the lecturer's interventions are strategically synchronized to uncover, contrast, and challenge the students' prior beliefs with real-world professional practices.
7	Merk et al.	2017	Beliefs	Quantitative	Pre-service teachers' valuation of pedagogical knowledge for practice is driven less by the

No	Author	Year	Focus	Methods	Findings
					source of that information (science vs. practitioner) and more by their own epistemic beliefs regarding whether knowledge is absolute, subjective, or evidence-based.
8	Yang et al.	2020	Beliefs	Quantitative	Pre-service teachers' mathematical knowledge does not directly determine their instructional practices; instead, its influence is mediated by their epistemological beliefs, which serve as a primary predictor of their teaching style.
9	Rochnia et al.	2023	Theory-Practice Gap	Quantitative	High-quality university training focused on research and practice enables teachers to better apply theoretical knowledge in the classroom, which serves as a critical driver for improving overall teaching quality
10	Christiansen et al.	2021	Pedagogical Identity	Qualitative	Practicum observation protocols do not just assess performance but actively construct various stereotypical "images" of the desired teacher, such as the "efficient" or "constantly improving" teacher, which can lead to a fragmented and inconsistent development of professional identity.
11	Atjonen et al.	2022	Pedagogical Identity	Qualitative	Building assessment literacy among prospective teachers is not merely about teaching them how to create test items, but rather about fostering a mindset that views assessment as an integral part of the learning process, while continuously honing their ability to collaboratively discuss assessment data.
12	Susilawati et al.	2022	Beliefs	Qualitative	The higher pre-service teacher' self-efficacy, the more

No	Author	Year	Focus	Methods	Findings
					systematic and efficient their numerical thinking process is when solving problems.
13	Lutovac & Kaasila	2018	Pedagogical Identity	Qualitative	The long-term success of teachers depends heavily on their ability to engage in identity work to connect who they were in the past with who they want to become in the future, and to view the challenges of teaching as opportunities for personal growth.
14	Soysal & Radmard	2020	Theory-Practice Gap	Qualitative	Many pre-service teachers are still stuck in a traditional mindset which demonstrates a clear disconnect between the modern educational theories they learn in college and their personal beliefs that remain strongly influenced by their own school experiences.
15	Nickl et al.	2022	Pedagogical Identity	Quantitative	The effectiveness of digital simulations depends not only on the quality of the system but is also greatly influenced by pre-service teacher' prior knowledge. Therefore, support during simulations must be tailored to the specific profile of each pre-service teacher.
16	Radkowitsch et al.	2023	Pedagogical Identity	Quantitative	The main difference among pre-service teachers in conducting diagnostic analysis lies not only in "what they know," but also in "how they behave" when seeking information.
17	Matsumoto-Royo et al.	2023	Beliefs	Mixed-Methods	Constructive feedback serves as a catalyst for reflection, transforming pre-service teachers' perceptions of mistakes into learning opportunities, thereby fostering lifelong independent learning.
18	Nolan	2015	Theory-	Qualitative	Addressing the conflict between

No	Author	Year	Focus	Methods	Findings
			Practice Gap		idealistic teaching theories and the procedure-heavy reality of schools through the ongoing negotiation of professional identity.
19	Cavanagh	2018	Beliefs	Quantitative	Pre-service teacher who have high self-efficacy and optimism about being "ready to teach" prior to their field practicum tend to be more confident in their teaching strategies than in their classroom management skills, suggesting that their optimism may not yet have been tested by the real challenges of the classroom.
20	Olawale	2024	Pedagogical Identity	Mixed-Methods	Teacher education has successfully equipped pre-service teachers with teaching materials, but it still needs to strengthen the aspect of teaching methods that accommodate students' differences, especially when dealing with the reality of classrooms where students have varying levels of ability.

Result

This study aims to systematically review the existing body of research on pre-service mathematics teachers' belief, pedagogical identity, and theory-practice gap which influence each other. Specifically, it seeks to answer Research Questions (RQ) below:

1. How do the mathematical beliefs of pre-service teachers influence their instructional practices?
2. How is pedagogical identity constructed during initial teacher education?
3. Which factors influence the transition from theoretical pedagogical knowledge to practical classroom application?

To systematically address the research questions, a structured data extraction process was employed to organize and synthesize relevant information from the selected studies. The extraction framework was specifically designed to capture key aspects related to pre-service mathematics teachers' beliefs (RQ1), pedagogical identity (RQ2), and the theory-practice gap (RQ3). Based on the data presented in Table 1 and to answer each RQ, the results of the systematic literature review identified three major themes, namely beliefs shape the reception of theory and feedback, crisis as the catalyst for identity transformation, and clash between theory and practice reality. The following sections provide a detailed examination of each themes.

Beliefs Shape the Reception of Theory and Feedback

(RQ1) How do the mathematical beliefs of pre-service teachers influence their instructional practices?

The beliefs held by pre-service mathematics teachers play a crucial role in determining how they will manage their classrooms and deliver instruction in the future. Based on research conducted with pre-service teachers in China, it was found that beliefs have a stronger and more direct influence on teaching practices than mathematical content knowledge (MCK) or pedagogical content knowledge (MPCK) alone (Yang et al., 2020). These beliefs function as a filter through which teachers evaluate their teaching behaviors, ultimately shaping the instructional strategies they choose.

Specifically, views on the nature of mathematics and how it is learned significantly influence teachers' tendencies to adopt certain methods. Prospective teachers who hold a dynamic view (seeing mathematics as a process of discovery) and possess constructivist beliefs tend to report inquiry-oriented teaching practices (Yang et al., 2020). Conversely, if prospective teachers view mathematics merely as a collection of facts and procedures to be memorized, they will place greater emphasis on traditional, teacher-centered instruction (Kusaeri & Aditomo, 2019).

In addition, self-efficacy or belief in one's own abilities (teacher self-efficacy) significantly determines a pre-service teacher's readiness and commitment to teaching (Cavanagh, 2018). Pre-service teachers with high self-efficacy are typically more open to adopting innovative teaching practices and more persistent in helping students who struggle academically (Grigaliuniene & Lehtinen, 2025). This belief also influences a teacher's communication style, level of motivation, and patience when interacting with students in the classroom (Kusaeri & Aditomo, 2019).

However, challenges arise when preservice teachers have a fixed mindset regarding their teaching abilities. Pre-service teachers with this mindset tend to view criticism or negative feedback as a threat to their professional identity, rather than as an opportunity to learn (Lutovac, 2023). This can hinder professional development because they become less receptive to suggestions for improvement and tend to "play it safe" in their teaching practices rather than experimenting with new, more effective methods

Finally, beliefs about specific learning objectives, such as critical thinking, influence the design of instructional materials and classroom interactions. For example, pre-service teachers who believe in the importance of independent thinking and logical communication will formulate learning objectives that provide opportunities for students to construct arguments and understand concepts in depth, rather than merely applying formulas or algorithms (Kusaeri & Aditomo, 2019). Thus, transformation in mathematics education depends heavily on the ability of teacher education institutions to shape and guide pre-service teachers' beliefs toward a more constructivist and adaptive approach (Yang et al., 2020).

Crisis as the Catalyst for Identity Transformation

(RQ2) How is pedagogical identity constructed during initial teacher education?

The formation of pedagogical identity among pre-service teachers is a complex process involving active reflection, social interaction, and the transformation of personal beliefs through practical experience. This identity is not static but continues to evolve through narrative identity work, in which pre-service teachers interpret their learning and teaching experiences to build an understanding of who they are as educators (Lutovac & Kaasila, 2018). In mathematics teacher education, this process often begins with a shift in consciousness from the voice of a student to the voice of a teacher, as they begin to realize the importance of deep conceptual understanding to effectively teach the material to students (Fonseca, 2021).

The key component in the formation of this identity is the development of pedagogical

literacy, such as assessment literacy and diagnostic skills. Through the Teacher Assessment Literacy in Practice (TALiP) model, the teacher's identity as an assessor is reconstructed through continuous learning and reflection on assessment practices (Atjonen et al., 2022). The use of video-based simulations in teacher education also plays a crucial role; these simulations allow pre-service teachers to practice diagnostic skills, such as describing, explaining, and making decisions, in a safe yet authentic environment. Cognitive characteristics (content and pedagogical knowledge) as well as motivational factors (self-efficacy and interest) significantly influence how pre-service teachers navigate these simulations and shape their professional profiles (Nickl et al., 2022).

Field experience serves as a crucial catalyst in the formation of identity. In schools, pre-service teachers confront classroom realities that challenge their initial identities, which are often still theoretical or traditional. Quality teacher education helps boost their self-confidence through guidance, constructive feedback, and the modeling of instructional techniques aligned with curriculum standards (Olawale, 2024). Through practicum observation protocols, educational institutions also convey the image of the "desired teacher", whether that is a knowledgeable teacher, an efficient teacher, or a teacher who continuously improves, which pre-service teachers then internalize as part of their professional identity (Christiansen et al., 2021).

The identity-formation process often involves phases of deconstruction, co-construction, and reconstruction. Pre-service teachers must deconstruct their past experiences and intuitive beliefs, then collaborate with peers and experts to construct new pedagogical concepts competencies (Alsina & Mul, 2019). In this process, the emergence of a crisis or cognitive conflict when facing teaching challenges is actually considered necessary to trigger deeper self-development (Lutovac & Kaasila, 2018). Through active engagement (agentic engagement) and critical reflection synchronized with faculty guidance, prospective teachers can transform their initial knowledge and experiences into transformative professional.

Clash Between Theory and Practice Reality

(RQ3) Which factors influence the transition from theoretical pedagogical knowledge to practical classroom application?

The transition from theory to practice in teacher education is strongly influenced by the initial beliefs and meaning orientation that pre-service teachers develop during their studies. Pre-service teachers often bring preconceptions formed from thousands of hours of observation over the years as students, which tend to shape a traditional view that teaching is merely a process of conveying facts (Soysal & Radmard, 2020). Meaning orientation serves as a crucial mediator in this process; research indicates that a deep understanding of pedagogical theory is more effective in helping pre-service teachers recognize the relevance of theory compared to merely a superficial practical orientation. Without broad pedagogical awareness and the ability to integrate various sources of knowledge, pre-service teachers will struggle to apply innovative theories and tend to revert to simple, linear instructional models when faced with the complex realities of the classroom (Rochnia et al., 2023).

On the other hand, this transition is also severely constrained by social dynamics within the school and the pressure to conform to established practices (compliance). Pre-service teachers often experience a gap where they must negotiate their identity between idealized theory and real-world practice. In this environment, the relationship with the cooperating teacher is often considered more valuable than that with the academic advisor, as the cooperating teacher is seen as possessing "cultural capital" better suited to the practical needs of the classroom (Nolan, 2015). This often triggers a survival strategy, in which pre-service teachers prefer to engage in tinkering, subjective and trial-and-error problem-solving, rather than consistently applying theory, especially if the school environment does not support

the reform philosophy taught at the pre-service teacher education program.

Discussion

Beliefs are the most fundamental element that serve as a cognitive filter for pre-service teachers in evaluating their teaching behavior. Research indicates that beliefs exert a stronger and more direct influence on teaching practice than content knowledge or pedagogical knowledge. This aligns with research by Čuka (2025) which states that beliefs about teaching in elementary mathematics had the strongest effect on instructional practice, while content knowledge and attitudes worked partly through beliefs. These beliefs intrinsically shape pedagogical identity. An educator's identity is not merely an accumulation of knowledge but the result of transition in which pre-service teachers shift from a student-centric perspective to to a professional educator's persona signifies a critical evolution in pedagogical identity. This transition involves moving beyond the mere consumption of knowledge toward a deeper awareness of how to facilitate conceptual understanding for others (Torres-cladera et al., 2021).

Challenges arise when the theoretical identity formed at the pre-service teacher education program clashes with the realities of the field. There is a strong dichotomy between academic theory and school practice, in which pre-service teachers often feel caught between these two worlds. Within this developmental period, numerous pre-service teachers encounter a dissonance in their professional identity triggered by the apprenticeship of observation. This phenomenon stems from the extensive time spent observing traditional teaching during their teacher education program period, which creates an internal pressure to revert to habitual, teacher-centered techniques rather than adopting modern pedagogical theories (Pretorius, 2024). This gap is exacerbated by external pressure to conform to established school rules, which often hinder the implementation of innovative theories. That opinion is consistent with Serdyukov (2026), which states that external educational frameworks frequently lack contextual relevance, resulting in administrative directives that suppress creative problem-solving. Without a strong theoretical foundation and a meaning orientation, pre-service teacher teachers risk engaging in tinkering subjective, trial-and-error problem-solving without a solid scientific basis.

Based on the explanation above indicate that the preparation of prospective mathematics teachers is not a fragmented process, but rather an interconnected ecosystem of cognitive, affective, and practical aspects. The relationship between beliefs, identity, and the reality of the theory-to-practice transition forms a professional framework that determines the quality of future teaching (Martinez et al., 2025) . The relationship between these three elements can be summarized that personal beliefs provide a crucial foundation of values, where a commitment to aspects such as critical thinking guides prospective teachers in formulating meaningful learning objectives. Pedagogical identity then serves as a bridge that enables them to navigate cognitive conflicts during field practice, transforming these challenges into opportunities for mature professional deconstruction and reconstruction. Field practice often shatters the idealism of pre-service teachers through various situational and emotional challenges, creating an identity crisis that forces them to confront the stark contrast between theory and reality (Jadid, 2025). Ultimately, the theory-practice continuum acts as an experimental laboratory where field experiences challenge initial theoretical identities, compelling prospective teachers to transform prior knowledge into transformative professional competencies through critical reflection.

To become professional educators capable of bridging the gap between theory and practice, pre-service teachers must first cultivate a growth mindset and strong pedagogical literacy. This involves a shift in attitude toward viewing negative feedback not as a threat, but as an opportunity to experiment with new methods rather than simply playing it safe. The program to foster a growth mindset among education professionals and pre-service teachers contributes to increased self-efficacy and professional resilience, which directly supports

individuals' persistence in overcoming obstacles and handling critical feedback (Wahdeni et al., 2025). Additionally, strengthening diagnostic literacy through video-based simulations and mastering assessment models such as TALiP is crucial so that they can establish an identity as objective evaluators before diving into the actual dynamics of the classroom. This statement also supported by Sommerhoff et al. (2023) which stated that structured video simulations improve teachers' ability to notice evidence, interpret student behavior, reduce subjective bias, and make more accurate judgments.

On the other hand, professional development also demands the strengthening of agentic engagement and a deep search for meaning within the profession. Pre-service teachers must not merely be passive followers of mentor teachers but must actively engage in critical reflection aligned with academic guidelines to ensure their practices remain grounded in scientific evidence, rather than merely replicating one-way transmission methods. Pre-service teachers need to be equipped with research-based education to hone their professional judgment and develop more flexible and relevant teaching skills (Foliot & Chaliès, 2025). By consciously building connections between university theory and its practical relevance, pre-service teachers will have a clear compass so they do not get trapped in a trial-and-error approach when facing various instructional challenges in the field. The effectiveness of pre-service teachers in integrating theoretical frameworks into field practice is positively correlated with increased self-efficacy, strategic decision-making skills, and adaptability in delivering instructional content (Phillips & Condy, 2023).

Conclusion

The educational process for pre-service mathematics teachers is not a series of separate processes, but rather a dynamically interconnected system of cognitive, affective, and practical aspects. Beliefs, pedagogical identity, and the reality of practical practice in the field form a unity that determines the quality of future teacher professionalism. Foundational beliefs primarily influence how prospective teachers understand, assess, and make decisions in teaching practice. Therefore, changes or strengthening of beliefs will directly impact the quality of pedagogical actions taken.

Furthermore, pedagogical identity develops as a result of the interaction between beliefs and learning experiences, both in academic settings and in practice. This identity formation process requires a profound transformation from a learner to a reflective and responsible educator. A mature identity enables pre-service teachers to constructively address conflicts or tensions between theory and practice. In this case, an identity crisis is not an obstacle, but rather an opportunity for stronger professional reconstruction. Therefore, systematic efforts are needed to strengthen the integration between beliefs, identity, and practice.

Developing a growth mindset is crucial so pre-service teachers can view feedback as a learning tool, not a threat. Furthermore, improving pedagogical and diagnostic literacy will help them make informed decisions based on data and analysis. Critical reflection and active engagement are also key to ensuring that prospective teachers not only follow existing practices but also generate and develop them independently. Finally, constructing meaning from each learning experience is crucial in bridging theory and practice. Pre-service teachers need to consciously integrate academic concepts with real-world classroom situations to avoid becoming trapped in a trial-and-error approach. With a strong integration of these three aspects, prospective mathematics teachers can develop into adaptive, reflective professionals capable of delivering meaningful learning.

Further research is recommended to examine in more depth the relationship between beliefs, pedagogical identity, and practice through longitudinal designs and mixed methods approaches in order to comprehensively capture the dynamics of change to bridge the gap between theory and practice.

Acknowledgement

The author would like to express sincere gratitude to the Teacher Professional Education (Pendidikan Profesi Guru/PPG) Program at Universitas Islam Malang for providing financial support for this research.

References

Alsina, Á., & Mul, I. (2019). *Advancing towards a Transformational Professional Competence Model through Reflective Learning and Sustainability : The Case of Mathematics Teacher Education*.

Alsina, Á., & Pincheira, N. (2025). *Mathematics teachers ' professional development : A systematic review of training methods*. *21*(3).

Atjonen, P., Pöntinen, S., Kontkanen, S., Ruotsalainen, P., & Hill, M. F. (2022). *In Enhancing Preservice Teachers ' Assessment Literacy : Focus on Knowledge Base , Conceptions of Assessment , and Teacher Learning Definitions of Teacher Assessment*. *7*(July), 1–12. https://doi.org/10.3389/feduc.2022.891391

Bjerke, A. H., & Nolan, K. (2023). The return to university after fieldwork : toward disrupting practice-theory challenges identified by mathematics teacher educators. *Frontiers in Education*, *June*, 1–13. https://doi.org/10.3389/feduc.2023.1129206

Cavanagh, M. (2018). *Classroom Ready ? Pre-Service Teachers ' Self-Efficacy for Their First Professional Experience Placement*. *43*(7). https://doi.org/10.14221/ajte.2018v43n7.8

Christiansen, I. M., Österling, L., & Skog, K. (2021). Research Papers in Education Images of the desired teacher in practicum observation protocols. *Research Papers in Education*, *36*(4), 439–460. https://doi.org/10.1080/02671522.2019.1678064

Čuka, J. (2025). Teacher beliefs about mathematics instruction and teaching practices in Croatian primary schools. *EUROPEAN JOURNAL OF SCIENCE AND MATHEMATICS EDUCATION*, *13*(4), 433–448. https://doi.org/10.30935/scimath/17512

Foliot, C., & Chaliès, S. (2023). Reverse mentoring : an innovative way of training in-service and pre-service teachers. *Journal of Education for Teaching, 51*(3), 479-493. https://doi.org/10.1080/02607476.2025.2492693

Fonseca, K. (2021). *Self-reported mathematical problem-solving skills of future mathematics teachers*. 1–8.

Grigaliuniene, M., & Lehtinen, E. (2025). *Mathematics teachers ' career length and teaching self-efficacy*. *June*, 1–10. https://doi.org/10.3389/feduc.2025.1536429

Jadid, U. N. (2025). *CONSTRUCTING THE TEACHER SELF : THE ROLE OF INITIAL TEACHER EDUCATION IN SHAPING PRE SERVICE ENGLISH*. *07*(02), 494–506.

Kavrayici, C. (2020). Evaluation of the Factors Affecting Teacher Identity Development of Pre-Service Teachers: A Mixed Method Study. *Eurasian Journal of Educational Research*, *89*, 93–110. https://doi.org/10.14689/ejer.2020.89.5

Keiler, L. S. (2018). Teachers ' roles and identities in student-centered classrooms. *International Journal of STEM Education*, *5*(34), 1–20. https://doi.org/10.1186/s40594-018-0131-6

Kitchenham, B. (2004). *Procedures for Performing Systematic Reviews*. NICTA Technical Report.

Kusaeri, & Aditomo, A. (2019). Pedagogical Beliefs about Critical Mathematics Pre-service Teachers Thinking Indonesian. *International Journal of Instruction*, *12*(1), 573–590. https://doi.org/10.29333/iji.2019.12137a

Lee, H. (2021). The Effect of Mathematics Learning Mentoring on Pre-service Mathematics Teachers' Mathematics Pedagogical Knowledge (MKT). *Journal of the Korean School Mathematics Society*, *24*(4), 327–348. https://doi.org/10.30807/ksms.2021.24.4.001

Li, X., Zhou, W., Hwang, S., & Cai, J. (2022). *Learning to Teach Mathematics Through Problem Posing : Teachers ' Beliefs and Their Instructional Practices*. *115*(June). https://doi.org/10.1016/j.ijer.2022.102038

Lo, W. Y. (2021). Pre-Service Teachers ' Prior Learning Experiences of Mathematics and the Influences on Their Beliefs about Mathematics Teaching. *International Journal of Instruction*, *14*(1), 795–812. https://doi.org/10.29333/iji.2021.14148a

Lutovac, S. (2020). How failure shapes teacher identities : Pre-service elementary school and mathematics teachers ' narrated possible selves. *Teaching and Teacher Education*, *94*, 103120. https://doi.org/10.1016/j.tate.2020.103120

Lutovac, S. (2023). *Fixed mindset as a challenge in teaching practice : A pre- service teacher ' s experiences of received feedback*. *11*(1), 167–181.

Lutovac, S., & Kaasila, R. (2018). An elementary teacher's narrative identity work at two points in time two decades apart. *Educational Studies in Mathematics*, *98*(3), 253–267. https://doi.org/10.1007/s10649-018-9816-5

Lutovac, S., & Kaasila, R. (2022). Towards conceptualising failure in mathematics as an autobiographical experience. *European Journal of Teacher Education*, *45*(5), 689–706. https://doi.org/10.1080/02619768.2021.1892070

Martinez, M. I., Lara, G. D., Whitney, C. R., Martinez, M. I., Lara, G. D., & Whitney, C. R. (2025). The role of teacher beliefs in teacher learning and practice : implications for meeting the needs of English learners / emergent bilinguals. *Language and Education*, *39*(3), 717–735. https://doi.org/10.1080/09500782.2024.2362305

Matsumoto-Royo, K., Conget, P., & Ramirez-Montoya, M. S. (2023). Feedback as an opportunity to promote lifelong learning in pre-service teachers : a mixed methods study. *Frontiers in Education*, *September*, 1–12. https://doi.org/10.3389/feduc.2023.1210678

Merk, S., Rosman, T., Rueß, J., & Syring, M. (2017). *Pre-service teachers ' perceived value of general pedagogical knowledge for practice : Relations with epistemic beliefs and source beliefs*. *Hypothesis 3*, 1–25. https://doi.org/10.17605/OSF.IO/WFVK5.

Muhtarom, Siswono, T., & Juniati, D. (2020). Climber prospective teacher : Relationship beliefs and mathematics teaching practice. *Al Jabar Jurnal Pendidikan Matematika*, *11*(1), 83–92. https://doi.org/10.24042/AJPM.V11I1.6103

Mukuka, A., & Alex, J. K. (2024). Review of research on microteaching in mathematics teacher education: Promises and challenges. *Eurasia Journal of Mathematics, Science and Technology Education*, *20*(1). https://doi.org/10.29333/ejmste/13941

Nickl, M., Huber, S. A., Sommerhoff, D., Codreanu, E., Ufer, S., & Seidel, T. (2022). Video - based simulations in teacher education : the role of learner characteristics as capacities for positive learning experiences and high performance. *International Journal of Educational Technology in Higher Education*. https://doi.org/10.1186/s41239-022-00351-9

Nolan, K. (2015). Beyond tokenism in the field ? On the learning of a Mathematics teacher educator and faculty supervisor Beyond tokenism in the field ? On the learning of a Mathematics teacher educator and faculty supervisor. *Cogent Education*, *59*(1). https://doi.org/10.1080/2331186X.2015.1065580

Olawale, B. E. (2024). *Impact of Pre-Service Teacher Education Programme on Mathematics Student Teachers' Teaching Practices during School Experiences*.

Page, M. J., Mckenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-wilson, E., Mcdonald, S., … Moher, D. (2021). The PRISMA 2020 statement : an updated guideline for reporting systematic reviews Systematic reviews and Meta-Analyses. *Research Methods and Reporting*, 1–9. https://doi.org/10.1136/bmj.n71

Phillips, H. N., & Condy, J. (2023). *PEDAGOGICAL DILEMMA IN TEACHER EDUCATION :*

BRIDGING THE THEORY PRACTICE GAP. *37*(2), 201–217. https://doi.org/10.20853/37-2-4610

Pretorius, L. (2024). *An active learning intervention for in-service teachers : self- determination theory , heutagogy , neuroeducation and the (altered) flipped classroom in practice*. https://doi.org/10.1007/s41297-024-00299-y

Radkowitsch, A., Sommerhoff, D., Nickl, M., Codreanu, E., Ufer, S., & Seidel, T. (2023). Exploring the diagnostic process of pre-service teachers using a simulation e A latent pro fi le approach *. *Teaching and Teacher Education*, *130*, 104172. https://doi.org/10.1016/j.tate.2023.104172

Rochnia, M., Radisch, F., & Kastens, C. (2023). *Theory Application in School and Meaning-Oriented Learning Opportunities at University — Resources for Teaching Quality*.

Serdyukov, P. (2026). *Innovation in education : what works , what doesn ' t , and what to do about it ? April*, 4–33. https://doi.org/10.1108/JRIT-10-2016-0007

Sommerhoff, D., Codreanu, E., Nickl, M., Ufer, S., & Seidel, T. (2023). *Pre-service teachers ' learning of diagnostic skills in a video-based simulation : Effects of conceptual vs . interconnecting prompts on judgment accuracy and the diagnostic process*. *83*(August 2022). https://doi.org/10.1016/j.learninstruc.2022.101689

Soysal, Y., & Radmard, S. (2020). Developing a phenomenographic argument for the exit-level prospective teachers ' conceptions about teaching and learning. *Ilkogretim Online - Elementary Education Online*, *19*(4), 1998–2016. https://doi.org/10.17051/ilkonline.2020.763207

Susilawati, Aznam, N., & Paidi. (2022). Attitudes Towards Science : A Study of Gender Differences and Grade Level. *European Journal of Educational Research*, *11*(2), 599–608.

Torres-cladera, G., Simó-gil, N., & Domingo-peñafiel, L. (2021). *Building Professional Identity During Pre-Service Teacher Education Oblikovanje poklicnih identitet v okviru izobraževanja učiteljev*. *11*, 35–54. https://doi.org/10.26529/cepsj.1070

Vidal, S., & Kuckuck, M. (2025). Pre-Service Teacher Action Competence in Education for Sustainable Development : A Scoping Review. *Sustainability*, *17*. https://doi.org/10.3390/su17093856

Wahdeni, Hasibuan, K., Khairani, T., & Hamka. (2025). *DEVELOPING A GROWTH MINDSET IN ELEMENTARY SCHOOL TEACHERS : A TRAINING GUIDE TO ENHANCE DEEP LEARNING MENGEMBANGKAN POLA PIKIR BERTUMBUH PADA GURU SEKOLAH DASAR : PANDUAN PELATIHAN UNTUK*. *2*(4), 5251–5260. https://doi.org/10.62567/micjo.v2i4.1477

Woltron, F., & Götz, S. (2025). Prospective teachers ' beliefs on mathematics during internships — a quasi-longitudinal analysis. *Frontiers in Education*, *April*, 1–15. https://doi.org/10.3389/feduc.2025.1462662

Yang, X., Kaiser, G., König, J., & Blömeke, S. (2020). Relationship between pre-service mathematics teachers' knowledge, beliefs and instructional practices in China. *ZDM - Mathematics Education*, *52*(2), 281–294. https://doi.org/10.1007/s11858-020-01145-x

Zhao, H., & Zhang, X. (2017). *The Influence of Field Teaching Practice on Pre-service Teachers ' Professional Identity : A Mixed Methods Study*. *8*(July), 1–11. https://doi.org/10.3389/fpsyg.2017.01264