



Pre-service Mathematics Teachers' Beliefs and Identity in Shaping Teaching Practices: a Systematic Literature Review

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Abstract. Pre-service mathematics teachers play a crucial role in shaping future instructional practices, yet their teaching is often influenced by the interplay between beliefs and identity. This study aims to systematic review the literature on how pre-service mathematics teachers' belief and identity interact in shaping teaching practices, as well as how critical experiences and contextual conditions influence this process. Specifically, it addressess two research question: (1) How do pre-service mathematics teachers' beliefs and professional identity interact to shape, mediate, and sometimes disrupt the implementation of teaching practices? and (2) In what ways do critical experiences and contextual conditions influence the reconstruction of beliefs and identity, and how does this process affect the development of professional competence in teaching practice?. A systematic literature review was conducted using Scopus databese, focusing on peer-reviewed journal article published between 2017 and 2026. Using keywords related to belifes and identity, also applying predefined inclusion and exclusion criteria. 26 articles were selected. The findings reveal that beliefs and identity interact dynamicaly through processes of interaction, mediation, and disruption, affecting the cinsistency of teaching practices. both are continously reconstructed through critical experiences such as teaching practcies, reflection, and collaboration while contextual factors further shape this process. This study highlight the importance of integrating beliefs, identity, and experience to support the development of professional competence in teacher education.

Keywords: Beliefs, Critical experience, Identity, Pre-service mathematics teachers, Teaching practices

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Introduction

Mathematics plays an important role in daily life and in the development of students' critical thinking skills. However, teaching practice still face challenges, as some teachers continue to struggle with teaching mathematical content (Khanal et al., 2022; Teng & Yang, 2024). This situation underscores the importance of focusing on the quality of teachers' instructional practices, particularly beginning during pre-service education. Prospective teachers are expected to demonstrate professional growth as a result of their educational training and learning experience (Fitzsimons et al., 2025).

One internal factors that influences teaching practices is teachers' belief (Basckin et al., 2021; Lazdina & Daga-krumina, 2022). Teachers' belief are shaped by their experiences, training, and personal philosophies, which influence their instructional decisions and teaching

practices. Teachers who hold strong beliefs about the importance of student engagement (Wang et al., 2022), active participation (Du et al., 2025), and conceptual understanding (Hussein, 2022) tend to create more effective learning environment. Beliefs are not merely abstract views, but cognitive construct that directly impact how teachers design and implement instructional practices (Kasa & Woldemichael, 2024).

On the other hand, teachers' professional identity also plays an equally important role. Professional identity refers to how teachers view themselves, their roles, and the values and commitments they hold as educators (Arslan et al., 2025). Teachers' professional identity is an ongoing process of negotiating and reconstructing personal and professional beliefs. Beliefs about mathematics as a discipline and about affective teaching practice shape how teachers understand and respond to their professional role, responsibilities, and challenges. Furthermore, teacher identity closely linked to the quality of teaching, emotional well-being (Zhao, 2022), and commitment to the profession (Vermote et al., 2024).

Beliefs and identity are interrelated in shaping teaching practices (Huang et al., 2019). Beliefs encompass perspectives as a cognitive foundation that influence instructional decisions, while identity serves as an interpretive framework that mediates how those beliefs are manifested in action. However, the relationship between beliefs and practices is not always linear because inconsistencies often occur due to contextual constraints and identity factors (Tran et al., 2025). This suggests that to understand teaching practices, we need to examine beliefs and identity simultaneously.

This issue is particularly important in the context of pre-service mathematics teachers. As pre-service teachers, they are in a transitional phase where their prior learning experiences interact with the new pedagogical knowledge gained during their teacher education program. Their beliefs and identities are still developing and can be shaped through coursework, field experience, and reflection (Conner et al., 2022). Therefore, this stage is crucial for understanding how pre-service teachers construct and implement their teaching practices.

Although study on teachers' beliefs and identities is growing, existing studies tend to examine two constructs separately or within limited contexts. A comprehensive understanding of how beliefs and identities interact to shape teaching practices remains insufficient, particularly among pre-service mathematics teachers. To address this gap, this study adopts a systematic literature review to synthesize existing research and provide a comprehensive understanding of the role of mathematics pre-service teachers' beliefs and identities in shaping teaching practices. This approach allows for a structured and transparent process in identifying, selecting, and analyzing relevant studies, thereby providing a more comprehensive understanding of how these constructs interact in shaping teaching practices.

The literature search was conducted using Scopus database, focusing on peer-reviewed international journal articles published between 2017 until 2026. A combination of keywords "identity" and "beliefs" was used to obtain a broad range of relevant studies, which were then refined through specific inclusion criteria related to "pre-service teachers" and "mathematics". The selection of studies followed a systematic procedure based on the PRISMA framework, including identification, screening, eligibility assessment, and inclusion.

Therefore, this study aims to systematically review the existing body of research on pre-service mathematics teachers' identity and beliefs in shaping teaching practices. Specifically, it seeks to examine:

- (1) How do pre-service mathematics teachers' beliefs and professional identity interact to shape, mediate, and sometimes disrupt the implementation of teaching practices?
- (2) In what ways do critical experiences and contextual conditions influence the reconstruction of beliefs and identity, and how does this process affect the development of professional competence in teaching practice?

By providing a structured and critical synthesis of the literature, this study contributes to a more

integrated understanding of the dynamic relationship between beliefs, identity, and teaching practices in mathematics education.

Method

This study employs a Systematic Literature Review (SLR) methodology guided by “Preferred Reporting Items for Systematic Review and Meta-Analyses” or PRISMA framework (Gough et al., 2017). PRISMA provides a transparent, reproducible, and structured approach to identifying, screening, and synthesizing existing empirical literature, minimizing selection bias, and enhancing methodological rigor (Page et al., 2021). An SLR is appropriate for this study as it enables a comprehensive and critical synthesis of dispersed literature on pre-service mathematics teachers' beliefs and identity. This study's PRISMA flow diagram may help understand how the studies were found and chosen.

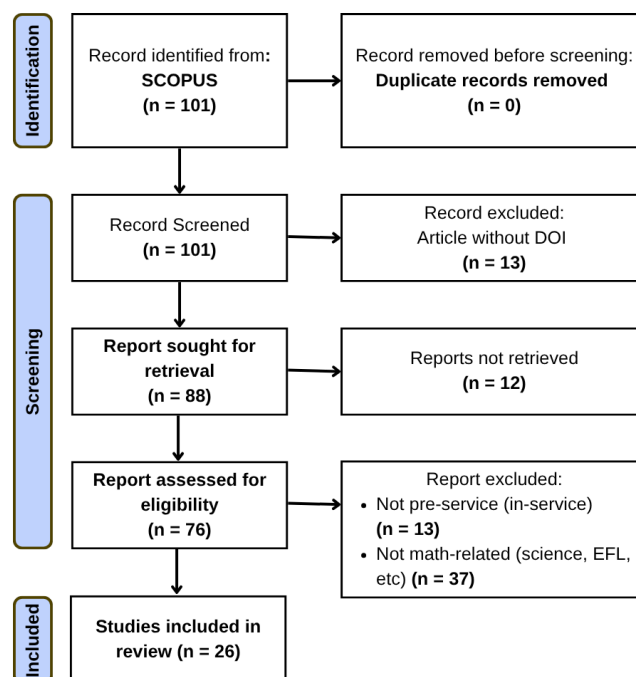


Figure 1. PRISMA Flow Diagram

The literature search was conducted systematically using the SCOPUS database as a primary source of peer-reviewed international publications. To obtain relevant studies, a combination of keyword was used, including “beliefs”, and “identity”. These keywords were combined using Boolean operators. In addition, the search was limited to publications within year range of 2017-2026 to capture recent developments in the field.

The study selection process followed the PRISMA flow procedure. Initially, a total a total of 101 records were retrieved from SCOPUS. Prior to screening, all records were checked for duplicates, no duplicated entries were detected. Thats indicating minimal redundancy un the search result. In the screening phase, all 101 were reviewed for titles and abstracts. During screening process, 13 articles were excluded because they did not have a DOI. So that, were found 88 articles for full-text retrieval as a consequence of this procedure. Next, the retrieval stage was conducted to obtain full-text versions of the selected articles. From 88 articles, 76 were successfully retrieved, while 12 articles could not be accessed in full-text and were therefore excluded from further analysis. The remaining 76 reports the proceeded to the eligibility

assessment phase. At this stage, two main categories of exclusion were applied. First First, 13 studies focusing on “in-service” rather than “pre-service” were excluded. Second, 37 studies addressing subject areas other than mathematics including science, English, and other disciplines, were also excluded. Following application of these criteria, a total of studies are 26 included in the final synthesis. The selected studies were then analyzed using a qualitative synthesis approach.

Result

To systematically address the research questions, a structured data extraction process was used to organize and synthesize information from the selected studies. The framework was designed to capture key aspects related to the interaction between pre-service mathematics teachers’ beliefs and professional identity (RQ1), as well as the influence of critical experiences and contextual conditions and their impact on professional competence (RQ2). Each study was analyzed based on its focus, context, and main findings, followed by identifying how beliefs and identity interact and how they are shaped by experiences and context. In addition, the outcomes were examined in terms of teaching practices and professional competence. This approach allows for a clear and consistent comparison across studies and helps identify common patterns in the literature. The results of this process are presented in Table 1.

Table 1. Synthesis of selected studies on pre-service mathematics teachers’ beliefs, identity, and teaching practices.

No.	Author(s) & Year	Counrty	Reserach Focus (Beliefs-Identity)	Critical Experiences / Contextual Conditions	Mechanism (Interaction / Mediation / Disruption)	Practice & Professional Competence Outcome
1	Birgili et al., (2025)	Türkiye	Theory–practice gap in mathematics teacher education	Online field experience, lesson planning meetings, reflective discussions	Weak integration between beliefs and enacted practice; limited mediation by coursework	Struggles in translating theoretical knowledge into effective teaching practice
2	Ramos et al., (2025)	Philippines	Professional identity, motivation, and career aspiration	Social influence, self-efficacy, institutional context	Identity mediated by motivation and decision-making processes	Strengthened career commitment and professional orientation
3	Vesga-Bravo et al., (2022)	Colombia	Beliefs about mathematics and teaching	Teacher education vs. classroom practice comparison	Misalignment between espoused beliefs and actual teaching practices	Inconsistent instructional practices; need for reflective alignment
4	Goos & Bennison, (2018)	Australia	Boundary crossing in teacher identity development	Interdisciplinary contexts, teacher education structures	Identity negotiated across disciplinary boundaries	Enhanced adaptive teaching practices and professional flexibility

No.	Author(s) & Year	Counrty	Reserach Focus (Beliefs-Identity)	Critical Experiences / Contextual Conditions	Mechanism (Interaction / Mediation / Disruption)	Practice & Professional Competence Outcome
5	(G. J. Vesga-Bravo & Angel-Cuervo, 2021)	Colombia	Epistemol ogical beliefs vs. teaching practice	Teaching practicum, curriculum demands	Disruption: beliefs do not consistently translate into practice	Limited coherence in pedagogical implementati on
6	Machalow et al., (2022)	USA	Narrative identity and mathemat ical orientatio ns	Long-term critical moments across teacher development	Identity reconstructed through critical experiences	Evolving teaching orientations and deeper professional competence
7	Lutovac (2020)	Finland	Identity formation through failure experien ces	Failure narratives, emotional experiences	Disruption leading to identity reconstruction	Development of resilience and adaptive teaching identity
8	Gildehaus et al.(2024)	Germany	Identity positionin g in mathemat ics learning environm ents	University mathematics vs. teaching contexts	Tension between “figured worlds” mediates identity formation	Disengagem ent or reorientation in teaching identity
9	Mainali (2022)	Nepal	Beliefs about mathemat ics	Teacher education context, belief exploration	Beliefs influence instructional decision-making	Variation in teaching approaches and competence
10	Kim et al. (2026)	USA	Vision- based teaching and identity developm ent	Lesson study, collaborative reflection	Mediation through shared professional vision	Improved instructional quality and professional competence
11	Kurniawati et al. (2023)	Indonesia	Mathemat ical identity of preservice teachers	Affective factors, self- perception, anxiety	Identity shaped by internal cognitive– affective conditions	Mixed competence; need for identity strengthenin g
12	Arslan et al. (2025)	Türkiye	Teacher identity profiles	Educational background, training pathways	Identity profiles influence belief structures	Differentiate d teaching competence levels

No.	Author(s) & Year	Counrty	Reserach Focus (Beliefs-Identity)	Critical Experiences / Contextual Conditions	Mechanism (Interaction / Mediation / Disruption)	Practice & Professional Competence Outcome
13	Rahman et al. (2019)	Malaysia	Beliefs, knowledge, and opportunities to learn	Teacher education curriculum, learning opportunities	Beliefs mediate relationship between knowledge and practice	Enhanced teaching knowledge when beliefs are constructivist
14	Lutovac (2019)	Finland	Identity and resilience through failure narratives	Personal teaching struggles	Identity reconstruction via reflective processes	Increased professional resilience
15	Segarra et al. (2021)	Spain	Self-efficacy beliefs in teaching mathematics	Teaching practicum	Beliefs mediate teaching confidence	Improved instructional confidence and competence
16	Kaya & Dede (2025)	Türkiye	Beliefs and mathematical modeling competence	Modeling tasks, assessment context	Beliefs directly influence competence development	Higher competence with constructivist beliefs
17	Portaankorva-Koivisto & Grevholm (2019)	Finland	Emerging professional identity	Metaphors, self-reflection	Identity constructed through symbolic representation	Early-stage professional identity formation
18	Mitiche (2024)	International	Identity transformation in teacher education	Turning points, lived experiences	Critical experiences reconstruct identity	Long-term professional growth
19	Yang et al. (2026)	China	Beliefs, knowledge, and noticing	Cultural norms, teaching experience	Beliefs mediate knowledge → noticing relationship	Enhanced professional noticing and teaching competence
20	Conner et al. (2022)	USA/Chile	Belief structures and identity interpretation	Field experiences, coursework interaction	Divergent identity–belief alignment leads to different interpretations	Varied success in integrating theory into practice
21	Yang et al. (2020)	China	Relationship among knowledge, beliefs,	Teacher education context; inquiry-oriented	Beliefs mediated the relationship between pedagogical knowledge and	Constructivist beliefs were associated with inquiry-oriented

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			and instructional practice of pre-service mathematics teachers	instructional setting	instructional practice	teaching practices
22	Guse et al. (2024)	Germany	Preservice teachers' connectedness to the mathematics discipline	Comparison between teacher education and mathematics major programs	Professional identity and sense of belonging shaped disciplinary identification	Lower disciplinary connectedness potentially influenced confidence and professional orientation toward teaching
23	Kul & Celik (2017)	Türkiye	Pre-service teachers' beliefs and classroom-based mathematics teaching activities	School practicum and classroom teaching experience	Tensions between constructivist beliefs and enacted classroom practices	Some participants showed inconsistency between learner-centered beliefs and traditional teaching practices
24	Li et al. (2022)	USA	Reconstruction of beliefs through teacher education experiences	Critical teaching experiences and reflective learning processes	Professional identity evolved through reflection on beliefs and practice	Reflective experiences contributed to pedagogical competence development
25	Gibbons et al. (2018)	Netherlands	Identity tensions in pre-service teacher development	Practicum experiences and institutional expectations	Identity conflicts mediated adaptation to professional teaching roles	Managing tensions supported the development of adaptive teaching competence
26	Herppich & Wittwer (2018)	International	Influence of contextual	Social, institutional, and	Contextual pressures reshaped beliefs	Shifts in beliefs affected

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			l condition s on belief transform ation	instructional contexts	and emerging professional identity	instructional decision- making and professional growth

The data extracted from the selected studies reveal consistent patterns regarding the interaction between pre-service mathematics teachers' beliefs, professional identity, and teaching practices. Overall, beliefs and identity are closely related and tend to develop simultaneously rather than independently.

Regarding **RQ1**, the findings indicate that beliefs and professional identity interact in three main ways: interaction, mediation, and disruption. In some studies, beliefs and identity work together to shape teaching practices, where beliefs about mathematics influence how teachers see their role in the classroom. In other cases, professional identity acts as a mediator, determining how beliefs are translated into instructional decisions. However, several studies also show disruption, where pre-service teachers hold certain beliefs (e.g., constructivist) but fail to implement them in practice, indicating inconsistency between identity and enacted teaching.

Regarding **RQ2**, the findings show that beliefs and identity are influenced by critical experiences and contextual conditions. Experiences such as teaching practicum, reflection, collaboration, and even failure play an important role in reshaping both beliefs and identity. Contextual factors such as curriculum demands, institutional environment, and cultural background also affect this process. These experiences can lead to changes in how pre-service teachers think and act in teaching situations.

Furthermore, the reconstruction of beliefs and identity impacts professional competence in different ways. In some cases, positive experiences lead to better teaching skills and more adaptive practices. In other cases, limited or conflicting experiences result in partial development, where teaching competence is inconsistent. Overall, the findings suggest that professional competence develops through the ongoing interaction between beliefs, identity, and experience, rather than from beliefs alone.

Discussion

The findings of this review highlight that the relationship between beliefs, professional identity, and teaching practices is complex and not always consistent. Several studies indicate that beliefs and identity are closely connected, but do not always lead directly to coherent teaching practices (Birgili et al., 2025; Mainali, 2022; G.-J. Vesga-Bravo et al., 2022; G. J. Vesga-Bravo & Angel-Cuervo, 2021). This suggests that holding certain beliefs is not sufficient to ensure their implementation in practice.

Regarding **RQ1**, the findings show that professional identity plays a key role in shaping how beliefs are enacted. In some cases, beliefs and identity support each other and lead to more adaptive and flexible teaching practices (Goos & Bennison, 2018; Kim et al., 2026; Rahman et al., 2019). However, other studies reveal that identity can mediate or even disrupt this relationship, resulting in inconsistencies between beliefs and practice (Conner et al., 2022; Gildehaus et al., 2024). In addition, differences in identity profiles and internal factors such as self-efficacy and emotions also influence how beliefs are interpreted and applied (Arslan et al., 2025; Kurniawati et al., 2023; Segarra et al., 2021).

In relation to **RQ2**, the findings emphasize the important role of critical experiences in shaping and reconstructing beliefs and identity. Experiences such as teaching practicum, reflection, and collaborative learning contribute to the development of more refined teaching orientations (Kim et al., 2026; Rahman et al., 2019). Moreover, significant experiences such as failure and long-term critical moments can trigger identity reconstruction and lead to the development of more resilient and adaptive teaching approaches (Lutovac, 2019, 2020; Machalow et al., 2022; Mitiche, 2024).

At the same time, contextual conditions also influence this process. Factors such as curriculum demands, institutional environments, and cultural norms shape how beliefs and identity develop and are enacted in practice (Gildehaus et al., 2024; Yang et al., 2026). In some cases, these conditions support the alignment between beliefs and practice, while in others they create tensions that lead to inconsistency.

Furthermore, the findings show that the reconstruction of beliefs and identity has direct implications for professional competence. Constructivist-oriented beliefs and well-developed identity are associated with higher levels of teaching competence and instructional quality (Kaya & Dede, 2025; Yang et al., 2026). In contrast, weak integration between beliefs, identity, and practice may result in limited or inconsistent teaching performance (Birgili et al., 2025; G.-J. Vesga-Bravo et al., 2022).

Overall, these findings suggest that professional competence develops through the continuous interaction between beliefs, identity, and experience. Therefore, improving teaching practice requires not only focusing on beliefs, but also supporting identity development and providing meaningful and reflective learning experiences throughout teacher education.

Conclusion

This study aims to examine how pre-service mathematics teachers' beliefs and professional identity interact in shaping teaching practices, as well as how critical experiences and contextual conditions influence this process and its impact on professional competence. The findings show that beliefs and professional identity are closely related and interact in dynamic ways, including interaction, mediation, and disruption. This interaction determines whether beliefs are consistently implemented in teaching practice or not. In addition, beliefs and identity are not static but are continuously reconstructed through critical experiences such as teaching practicum, reflection, collaboration, and personal challenges. Contextual conditions, including institutional settings and curriculum demands, also play an important role in shaping this process. As a result, the development of professional competence depends on how well beliefs, identity, and experience are integrated.

This study concludes that improving teaching practice cannot rely on beliefs alone. Instead, it requires an integrated approach that supports the development of professional identity and provides meaningful learning experiences in teacher education programs. Future research is recommended to explore this interaction more deeply, particularly through longitudinal studies and in diverse educational contexts.

Future research is recommended to explore the interaction between beliefs and professional identity using longitudinal designs to better understand how they develop over time. In addition, studies in diverse socio-cultural contexts are needed to examine how contextual factors influence this process. Future research may also focus on identifying specific mechanisms that support alignment between beliefs, identity, and teaching practices. For teacher education programs, it is important to provide meaningful and structured experiences such as teaching practicum, reflective activities, and collaborative learning. These experiences can help pre-service teachers connect their beliefs with professional identity and actual teaching practices. In addition, creating supportive

learning environments may strengthen the development of adaptive and consistent teaching competence.

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