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Metacognitive Awareness in Preservice Teachers: A Review of Lesson Planning and Practicum Experiences

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Abstract
Metacognitive awareness (MA) is an important skill for preservice teachers (PSTs) as they address the dual challenges of lesson planning and practicum experiences in teacher education programs. This paper examines recent research on the impact of MA in improving PSTs' teaching competencies, exploring innovative tools and strategies, including web-based portfolios, reflective journals, and mixed reality simulations. Studies show that these interventions promote reflective thinking, self-regulation, and adaptability in teaching, leading to enhanced lesson design and classroom performance. Collaborative approaches, such as lesson study, further engage PSTs in codifying and refining their pedagogical knowledge. However, several challenges remain, including varied definitions of metacognitive constructs, limited applicability of findings across disciplines, and insufficient longitudinal studies to assess the sustained impact of metacognitive training. Methodological variability across studies illustrates both the opportunities and difficulties in integrating metacognitive strategies into teacher education programs. Future research should focus on designing scalable, interdisciplinary metacognitive training models, conducting longitudinal studies to examine the lasting effects of MA on teaching performance, and incorporating AI-based tools to provide personalized feedback. Addressing these gaps will enhance teacher education programs' capacity to prepare PSTs as reflective and adaptable educators ready to meet the changing needs of modern classrooms. This review highlights the transformative role of metacognition in improving teaching practices and fostering continuous professional development.

Keywords: *metacognitive awareness, preservice teachers, lesson planning, practicum experiences, teacher education programs*

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I. Introduction

Metacognitive awareness (MA), defined as the ability to reflect on and regulate one's cognitive processes, plays a central role in teaching and learning (Flavell, 1979; Schraw & Dennison, 1994). In teacher education, MA equips preservice teachers (PSTs) with the capacity to evaluate instructional strategies, adapt to varied classroom contexts, and engage in reflective practice (Luke, Ford, Vaughn, & Fulchini-Scruggs, 2021; Wei, Hutagalung, & Peng, 2022). Developing this awareness is particularly relevant during the stages of teacher preparation, including lesson planning and practicum experiences, where PSTs apply pedagogical knowledge in practice. MA contributes to self-regulation and professional development, while also enhancing student learning outcomes (Mbato & Triprihatmini, 2022; Yildiz & Akdag, 2017), underscoring its importance in preparing future educators.

Despite increased attention to the role of MA in teacher education, comprehensive reviews connecting its development to lesson planning and practicum experiences remain scarce. Many studies focus on isolated aspects of MA or are constrained by their disciplinary or contextual scope (Yerdelen-Damar, Özdemir, & Unal, 2015; Ozturk, 2016). For instance, some research examines the benefits of reflective journaling during practicum experiences (Almutawa & Alfahid, 2024; Hourani, 2013), while others examine how MA informs adaptive teaching decisions in lesson planning (Cheng, 2023; Griffith, Bauml, & Quebec-Fuentes, 2016). However, there is limited integration of these findings, leaving a fragmented understanding of how MA develops across key phases of preservice teacher training and how it can be systematically supported. This paper addresses these gaps by synthesizing research on the role of MA in developing PSTs' competencies in lesson planning and practicum experiences. By connecting these domains, this review aims to provide a more cohesive perspective on the contribution of MA to teacher preparation programs.

This paper offers three primary contributions to the understanding of MA in teacher education. First, it consolidates findings on how MA supports PSTs' development in both lesson planning and practicum

experiences, offering a unified view of these interrelated areas. Second, it examines innovative tools and methodologies, including reflective journals, web-based portfolios, mixed reality simulations, and lesson study frameworks, that advance MA and professional growth among PSTs. Third, it identifies ongoing challenges in research, such as inconsistent definitions of metacognitive constructs, the absence of longitudinal studies, and difficulties in scaling interventions, providing a foundation for future inquiry and program improvement.

The paper is organized into four sections. The first section introduces the topic and outlines the objectives of the review. The second section presents the conceptual framework, detailing how MA supports reflective practices and metacognitive strategies in lesson planning and its role in practicum experiences, including its influence on self-regulation, adaptability, and emotional resilience. The third section suggests future research directions. The conclusion discusses the implications of these findings for teacher education programs, emphasizing the need to further integrate MA into teacher preparation practices.

1. Conceptual framework: Metacognitive awareness, lesson planning, and practicum experiences

This paper presents a review that focuses on the interrelated concepts of **metacognitive awareness (MA)**, **lesson planning**, and **practicum experiences**, as they pertain to preservice teachers (PSTs) in teacher education programs. By synthesizing recent research, the review highlights how these concepts collectively influence PSTs' development as reflective and adaptive educators. Each concept plays a distinct but interconnected role in supporting PSTs' teaching practices and professional development.

1.1. Metacognitive awareness (MA)

Metacognitive awareness (MA) refers to an individual's ability to reflect on and regulate their cognitive processes during learning, encompassing key skills such as planning, monitoring, and evaluating (Flavell, 1979; Schraw & Dennison, 1994). Flavell (1979), a pioneer in the field of metacognition, defined the concept as "knowledge and cognition about cognitive phenomena" (p. 906). MA encompasses two primary components: metacognitive knowledge and metacognitive regulation (Schraw & Dennison, 1994). Metacognitive knowledge involves awareness of one's cognitive processes, tasks, and strategies, while metacognitive regulation includes the monitoring, control, and evaluation of those processes to achieve specific goals.

In educational contexts, MA has been recognized as significant component of effective learning and teaching. It enables learners to evaluate their understanding, select appropriate strategies, and adapt their approaches to overcome challenges (Pintrich, 2002). Similarly, teachers benefit from MA by reflecting on their instructional practices, assessing the impact of their teaching strategies, and making adjustments to enhance student learning outcomes (Luke, Ford, Vaughn, & Fulchini-Scruggs, 2021). For preservice teachers (PSTs), MA plays a key role in their professional development, particularly during lesson planning and practicum experiences where they are required to apply theoretical knowledge in real-world classroom settings (Yildiz & Akdag, 2017; Wei, Hutagalung, & Peng, 2022). MA serves as a foundational framework that enhances their capacity to critically assess their teaching strategies, reflect on instructional effectiveness, and adapt to diverse classroom challenges (Adadan & Oner, 2018; Mbato & Triprihatmini, 2022). Through this awareness, PSTs become better equipped to design lessons, respond to real-time classroom dynamics, and engage in lifelong professional learning.

The theoretical foundation of MA draws on both cognitive and constructivist perspectives, which emphasize the active role of individuals in regulating their learning processes. For instance, Zimmerman's (2000, 2002) model of self-regulated learning positions metacognition as one of the core components influencing motivation and behavior. In this model, MA is integral to the planning, monitoring, and evaluation phases of self-regulation, supporting learners in achieving their academic goals. Despite its broad applicability, research on MA reveals several challenges. Inconsistent definitions and varying methodologies have hindered the development of a unified framework for studying the concept (Mbato & Triprihatmini, 2022).

1.2. Lesson planning

Lesson planning is a pedagogical process that involves the deliberate and systematic design of instructional activities (Panasuk & Todd, 2005; Farrel & Ashcraft, 2024). It serves as a blueprint for effective teaching and learning, ensuring that instructional goals align with student needs and that learning experiences are thoughtfully structured. Figure 1 shows the lesson planning process that typically involves several key stages.

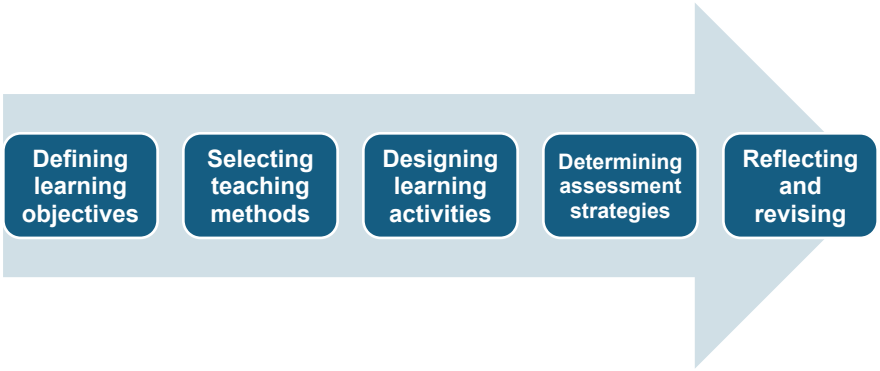

Figure 1. Phases of pedagogical processes typically involved in lesson planning.

Lesson planning begins with defining clear learning objectives that outline the specific knowledge, skills, and understandings students are expected to achieve. Educators often rely on frameworks like Bloom's Taxonomy (1956) to structure objectives across cognitive levels, from foundational recall to complex critical thinking and problem-solving. These objectives serve as a roadmap, ensuring alignment between instructional goals and teaching practices while addressing diverse student needs.

Once objectives are established, teachers select instructional strategies that support student engagement and learning outcomes. Effective methods include direct instruction, cooperative learning, inquiry-based approaches, technology integration and assessment activities, all tailored to accommodate various learning styles and abilities (Marzano, Pickering, & Pollock, 2001; Tomlinson, 2001). Educators then design interactive activities that align with these methods, incorporating hands-on experiences, group discussions, and real-world applications to promote active participation and critical thinking (Shavelson & Stern, 1981).

Finally, the lesson planning process concludes with a reflection stage. After each lesson, teachers carefully analyze the effectiveness of the plan, considering factors such as student engagement, the clarity of instruction, and the achievement of learning objectives. This reflective process allows teachers to identify areas for improvement and refine their plans for future lessons, ensuring continuous enhancement of their instructional practices (Schön, 1983).

1.3. Practicum experiences

The practicum in preservice teacher education is an integral part of teacher preparation programs. It provides aspiring teachers with the opportunity to apply theoretical knowledge and pedagogical skills in a real-world classroom setting (Zeichner & Liston, 2013). During the practicum, preservice teachers engage in a supervised period of teaching under the guidance of experienced mentors, typically classroom teachers or university supervisors. This immersive experience allows them to develop professional teaching competencies, such as lesson planning, classroom management, student assessment, and effective communication (Korthagen & Kessels, 1999).

The practicum experience is designed to bridge the gap between theory and practice, enabling preservice teachers to develop a deeper understanding of the complexities of teaching and learning. Through observation, planning, and implementation of lessons, they gain firsthand experience in addressing diverse learning needs, managing classroom behavior, and fostering a positive learning environment. Regular feedback and reflection sessions with mentors provide opportunities for preservice teachers to analyze their teaching practices, identify areas for improvement, and refine their pedagogical approaches. As shown in Figure 2, the practicum experience focuses on the relationship between metacognitive awareness, lesson planning, and real-world classroom application, demonstrating how these components contribute to the development of preservice teachers' competencies.

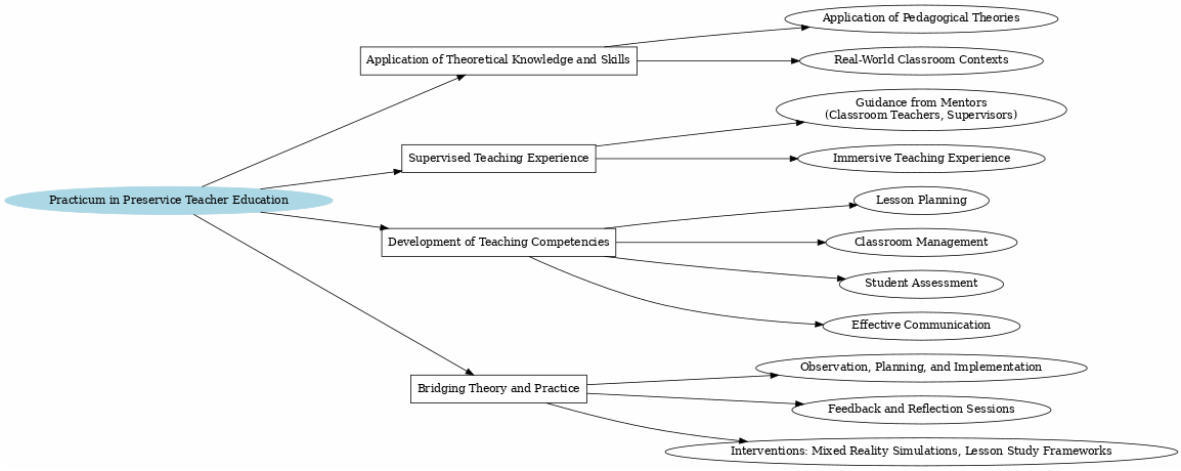

Figure 2. Illustration of the relevant aspects related to the practicum experience of preservice teachers in real classrooms.

Practicum experiences offer PSTs the opportunity to implement and refine their lesson plans in real-world classroom settings. During this phase, MA enables PSTs to monitor their teaching strategies, evaluate their effectiveness, and adapt to dynamic classroom scenarios (Luke, Ford, Vaughn, & Fulchini-Scruggs, 2021; Wei, Hutagalung, & Peng, 2022). Interventions such as mixed reality simulations and lesson study frameworks have been shown to enhance PSTs' ability to reflect on their teaching practices and make informed decisions in the moment (Ford, Luke, Vaughn, & Fulchini-Scruggs, 2023). Practicum experiences therefore significantly contribute to bridging the gap between theoretical knowledge and practical application, with MA acting as a guiding force.

II. Review Findings: Metacognitive awareness in lesson planning and practicum experiences of preservice teachers

This section presents the key findings from the literature on the role of metacognitive awareness (MA) in preservice teachers' (PSTs) lesson planning and practicum experiences. Lesson planning provides PSTs with an opportunity to apply metacognitive strategies in designing and refining instructional activities, while practicum experiences allow them to implement and adapt these plans in real-world classroom settings. The review highlights how MA supports reflective thinking, self-regulation, and adaptive teaching practices in these two interconnected domains. Additionally, it explores the effectiveness of tools and frameworks, such as reflective journals, web-based portfolios, and mixed reality simulations, in fostering MA and enhancing PSTs' teaching competencies. These findings contribute to a deeper understanding of how MA supports successful teacher preparation and professional growth. As shown in Figure 3, metacognitive awareness is central to the lesson planning and practicum experiences of preservice teachers, illustrating its role in guiding reflective practices, decision-making, and the application of teaching strategies.

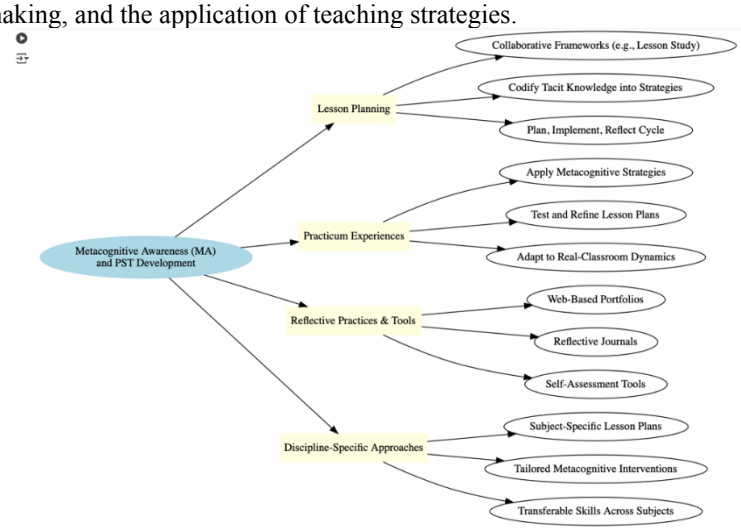

Figure 3. *Metacognitive awareness in lesson planning and practicum experiences of preservice teachers, illustrating its role in reflective practices, strategic decision-making, and the effective application of pedagogical strategies in real-world contexts.*

2.1 Lesson planning

Metacognitive awareness (MA) has been identified as an important factor in developing preservice teachers' (PSTs) pedagogical competencies, particularly in lesson planning and practicum experiences. Cheng (2023) explored the use of the SECI (Socialization, Externalization, Combination, Internalization) model within Lesson Study (LS) to enhance PSTs' ability to co-construct metacognitive pedagogies. The findings indicated that collaborative lesson planning, implementation, and post-lesson conferences foster PSTs' reflective practices, enabling them to codify tacit pedagogical knowledge into actionable strategies. Similarly, Adadan and Oner (2018) demonstrated the role of digital tools, such as web-based portfolios, in enhancing reflective thinking through metacognitive processes like monitoring, evaluation, and planning. Their study revealed a statistically significant relationship between high levels of MA and high-level reflective thinking indicators, highlighting the importance of integrating metacognitive practices into teacher education. These findings collectively point to the necessity of structured and collaborative frameworks, such as LS, that facilitate PSTs' development of MA and reflective thinking, especially in contexts that integrate technological tools to support deeper learning.

Several studies have emphasized the importance of structured reflection in improving PSTs' teaching practices. Mendoza and Elepaño (2023) found that PSTs with high MA effectively self-regulated their learning processes, adapted to challenges, and improved their teaching strategies. Similarly, Shelley (2019) underscored the role of reflective journaling in fostering self-awareness, allowing PSTs to critically evaluate their teaching practices and refine their pedagogical approaches. These findings support the inclusion of metacognitive skill development in teacher education curricula, as such practices not only improve lesson planning and classroom effectiveness but also encourage lifelong professional growth. However, the reliance on reflective tools such as journaling raises questions about how best to ensure that these methods are consistently effective across diverse teacher education programs and varying individual capacities for self-regulation.

Discipline-specific studies further illustrate the impact of metacognitive strategies on PSTs' development. Susantini, Indana, Isnawati, and Nursanti (2019) demonstrated that engaging PSTs in self-assessment activities, such as using the Self-Understanding Evaluation Sheet, significantly improved their ability to design effective biology lesson plans. Iwai (2019) similarly reported that PSTs who employed metacognitive strategies in elementary literacy education showed increased awareness and critical analysis of their teaching methods. These findings suggest that metacognitive interventions designed specifically for each subject area can enhance PSTs' competencies, offering a pathway for improving discipline-specific pedagogical practices. The evidence also indicates the need for teacher education programs to incorporate discipline-specific approaches while ensuring the transferability of metacognitive skills across subjects, thereby addressing both general and specialized teaching needs.

The lesson study approach remains a particularly effective framework for encouraging MA and reflective practice among PSTs. Manisa, Setyawan, and Susilo (2021) argued that the effectiveness of the PLAN, DO, and SEE stages in lesson study lies in their ability to enable PSTs to engage in self-reflection and critical thinking. By collaboratively designing, implementing, and analyzing lessons, PSTs internalized metacognitive strategies, which significantly improved their teaching competencies. Collectively, these studies indicate the value of embedding metacognitive awareness in teacher education programs, with an emphasis on reflective practices, collaborative learning, and discipline-specific training to prepare educators for the complexities of 21st-century classrooms. Future research should explore the scalability of lesson study and similar frameworks, as well as their adaptability to virtual learning environments and interdisciplinary teaching contexts, to broaden their impact.

2.2 Practicum experiences

Metacognitive awareness (MA) is a central aspect of preservice teachers' (PSTs) development, especially during practicum experiences. Mbato and Triprihatmini (2022) found that explicit reflection significantly enhanced PSTs' MA, enabling them to evaluate and refine their teaching practices. Their study revealed that Indonesian pre-service English teachers demonstrated a marked improvement in their ability to self-regulate and adapt their teaching strategies following structured reflection sessions. Similarly, Almutawa and Alfahid (2024) emphasized the effectiveness of reflective journal writing in developing critical thinking, self-awareness, and professional growth among pre-service English teachers in Kuwait. Despite its benefits, time constraints and challenges in classroom management were identified as barriers to effective reflective practices. These findings underscore the importance of integrating structured reflection as a cornerstone of teacher education programs to promote sustainable professional growth.

Discipline-specific studies reveal important nuances in how MA influences instructional practices. Yerdelen-Damar, Özdemir, and Unal (2015) examined PSTs' metacognitive knowledge in physics teaching and found that, while content knowledge was satisfactory, their understanding of instructional methods and student pre-instructional knowledge required improvement. Similarly, Ozturk (2016) identified gaps in pre-service

elementary teachers' ability to teach metacognitive strategies, emphasizing the need for practice-oriented methodology courses. These findings suggest the necessity of customizing teacher education programs to address discipline-specific challenges, ensuring that PSTs can apply metacognitive strategies effectively across various teaching contexts.

The role of technology and practice-based interventions in supporting the development of MA has been widely documented. Luke, Ford, Vaughn, and Fulchini-Scruggs (2021) demonstrated that mixed reality simulations and roleplay significantly improved PSTs' MA by providing opportunities to practice teaching strategies in simulated environments. In a related study, Ford, Luke, Vaughn, and Fulchini-Scruggs (2023) reported that virtual simulations enhanced PSTs' awareness and accuracy in leading whole-group discussions. Both studies point to the potential of technology-enhanced tools to bridge the gap between theoretical knowledge and practical teaching applications. However, PSTs often overestimate their metacognitive abilities, indicating the need for guided feedback within these platforms to ensure accurate self-assessment.

Metacognitive strategies also intersect with broader factors like self-efficacy and emotion regulation. Wei, Hutagalung, and Peng (2022) found that MA mediates the relationship between emotion regulation and self-efficacy, enabling PSTs to manage stress and enhance teaching quality. Similarly, Yildiz and Akdag (2017) reported that metacognitive strategies improved PSTs' teacher self-efficacy beliefs but noted limited gains in specific teaching competencies, such as science instruction. These findings suggest that metacognitive awareness not only enhances cognitive processes but also supports emotional resilience, making it a foundational skill for navigating the complexities of teaching.

Other studies suggest the importance of developing reflective skills as part of professional growth. Bowman, Galvez-Martin, and Morrison (2006) advocated for deliberate and ongoing opportunities for reflection, such as journaling and guided prompts, to help PSTs internalize metacognitive strategies and transfer these practices into their classrooms. Hourani (2013) identified barriers such as language limitations and socio-cultural constraints that hinder PSTs' reflective practices, suggesting that teacher education programs must address these challenges to fully support reflective growth. Griffith, Bauml, and Quebec-Fuentes (2016) further indicated the importance of metacognitive decision-making in adaptive teaching, demonstrating how deliberate reflection during instruction enhances PSTs' ability to respond effectively to classroom dynamics.

Finally, the relationship between metacognition and identity development plays a meaningful role in the growth of PSTs. Dunham, Alexander, and McDonald (2024) explored how meta-awareness influences literacy teaching identities, finding that reflective practices help PSTs connect their personal and professional identities, leading to more effective literacy instruction. Similarly, Joshpine and Albina (2023) identified a positive correlation between MA and technological pedagogical content knowledge (TPACK), underscoring the importance of integrating metacognitive training into teacher preparation programs to enhance PSTs' ability to adapt to the demands of modern classrooms. Together, these findings emphasize the value of metacognitive awareness in shaping PSTs as reflective, adaptable, and effective educators prepared for the complexities of contemporary teaching.

2.3 Relationships among concepts

Metacognitive awareness (MA), lesson planning, and practicum experiences are interconnected elements in teacher education that collectively shape preservice teachers' (PSTs) development. Existing literature emphasizes the role of MA in helping PSTs reflect on their instructional strategies, regulate their thought processes, and make informed decisions during lesson planning (Schraw & Dennison, 1994; Cheng & Chang, 2021; Cheng, 2023).

The relationships among MA, lesson planning, and practicum experiences are dynamic and reciprocal, forming the core framework of this review. MA acts as a unifying construct that informs both the planning and execution phases of teaching. During lesson planning, MA helps PSTs design coherent and effective instructional strategies, while practicum experiences allow them to test and refine these strategies through reflective and adaptive practices (Cheng, 2023; Griffith, Bauml, & Quebec-Fuentes, 2016). The iterative feedback loop between planning and practice, mediated by metacognitive processes, promotes continuous professional growth and prepares PSTs to navigate the complexities of contemporary teaching. Lesson planning, in turn, provides PSTs with a structured opportunity to apply pedagogical knowledge, aligning instructional goals with teaching methods and addressing potential challenges (Yerdelen-Damar, Özdemir, & Unal, 2015). As shown in Figure 3, the dynamic relationship among metacognitive awareness, lesson planning, and practicum experiences emphasizes their interconnected roles in developing preservice teachers' competencies, detailing the key contributions of the study.

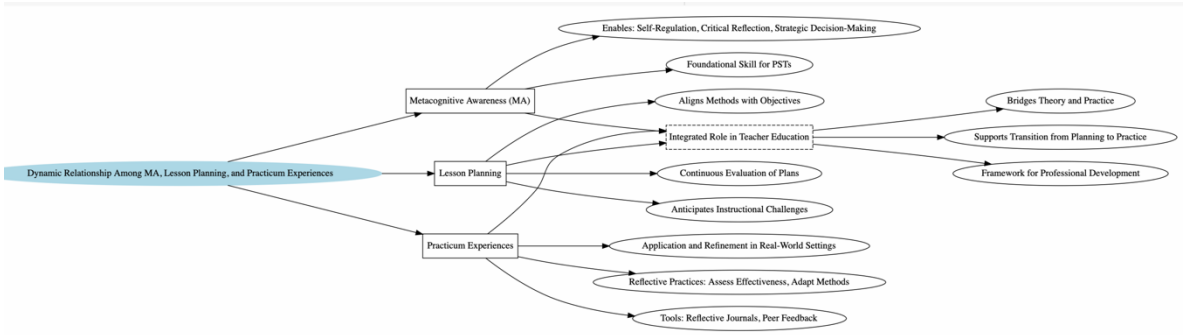

*Figure 3. Illustration of the dynamic relationship among **metacognitive awareness (MA)**, **lesson planning**, and **practicum experiences**, focusing on their interconnected roles in shaping preservice teachers' (PSTs) competencies. It is divided into three main branches that detail the key contributions of the study*

Practicum experiences are frequently identified as the practical arena where MA and lesson planning converge. During the practicum, PSTs put their metacognitive skills and lesson plans into action, reflecting on their teaching effectiveness and adapting to real-world classroom dynamics (Almutawa & Alfahid, 2024; Wei, Hutagalung, & Peng, 2022). Research also highlights that reflective tools, such as journals and peer feedback, bridge the gap between theoretical planning and practical implementation, allowing PSTs to refine their teaching practices based on self-observation and external input (Hourani, 2013). However, studies note limitations in fully understanding this relationship. Many investigations focus on isolated aspects of these components rather than exploring their dynamic interplay. For instance, while some research highlights MA's influence on reflective teaching (Schraw, 1998), others examine its role in lesson planning or practicum performance separately (Cheng, 2023; Griffith, Bauml, & Quebec-Fuentes, 2016). This fragmented perspective underscores the need for integrative approaches that examine how MA underpins the transition from planning to practice in teacher preparation programs.

2.4 Critical assessment of current approaches

The literature on metacognitive awareness (MA) presents significant advancements in its application to preservice teachers' (PSTs) lesson planning and practicum experiences. Innovative tools such as mixed reality simulations, web-based portfolios, and reflective journals have demonstrated effectiveness in enhancing PSTs' MA. In the context of lesson planning, web-based portfolios (Adadan & Oner, 2018) and reflective journaling (Almutawa & Alfahid, 2024) allow PSTs to critically assess their planning strategies, encouraging reflective practices that improve the quality of instructional design. Similarly, lesson study frameworks (Cheng, 2023) provide collaborative environments for PSTs to codify tacit pedagogical knowledge into explicit strategies, fostering deeper metacognitive engagement. During practicum experiences, tools like mixed reality simulations (Luke, Ford, Vaughn, & Fulchini-Scruggs, 2021) enable PSTs to practice adaptive teaching strategies in a controlled setting, bridging the gap between theoretical knowledge and real-world teaching scenarios.

Despite these strengths, several limitations persist. In lesson planning, lack of consistent definitions of metacognitive constructs complicates the identification of key components that contribute to effective planning. While some studies suggest planning and monitoring as central metacognitive skills (Yerdelen-Damar et al., 2015), others include emotional and reflective dimensions (Wei et al., 2022). In practicum experiences, while simulations and reflective journals provide structured opportunities for MA development, the absence of longitudinal studies limits our understanding of how these interventions sustain growth beyond initial training (Yildiz & Akdag, 2017). Moreover, the methodological diversity in existing research poses challenges to generalizability. Many studies, particularly those focusing on practicum experiences, are conducted with small, discipline-specific samples, such as physics or literacy education (Ozturk, 2016; Dunham et al., 2024). This lack of scalability and limited scope in lesson planning and practicum research hinders the development of comprehensive strategies that address the broader needs of teacher education programs.

III. Discussion and future directions

This study contributes to the understanding of the dynamic relationship among metacognitive awareness (MA), lesson planning, and practicum experiences by providing new insights into how these components interact to shape preservice teachers' (PSTs) competencies. The findings reveal that MA serves as a foundational skill, enabling PSTs to navigate the lesson planning process with greater self-regulation, critical reflection, and strategic decision-making. The literature reviewed demonstrated that MA allowed to PSTs to anticipate instructional challenges, align teaching methods with learning objectives, and continuously evaluate their lesson plans.

The research further highlights how practicum experiences provide a context for PSTs to apply and refine their metacognitive strategies and lesson plans in real-world settings. During the practicum, PSTs reported using reflective practices to assess the effectiveness of their instructional methods and adapt to diverse classroom scenarios. Notably, tools like reflective journals and collaborative peer feedback were instrumental in helping PSTs bridge theoretical planning with practical application, fostering a continuous cycle of reflection, adjustment, and growth.

These findings extend the literature by illustrating the interdependent nature of MA, lesson planning, and practicum experiences. Unlike prior studies that often examine these components in isolation, this research emphasizes their integrated role in teacher education. It also underscores the importance of designing teacher preparation programs that explicitly incorporate metacognitive training and reflective tools to support PSTs in transitioning seamlessly from planning to practice. By addressing these interconnections, this study provides a comprehensive framework for understanding how MA enhances teaching preparation and professional development. Figure 4 illustrate the interdependent nature of MA, lesson planning, and practicum experiences.

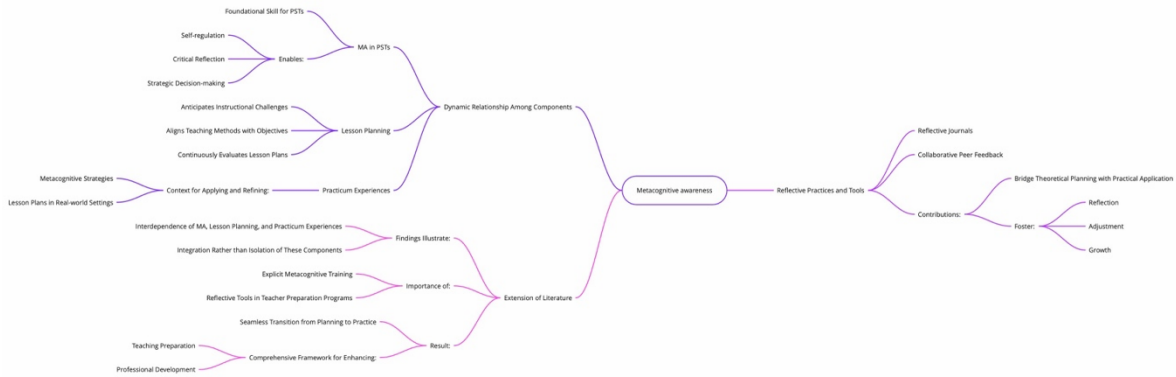

Figure 4. Interdependent nature of metacognitive awareness (MA), lesson planning, and practicum experiences, illustrating how these components work together to support the development of preservice teachers' competencies.

Future research should focus on the integration of scalable frameworks for metacognitive training that address both lesson planning and practicum experiences. In lesson planning, these frameworks could standardize reflective tools, such as web-based portfolios, artificial intelligence and structured journal prompts, to guide PSTs in assessing and improving their instructional designs. Collaborative models like lesson study (Cheng & Chan, 2021; Cheng, 2023) should also be expanded to incorporate digital tools that allow PSTs to collaboratively design, implement, and evaluate lesson plans while engaging in reflective discourse. These approaches would ensure consistency in metacognitive training while supporting the development of peer learning and critical thinking.

In practicum experiences, longitudinal studies are necessary to examine how MA develops over time and its influence on teaching efficacy. Such studies could examine the sustained effects of interventions like mixed reality simulations (Luke et al., 2021) and reflective journaling (Hourani, 2013), providing knowledge into how these tools shape PSTs' ability to adapt to diverse classroom environments. Longitudinal data would also allow researchers to track the relationship between MA and professional growth across different stages of teacher preparation, from coursework to in-service teaching.

Additionally, integrating advanced technologies, such as AI-based tools, offers immense potential for enhancing both lesson planning and practicum experiences. For lesson planning, AI systems could analyze PSTs' designs, identify areas for improvement, and provide personalized feedback. In practicum settings, AI-powered simulations could simulate complex classroom scenarios, allowing PSTs to practice adaptive teaching strategies and receive real-time feedback on their metacognitive processes. For instance, AI could assess how well PSTs monitor their decision-making and reflect on their teaching strategies, promoting deeper engagement with metacognitive skills.

Finally, teacher education programs should focus on combining discipline-specific and generalizable metacognitive interventions. While adapted approaches are necessary to address unique challenges in specific subjects, such as physics or literacy (Yerdelen-Damar et al., 2015; Ozturk, 2016), overarching frameworks should ensure that metacognitive training is transferable across disciplines. By aligning lesson planning and practicum experiences within a unified metacognitive framework, future research and practice can prepare PSTs to become reflective, adaptive educators capable of addressing the dynamic demands of contemporary classrooms.

IV. Conclusion

This paper presents a review focusing on the interconnected concepts of metacognitive awareness (MA), lesson planning, and practicum experiences as they relate to preservice teachers (PSTs) in teacher education programs. MA serves as a foundational construct that enhances PSTs' ability to reflect on and regulate their teaching practices, supporting skills such as self-regulation, adaptive teaching, and critical reflection. These abilities are necessary during both the lesson planning phase, where PSTs develop and refine instructional strategies, and the practicum phase, where they apply and adapt these strategies in real-world classroom environments. By synthesizing existing research, this review underscores how these concepts work in tandem to shape reflective, adaptive educators prepared to address the complexities of contemporary teaching.

The paper makes three key contributions to the scientific understanding of MA in teacher education. First, it synthesizes research across lesson planning and practicum experiences, providing a holistic perspective on how MA supports PSTs' professional growth in both theoretical and practical contexts. Second, it identifies innovative tools and methodologies, such as mixed reality simulations, reflective journals, and lesson study, which effectively enhance metacognitive engagement, offering actionable insights for teacher educators and researchers. hird, it identifies key gaps in the literature, such as the need for consistent definitions of MA, longitudinal studies, and scalable frameworks, setting the stage for future research that can advance the integration of MA into teacher preparation programs.

Future research should prioritize creating longitudinal studies that examine the evolution of MA throughout teacher preparation and beyond, as well as integrating emerging technologies, such as AI-based tools, for personalized metacognitive feedback. These advancements can provide tailored support to PSTs, enhancing their ability to connect lesson planning with effective practicum experiences. By addressing these gaps and leveraging innovative approaches, teacher education programs can better prepare PSTs to become reflective, adaptable, and competent educators capable of meeting the demands of modern classrooms and fostering student success. This review emphasizes the transformative potential of integrating MA into teacher education, ensuring that PSTs are equipped to navigate and excel in the evolving landscape of education.

Ethical declarations and transparency

This study is a systematic review of the literature and, therefore, did not require approval from an ethics committee, as it did not involve direct participation of human subjects or the use of animals. Likewise, informed consent was not required. The author declares no conflicts of interest related to this work. No external funding was received for the completion of this study. The data and materials used in this research are available and can be requested from the corresponding author.

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