



# MAPPING METACOGNITIVE AWARENESS AMONG PRE-SERVICE TEACHERS: IMPLICATIONS FOR REFLECTIVE TEACHING PRACTICE

**Dr. Usharani Khuntia**

Assistant Professor in Teacher Education, Govt. Teacher Training College, Odisha, India

## ABSTRACT

Metacognitive awareness represents a critical competency for effective teaching, enabling educators to reflect on their thinking processes and instructional decisions. This research investigates the levels and patterns of metacognitive awareness among pre-service teachers and explores implications for developing reflective teaching practices. Through a mixed-methods study involving 320 pre-service teachers across four teacher education institutions, this research employed the Metacognitive Awareness Inventory (MAI) alongside qualitative reflective journal analysis. The findings reveal that pre-service teachers demonstrate moderate overall metacognitive awareness (mean score 3.42 on a 5-point scale), with significant variations across different metacognitive dimensions. Knowledge of cognition scored higher (3.68) than regulation of cognition (3.21), indicating stronger theoretical understanding than practical application of metacognitive strategies. Notably, 62% of participants showed weak connections between metacognitive awareness and actual teaching practice during field experiences. The research identifies critical gaps in procedural and conditional knowledge that hinder reflective teaching development. These findings have important implications for teacher education programs, suggesting the need for explicit metacognitive instruction, structured reflection protocols, and authentic teaching contexts that promote metacognitive strategy application. This study contributes to understanding how metacognitive competencies develop among novice teachers and provides evidence-based recommendations for strengthening reflective practice in teacher preparation.

**Keywords:** Metacognitive awareness, pre-service teachers, reflective practice, teacher education, knowledge of cognition, regulation of cognition, teaching strategies

## 1. INTRODUCTION

The ability to think about one's own thinking has long been recognized as fundamental to effective teaching. Teachers who possess strong metacognitive awareness can monitor their instructional decisions, evaluate teaching effectiveness, and adjust strategies based on student needs and learning outcomes (Flavell, 1979). This capacity for reflection and self-regulation distinguishes expert teachers from novices and serves as a cornerstone of professional growth throughout a teaching career.

Despite widespread acknowledgment of metacognition's importance, teacher education programs often struggle to systematically develop these competencies among pre-service teachers. Many novice teachers enter classrooms with theoretical knowledge about teaching and learning but lack the metacognitive skills necessary to apply this knowledge flexibly in complex classroom situations. This gap between knowing and doing represents a persistent challenge in teacher preparation.

Metacognition encompasses two primary components: knowledge of cognition and regulation of cognition (Schraw & Dennison, 1994). Knowledge of cognition includes declarative knowledge (knowing what), procedural knowledge (knowing how), and conditional knowledge (knowing when and why). Regulation of cognition involves planning, monitoring, and evaluating one's cognitive processes. For teachers, these dimensions translate into awareness of instructional strategies, ability to implement teaching approaches effectively, and capacity to assess and adjust instruction based on ongoing classroom dynamics.

Research on teacher metacognition has grown substantially over the past two decades, yet significant questions remain about how metacognitive awareness develops among pre-service teachers and how this awareness translates into reflective teaching practice. Most existing studies focus on in-service teachers with years of classroom experience, leaving gaps in understanding metacognitive development during initial teacher preparation. Furthermore, limited research examines the relationship between measured metacognitive awareness and actual reflective practice in authentic teaching contexts.

This study addresses these gaps by mapping metacognitive awareness patterns among pre-service teachers and investigating connections between metacognitive competencies and reflective teaching behaviors. The research pursues three fundamental questions: What levels of metacognitive awareness do pre-service teachers demonstrate across different metacognitive dimensions? How does metacognitive awareness relate to quality of reflection in teaching practice? And what factors facilitate or hinder the translation of metacognitive awareness into reflective teaching behaviors?

Understanding these questions has practical importance for teacher educators seeking to strengthen preparation programs. If we can identify specific metacognitive strengths and weaknesses among pre-service teachers, we can design targeted interventions to address gaps. If we understand how metacognitive awareness connects to reflective practice, we can create learning experiences that bridge theory and application more effectively.

This paper proceeds through eight additional sections. Section 2 outlines specific research objectives. Section 3 defines the study scope. Section 4 reviews relevant literature on metacognition and teacher reflection. Section 5 describes the research methodology. Sections 6 and 7 present quantitative and qualitative findings respectively. Section 8 discusses implications, and Section 9 concludes with recommendations for teacher education.

## 2. OBJECTIVES

This research pursues the following specific objectives:

- **Primary Objective:** To comprehensively map the metacognitive awareness levels and patterns among pre-service teachers across knowledge and regulation dimensions using validated measurement instruments.
- **Secondary Objective 1:** To identify specific metacognitive strengths and weaknesses among pre-service teachers that have implications for teaching effectiveness and professional development.
- **Secondary Objective 2:** To examine relationships between metacognitive awareness levels and the quality of reflective practice demonstrated during field teaching experiences.
- **Secondary Objective 3:** To investigate how demographic and contextual factors (program year, subject specialization, prior teaching exposure) influence metacognitive awareness development.
- **Secondary Objective 4:** To develop evidence-based recommendations for teacher education programs to enhance metacognitive competencies and reflective teaching practices among pre-service teachers.

## 3. SCOPE OF STUDY

This research operates within the following boundaries:

- **Participant Scope:** Pre-service teachers enrolled in undergraduate teacher education programs, specifically those in years 2-4 of their programs with at least one field teaching experience.
- **Geographical Scope:** Four teacher education institutions across urban and semi-urban settings in three states, representing diverse program models and student populations.

- **Temporal Scope:** Data collection occurred during the 2023-2024 academic year, with particular focus on periods following field teaching placements when reflective capacity could be assessed.
- **Metacognitive Dimensions:** Study examines both knowledge of cognition (declarative, procedural, conditional) and regulation of cognition (planning, monitoring, evaluating) as defined by established metacognitive frameworks.
- **Reflective Practice Context:** Analysis focuses on reflection related to classroom teaching experiences rather than broader professional or personal reflection.
- **Included Variables:** Metacognitive awareness scores, reflection quality ratings, program characteristics, teaching subject areas, year in program, and prior teaching exposure.
- **Excluded Elements:** Cognitive abilities, personality traits, general academic achievement, and specific content knowledge are acknowledged as relevant but not directly measured in this study.

## 4. LITERATURE REVIEW

### 4.1 Theoretical Foundations of Metacognition

Metacognition, defined as "thinking about thinking," has roots in cognitive psychology dating to Flavell's seminal work in the 1970s (Flavell, 1979). The construct encompasses awareness and regulation of one's own cognitive processes, enabling learners to become more strategic and self-directed. Flavell's framework distinguished between metacognitive knowledge (what one knows about cognition) and metacognitive experiences (conscious cognitive or affective experiences during problem-solving).

Subsequent research refined these concepts into more operational frameworks. Schraw and Dennison (1994) proposed a two-factor model distinguishing knowledge of cognition from regulation of cognition, providing a structure that has proven particularly useful in educational research. Their Metacognitive Awareness Inventory (MAI) operationalizes these dimensions through measurable sub-components, enabling quantitative assessment of metacognitive awareness across diverse populations.

Knowledge of cognition encompasses three types of awareness. Declarative knowledge involves understanding one's own learning characteristics, strategy knowledge, and task demands. Procedural knowledge concerns knowing how to employ various strategies and procedures. Conditional knowledge addresses when and why to use particular strategies or approaches. These knowledge types build progressively, with conditional knowledge representing the most sophisticated level requiring integration of declarative and procedural understanding.

Regulation of cognition involves active control over learning and thinking processes. Planning includes goal setting, resource allocation, and strategy selection before approaching a task. Monitoring involves awareness of task comprehension and performance during learning activities. Evaluation encompasses assessment of learning outcomes and regulatory process effectiveness after task completion. Effective learners move fluidly among these regulatory processes, adjusting strategies based on ongoing assessment.

### 4.2 Metacognition in Teaching and Teacher Education

The teaching context adds complexity to metacognitive processes because teachers must manage both their own cognition and facilitate student metacognitive development. Teacher metacognition involves awareness of instructional decision-making, monitoring of teaching effectiveness, and adjustment of pedagogical approaches based on student responses (Lin et al., 2005). Expert teachers demonstrate sophisticated metacognitive skills, constantly reading classroom situations and making rapid instructional adjustments.

Research on teacher metacognition reveals several patterns. Experienced teachers possess more elaborate metacognitive knowledge about teaching and learning than novices, drawing on extensive experience to inform instructional decisions (Zohar & Ben David, 2008). They engage in more automatic monitoring of classroom dynamics, freeing cognitive resources for higher-level instructional planning. They also demonstrate superior evaluation skills, accurately assessing lesson effectiveness and identifying specific improvement areas.

However, metacognitive expertise does not develop automatically with teaching experience. Some teachers with years in classrooms show limited metacognitive awareness, falling into routinized practices without critical reflection. This observation underscores the importance of intentionally developing metacognitive competencies during teacher preparation rather than assuming they emerge naturally through experience.

### 4.3 Reflective Practice in Teaching

Reflective practice represents the application of metacognitive processes to teaching. Schön's influential work distinguished reflection-in-action (thinking during teaching) from reflection-on-action (thinking after teaching), both requiring metacognitive awareness (Schön, 1983). Effective teachers engage in both forms, monitoring and adjusting instruction in real-time while also critically analyzing teaching experiences to inform future practice.

Various frameworks characterize levels of teacher reflection. Van Manen (1977) proposed three levels: technical rationality (focus on technique effectiveness), practical action (consideration of educational goals and consequences), and critical reflection (examination of ethical and social implications). Higher reflection levels require more sophisticated metacognitive awareness, particularly conditional knowledge about when different approaches are appropriate.

Pre-service teachers typically begin at technical reflection levels, focusing primarily on classroom management and lesson implementation rather than deeper pedagogical or ethical considerations (Ward & McCotter, 2004). Progression to higher reflection levels requires explicit instruction, structured scaffolding, and authentic teaching experiences providing material for reflection. Without intentional development, many teachers remain at surface reflection levels throughout their careers.

### 4.4 Metacognitive Development Among Pre-Service Teachers

Research on pre-service teacher metacognition reveals both opportunities and challenges. Novice teachers often possess theoretical knowledge about learning and instruction but struggle to apply this knowledge flexibly in classroom contexts (Hartman, 2001). This application gap suggests weak conditional knowledge—understanding what and how but not when and why.

Several factors influence metacognitive development during teacher preparation. Field experiences providing authentic teaching responsibilities offer opportunities for metacognitive skill application, though benefits depend on quality of supervisory feedback and structured reflection requirements (Peker, 2009). Explicit instruction in metacognitive strategies proves more effective than assuming metacognitive development occurs implicitly through general teacher education coursework.

Reflection tools and protocols can scaffold metacognitive development. Structured journal prompts, video analysis of teaching, peer observation, and portfolio development all serve as vehicles for promoting metacognitive awareness when designed thoughtfully (Benton-Kupper, 2001). However, these tools vary in effectiveness, with some promoting surface-level description rather than genuine metacognitive reflection.

### 4.5 Research Gaps

Despite growing interest in teacher metacognition, several gaps remain in the literature. First, most research relies on self-report measures that may not accurately capture actual metacognitive processes during teaching. Second, limited studies examine relationships between measured metacognitive awareness and observed teaching quality or student learning outcomes. Third, research on effective interventions for developing metacognitive competencies among pre-service teachers remains sparse, with many recommendations based on theoretical arguments rather than empirical evidence.

This study addresses these gaps by combining metacognitive awareness measurement with qualitative analysis of reflective practice quality, providing insight into how measured metacognition translates into actual reflective teaching behaviors. The research also examines patterns across different pre-service teacher populations, identifying factors associated with stronger metacognitive development.

## 5. RESEARCH METHODOLOGY

### 5.1 Research Design

This study employs a convergent mixed-methods design, collecting and analyzing both quantitative and qualitative data to provide comprehensive understanding of pre-service teacher metacognitive awareness and reflective practice. The design enables both broad pattern identification through survey data and deep insight into metacognitive processes through reflective journal analysis.

### 5.2 Participants and Sampling

The research involved 320 pre-service teachers from four teacher education institutions representing diverse program models. Participants were distributed across program years: Year 2 (n=78), Year 3 (n=132), and Year 4 (n=110). Subject specializations included elementary education (n=128), mathematics (n=64), science (n=58), language arts (n=42), and social studies (n=28).

Purposive sampling ensured participants had completed at least one field teaching experience, providing a basis for assessing connections between metacognitive awareness and reflective practice. Recruitment occurred through teacher education program coordinators, with participation voluntary and confidential. The sample achieved reasonable diversity across program characteristics, enabling examination of contextual factors influencing metacognitive development.

### 5.3 Data Collection Instruments

**Metacognitive Awareness Inventory (MAI):** The 52-item MAI developed by Schraw and Dennison (1994) served as the primary quantitative instrument. This validated scale assesses knowledge of cognition (17 items across declarative, procedural, and conditional knowledge subscales) and regulation of cognition (35 items across planning, monitoring, and evaluation subscales). Participants rated agreement with each statement on a 5-point Likert scale (1=strongly disagree to 5=strongly agree). The MAI demonstrates strong reliability (Cronbach's  $\alpha = 0.93$ ) and has been extensively used in educational research.

**Reflective Teaching Journals:** Participants submitted three reflective journal entries following field teaching experiences during the data collection semester. Journal prompts encouraged metacognitive reflection: "Describe your thinking process while planning this lesson," "What did you notice about student learning during teaching, and how did you respond?" and "Evaluating this teaching experience, what would you change and why?" Entries averaged 400-600 words.

**Demographic Questionnaire:** A brief questionnaire collected information on program year, subject specialization, prior teaching or tutoring experience, and self-assessed confidence in teaching abilities.

### 5.4 Data Collection Procedures

Data collection occurred in two phases during Spring 2024. Phase 1 involved administering the MAI and demographic questionnaire through online survey platforms, taking approximately 20-25 minutes per participant. Phase 2 involved collecting reflective journals submitted electronically following field teaching experiences spaced throughout the semester.

Clear instructions emphasized honest self-assessment on the MAI, with assurance that responses would not affect program standing. For reflective journals, participants received guidelines on reflection depth and focus while maintaining flexibility for individual expression. All data collection procedures received institutional review board approval, with informed consent obtained from all participants.

## 5.5 Data Analysis

**Quantitative Analysis:** MAI responses underwent descriptive statistical analysis to calculate mean scores for overall metacognitive awareness, knowledge and regulation dimensions, and individual subscales. Independent samples t-tests and ANOVA examined differences across demographic groups (program year, subject area, prior experience). Correlation analysis explored relationships between metacognitive awareness levels and reflection quality ratings.

**Qualitative Analysis:** Reflective journals were analyzed using a coding framework based on Ward and McCotter's (2004) reflection levels: routine (descriptive accounts), technical (focus on technique effectiveness), dialogic (consideration of multiple perspectives), and transformative (critical examination of assumptions). Two independent raters coded a random sample of 25% of journals, achieving inter-rater reliability of  $\kappa=0.78$ . Coded journals were then analyzed for patterns related to metacognitive dimensions and connections to MAI scores.

**Integration:** Mixed-methods integration occurred during interpretation, with qualitative findings elaborating and contextualizing quantitative patterns. Cases showing divergence between MAI scores and reflection quality received particular attention to understand measurement limitations and practical application gaps.

## 5.6 Validity and Reliability

Multiple measures enhanced research validity and reliability. The MAI's established psychometric properties provided confidence in quantitative measurement. Triangulation between quantitative awareness measures and qualitative reflection analysis strengthened overall validity. Member checking involved sharing preliminary findings with a subset of participants to verify interpretations resonated with their experiences.

## 5.7 Ethical Considerations

Research protocols ensured participant confidentiality through anonymous coding and secure data storage. Participation was voluntary with no penalties for withdrawal. Data was used solely for research purposes, with aggregated findings shared only after removing identifying information. Participants received summaries of findings to support their professional development.

## 5.8 Limitations

Several limitations warrant acknowledgment. Self-report data on the MAI may reflect social desirability bias or inaccurate self-assessment. Reflective journals, while providing insight into thinking processes, represent participants' accounts of their thinking rather than direct observation of metacognitive processes during teaching. The cross-sectional design captures a snapshot rather than tracking metacognitive development longitudinally. Finally, the sample, while diverse, comes from specific institutional contexts that may not represent all teacher preparation approaches.

# 6. QUANTITATIVE FINDINGS: METACOGNITIVE AWARENESS PATTERNS

## 6.1 Overall Metacognitive Awareness Levels

Analysis of MAI responses reveals that pre-service teachers demonstrate moderate overall metacognitive awareness, with a mean score of 3.42 (SD=0.54) on the 5-point scale. This places the sample between "neutral" and "agree" on metacognitive awareness statements, suggesting developing but not yet expert-level metacognitive competencies.

Significant variation exists across participants, with scores ranging from 2.15 to 4.73. Approximately 28% of participants scored below 3.0, indicating limited metacognitive awareness, while 15% scored above 4.0, demonstrating strong metacognitive competencies. The majority (57%) fell in the moderate range between 3.0-4.0, representing the typical pre-service teacher profile in this sample.

## 6.2 Knowledge of Cognition versus Regulation of Cognition

A critical finding emerges in comparing the two primary metacognitive dimensions. Knowledge of cognition scored significantly higher ( $M=3.68$ ,  $SD=0.61$ ) than regulation of cognition ( $M=3.21$ ,  $SD=0.58$ ), with paired-samples t-test revealing this difference as statistically significant ( $t=11.43$ ,  $p<0.001$ ). This pattern indicates that pre-service teachers possess better theoretical understanding of cognitive processes than practical ability to regulate their cognition during teaching.

[TABLE 1: Metacognitive Awareness Inventory Scores by Dimension]

Metacognitive Dimension	Mean Score	Standard Deviation	Score Range	% Scoring >4.0
<b>Overall MAI</b>	3.42	0.54	2.15 - 4.73	15%
<b>Knowledge of Cognition</b>	3.68	0.61	2.29 - 4.88	24%
- Declarative Knowledge	3.91	0.68	2.33 - 5.00	32%
- Procedural Knowledge	3.62	0.72	1.83 - 4.83	21%
- Conditional Knowledge	3.45	0.79	1.67 - 4.83	18%
<b>Regulation of Cognition</b>	3.21	0.58	1.86 - 4.69	9%
- Planning	3.48	0.64	2.00 - 4.88	14%
- Monitoring	3.12	0.71	1.71 - 4.71	8%
- Evaluation	3.04	0.74	1.43 - 4.86	7%

Note: Scores based on 5-point Likert scale (1=strongly disagree, 5=strongly agree);  $n=320$

## 6.3 Subscale Analysis: Specific Strengths and Weaknesses

Within knowledge of cognition, declarative knowledge scores highest ( $M=3.91$ ,  $SD=0.68$ ), indicating that pre-service teachers understand their own learning characteristics and recognize the importance of metacognitive awareness in teaching. Procedural knowledge scored moderately ( $M=3.62$ ,  $SD=0.72$ ), suggesting reasonable awareness of metacognitive strategies and how to employ them. Conditional knowledge showed the lowest scores in this dimension ( $M=3.45$ ,  $SD=0.79$ ), revealing weaknesses in knowing when and why to apply specific strategies.

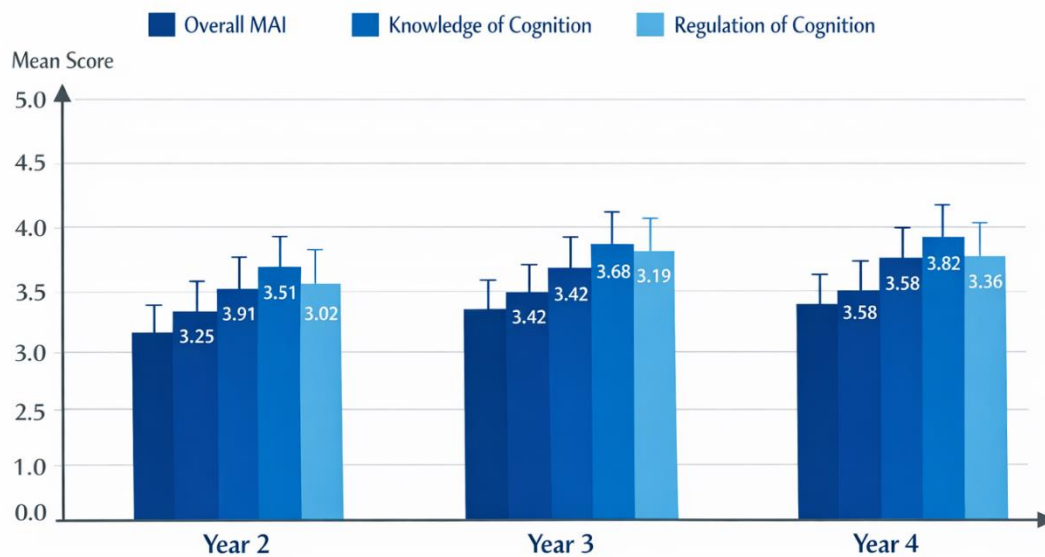
Regulation of cognition subscales all scored below the overall mean, with evaluation showing particular weakness ( $M=3.04$ ,  $SD=0.74$ ). This indicates pre-service teachers struggle most with assessing their cognitive performance and teaching effectiveness after lessons. Monitoring scored slightly higher ( $M=3.12$ ,  $SD=0.71$ ) but still reflects limited capacity to track comprehension and adjust strategies during teaching. Planning showed the strongest regulation scores ( $M=3.48$ ,  $SD=0.64$ ) yet remained below knowledge dimension scores, suggesting pre-service teachers can think about planning but struggle with actual strategic planning execution.

## 6.4 Variation by Program Year

ANOVA analysis examining metacognitive awareness across program years reveals statistically significant differences ( $F=8.92$ ,  $p<0.001$ ). Year 4 students scored highest ( $M=3.58$ ,  $SD=0.51$ ), followed by Year 3 ( $M=3.42$ ,  $SD=0.52$ ) and Year 2 ( $M=3.25$ ,  $SD=0.57$ ). Post-hoc tests indicate significant differences between Year 2 and Year 4 ( $p<0.001$ ) and between Year 2 and Year 3 ( $p<0.05$ ), but not between Year 3 and Year 4 ( $p=0.12$ ).

This pattern suggests metacognitive awareness develops progressively through teacher education programs, with most growth occurring between second and third years. The plateau between years 3 and 4 raises questions about whether programs provide sufficient advanced metacognitive development opportunities or whether natural ceiling effects emerge.

## Metacognitive Awareness Scores by Program Year and Dimension



**FIGURE 1: Metacognitive Awareness Scores by Program Year and Dimension**

### 6.5 Variation by Subject Specialization

Subject area analysis reveals modest but statistically significant differences in metacognitive awareness ( $F=3.24$ ,  $p<0.05$ ). Science pre-service teachers scored highest ( $M=3.58$ ,  $SD=0.49$ ), followed by mathematics ( $M=3.52$ ,  $SD=0.51$ ), language arts ( $M=3.41$ ,  $SD=0.58$ ), elementary education ( $M=3.36$ ,  $SD=0.55$ ), and social studies ( $M=3.29$ ,  $SD=0.61$ ).

The stronger metacognitive awareness among science and mathematics pre-service teachers may reflect emphasis on problem-solving and procedural thinking in these disciplines. However, differences are relatively small, suggesting subject area exerts less influence on metacognitive development than program experiences and individual characteristics.

### 6.6 Influence of Prior Teaching Experience

Participants with prior teaching or tutoring experience ( $n=147$ ) scored significantly higher on metacognitive awareness ( $M=3.54$ ,  $SD=0.51$ ) than those without such experience ( $n=173$ ,  $M=3.32$ ,  $SD=0.55$ ),  $t=3.58$ ,  $p<0.001$ . This difference was particularly pronounced for regulation of cognition (experienced:  $M=3.35$  vs. inexperienced:  $M=3.09$ ,  $t=4.12$ ,  $p<0.001$ ), while knowledge of cognition showed smaller differences (experienced:  $M=3.76$  vs. inexperienced:  $M=3.61$ ,  $t=2.21$ ,  $p<0.05$ ).

These findings suggest that practical teaching experience contributes to metacognitive development, particularly regulatory skills that require application in authentic contexts. However, the moderate effect size indicates experience alone does not guarantee strong metacognitive awareness, highlighting the importance of structured reflection and feedback during field experiences.

[TABLE 2: Metacognitive Awareness by Prior Teaching Experience]

Metacognitive Dimension	With Prior Experience (n=147)	Without Prior Experience (n=173)	t-value	p-value
Overall MAI	3.54 (0.51)	3.32 (0.55)	3.58	<0.001***
Knowledge of Cognition	3.76 (0.58)	3.61 (0.63)	2.21	0.028*
Regulation of Cognition	3.35 (0.55)	3.09 (0.60)	4.12	<0.001***
Planning	3.61 (0.61)	3.37 (0.65)	3.29	0.001**
Monitoring	3.26 (0.68)	3.01 (0.72)	3.12	0.002**
Evaluation	3.18 (0.71)	2.92 (0.75)	3.18	0.002**

\*Note: Values shown as Mean (Standard Deviation); \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

## 7. QUALITATIVE FINDINGS: REFLECTIVE PRACTICE QUALITY

### 7.1 Distribution of Reflection Levels

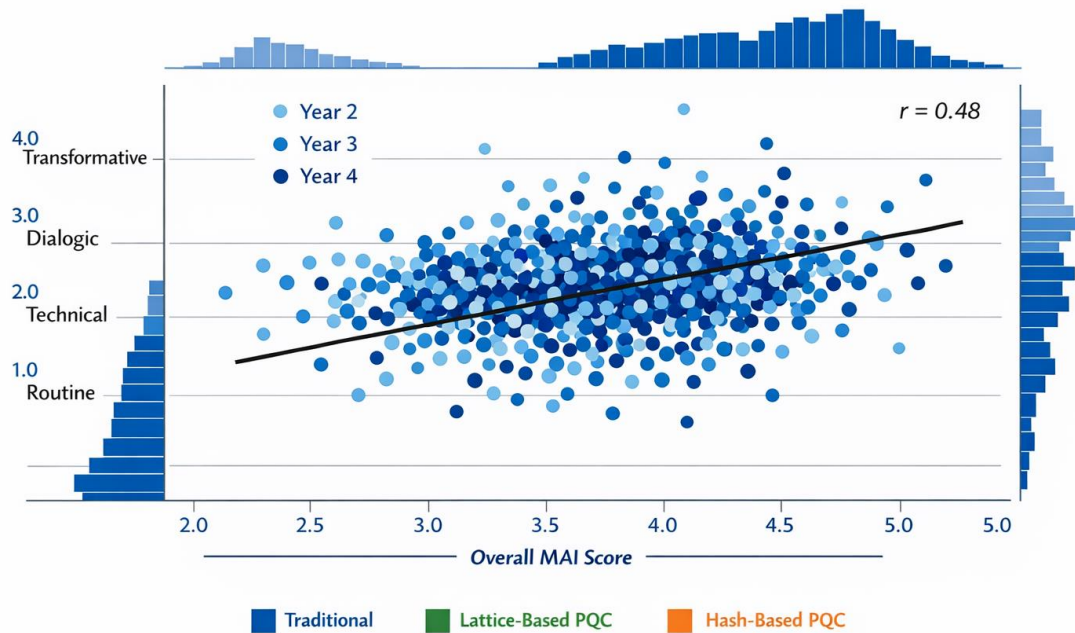
Analysis of 960 reflective journal entries (three per participant) reveals substantial variation in reflection quality. Using Ward and McCotter's (2004) framework, entries were coded as: routine descriptive (32%), technical (45%), dialogic (19%), or transformative (4%). This distribution indicates most pre-service teachers engage in technical reflection focusing on teaching effectiveness, with fewer achieving higher-level dialogic or transformative reflection involving critical examination of assumptions and multiple perspectives.

Only 23% of participants consistently demonstrated dialogic or transformative reflection across all three journal entries, while 41% remained at routine or technical levels throughout. The remaining 36% showed variable reflection quality, suggesting developing but inconsistent metacognitive skills.

### 7.2 Relationship Between MAI Scores and Reflection Quality

Correlation analysis reveals moderate positive relationships between metacognitive awareness scores and reflection quality ratings ( $r=0.48$ ,  $p < 0.001$ ). Participants with higher MAI scores were more likely to produce dialogic or transformative reflections, while those with lower scores tended toward routine or technical reflection.

However, 62% of participants showed discrepancies between MAI scores and reflection quality. Some participants with high MAI scores (above 4.0) produced predominantly technical reflections, while others with moderate scores (3.0-3.5) demonstrated sophisticated dialogic reflection. This divergence suggests that measured metacognitive awareness does not automatically translate into reflective practice, highlighting the importance of additional factors like reflection prompts, supervisory feedback, and contextual support.



**FIGURE 2: Relationship Between Metacognitive Awareness and Reflection Quality**

### 7.3 Metacognitive Themes in Reflective Journals

Qualitative coding identified specific metacognitive themes appearing in reflective journals. Entries demonstrating strong metacognitive awareness included explicit discussion of planning processes, monitoring of student understanding during teaching, evaluation of lesson effectiveness with specific evidence, and identification of alternative strategies with rationales. Weaker entries focused primarily on describing events without analysis, evaluating lessons based on feelings rather than evidence, or discussing changes without explaining underlying reasoning.

Representative quotes illustrate these patterns:

**Strong Metacognitive Reflection:** "While planning this lesson, I initially thought a lecture format would work, but then I considered that my students struggle with sustained attention. I chose to break content into three segments with active learning in between. During teaching, I noticed confusion when I introduced the third concept, so I added an impromptu example and checked understanding before continuing. Looking back, I should have anticipated this confusion and included that example in my original plan."

**Weak Metacognitive Reflection:** "The lesson went okay. Students seemed engaged most of the time. I would make the activity longer because students enjoyed it. I feel good about how I managed the class and I think they learned the material."

The strong example demonstrates procedural and conditional knowledge about instructional strategies, monitoring during teaching, and evaluation with specific evidence. The weak example lacks metacognitive depth, relying on feelings and impressions rather than evidence-based analysis of teaching decisions.

### 7.4 Barriers to Metacognitive Reflection

Analysis of lower-quality reflections and participant comments reveals several barriers to metacognitive reflection. First, many pre-service teachers lack frameworks for structured reflection, defaulting to chronological descriptions of teaching events. Second, limited teaching experience provides insufficient knowledge base for comparative evaluation—novices struggle to imagine alternative approaches because they have limited strategy repertoires. Third, emotional responses to teaching experiences sometimes overshadow analytical reflection, with participants focusing on anxiety or satisfaction rather than examining instructional decisions. Fourth, time constraints and competing demands lead to superficial reflection completion rather than deep analysis.

## 7.5 Facilitating Factors for Metacognitive Reflection

Conversely, certain factors appeared to support higher-quality metacognitive reflection. Specific reflection prompts directing attention to planning, monitoring, and evaluation processes yielded more metacognitive responses than general "reflect on your teaching" instructions. Participants who received detailed supervisory feedback focusing on instructional decision-making produced more sophisticated subsequent reflections. Those with opportunities to observe peer teaching and discuss alternative approaches showed stronger conditional knowledge in reflections. Finally, participants who engaged in video analysis of their own teaching demonstrated enhanced monitoring awareness in reflective writing.

Metacognitive Themes Frequency by Reflection Level

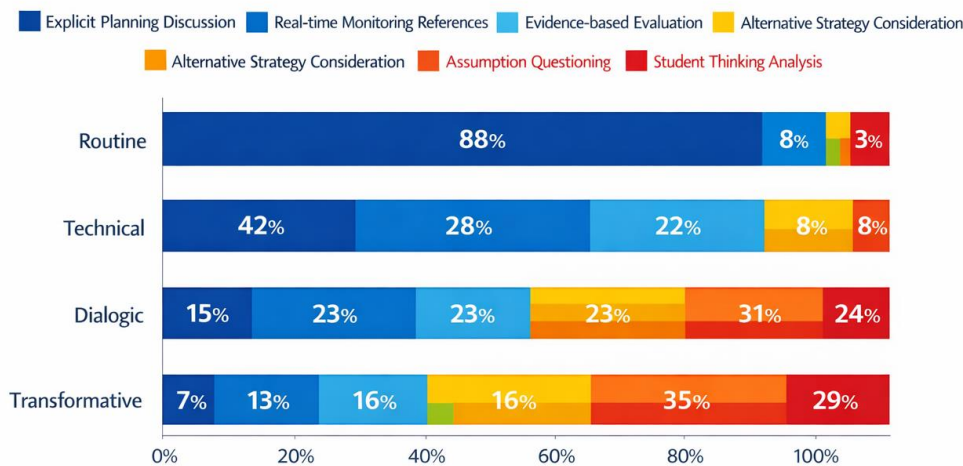


FIGURE 3: Metacognitive Themes Frequency by Reflection Level

## 8. DISCUSSION

### 8.1 Interpretation of Findings

The research reveals a troubling gap between pre-service teachers' metacognitive knowledge and their capacity to regulate cognition during teaching. While participants demonstrate reasonable understanding of metacognitive concepts (knowledge of cognition  $M=3.68$ ), their ability to apply regulatory processes during teaching lags significantly (regulation of cognition  $M=3.21$ ). This pattern suggests that teacher education programs successfully convey metacognitive concepts theoretically but provide insufficient opportunities for applying these concepts in authentic teaching contexts.

The particularly low scores for evaluation ( $M=3.04$ ) warrant concern, as evaluative reflection serves as the foundation for professional growth. Teachers who cannot accurately assess their teaching effectiveness struggle to identify improvement areas and make informed adjustments to practice. This weakness may explain why some teachers plateau professionally, continuing ineffective practices because they lack evaluative metacognitive skills to recognize problems.

The weak conditional knowledge scores ( $M=3.45$ ) also have important implications. Knowing when and why to employ particular teaching strategies represents sophisticated understanding that develops through experience analyzing diverse teaching situations. Pre-service teachers' limited conditional knowledge suggests they may apply strategies inappropriately or rigidly adhere to prescribed approaches without considering contextual appropriateness.

The correlation between metacognitive awareness and reflection quality ( $r=0.48$ ), while statistically significant, leaves substantial unexplained variance. This suggests metacognitive awareness represents necessary but insufficient condition for reflective practice. Other factors—reflection prompts, feedback quality, teaching context complexity, emotional state—also influence whether teachers engage in sophisticated reflection. Teacher educators cannot assume high metacognitive awareness automatically translates into reflective practice without creating supportive structures.

## 8.2 Implications for Teacher Education

These findings carry several implications for teacher education programs. First, programs should provide explicit metacognitive instruction rather than assuming metacognitive development occurs implicitly through general coursework. This includes teaching the conceptual framework of metacognition, modeling metacognitive thinking processes, and providing practice applying metacognitive strategies to teaching scenarios.

Second, field experiences require intentional design to promote metacognitive development. Simply placing pre-service teachers in classrooms does not guarantee metacognitive growth; experiences must include structured reflection requirements, supervisory feedback focusing on instructional decision-making, and opportunities to observe and discuss alternative teaching approaches. Video analysis of teaching appears particularly promising for developing monitoring skills, allowing teachers to notice classroom dynamics they missed during real-time instruction.

Third, reflection tools and protocols should scaffold metacognitive processes explicitly. Generic reflection prompts yield superficial responses; structured prompts directing attention to planning, monitoring, and evaluation processes produce more metacognitive reflection. Programs might implement progressive reflection frameworks that increase sophistication as pre-service teachers develop competencies.

Fourth, assessment of metacognitive competencies should extend beyond self-report measures. While MAI scores provide useful information, they should be supplemented with analysis of actual reflective practice quality, observation of teaching with attention to real-time adjustments, and portfolio evidence demonstrating metacognitive growth over time.

## 8.3 Addressing the Knowledge-Practice Gap

The documented gap between knowledge and regulation suggests teacher education needs specific strategies bridging theory and practice. One approach involves guided practice with gradually released scaffolding—beginning with highly structured metacognitive prompts during teaching, progressively removing scaffolds as pre-service teachers internalize processes. Another strategy uses case-based learning where pre-service teachers analyze teaching scenarios requiring metacognitive decision-making, building conditional knowledge about when and why to employ strategies.

Peer collaboration also shows promise for bridging this gap. When pre-service teachers observe peers teaching and discuss instructional decisions collaboratively, they build strategy repertoires and conditional knowledge more efficiently than through individual experience alone. Creating communities of practice focused on metacognitive development may accelerate growth beyond what individual coursework achieves.

## 8.4 Limitations and Future Research

This study's limitations suggest directions for future research. The cross-sectional design captures developmental trends but cannot definitively establish causation; longitudinal studies tracking individual pre-service teachers' metacognitive development throughout preparation programs would provide more definitive evidence about developmental trajectories and intervention effectiveness.

Research should also examine how metacognitive awareness and reflective practice relate to teaching effectiveness and student learning outcomes. While theoretical frameworks assume these connections, empirical evidence linking teacher metacognition to student achievement remains limited. Studies incorporating classroom observation data and student learning measures alongside metacognitive assessments would strengthen understanding of why metacognition matters for teaching.

Finally, intervention research testing specific approaches for developing metacognitive competencies would inform evidence-based teacher education practice. Comparative studies examining different reflection protocols, feedback strategies, and field experience structures could identify particularly effective approaches for promoting metacognitive growth.

## 9. CONCLUSION

This research provides comprehensive evidence that pre-service teachers demonstrate moderate metacognitive awareness with significant gaps in regulatory competencies critical for reflective teaching practice. The finding that knowledge of cognition ( $M=3.68$ ) substantially exceeds regulation of cognition ( $M=3.21$ ) reveals that teacher education successfully conveys metacognitive concepts theoretically but insufficiently develops practical application skills.

The study achieves its primary objective of mapping metacognitive patterns, identifying specific strengths in declarative knowledge and weaknesses in evaluation and conditional knowledge. Secondary objectives were similarly accomplished: relationships between metacognitive awareness and reflection quality were established ( $r=0.48$ ), contextual factors influencing development were identified (program year, prior experience), and evidence-based recommendations were formulated.

The particularly troubling finding that only 23% of pre-service teachers consistently demonstrate dialogic or transformative reflection raises concerns about readiness for the complex reflective practice demands of teaching. While 62% show some capacity for sophisticated reflection, inconsistency suggests fragile metacognitive competencies requiring continued development.

The documented gap between measured metacognitive awareness and actual reflective practice quality underscores that knowing about metacognition differs fundamentally from applying metacognitive processes during teaching. Teacher education cannot rely solely on theoretical instruction or assume field experiences automatically produce metacognitive development. Instead, programs require intentional, scaffolded approaches explicitly developing both metacognitive knowledge and regulatory skills.

Several recommendations emerge for strengthening metacognitive development in teacher preparation:

**Curricular Recommendations:** Incorporate explicit metacognitive instruction throughout coursework rather than treating it as implicit outcome. Use frameworks like knowledge of cognition and regulation of cognition to organize instruction. Employ modeling and think-alouds demonstrating metacognitive processes during teaching demonstrations.

**Field Experience Recommendations:** Structure placements to progressively increase complexity, allowing pre-service teachers to focus on metacognitive processes without overwhelming demands. Implement required reflection protocols using specific prompts directing attention to planning, monitoring, and evaluation. Incorporate video analysis of teaching to develop monitoring skills and enable noticing of classroom dynamics.

**Supervision and Feedback Recommendations:** Train supervisors to provide feedback focusing on instructional decision-making processes rather than only outcomes. Facilitate post-lesson conferences using metacognitive questioning that promotes reflection. Create opportunities for pre-service teachers to observe and discuss alternative teaching approaches, building conditional knowledge.

**Assessment Recommendations:** Use multiple measures of metacognitive competency including MAI scores, reflection quality analysis, teaching observation with attention to real-time adjustments, and portfolio evidence showing growth. Provide feedback on reflection quality itself, teaching pre-service teachers what sophisticated reflection looks like.

**Program-Level Recommendations:** Create communities of practice where pre-service teachers collaboratively analyze teaching experiences and share metacognitive insights. Establish partnerships with mentor teachers who model reflective practice and can scaffold metacognitive development. Design capstone experiences requiring demonstration of metacognitive competencies through comprehensive teaching portfolios or reflective case studies.

These recommendations recognize that metacognitive development requires sustained, intentional effort across multiple program components. No single course or field experience will produce expert metacognitive awareness; instead, programs need coherent, progressive approaches building competencies throughout preparation.

The research contributes to teacher education scholarship by providing empirical evidence about metacognitive development patterns among pre-service teachers and documenting gaps between theoretical knowledge and practical application. The findings advance understanding of how metacognitive competencies relate to reflective practice quality and identify specific developmental needs among novice teachers.

Practically, the study offers teacher educators diagnostic information about where pre-service teachers struggle metacognitively and evidence-based guidance for addressing these challenges. The finding that regulation of cognition lags behind knowledge of cognition should prompt programs to increase emphasis on authentic application opportunities with structured reflection support.

Looking forward, metacognitive competencies will become increasingly important as teaching grows more complex. Teachers face diverse student populations, rapid technological change, evolving curriculum standards, and accountability pressures requiring constant adaptation. These demands necessitate sophisticated metacognitive skills enabling teachers to monitor effectiveness, evaluate approaches, and adjust strategies based on evidence rather than habit or assumption.

Pre-service teachers who develop strong metacognitive awareness and reflective practice capacity during preparation enter the profession equipped for ongoing growth. Those who lack these competencies risk plateauing professionally, repeating ineffective practices without the evaluative skills needed to recognize and correct problems. Given that teachers influence thousands of students throughout careers, ensuring strong metacognitive foundations during preparation represents a high-leverage intervention for improving educational quality.

This research demonstrates that many pre-service teachers currently lack the metacognitive competencies needed for sophisticated reflective practice. However, the developmental patterns observed—increases across program years, benefits of prior teaching experience—suggest these competencies can be cultivated through intentional teacher education approaches. The challenge facing the profession is translating research insights into systematic improvements in how we prepare reflective practitioners.

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