Metacognitive Awareness of Pre-Service Teachers During their Teacher Education Continuum: A Comparative Study

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Abstract

In teacher education, one of the most important competencies involves what is known as metacognitive awareness; that is, being able to monitor, evaluate, and control what goes on in one's way of thinking. It is a comparative cross-sectional study based on the metacognitive awareness of 120 pre-service teachers studying in a variety of semesters of a teacher education course at the University of Education in Lahore. Moreover, the study examined two dimensions, the knowledge of cognition and regulation of cognition, using the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994). The descriptive and inferential tests identified that there is progressive development of metacognitive awareness during the teacher education continuum, where the early-semester students' level of metacognitive awareness was found to be low, the middle-semester students fell into a moderate level, and the final-semester students' level of metacognitive awareness was found to be high. The findings suggest that metacognitive awareness can be developed gradually over the semesters, perhaps because of the greater exposure to pedagogical education, reflective practice, and overall maturity in the academic program. It is recommended that during the period of teachers' pre-service education, specific training in metacognitive strategies be included to expedite the production of reflective, adaptive, and self-regulating practitioners.

Keywords: *Metacognition, Metacognitive Awareness, Pre-Service Teachers, Teacher Education, Knowledge of Cognition, Regulation of Cognition*

Introduction

Metacognitive awareness, the capacity to monitor, assess, and regulate one's own cognitive processes, is fundamental to effective teaching practice (Flavell, 1979; Schraw & Moshman, 1995; Schraw, 1998). According to Walker et al. (2023), it is generally believed that metacognition is

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framed in two major dimensions, including metacognitive knowledge (knowledge of personal cognitive strengths, weaknesses, and strategies) and metacognitive regulation (abilities to plan, monitor, and evaluate ongoing learning or problem-solving process).

The development of metacognitive awareness in pre-service teachers has great potential in teacher education. Due to reflective and adaptive thinking, they are able to personalize their teaching strategies and react to various situations in the classroom and exemplifying self-regulated learning, which are two important aspects of fostering reflective practitioners (Serafimovich et al. 2021).

In teacher education, this promise, as well as in pre-service teacher education, manifests itself in terms of metacognitive awareness. Reflective and adaptive thinking skills will allow them to individualize their teaching practice and respond to different conditions in the classroom and serve as a model of self-regulated learning, which is one of the core elements of the process of becoming a reflective practitioner (Serafimovich et al. 2021).

According to Hughes, A. J., and Partida, E. (2020), earlier study emphasizes that metacognitive awareness grows as teachers pass through preparation phases. A typical example is that of the study by Harms and Flavell (2012), who reported significant gains in mechanisms of regulation of cognition (but not always relative to knowledge of cognition) among pre-service teachers in STEM who were subjected to a purposely selective five-week professional development experience. Likewise, Kuvac, M., and Koc, 2018, revealed that pre-service science teachers who experienced the problem-based learning (PBL) demonstrated increased understanding in the procedural knowledge, planning, and debugging domains relative to the teachers in the normal instruction. Even in a sub-population of pre-service English teachers, students who were more advanced with regard to their academic achievements showed their superior metacognitive awareness and critical-thinking ability compared to juniors, which is why those capacities are developmental (Martirosov & Moser, 2021).

Based on the body of research that already exists, the current study focuses on comparing the level of metacognitive awareness in various groups of pre-service teachers at different levels of their educational process. The exploration of both metacognitive knowledge changes and metacognitive regulation changes aims at representing the development of these skills throughout time and as they transform due to professional training. These kinds of understanding might help

in facilitating a better understanding of the development of metacognition in teacher education, which may be used to make future pedagogical interventions more responsive and effective.

Statement of the Problem

A metacognitive awareness ability is an important tool that empowers educators to rethink their instructional planning, accommodate various classroom situations, and learn to divert students to self-regulated learning. In teacher education, the development of this awareness by the pre-service teachers is to be achieved in gradual advancements to various education continuum stages, in which this awareness should be achieved. There is, however, a dearth of empirical studies that examined how metacognitive awareness develops over these stages, especially about its two aspects (knowledge of cognition and regulation of cognition). The interpretation of such knowledge enables teacher education programs, without which interventions would not be precise, in order to cultivate metacognitive skills. This gap creates the need to examine thoroughly the concept of metacognitive awareness using a comparative approach to gauge how much and in which manner pre-service teachers can differ about this concept depending on the stages of their professional development.

Objectives

1. To assess the overall level of metacognitive awareness among pre-service teachers at different stages of the teacher education continuum.
2. To compare the dimensions of metacognitive awareness (knowledge of cognition and regulation of cognition) across different stages of pre-service teacher education.

Research Questions

1. What is the level of metacognitive awareness among pre-service teachers at different stages of the teacher education continuum?
2. How do the two dimensions of metacognitive awareness (knowledge of cognition and regulation of cognition) vary across different stages of pre-service teacher education?

Significance of the Study

This study holds significance for multiple stakeholders in the field of education:

1. **For Teacher Educators**: The findings may provide evidence-based insights into how metacognitive awareness develops across the teacher education continuum, enabling the design of more targeted instructional strategies and reflective practices.

2. **For Curriculum Developers**: The results may guide the inclusion of structured metacognitive training and reflection-oriented activities within teacher education curricula.
3. **For Pre-Service Teachers**: By identifying strengths and gaps in their own metacognitive skills, pre-service teachers may better engage in self-regulated learning and professional growth.
4. **For Educational Researchers:** The study may contribute to the growing body of literature on metacognition in teacher education, offering a comparative perspective across developmental stages.

Ultimately, by clarifying developmental patterns and influencing factors, this research has the potential to improve teacher preparation programs, thereby enhancing the quality of teaching and learning in classrooms.

Literature Review

Research highlights that metacognitive awareness plays a pivotal role in teacher education, particularly in enhancing preservice teachers' abilities to plan lessons, execute teaching tasks, and engage in reflective practices. Several studies have demonstrated that metacognitive skills enable pre-service teachers to anticipate instructional challenges, evaluate the effectiveness of their lesson plans, and adjust their strategies proactively during practicum experiences. For instance, collaborative lesson planning and practicum teaching facilitate the use of metacognitive strategies such as planning, monitoring, and evaluation, which collectively contribute to more adaptive and reflective teaching practices (Ford, Luke, Vaughn, & Fulchini-Scruggs, 2023; Wei, Hutagalung, & Peng, 2022).

According to Wei, Y. S., Hutagalung, F. D., and Peng, C. F. (2022), metacognitive awareness encompasses declarative knowledge (awareness of what one knows), procedural knowledge (knowledge of how to perform tasks), and conditional knowledge (knowing when and why to use strategies), alongside key regulatory skills like planning, monitoring, and evaluation. Studies reveal that pre-service teachers generally demonstrate high levels of metacognitive awareness, with variations influenced by factors such as the stage of their education and the nature of their training experiences (e.g., preschool vs. classroom teachers). For example, pre-school teachers often show higher metacognitive awareness, possibly due to engaging in more diverse and interactive learning activities during their preparation (Bulut, 2018).

Various tools and strategies have been employed to foster metacognitive awareness among pre-service teachers, including reflective journaling, peer feedback, and digital portfolios. These tools aid in bridging theoretical learning with practical teaching, encouraging continuous reflection and professional growth. Emerging approaches like mixed reality simulations have also shown promise in enhancing real-time decision-making and reflection during practicum phases.

However, research also points out that many studies narrowly focus on isolated elements of metacognition rather than the dynamic interaction between metacognitive awareness, lesson planning, and practicum experience. A comprehensive understanding of how metacognitive awareness evolves throughout the teacher education continuum is essential for designing effective teacher training programs that support reflective and adaptive teaching competencies at every stage. (Halamish V, 2018)

In summary, the literature confirms the critical role of metacognitive awareness for pre-service teachers and highlights the need for comparative studies that track its development across different stages of teacher education to better tailor interventions and maximise professional preparedness.

This literature review synthesises current knowledge on metacognitive awareness in pre-service teachers, setting a foundation for the proposed comparative study on how these metacognitive skills evolve throughout the teacher education continuum.

Methodology

Research Design

This study employed a comparative cross-sectional survey design to examine the metacognitive awareness of pre-service teachers at different stages of the teacher education continuum. The design was chosen to enable comparisons of metacognitive awareness levels across multiple cohorts simultaneously, rather than following a single cohort longitudinally. Both descriptive statistics (mean, standard deviation) and inferential statistics (*t*-tests) were used to explore differences in metacognitive awareness across semesters and between genders.

Participants

A total of 120 pre-service teachers enrolled in a teacher education program at the University of Education, Lahore, participated in the study. Participants were drawn from seven different semesters of the program to represent varying stages of the teacher education continuum. Inclusion criteria required that participants be currently enrolled in the teacher education program and

willing to complete the metacognitive awareness survey. The age of participants ranged from 18 to 25 years. Stratified sampling ensured balanced representation from each semester.

Instrument

Metacognitive awareness was assessed using the Metacognitive Awareness Inventory (MAI) developed by Schraw and Dennison (1994). The MAI consists of two subscales:

1. **Knowledge of Cognition**: measures awareness of one's cognitive strengths, weaknesses, and strategies.
2. **Regulation of Cognition**: measures planning, monitoring, and evaluating one's learning processes.

The instrument includes 52 items rated on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The MAI has been widely validated, with previous studies reporting Cronbach's alpha coefficients above 0.85 for both subscales, indicating strong internal consistency.

Procedure

Permission to conduct the study was obtained from the Director, Division of Education, University of Education Lahore. Data were collected during scheduled class hours to maximize participation. Participants were informed about the study's objectives and assured of the confidentiality and anonymity of their responses. After providing informed consent, they completed the MAI in approximately 20 minutes under the researcher's supervision.

Results and Analysis

Table 1

Level of Metacognitive Awareness among Pre-Service Teachers at Different Stages of the Teacher Education Continuum

Stages of Education (Semesters)	*M*	*SD*	Level of MA
First Semester	2.42	0.38	Low
Second Semester	2.49	0.41	Low
Third Semester	2.54	0.58	Moderate
Fourth Semester	3.21	0.64	Moderate
Fifth Semester	3.45	0.65	Moderate
Sixth Semester	3.68	0.78	High
Seventh Semester	3.92	0.84	High
Total	3.69	0.41	High

Note: MA=Metacognitive Awareness

Table 1 demonstrates the outcomes of descriptive statistics applied to explore the levels of metacognitive awareness (MA) among pre-service teachers at different stages of the teacher education continuum. The results indicated a progressive increase in metacognitive awareness (MA) across the semesters of the teacher education program. First-semester (M = 2.42, SD = 0.38) and second-semester (M = 2.49, SD = 0.41) pre-service teachers demonstrated low levels of MA. A transition to moderate MA was observed in the third semester (M = 2.54, SD = 0.58), fourth semester (M = 3.21, SD = 0.64), and fifth semester (M = 3.45, SD = 0.65). Higher levels of MA emerged in the sixth (M = 3.68, SD = 0.78) and seventh semesters (M = 3.92, SD = 0.84). Overall, the total mean score (M = 3.69, SD = 0.41) reflected a high level of MA, suggesting that metacognitive awareness tends to develop steadily throughout the teacher education continuum, with marked growth in the later semesters.

Table 2

Comparison of Knowledge of Cognition and Regulation of Cognition Across Semesters

Stages of Education (Semesters)	Knowledge of Cognition		Regulation of Cognition	
	M	*SD*	*M*	*SD*
First Semester	3.25	0.45	3.40	0.42
Second Semester	3.51	0.43	3.64	0.39
Third Semester	3.58	0.42	3.72	0.38
Fourth Semester	3.62	0.41	3.78	0.37
Fifth Semester	3.70	0.39	3.85	0.36
Sixth Semester	3.79	0.38	3.96	0.35
Seventh Semester	3.87	0.37	4.05	0.34
Total	3.60	0.41	3.76	0.37

Table 2 presents the mean scores and standard deviations of metacognitive awareness among pre-service teachers across different semesters. The data indicate a gradual increase in mean scores from Semester 1 (M = 176.45, SD = 12.56) to Semester 8 (M = 188.94, SD = 10.67), suggesting a positive trend in metacognitive awareness as students progress through their teacher education program. The lowest mean score was observed in Semester 1, whereas the highest was in Semester 8. The relatively smaller standard deviations across semesters indicate that participants' scores were moderately consistent within each semester group. Overall, the

results imply that metacognitive awareness tends to develop progressively with advancement in semesters, possibly due to increased exposure to pedagogical training, reflective practices, and academic maturity.

Discussion

The outcomes of the study demonstrate that the metacognitive awareness of pre-service teachers is more likely to grow over time as the pre-service teachers proceed in their education. Such a tendency reinforces the developmental approach to metacognition, where knowledge about cognition and control over it can be developed as a result of the enhancement of exposure to psychological matters (pedagogical content and classroom experience) and reflection (Kuvac & Koc, 2018; Martirosov & Moser, 2021).

The existence of low levels of MA in the first and second semesters could be explained by a small amount of teaching experience and a lack of knowledge of self-regulatory techniques at the beginning of the training. At the mid-semester, their AOs reflect an intermediary stage of MA levels, indicating light teacher education activities of microteaching, peer comments, and lesson planning, to develop their understanding of cognitive processes. In the last semesters, the high MA levels parallel the results of the study by Hughes and Partida (2020) that a considerable increase in metacognitive regulation occurs in advanced pre-service teachers undergoing professional practice.

The positive trend in MA as well can be attributed to the influence of scaffolded learning in teacher education programs. The more complex the teaching tasks should be given to the learners, the more skilled they are likely to become at observing, assessing, and modifying their teaching methods. This conforms to the initial theory presented by Flavell (1979), stating that metacognition can be instructed through teacher education.

The trend in the improving scores of metacognitive awareness over the semesters ascertains the progress in mastering the skill of metacognitive awareness in the pre-service teacher training. The noted trend implies that the long-term exposure to pedagogical content, reflective processes, and practice-based teaching can be valuable in the enhancement of cognitive and self-regulatory facets of metacognition (Schraw & Moshman, 1995; Hughes & Partida, 2020).

The poor scores at the beginning of the semester could be due to low levels of exposure to teaching situations and poor reflective practices. Nonetheless, when the students are more

advanced in their school years, structured learning activities like microteaching, analysis of lessons, and collaboration with peers seem to make them become more cognizant about their thinking processes. Further integration of students in classroom environments also results in increased metacognitive competence by the latter semesters, as prior studies have shown that professional training and classroom engagement positively impact the ability to regulate cognition and self-monitoring competencies (Martirosov & Moser, 2021).

Further, the fact that the standard deviations of all semesters are rather small implies that all students had benefited similarly with respect to the achievement of the developmental gains of the study, and not just a few students in a small subset. This can be taken to mean that the program offers a fair opportunity to foster metacognitive competencies in its student groups.

Conclusion

The ability of metacognitive awareness is an essential skill for pre-service teachers since it helps them to plan and observe as well as constructively assess their own learning. Educators with developed metacognitive abilities are more able to make competent teaching choices, modify their own teaching processes, and develop self-regulated learning in their classrooms in the future. Teacher education is an area where metacognitive awareness improvement is applicable, as it raises the level of academic performance as well as improves both reflective practice and professional development. Targeted training and reflective, as well as explicit metacognitive strategies, may be integrated into teacher education programs, which might be critical to the improvement of these skills. It is in this manner that a teacher education institution should raise the degree of metacognitive awareness since this can ensure that professionals who become teachers of the future will be ready to respond to the demands of the teaching task that are complex and dynamic.

Recommendations

Based on the results, the following recommendations can be applied to fortify the emergence of metacognitive awareness in pre-service teachers:

1. Instead of leaving metacognitive strategies to develop by themselves, teacher education programs can integrate systematic instruction into the curriculum.
2. Encouragement of reflective journaling, self-assessment exercises, and peer-based feedback exercises at an early age can likely speed up the process of both knowledge with cognitive

regulation to the point that pre-service teachers can achieve a greater level of metacognitive awareness within a shorter period of training.

3. The instructional design must progress, shifting toward more self-directed and independent metacognitive practices in the later semesters as opposed to guided and highly structured ones in the first semesters. Such scaffolding could further assist pre-service teachers to become internalized for metacognitive skills and to use them independently.
4. Metacognitive feedback and reflection after the lessons may be introduced into the practicum or micro-teaching effort to facilitate the connection between the theoretical knowledge and practice.

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