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Pedagogical Reflections and Practices of Prospective Elementary Teachers Through Video-Based Lesson Analysis: An Initial Metacognitive Examination in Lesson Study

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Abstract
The importance of teachers' thinking and practices in designing 21st-century student-centered learning has garnered increasing attention. Teachers are expected to possess the ability to create innovative and responsive instructional designs that cater to students' needs. This skill development must begin during teacher training programs. This study aims to analyze the reflections of prospective elementary teachers on the development of their pedagogical competencies through video-based lesson analysis (VBLA) as an initial part of lesson study. Using a descriptive qualitative research approach, the study involved 159 pre-service elementary teachers. Data were collected through instructional video screenings, observation sheets, questionnaires, and group discussions. The findings reveal that 6% of the participants demonstrated in-depth analysis, while 52% provided general yet less detailed evaluations. A key weakness identified was the lack of variation in teaching methods, with suggested solutions such as the use of deeper questioning to stimulate student discussions. This study emphasizes the importance of strengthening prospective teachers' metacognitive skills, particularly in conducting critical and reflective analysis, identifying instructional weaknesses, and redesigning lessons based on critical reflection. The integration of VBLA in teacher education is crucial to ensuring that prospective teachers acquire the necessary skills to design effective, student-centered learning.

Keywords: Video-Based Lesson Analysis (VBLA), Pedagogical Competencies, Prospective Elementary Teachers, Metacognitive Skills, Lesson Study.

Introduction

Innovative and student-centered instructional design has become an increasingly vital component in the context of 21st-century education. This modern educational paradigm demands that teachers create learning environments that foster the development of students' critical thinking, collaboration, creativity, and communication skills (Kennedy & Sundberg, 2020; Trilling & Fadel, 2009). Teachers are no longer expected to merely deliver content; they must also design learning experiences that align with students' needs. Instructional designs that are responsive to the diverse needs and characteristics of learners should be a central focus, and this requires teachers' thinking and practice to be continuously evolving and reflective (Shulman, 2006). As a result, education must emphasize the cultivation of skills relevant to 21st-century challenges, such as higher-order thinking and problem-solving abilities (Anderson & Krathwohl, 2001).

Teacher thinking and practice is a concept that refers to teachers' capacity to reflect, analyze, and apply effective teaching strategies, serving as a critical foundation for developing innovative instructional designs (Hattie & Timperley, 2011). Teachers must continually refine their abilities to plan, implement, and assess learning in order to meet the demands of 21st-century education. Therefore, the development of teacher thinking and practice should begin during pre-service teacher education, as these future teachers must be equipped with reflective and analytical skills early in their careers (Darling-Hammond, 2015).

Given the urgency of cultivating teacher thinking and practice in pre-service teachers, this study aims to explore how prospective elementary teachers develop pedagogical competence, particularly through the

analysis of their teacher thinking and practice using the Video-Based Lesson Analysis (VBLA) approach. VBLA was chosen as a method because it has proven effective in providing opportunities for pre-service teachers to critically evaluate and deeply reflect on real-life teaching practices while analyzing key elements of effective teaching presented in video form (Gaudin & Chaliès, 2015). Video-Based Lesson Analysis (VBLA) is an educational approach that utilizes video recordings of classroom lessons to facilitate reflective practice among educators (Roth et al., 2011). By reviewing and analyzing these recordings, teachers can gain insights into their instructional methods, student interactions, and overall teaching effectiveness. This process encourages self-reflection and professional growth, enabling educators to identify strengths and areas for improvement in their teaching practices. This approach allows pre-service teachers to identify strengths and weaknesses in teaching practices and develop more relevant solutions for improvement. Additionally, VBLA serves as an initial step in acquiring lesson study skills, a collaborative approach where teachers collectively plan, observe, and analyze lessons to enhance teaching quality (Chikiwa et al., 2019). This study also aims to assess how VBLA can be used to develop pre-service teachers' metacognitive skills, which support the creation of innovative instructional designs.

Several previous studies have demonstrated that video-based analysis can assist teachers in identifying both their strengths and weaknesses in the teaching process, thereby guiding them toward designing more relevant solutions for improvement (Roth et al., 2011). This approach aligns with the growing emphasis on integrating technology and innovation to enhance the reflective capabilities of pre-service teachers, allowing them to review their teaching practices from a broader perspective (Long et al., 2020; Mishra & Koehler, 2006). Video-based analysis provides an opportunity for teachers to critically reflect on their instructional methods, enabling them to assess their effectiveness and make necessary adjustments to improve student learning outcomes.

Furthermore, the integration of technological tools in education is critical in meeting the demands of the digital age and 21st-century learning. The importance of technological pedagogical content knowledge (TPACK) in empowering teachers to develop more adaptive and innovative teaching strategies (Koh et al., 2015). Teachers are thus encouraged to continuously develop their ability to plan, implement, and evaluate instruction in a way that is aligned with the evolving requirements of the digital era. This dynamic approach ensures that teachers remain responsive to technological advancements while fostering a student-centered learning environment that promotes critical thinking, creativity, and problem-solving skills (Voogt et al., 2013). These insights reinforce the necessity for teachers, particularly pre-service teachers, to cultivate reflective thinking and adaptability in instructional design, helping them meet the challenges of contemporary education more effectively.

The hypothesis of this study posits that the use of Video-Based Lesson Analysis (VBLA) can enhance the depth of reflection and sensitivity of pre-service teachers towards the quality of their designed lessons, while also triggering the development of innovative teaching strategies. The primary variables analyzed include reflection, analytical ability, and sensitivity to weaknesses and solutions for improvement. The research aims to answer the following questions: 1) To what extent do pre-service teachers demonstrate depth in analyzing teaching skills through video-based lesson analysis? 2) How sensitive are pre-service teachers in identifying weaknesses and strengths in video-based teaching practices, and how do they propose solutions for improvement? 3) How well do pre-service teachers' thinking and practice evolve in redesigning lessons based on video analysis?

Through this study, the researchers aim to provide a clearer picture of how pre-service teachers develop more reflective and innovative pedagogical skills, specifically in analyzing and improving teaching practices. Ultimately, this research is expected to contribute to the preparation of more competent and innovative future teachers. Additionally, the study paves the way for further exploration into the integration of VBLA within teacher education curricula, ensuring that pre-service teachers acquire the necessary skills to meet the challenges of 21st-century education (Gaudin & Chaliès, 2015; Santagata & Angelici, 2010). Metacognitive skills, defined as awareness and control over one's cognitive processes during learning, are critical in enhancing reflective thinking and learning outcomes. These skills enable individuals to recognize gaps in their understanding, select appropriate strategies, execute their learning plans effectively, and evaluate the success of these strategies, adjusting as necessary (Stanton et al., 2021). Thus, this research offers a significant contribution to understanding the role of VBLA in shaping teacher thinking, practice, and the metacognitive skills of future educators, aligning with the ongoing evolution of educational paradigms in the digital age.

Method

This study employed a descriptive qualitative research approach, supplemented by quantitative data to address the research questions. The research design followed the framework of Miles and Huberman, emphasizing an inductive logic when drawing conclusions from the collected data (Miles et al., 2014). The study involved 159 prospective elementary school teachers enrolled in a bachelor's degree program in Primary School Teacher Education at a private university in Cimahi. A purposive sampling approach was used, ensuring that all participants had completed a course on Teaching and Learning Strategies, which made them suitable for analyzing teaching practices via video-based lesson analysis (Creswell & Creswell, 2018).

Data were collected using video-based lesson analysis (VBLA) sessions, followed by an anonymous post-session questionnaire consisting of three open-ended questions. These questions were designed to assess participants' pedagogical reflection, analytical thinking, and instructional design capabilities (Grant & Kline, 2010). The responses were coded for further analysis to explore how VBLA influenced their teacher thinking and practice. Each participant engaged in VBLA after completing the designated coursework. Subsequently, they filled out the questionnaire during the same session. The entire process spanned approximately two months, ensuring that all participants could complete the VBLA exercise and questionnaire within the semester.

Data analysis followed the coding procedures included open coding, axial coding, and selective coding (Sumiarsi, 2015). Open coding was first applied to identify the foundational aspects of teacher thinking and practice, followed by axial coding to explore relationships between causes and effects. Finally, selective coding was used to highlight key findings related to teacher thinking and practice. The coding process aimed to explore pedagogical competence and metacognitive skills. A summary of this research framework is presented in the procedure shown in Figure 1.

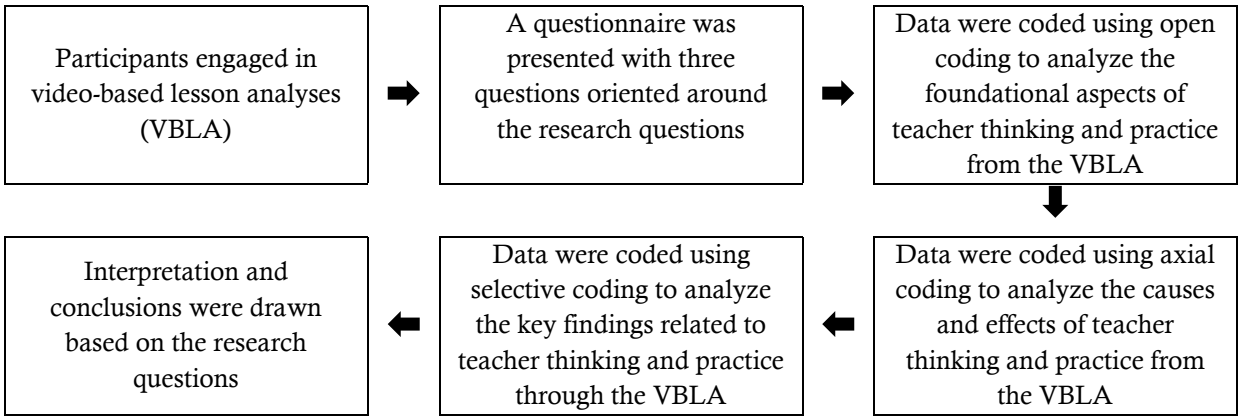

Figure 1. Research Framework

To ensure the validity of the data, triangulation was conducted by verifying questionnaire responses against observational data from VBLA. Reliability was addressed through consistent coding procedures applied by multiple researchers, ensuring inter-coder reliability (Patton, 2014). This was further strengthened by peer debriefing sessions and member-checking. It was assumed that all participants were actively engaged in the VBLA and that their responses to the questionnaire reflected genuine reflections on teaching practice. While the primary focus was on qualitative data, descriptive statistics were employed to categorize general trends in the responses, particularly in identifying how many participants demonstrated deeper analytical thinking versus general evaluations of teaching practice.

The scope of this research is limited to prospective elementary teachers who had completed relevant coursework, and it does not account for how their teacher thinking and practice might evolve in different contexts or with varying levels of teaching experience. Additionally, reliance on self-reported data may introduce bias, though the use of VBLA and triangulation helped mitigate this limitation (Maxwell, 2012).

Results and Discussion

This study revealed several findings based on research questions answered through data coding analysis, including open coding, axial coding, and selective coding. The initial open coding process generated the results presented in Table 1.

Table 1. Categorization of Metacognitive Ability Through Video-Based Lesson Analysis

Research Focused	Data Category
Metacognitive Ability in Analyzing Teaching Skills via VBLA	1. 6% of participants conducted in-depth analysis based on theoretical, deep, and contextual analyses. For example, one participant reflected on a video where a teacher effectively managed group discussions and linked the concepts of the lesson to students' real-world experiences. This analysis demonstrated a clear understanding of how pedagogical strategies can be adapted to different student needs and contexts. 2. 52% performed general analyses, with good but incomplete explanations, neglecting one or more of the eight teaching skills. For instance, one participant noted the teacher's use of questioning techniques, but did not fully address how the questioning technique could be adapted to engage a wider range of students. This type of reflection indicates an awareness of teaching strategies, but a lack of depth in understanding their broader implications. 3. 25% provided basic analyses, ignoring 2-3 of the eight teaching skills. An example of this was a participant who only commented on the teacher's classroom management but neglected to reflect on the teacher's instructional pacing or use of student feedback during the lesson. 4. 8% performed shallow analyses, disregarding most teaching skills. For example, a participant commented on the teacher's use of a projector but did not analyze its effectiveness in helping students understand the lesson. 5. 8% provided very superficial analyses, with no focus on teaching skills (zero analyses).
Metacognitive Ability in Analyzing Strengths, Weaknesses, and Teaching Solutions via VBLA	1. 66% demonstrated sharp analysis focusing on student learning processes, such as participation in discussions, student dominance, and management of student presentations. For example, one participant observed how a teacher's questioning techniques encouraged student participation, while also noting the dominance of one student in the discussion and suggesting strategies to encourage more equal participation. This reflects a deeper level of metacognitive reflection on student engagement. 2. 12% exhibited balanced analysis focusing on both teachers and students, including learning situations, responses, discussion management, and reflective conclusions. An example of this was a participant who discussed how the teacher managed time effectively but also noted that some students struggled with the pace of the lesson, recommending adjustments to accommodate different learning speeds. 3. 19% showed teacher-centered analysis, focused on aspects such as media efficiency, teacher's pace, teaching style, and seating arrangements. One participant analyzed how the teacher's media use (e.g., a PowerPoint presentation) supported the lesson but did not consider how students engaged with the content or how it supported their understanding. 4. 3% performed shallow analyses focused on non-core aspects like ice-breaking activities and explanation duration such as focusing on minor aspects like the length of the lesson or the teacher's tone of voice, without addressing the impact of these factors on student learning.
Metacognitive Ability in Redesigning Lessons Through VBLA	1. 32% were able to redesign lessons effectively based on pedagogical-content knowledge (PCK). For example, one participant redesigned a lesson by incorporating more hands-on activities and visual aids, based on their analysis of how students struggled to grasp the concept through traditional

methods. This demonstrates a strong ability to connect theory with practice.
2. 38% successfully redesigned lessons based on pedagogical flow. One participant adjusted the sequencing of activities to ensure smoother transitions and greater student engagement. For instance, they moved from a direct instruction phase to a collaborative group activity before revisiting the main concepts in a reflection session.
3. 27% developed general lesson designs without making significant improvements. For example, a participant simply reordered existing activities without critically evaluating their effectiveness or considering ways to address students' specific learning needs.
4. 3% produced lesson designs that lacked focus or were highly perceptual.

The following visualizations present the findings of the study regarding the metacognitive abilities of prospective teachers through Video-Based Lesson Analysis (VBLA). The pie charts offer a clearer overview of the distribution of different levels of metacognitive skills observed in the participants. The first chart (Figure 1) illustrates how prospective teachers categorized their metacognitive abilities in analyzing teaching skills, with varying levels of depth, ranging from in-depth to superficial analysis. The second chart (Figure 2) shows how participants evaluated the strengths, weaknesses, and solutions of teaching practices, emphasizing the focus on student learning processes and teacher-student interactions. The third chart (Figure 3) reflects the extent to which prospective teachers were able to redesign lessons effectively, with a focus on pedagogical content knowledge and teaching flow. These visualizations aim to enhance understanding of the data and highlight key trends in the development of reflective and analytical skills in teacher education.

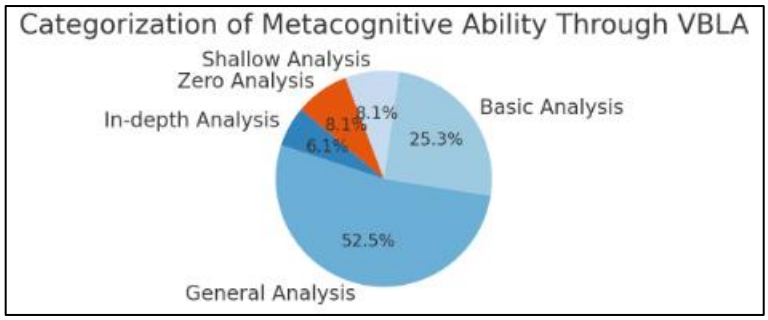

Figure 2. Categorization of Metacognitive Ability through VBLA

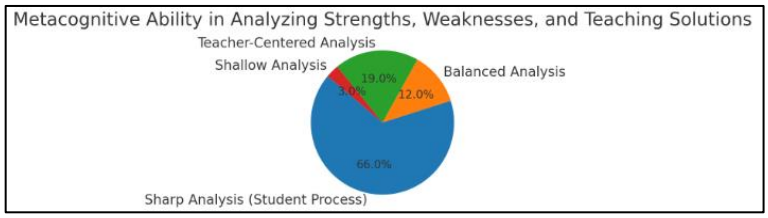

Figure 3. Metacognitive Ability in Analyzing Strengths, Weaknesses, and Teaching Solutions

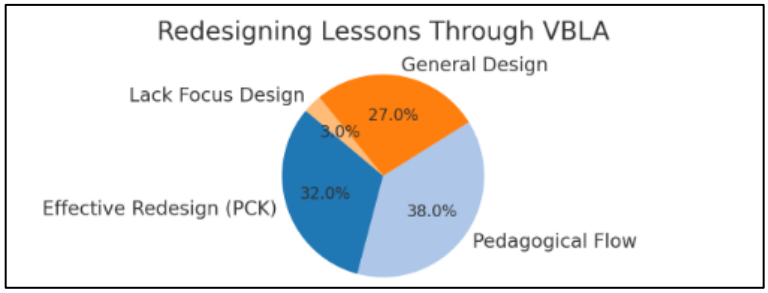

Figure 4. Redesigning Lesson Through VBLA

The second stage, axial coding, revealed relationships between categories generated in open coding. These findings are presented in Table 2.

Table 2. Causes and Effects of Teacher Thinking and Practice from VBLA

Criteria	Category
Focus Phenomenon	The metacognitive abilities of prospective teachers in analyzing teaching skills, analyzing strengths and weaknesses and learning solutions, and redesigning more effective learning designs based on experience in video-based lesson analyses remains suboptimal among prospective teachers.
Causal Conditions	1. Limited practical teaching experience, opportunities to conduct critical analysis of learning, and lack of practice in conducting VBLA. 2. Insufficient mentoring and analytical feedback.. 3. Limited mastery of factual, conceptual, procedural and metacognitive knowledge of prospective teachers in analyzing & designing learning..
The Context Surrounding The Findings	1. Teacher education curricula have not fully integrated video-based analysis effectively and or have not provided adequate resources for the development of these skill. 2. Limited access to technology supporting VBLA, so that the video reference is still not optimal.
Consequences of Findings	1. Suboptimal analytical skills can have an impact on the quality of teaching in the future, because teachers who are less able to analyze and improve the learning process tend to be less effective in teaching. 2. The professional development of prospective teachers who are not accustomed to conducting VBLA may be hampered in ongoing professional development that requires in-depth analysis and reflection on their teaching practice.
Strategies for Action and Intervening Condition	1. Increase training and mentoring from both academics and practitioners focused on VBLA.. 2. Improve access to technology that supports VBLA, such as research by (Roth et al., 2011). 3. Integrate VBLA, TBLA, and lesson study into the elementary school teacher education curriculum, including relevant materials.

The final selective coding aimed to provide a more comprehensive picture and a focal point for the research. The main focus of this study is how prospective elementary teachers develop critical and reflective analytical skills, particularly through metacognitive analysis in the context of video-based lesson analysis as part of an initial lesson study approach.

Table 3. The Key Findings of Teacher Thinking and Practice from Video-Based Lesson Analysis

Competency Indicator Achievement Level	Relevance
Teacher Thinking and Practice (Metacognitive abilities of prospective teachers in analyzing teaching skills): - Only 6% of prospective teachers showed in-depth analysis (theoretical, deep, contextual analyses). - Most (52%) showed good analysis although not in-depth and ignored some teaching skills. - There was a group that showed shallow analysis or even zero analysis.	This shows the need to strengthen critical and in-depth analytical skills from the stage of prospective teacher education.
Sensitivity in Identifying Strengths and Weaknesses also Teaching Solutions: - The majority of prospective teachers (66%) focused on the student learning process and showed a sharp understanding.. - A small portion (12%) combined teacher-oriented and student-oriented analysis and 20% still focused on teacher-centered aspects. - There were 3% who showed a very shallow analysis.	This shows that despite the awareness of the urgency of student-centered learning, there is still a need to guide prospective teachers in deepening student-based analysis and students' learning and thinking processes.
Redesigning Lesson Plans: - 32% of prospective teachers are able to design effective learning with PCK orientation. - 38% design designs with pedagogical flow orientation. - 27% produce general designs without significant improvements.	Emphasizes the need to train prospective teachers in critical and reflective action, not only designing but also improving and adapting learning designs.

Based on the results of this study, it confirms the importance of developing teacher thinking and practice in prospective elementary school teachers through the VBLA approach. This process involves several important steps including 1) improving metacognitive analysis skills towards teaching skills and student learning through critical reflection and video-based analysis, 2) ongoing mentoring from academics and practitioners to ensure consistent progress, and 3) elementary school teacher education curriculum needs to be integrated with practical components such as VBLA, TBLA, and lesson study to ensure that prospective teachers have adequate opportunities to develop these skills.

An important emphasis from the beginning of this metacognitive training emphasizes the ability to reflect on learning. This is because reflection on learning practices is considered a key component of quality teaching and learning. Learning reflection is considered important for reforming teaching so that teachers are able to adjust instructions based on responses (Hourigan & Leavy, 2019). However, meaningful observation and reflection have many perspectives which result in teachers tending to rely on excessive descriptive reflection which lacks criticism, analysis, and evaluation (Hourigan & Leavy, 2019). This indicates that pre-service teachers have difficulty developing appropriate reflective skills because the impact of their preconceptions about good learning is still abstract and difficult to define as is the case in the results of this study. Thus, the strategy of emphasizing learning patterns will be more effective, especially if prospective teacher students are continuously trained in reflective analysis developed by utilizing two lenses, namely the pedagogical content knowledge flow lens and the student thinking lens which greatly helps teachers analyze learning and improve learning practices (Roth et al., 2011). Moreover, if in the analysis method a coding system is carried out to produce quality indicators in teacher education assessment practices with implications for teacher education policies (König et al., 2020).

Video-based lesson analyses can help educators to notice positive examples of a lesson and train their sensitivity to see opportunities for development in redesigning the learning design and implementation (Suh et al., 2021). Video-based lesson analyses in several studies have been proven effective in supporting pre-service teachers' learning about teaching. This means that when pre-service teachers are given the opportunity to observe teaching through video, they will be more reflective and provide a more detailed analysis of practice (Santagata & Angelici, 2010). In addition, through the analysis of lessons recorded in video, pre-

service teachers can learn to focus their attention on student thinking (Santagata & Angelici, 2010). Another benefit is that video cases can help pre-service teachers learn classroom practices according to current recommendations which they rarely get during their fieldwork experiences (Santagata & Angelici, 2010). The use of video-based lesson analyses also contributes to the development of reflective practices that can enable pre-service teachers to have a stronger learning experience during teaching practice (Chikiwa et al., 2019). Authentic classroom videos are also increasingly being used in teacher professional development to help teachers learn and foster productive classroom discourse through dialogic teaching (Chen et al., 2020).

In terms of the ability to redesign learning that is still lacking, this reaffirms that some prospective teachers realize the importance of planning lessons but they still find it difficult to develop the lesson plan. The causal factor for this is that prospective teachers do not have enough time to introduce students so that they can consider their learning levels, needs and expectations to plan learning (Sahin-Taskin, 2017). Thus, this is certainly a focus of attention in the learning of prospective elementary school teachers in the future where consideration of learning levels, relevance of student needs and expectations and renewal of their views on learning can help develop their planning skills. Moreover, in the reconceptualization of educators, future teachers need to become competent craftsmen who refer to the concept of professional teachers, which means that teachers must become reflective professionals or be configured as someone who thinks and acts creatively, flexibly and wisely based on their experiences of what happens in their classrooms (Nugraha, 2024).

Based on the discussion, it can be highlighted that the important point is that teacher professionalism which includes various aspects of performance such as lesson planning based on students' prior knowledge and post-teaching reflection which are important for pre-service teacher education in the future can be accommodated by lesson study which provides a practical framework for prospective teachers to engage in learning from their teaching experiences before entering their careers. In Lesson Study, the depth of participants in analyzing learning that is oriented towards specific students will contribute more to the learning process at the individual level than the depth of participants who analyze groups of students (Vrikki et al., 2017). This means that lesson study participants who talk about specific students contribute to how many lesson study participants are involved in the descriptive process. On the other hand, if lesson study participants reveal more about groups of students or students in a classical way, then each participant is more involved in interpretive learning which is assumed to be able to abstract general principles from concrete cases and is more often associated with pedagogical thinking about groups of students. Thus, prospective teachers need to be introduced to more lesson study practices because classroom-based learning and learning studies can help train innovative and learning-sensitive professionals who are able to respond to current educational demands (Angelini & Álvarez, 2018).

However, integrating lesson study into pre-service teacher education can pose challenges due to logistical limitations and the limited experience of pre-service teachers themselves. Whereas lesson study has contributed not only to enhancing student achievement but also advancing educators' adaptability and capacity for adjustment (Kundariati et al., 2024). Therefore, the focus of addressing this issue can be done by combining clinical interviews to increase pre-service teacher awareness of children's or students' thinking, providing support or facilities for learning planning and encouraging active participation in subsequent lesson study discussions. In addition, future implications that may be carried out are to connect lesson study intervention method courses that have urgency in planting the foundation of learning trajectories and introducing expertise (Lee, 2019).

Conclusion

This study highlights the important role of developing teacher thinking and practice in preservice elementary teachers through Video-Based Lesson Analysis (VBLA). Key elements in this process include enhancing metacognitive analysis of teaching skills and student learning through a reflective video-based approach, providing ongoing academic and practical guidance, and integrating practical components such as VBLA, TBLA, and lesson study into the elementary teacher education curriculum to ensure ample opportunities for skill development. Appropriate approaches to preservice elementary teachers can develop the metacognitive skills needed to become effective and innovative teachers. The reflection aspect that is key in this study is critical to quality teaching, although preservice teachers often struggle with in-depth reflection, tending toward descriptive analysis rather than evaluative analysis. Therefore, training that focuses on reflective analysis through pedagogical content knowledge and student thinking perspectives is recommended to deepen understanding. However, this requires planned and sustained intervention in teacher education programs. Integrating lesson study into teacher training offers a valuable framework for

reflective growth despite logistical challenges. Addressing these barriers through clinical interviews, planning support, and reflective discussions can prepare preservice teachers to meet today's educational demands with adaptability and reflective professionalism. This study has several limitations such as less in-depth and specific data analysis, but it is expected to contribute significantly to the understanding of how preservice teachers can be trained to be more reflective, analytical, and responsive to students' needs through a lesson study approach that begins with video-based lesson analyses. Thus, the VBLA approach has great potential to be implemented in teacher training programs and to improve metacognitive abilities and other skills.

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