



Technology-Based Video Analysis for Evaluating Pedagogical Competence of Prospective Elementary School Teachers Using Gagné's Conditions of Learning

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ABSTRACT

Purpose of the study: This study aims to examine the use of digital learning videos as a technology-based assessment tool to evaluate the pedagogical competence of prospective elementary school teachers using Gagné's Conditions of Learning framework.

Methodology: A qualitative descriptive method supported by simple quantitative analysis was employed by analyzing 20 digitally recorded learning videos from a Teacher Professional Education program. A structured video analysis rubric was applied as a form of technology-mediated observation to identify pedagogical indicators, including responding, reinforcement, retrieval, and generalization.

Main Findings: The findings indicate that digital video analysis effectively captures pedagogical practices, with responding (43.5%) and reinforcement (29.0%) dominating classroom interactions, while retrieval (14.5%) and generalization (13.0%) appear less frequently. The use of video as a digital medium enables detailed, repeatable, and objective observation of instructional practices across different teaching contexts.

Novelty/Originality of this study: This study contributes to educational technology research by integrating classical learning theory with video-based digital assessment, offering a scalable and evidence-based approach for evaluating teacher pedagogical competence in professional education programs.

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1. INTRODUCTION

The rapid development of educational technology has transformed how teaching practices are observed, evaluated, and improved [1]-[3]. Digital learning media, particularly instructional videos, have become an essential component in teacher education programs as they allow for systematic, repeatable, and evidence-based analysis of classroom practices [4]-[6]. Unlike conventional observation methods, video-based analysis enables detailed examination of pedagogical actions, interaction patterns, and instructional strategies supported by digital documentation.

Pedagogical competence is the main requirement for teachers to create effective learning, especially at the elementary school level which is the foundation for students' academic development [7]-[9]. In the Indonesian context, the Teacher Professional Education program is present as a strategic effort to prepare professional teachers with pedagogical skills that meet national standards [10]-[12]. However, the pedagogical quality of teachers in the

Teacher Professional Education program still shows significant variation, both in terms of learning planning and implementation [13]-[15]. This situation poses challenges in ensuring that graduates of the Teacher Professional Education program are truly capable of implementing quality learning. This situation necessitates the need for objective evaluation instruments to measure the pedagogical competence of teachers in the Elementary School Teacher Professional Education program.

The Conditions of Learning theory introduced by Robert M. Gagné provides a comprehensive framework for understanding and evaluating the learning process [16]-[18]. This framework focuses on specific conditions that must be met for optimal learning to occur. In practice, this theory emphasizes the teacher's role in creating a learning environment that enables students to achieve the desired outcomes [19]-[21]. Thus, this theory can be used as a reference to assess the extent to which teachers in the Elementary School Teacher Professional Education program are able to implement effective learning strategies. The relevance of Gagné's theory becomes clearer when used as a pedagogical analysis instrument in the context of teacher professional education [22]-[24].

The Condition of Learning framework consists of four main indicators, namely responding, reinforcement, retrieval, and generalization [25]-[27]. Responding refers to the teacher's ability to facilitate students' active responses in the learning process [28]-[30]. Reinforcement emphasizes the importance of providing reinforcement to strengthen positive behavior demonstrated by students [31]-[33]. Retrieval is related to the teacher's ability to help students remember and reuse knowledge that has been acquired [34]-[36]. Meanwhile, generalization describes students' success in applying knowledge to new situations, which is an important indicator of learning effectiveness.

Teacher pedagogical competencies are clearly defined in Indonesia's national education standards and align with international competency frameworks. These competencies encompass the ability to design, implement, and evaluate learning that is appropriate to student characteristics [37]-[39]. From a global perspective, pedagogical competence is seen as an integral part of teacher professional standards which emphasize the importance of mastery of pedagogy in supporting the quality of learning [40]-[42]. Improving teachers' pedagogical competence is also a priority in achieving the Sustainable Development Goals (SDGs), especially in the target of quality education [43]-[45]. Therefore, research that focuses on teachers' pedagogical competence has an urgency that is not only local but also global.

The use of video analysis in education is gaining increasing attention because it can provide detailed insights into teaching practices. Through video recordings, teachers' teaching behavior can be analyzed more accurately than through direct observation [46]-[48]. In many developed countries, this method has been widely used in teacher training to improve the quality of teaching. Video analysis allows for visual evidence-based evaluation that can serve as a basis for teacher reflection [49]-[51]. Thus, the application of video analysis in this study has a strong foundation both from a methodological and practical perspective.

Although Conditions of Learning is widely used in educational studies, its application in video analysis to assess the pedagogical competence of teachers in Elementary School Teacher Professional Education programs is still rare. Most previous research has emphasized the effectiveness of Gagné's theory in learning design [23], [52], [53], not as a tool for evaluating pedagogical competence. On the other hand, research on the use of video analysis in Indonesia is still limited, particularly in the context of the Teacher Professional Education program. This indicates a wide scope for exploration. Identifying this gap provides an important basis for future research.

The novelty of this research lies in the integration of the Conditions of Learning theory with video analysis methods to assess the pedagogical competence of teachers in the Elementary School Teacher Professional Education program. This combination is not widely available in the literature, offering a new, more applicable and objective approach. This research is expected to yield relevant findings for both academic purposes and teacher training practice. Furthermore, the use of Gagné's framework in the context of professional education in Indonesia can contribute to the development of a more systematic teacher evaluation model. This novelty strengthens the research's position as a valuable study in the field of education.

The urgency of this research is driven by the need to improve the quality of Elementary School Teacher Professional Education program graduates to meet the expected pedagogical competence standards. Video analysis-based evaluation using the Conditions of Learning framework offers an innovative alternative for assessing teacher abilities more objectively. The primary objective of this study is to identify and assess the pedagogical competencies of teachers in the Elementary School Teacher Professional Education program through the analysis of instructional videos. Therefore, the results are expected to make a tangible contribution to improving the quality of teacher education in Indonesia.

2. RESEARCH METHOD

2.1. Research Design

This study uses a qualitative descriptive approach supported by simple quantitative analysis [54]-[56], utilizing digital learning video analysis as a technology-based assessment approach. This design was selected to enable systematic observation of pedagogical practices through technology-mediated classroom documentation,

allowing repeated viewing, precise coding, and objective interpretation of instructional behaviors. The analysis focused on identifying pedagogical indicators embedded in recorded learning activities, positioning digital video as both a research instrument and an educational technology tool. Qualitative analysis was used to interpret the meaning of teachers' practices, while quantitative analysis was used as a complement [57]-[59]. Thus, research results can have a balanced depth of interpretation and data accuracy.

2.2. Research Subject

The research subjects were 20 teachers participating in the Elementary School Teacher Professional Education program who were selected using purposive sampling techniques [60]-[62]. Each participant submitted one digitally recorded learning video, which served as the primary data source. The use of digital video recordings ensured consistency in observation and enabled cross-contextual analysis of teaching practices regardless of time and location, highlighting the scalability of video-based assessment in teacher education.

2.3. Data Collection

Data were collected using a video-based pedagogical analysis rubric developed from Gagné's Conditions of Learning theory. The rubric functioned as a technology-supported observation instrument to systematically code instructional behaviors captured in digital learning videos. Four core indicators were assessed: responding, reinforcement, retrieval, and generalization. Prior to full implementation, the rubric was piloted using five learning videos to ensure clarity and content validity, reinforcing the reliability of video-mediated assessment procedures. This process ensured the validity of the instrument before being widely applied to the entire sample [63]-[65]. The instrument grid in this study can be seen in the following table:

Table 1. Research Instrument Grid

Pedagogical Competence Aspects	Observation Indicators	Sub-Indicators
Responding (Teacher's Response to Students)	The teacher provides students with opportunities to respond to questions/assignments	<ul style="list-style-type: none"> • Number of students given the opportunity to answer • Variation of question types
Reinforcement (Strengthening)	The teacher provides feedback or recognition for student responses	<ul style="list-style-type: none"> • Frequency of giving verbal/non-verbal reinforcement • Quality of reinforcement relevance
Retrieval (Linking Material to Prior Knowledge)	The teacher encourages students to recall previous material	<ul style="list-style-type: none"> • Number of recall activities • Clarity of the relationship between old and new material
Generalization (Application of Concepts to New Contexts)	The teacher guides students in applying concepts in real-life situations	<ul style="list-style-type: none"> • Frequency of contextual examples • Suitability of application with material
General Pedagogical Competence (National Standards)	The teacher's ability to plan, implement, and evaluate learning	<ul style="list-style-type: none"> • Structure of learning activities • Use of media and learning strategies

2.4. Data Analysis Techniques

The data analysis process involved systematic digital video review, where each learning video was repeatedly examined using the predefined rubric. The coding results were then categorized thematically to identify patterns in the application of the Conditions of Learning [66], [67]. Pedagogical actions were coded and categorized according to the four indicators of the Conditions of Learning framework. To complement qualitative interpretation, simple frequency analysis was conducted to quantify the occurrence of each indicator. Inter-rater reliability was strengthened by involving two independent assessors who analyzed a subset of videos using the same digital observation protocol, ensuring consistency and objectivity in technology-based analysis.

2.5. Research Procedures

The research procedures were implemented through sequential technology-integrated stages. First, a digital video analysis rubric was developed and validated with educational experts. Second, participants were instructed to record and submit their classroom teaching using digital recording devices. Third, assessors

underwent coding training to standardize video-based observation techniques. Fourth, all submitted learning videos were analyzed using the rubric through a technology-mediated review process. Finally, the analyzed data were synthesized to draw conclusions regarding the effectiveness of video-based assessment in evaluating pedagogical competence. The research procedure can be seen in the following diagram:

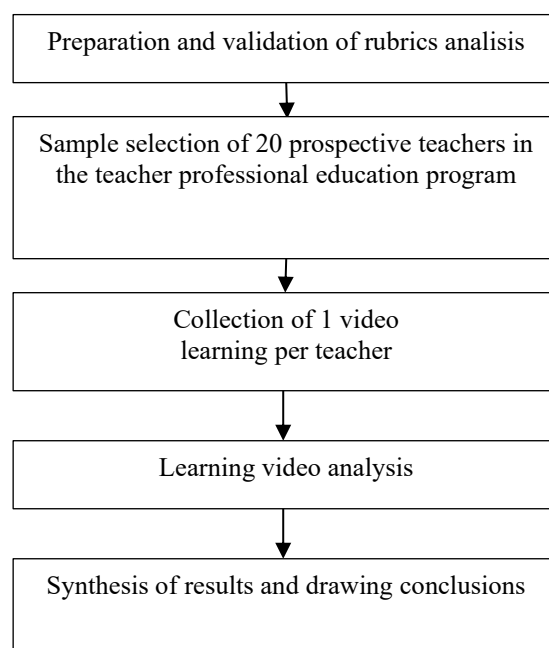


Figure 1. Research Procedures

3. RESULTS AND DISCUSSION

3.1. General Description of Data

This study analyzed 20 instructional videos collected from elementary school Teacher Professional Education program. Each video lasted between 30 and 45 minutes, with a total observation time of approximately 12 hours. The participating teachers came from various regions in Jambi. Their teaching experience also varied, ranging from two years to more. This variation provided an opportunity to assess the application of the Conditions of Learning theory in different contexts.

In general, the quality of the collected videos was good enough for analysis. Most videos were recorded with simple devices, such as cell phone cameras, but still allowed for observation of teacher-student interactions. Some videos experienced technical limitations, such as unclear sound or camera angles that did not fully capture classroom interactions. Nevertheless, the data could still be coded using a prepared rubric.

Furthermore, initial analysis revealed a tendency for teachers to follow the formal learning process design, although their practices were not always consistent. More experienced teachers appeared more flexible in managing their classes and adapting strategies to students' needs. In contrast, novice teachers tended to be rigid, focused on delivering material, and often missed opportunities to encourage students to think more deeply. This is an early indication that teaching experience plays an important role in the quality of pedagogical implementation.

These findings are in line with the Conditions of Learning theory which emphasizes the importance of learning stages such as responding, reinforcement, retrieval, and generalization to achieve an effective learning process [68], [69]. Experienced teachers tend to be better able to balance these four conditions, for example by providing appropriate reinforcement and encouraging generalization through contextual examples. Conversely, novice teachers who are still inflexible in their teaching practices often focus solely on the responding aspect without following up with reinforcement or linking to previous material (retrieval). This strengthens the relevance of Gagné's theory in explaining differences in pedagogical quality among teachers and demonstrates that teaching experience can influence the extent to which teachers are able to implement the learning conditions comprehensively [70]-[72].

3.2. Distribution of Condition of Learning Indicators

Coding was conducted based on four main indicators: responding, reinforcement, retrieval, and generalization. The analysis results showed that responding was the most dominant indicator, followed by reinforcement, while retrieval and generalization were used relatively rarely. The average occurrences per video

were: responding (12 times), reinforcement (8 times), retrieval (4 times), and generalization (2 times). This indicates a tendency for teachers to place more emphasis on student responses and reinforcement, compared to recall strategies or connecting concepts to new situations.

Table 2. Frequency of Indicator Appearance in 20 Videos

Indicators (Condition of Learning)	Total Appearances	Average per Video	Percentage (%)
Responding	240	12	43.5%
Reinforcement	160	8	29.0%
Retrieval	80	4	14.5%
Generalization	40	2	13.0%
Total	520	26	100%

Quantitative analysis was conducted on four main indicators: responding, reinforcement, retrieval, and generalization. The coding results revealed a total of 520 occurrences of these indicators in 20 videos. Of these, responding appeared 240 times (43.5%), making it the most dominant indicator. Reinforcement occurred 160 times (29.0%), retrieval 80 times (14.5%), and generalization 40 times (13.0%). These data indicate that teachers in the Teacher Professional Education program focus primarily on basic interactions such as questions and reinforcement, but less on in-depth material.

The difference in frequency between indicators indicates an imbalance in the application of Gagné's theory. A high response indicator indicates that teachers actively engage students in providing answers, but the majority of questions are factual and do not encourage critical thinking. Reinforcement generally takes the form of simple praise, such as "good" or "correct," which serves to maintain student motivation but is rarely used to guide further understanding. Meanwhile, low retrieval and generalization performance demonstrate teachers' weak ability to build connections between concepts and help students relate material to real-world contexts.

These findings indicate that although teachers in the Teacher Professional Education program are capable of creating an interactive classroom environment, the quality of these interactions remains limited. Teachers have not fully utilized opportunities to strengthen students' long-term memory through retrieval or expand students' understanding through generalization. This poses a significant challenge for the Teacher Professional Education program in ensuring more comprehensive pedagogical competencies.

The results of the distribution of these indicators are in line with Gagné's Conditions of Learning theoretical framework, which emphasizes that effective learning does not stop at student responses and simple reinforcement, but also requires a retrieval and generalization process to deepen and broaden understanding [68]-[70]. The dominance of responding and reinforcement indicates that Elementary School Teacher Professional Education teachers tend to focus on surface interactions, but have not fully integrated strategies that build connections between old and new knowledge, or the application of concepts to real-world contexts. In other words, the observed practices only partially meet Gagné's ideal learning conditions. This indicates the need for improvements in Teacher Professional Education training, particularly to strengthen the retrieval and generalization aspects, so that teachers' pedagogical competence can develop more comprehensively in accordance with modern learning theory.

3.3. Variation Patterns Between Teachers

Teaching experience has been shown to be a significant factor in variations in the implementation of Conditions of Learning. Teachers with more than 10 years of experience typically have more advanced skills in integrating learning strategies. In contrast, novice teachers tend to focus on basic interactions such as direct questions (responding) and simple reinforcement. To further illustrate these differences, Table 3 presents the distribution of Conditions of Learning indicators by category of experienced and novice teachers.

Table 3. Distribution of Condition of Learning Indicators Based on Teaching Experience

Indicators (Condition of Learning)	Experienced Teacher (>5 years, n=8)	Percentage (%)	Beginner Teachers (<5 years, n=12)	Percentage (%)
Responding	90	37.5%	150	47.6%
Reinforcement	70	29.2%	90	28.6%
Retrieval	50	20.8%	30	9.5%
Generalization	30	12.5%	10	3.2%
Total	240	100%	280	100%

Table 3 shows significant differences between experienced and novice teachers in implementing the Conditions of Learning theory. Experienced teachers tended to have a more balanced use of the four indicators, with a higher proportion of retrieval and generalization (20.8% and 12.5%). Conversely, novice teachers were

more dominant in responding (47.6%) and reinforcement (28.6%), while retrieval and generalization were relatively minimal. This finding confirms that teaching experience contributes to a richer and deeper variety of pedagogical strategies.

In-depth analysis revealed quite clear variations between teachers, especially when viewed by teaching experience. Teachers with more than five years of experience tended to display a more balanced distribution of indicators. They not only emphasized responding and reinforcement but also more frequently integrated retrieval and generalization into the learning process. For example, experienced teachers often asked students to recall last week's lesson before starting new material.

In contrast, novice teachers with less than five years of experience more often focused on only two main indicators: responding and reinforcement. They tended to ask students for short answers and provide reinforcement in the form of praise without further explanation. Practices like this make learning more one-way and oriented toward immediate results, rather than deep thinking. This situation indicates the need for training that emphasizes higher-level learning strategies.

Differences in pedagogical style are also evident in how teachers manage their classes. Experienced teachers are more flexible in shifting strategies if students experience difficulties, for example by providing additional examples or changing delivery methods. Novice teachers, on the other hand, tend to stick to the designed learning scenario without improvising. This variation reinforces the hypothesis that pedagogical competence is influenced not only by formal training but also by accumulated practical experience.

These differences in patterns of variation among teachers further emphasize the relevance of Gagné's Conditions of Learning theory, which emphasizes that effective learning requires a balanced combination of responding, reinforcement, retrieval, and generalization. Experienced teachers appear better able to orchestrate these four conditions, so that learning not only encourages student engagement but also strengthens memory and connects knowledge to new contexts. Meanwhile, novice teachers who focus more on responding and reinforcement tend to be less effective in building conceptual connections and real-world applications. This shows that practical experience is a key factor that enables teachers to internalize Gagné's theory more fully in classroom practice, while also implying the need for training strategies that place more emphasis on mastering advanced learning conditions [76]-[78].

3.4. Differences in School Context

In addition to experience, the school context also plays a role in influencing variations in teacher learning strategies. Teachers in urban schools have broader access to learning resources and tend to relate material to real-world phenomena in their surroundings. In contrast, teachers in rural schools generally emphasize simple reinforcement to maintain student engagement. The distribution of Conditions of Learning indicators across the two school contexts is presented in Table 4.

Table 4. Distribution of Condition of Learning Indicators Based on School Context

Indicators (Condition of Learning)	Urban Teachers (n=12)	Percentage (%)	Rural Teachers (n=8)	Percentage (%)
Responding	140	41.2%	100	47.6%
Reinforcement	90	26.5%	70	33.3%
Retrieval	60	17.6%	20	9.5%
Generalization	50	14.7%	5	2.4%
Total	340	100%	195	100%

Table 3 shows that teachers in urban schools used retrieval (17.6%) and generalization (14.7%) indicators more frequently than teachers in rural schools (9.5% and 2.4%). Urban teachers also used more varied methods in linking learning materials to real-life contexts, such as digital technology or urban environmental issues. Conversely, rural teachers emphasized reinforcement (33.3%), primarily in the form of simple verbal reinforcement. However, both groups showed a dominance of the responding indicator, although the quality of urban teachers' questions varied more than that of rural teachers. This indicates the influence of socioeconomic context on variations in teachers' pedagogical strategies.

In addition to experience, school context also influences teachers' pedagogical practices. Teachers in urban schools more frequently demonstrated generalization indicators, for example, linking mathematics material to the use of electronic money or traffic phenomena. Teachers in rural schools tended to emphasize reinforcement, primarily through simple verbal reinforcement, without extending the material to real-life contexts. This suggests that access to resources and socioeconomic context can influence the quality of the application of the Conditions of Learning theory.

Despite these differences, both groups of teachers demonstrated a dominance of the responding indicator. Both urban and rural teachers actively ask questions, although the quality of the questions varies. Urban teachers' questions tend to be more varied, including open-ended questions, while rural teachers tend to ask more closed-

ended questions with short answers. This variation demonstrates the differences in how teachers facilitate student engagement according to their respective contexts.

This finding underscores the importance of adapting Teacher Professional Education programs to kebutuhan guru di lingkungan yang berbeda [73]-[75]. Teachers in urban areas can focus more on developing retrieval strategies, while teachers in rural areas need to strengthen their generalization skills. With a differentiated approach tailored to the context, pedagogical competence can be developed more effectively.

3.5. Qualitative Findings from the Video

In addition to quantitative analysis, qualitative observations of video clips provided a more detailed picture of teachers' pedagogical practices. In the responding category, the majority of teachers only asked factual answers, such as "What is the sum of $3 + 4$?", without encouraging students to explain their thinking processes. Some experienced teachers were seen using open-ended questions that stimulated discussion, but this was still limited. This situation indicates that questioning skills remain a challenge for most teachers in the Teacher Professional Education program.

In terms of reinforcement, teachers generally used simple verbal reinforcement. Only a few teachers utilized elaborative reinforcement, such as providing additional explanations or linking students' answers to other concepts. This limited reinforcement practice made classroom interactions monotonous and did not motivate students to think more broadly. This indicates the need for teacher training to use more varied reinforcement.

The retrieval and generalization indicators also showed similar weaknesses. Retrieval often consisted of rote repetition, such as asking back definitions that had already been taught. Generalization, the weakest indicator, was rarely used explicitly. Only a few teachers connected the material to everyday life, for example, linking the concept of fractions to buying and selling in the market. The lack of generalization practice indicates that teachers still struggle to encourage students to apply knowledge outside the classroom context.

3.6. Implications for Educational Technology

From an educational technology perspective, the findings of this study demonstrate that video-based analysis functions as an effective technology-mediated tool for evaluating pedagogical competence in teacher education programs. Digital learning videos enable systematic, repeatable, and evidence-based observation of instructional practices, which cannot be fully achieved through conventional in-class observations or self-report instruments [82], [83]. The ability to pause, replay, and code classroom interactions positions video as a powerful medium for pedagogical analytics and professional assessment.

Furthermore, the use of digital video as an assessment medium supports reflective learning and continuous professional development. Prospective teachers can revisit recorded instructional sessions to identify strengths and weaknesses in their pedagogical practices, particularly in the application of responding, reinforcement, retrieval, and generalization strategies [78]-[80]. This aligns with current trends in educational technology that emphasize technology-enhanced reflection, where digital media facilitates deeper self-evaluation and instructional improvement.

In addition, video-based pedagogical assessment offers significant advantages in terms of scalability and flexibility [87]-[89]. Learning videos can be collected and analyzed asynchronously across diverse geographic contexts, making this approach particularly relevant for large-scale Teacher Professional Education programs [90]-[92]. From a technological standpoint, this approach reduces dependency on real-time classroom supervision while maintaining assessment accuracy and transparency.

The findings also indicate that video-based assessment can serve as a foundation for data-informed instructional improvement. Frequency data generated from video coding provide concrete evidence of pedagogical patterns, enabling teacher educators to identify dominant and underdeveloped instructional strategies. This supports the integration of learning analytics principles into teacher education, where digital data from instructional videos are used to guide targeted training interventions.

Overall, the integration of Gagné's Conditions of Learning framework with digital video analysis represents a meaningful convergence of pedagogical theory and educational technology. This hybrid approach extends the application of classical learning theory into a technology-enhanced evaluation context, reinforcing the role of digital media not only as instructional support but also as a core component of teacher competency assessment systems.

Teacher pedagogical competence is a fundamental dimension of education, both at the national and global levels. Learning effectiveness is largely determined by teachers' ability to design, implement, and evaluate learning reflectively [85]-[87]. In the context of primary education, teachers are required not only to deliver material but also to create a learning environment that facilitates active student engagement. This study, by adopting the Conditions of Learning framework, places the analysis of teacher competencies within a measurable and comparable framework with similar global studies.

The application of the Conditions of Learning theory to the practice of Teacher Professional Education programs also emphasizes the importance of a theoretical foundation in teacher education. This theory, originally developed by Robert Gagné, provides a foundation for understanding how the learning process can be optimized through specific strategies, such as responding, reinforcement, retrieval, and generalization. Previous international

studies [88]-[90] has shown that a clear theoretical framework helps prospective teachers develop more systematic instructional practices. Thus, this research extends the use of classical theory to the context of modern teacher training.

Furthermore, the use of video analysis as a research instrument has significant global resonance. Video allows researchers to capture nuances of classroom interactions that are not always reflected in conventional instruments such as questionnaires or interviews. A study in the United States, for example, found that video analysis helped teachers identify implicit bias in their interactions with students. [91]-[93]. In Europe, videos are also being used to support cross-country lesson studies aimed at enhancing collective reflection among teachers. Therefore, this research is not only locally relevant but also aligns with global trends in leveraging digital technology to enhance teacher professionalism.

The socio-economic context in which teachers teach is also an important dimension in international discourse. Research in developing countries shows that resource constraints often hinder the implementation of more complex learning strategies [94]-[96]. This aligns with the findings of this study, where teachers in rural schools tend to rely more on simple reinforcement. Meanwhile, teachers in urban areas with better access to technology and learning resources more frequently use retrieval and generalization [97]-[99]. This discussion demonstrates that variations in local contexts have global implications, particularly in understanding disparities in education quality across regions.

In terms of novelty, this study places the classic Conditions of Learning theory within a modern video analysis framework to identify the pedagogical competencies of teachers in the Teacher Professional Education program. Although Gagné's theory has been widely used in curriculum development [108]-[110], its integration with a video-based technology approach in the context of the Elementary School Teacher Professional Education program in Indonesia remains rarely researched. This represents a novel contribution to the literature, providing a hybrid model that combines pedagogical theory with modern observational technology.

The impact of this research lies in its ability to provide practical insights for Teacher Professional Education programs and teacher education institutions. By identifying which indicators are dominant and which are weak, training programs can better focus on aspects that need strengthening, such as retrieval and generalization strategies. Furthermore, this research can inspire the development of video-based evaluation instruments that can be widely used to improve the accountability and quality of teacher education.

However, this study has several limitations. First, the relatively small sample size (20 teachers) means the results cannot be broadly generalized to all participants in the Teacher Professional Education program in Indonesia. Second, the analysis focused only on the four main indicators of Gagné's theory, potentially overlooking other aspects of pedagogical competence not covered by the framework. Third, the limited socio-economic context of the schools observed (urban and rural) does not fully represent the diversity of educational conditions in Indonesia. Therefore, further research is needed to involve larger and more diverse samples and integrate additional pedagogical indicators to enrich the findings.

4. CONCLUSION

The analysis results indicate that teachers in the Elementary School Teacher Professional Education program have been able to demonstrate pedagogical competencies according to national standards, particularly in lesson planning, classroom management, and educational interactions with students. Learning videos have proven to be an effective instrument for objectively assessing pedagogical practices, as they provide a concrete depiction of the application of teaching theories and strategies in the field. These findings confirm that video-based evaluation can be a relevant approach in measuring the pedagogical quality of prospective teachers, while simultaneously supporting the continuous improvement of the quality of the Elementary School Teacher Professional Education program. Thus, this study contributes to strengthening the teacher competency evaluation system that is aligned with developments in educational practices at the national and global levels. As a recommendation, further research can expand the teacher sample and integrate quantitative and qualitative analyses to obtain a more comprehensive picture of teacher pedagogical competency.

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USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the preparation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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