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DIFFERENTIAL EFFECTS OF PROBLEM-BASED LEARNING AND ANIMATED VIDEOS ON AFFECTIVE AND COGNITIVE OUTCOMES IN MULTI-GRADE ELEMENTARY CLASSROOMS

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Abstract

This study aims to analyze the differential effects of Problem-Based Learning (PBL) and animated videos on students' affective and cognitive outcomes in multi-grade elementary classrooms. This research employed a quantitative approach with an explanatory design involving 53 students selected through saturated sampling. Affective data were collected using a Likert-scale questionnaire, while cognitive data were measured through achievement tests. Data were analyzed using multivariate analysis of variance (MANOVA) and multiple linear regression at a significance level of 0.05. The results revealed a significant simultaneous effect of PBL and animated videos on affective and cognitive outcomes (Wilks' Lambda = 0.742, $F = 8.965$, $p < 0.001$, $\eta^2 = 0.26$). Partial analysis showed that PBL had a stronger effect on cognitive outcomes ($\beta = 0.602$, $p = 0.001$, $R^2 = 0.36$), whereas animated videos were more influential in improving affective outcomes ($\beta = 0.641$, $p < 0.001$, $R^2 = 0.41$). These findings indicate a clear differential effect between instructional models and media. This study highlights the importance of strategically integrating PBL and animated videos to achieve balanced learning outcomes. The findings contribute empirically to the development of evidence-based instructional strategies in multi-grade elementary classrooms.

Keywords: Problem-Based Learning, Animated Video, Affective Domain, Cognitive Domain, Multi-grade Classroom, Elementary Education, MANOVA

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INTRODUCTION | مقدمة

Learning in elementary education is not solely oriented toward cognitive achievement but also emphasizes the development of students' affective domains. According to Sari et al. (2025) explain that cognitive domain relates to students' ability to think, understand concepts, and solve problems logically, while the affective domain encompasses attitudes, interests, motivation, and emotional engagement in the learning process. A balance between these domains is essential, as imbalances may lead to low participation and suboptimal learning outcomes (Akçayır & Akçayır, 2018).

The complexity of achieving this balance becomes more evident in multi-grade classrooms, where teachers are required to manage students from different grade levels within the same instructional setting. According to Hasanah et al. (2025) explain that condition this demands flexible, efficient, and adaptive instructional strategies. Limited instructional time and divided teacher attention often hinder optimal learning management, highlighting the need for innovative learning models and media that can address these challenges effectively (Taib &

Rahman, 2021).

Problem-Based Learning (PBL) is widely recognized as an instructional model that promotes active learning through contextual problem solving. It positions students as active agents who construct knowledge through investigation, collaboration, and reflection. Previous studies have shown that PBL enhances higher-order thinking skills and improves conceptual understanding by engaging students in authentic learning experiences (Putri et al., 2024). From a constructivist perspective, as proposed by Jean Piaget, learning occurs through active interaction with the environment. This is particularly relevant for elementary students, who are in the concrete operational stage and benefit from experiential learning processes (Lestari et al., 2023).

In addition to instructional models, learning media also play a crucial role in supporting effective learning. According to Khasanah et al. (2025) explain that animated videos have emerged as an engaging medium that integrates visual, auditory, and motion elements to facilitate understanding, particularly for abstract concepts. According to multimedia learning theory proposed by Richard Mayer, the integration of visual and verbal information enhances comprehension by optimizing cognitive processing. Well-designed animated videos can reduce cognitive load and increase students' attention and motivation (Prasetyo & Siregar, 2020).

Despite the growing body of research on PBL and animated videos, most studies have been conducted in single-grade classrooms and tend to focus on either cognitive or affective outcomes separately. Empirical studies examining the differential effects of instructional models and media on both domains simultaneously, particularly in multi-grade elementary classrooms, remain limited. This gap indicates the need for a more comprehensive analysis that captures the distinct contributions of each approach.

Furthermore, evaluating learning effectiveness based on a single outcome variable often results in a partial understanding. The cognitive and affective domains are interrelated and should be examined concurrently to obtain a holistic picture of learning outcomes. A multivariate approach allows for the simultaneous analysis of these domains, providing more robust and comprehensive findings Nasution et al. (2025).

Initial observations in multi-grade classrooms indicate an imbalance between students' affective engagement and cognitive achievement. Some students demonstrate high enthusiasm but low academic performance, while others achieve high cognitive scores with minimal emotional involvement. These conditions highlight the need for instructional strategies that can balance both domains effectively.

Based on these considerations, this study aims to examine the differential effects of Problem-Based Learning and animated videos on students' affective and cognitive outcomes in multi-grade elementary classrooms. Specifically, this study analyzes both the simultaneous and partial effects of the two instructional approaches and identifies which approach is more dominant in each domain. The findings are expected to contribute to the development of evidence-based instructional strategies that are both effective and contextually relevant.

METHOD | منهج

This study employed a quantitative approach with an explanatory research design to analyze the differential effects of Problem-Based Learning (PBL) and animated videos on students' affective and cognitive outcomes in multi-grade elementary classrooms. A quantitative approach was selected to objectively examine the relationships and causal effects between

variables using statistical analysis. The explanatory design enables the analysis of both simultaneous and partial effects of independent variables on dependent variables.

The study was conducted during the even semester of the 2025/2026 academic year in a multi-grade elementary classroom setting, where two grade levels are taught simultaneously in the same learning environment. The population consisted of all students in the multi-grade classroom, totaling 53 students. A saturated sampling technique was applied, in which the entire population was included as research participants due to the relatively small sample size. The participants represented heterogeneous academic abilities, reflecting authentic classroom conditions.

This study involved two independent variables and two dependent variables. The independent variables were Problem-Based Learning (X_1) and animated video (X_2). The dependent variables were students' affective outcomes (Y_1), measured through indicators of attention, interest, engagement, and positive attitudes, and cognitive outcomes (Y_2), measured using learning achievement tests.

The implementation of PBL followed structured stages, including problem orientation, student organization, group investigation, presentation of results, and reflection. Animated videos were used as instructional stimuli to present learning materials through visual and auditory elements. The treatment was conducted over several instructional sessions based on a standardized lesson plan to ensure consistency. To maintain treatment fidelity, implementation guidelines and observation checklists were used to monitor adherence to the planned instructional procedures.

The affective domain was measured using a Likert-scale questionnaire with five response categories. Instrument validity was tested using Pearson product-moment correlation, while reliability was assessed using Cronbach's Alpha coefficient. The cognitive domain was measured using multiple-choice tests developed based on learning competency indicators.

Data collection was conducted after the completion of the instructional treatment. Affective data were collected through questionnaires, while cognitive data were obtained through achievement tests. All collected data were analyzed using SPSS version 27.

Data analysis employed multivariate analysis of variance (MANOVA) to examine the simultaneous effects of independent variables on affective and cognitive outcomes. Multiple linear regression analysis was used to determine the partial effects of each independent variable. Prior to analysis, assumption tests were conducted, including tests of normality, homogeneity of variance, and multicollinearity. The level of significance was set at 0.05. In addition, effect size measures (e.g., partial eta squared for MANOVA and R^2 for regression) were reported to provide a more comprehensive interpretation of the magnitude of the effects.

RESULT | نتائج

Data analysis was conducted after all instruments were confirmed to be valid and reliable and met the statistical assumptions. The normality test indicated that both affective and cognitive outcome data were normally distributed ($p > 0.05$). The homogeneity test showed equal variances across groups, and multicollinearity diagnostics indicated acceptable values (VIF < 10; tolerance > 0.10). These results confirm that the data were suitable for further analysis using MANOVA and multiple regression.

Descriptive statistics revealed differences in the mean scores across variables. Students

exposed to animated videos demonstrated higher mean scores in affective outcomes, while those engaged in Problem-Based Learning (PBL) showed higher cognitive outcomes. The distribution of scores indicated moderate variability across both domains, suggesting a potential differential effect between instructional approaches.

Table 1. Descriptive Statistics of Research Variables

Variable	N	Mean	Std. Deviation
Affective Outcomes	53	82.45	6.32
Cognitive Outcomes	53	78.90	7.15

Note: Descriptive statistics for independent variables (PBL and animated video) represent students' perceived engagement levels during treatment implementation.

Multivariate analysis was conducted to examine the simultaneous effects of PBL and animated videos on affective and cognitive outcomes. The MANOVA results showed a significant multivariate effect, Wilks' Lambda = 0.742, $F(2, 50) = 8.965$, $p < 0.001$, indicating that the independent variables jointly influenced both dependent variables. The effect size, measured using partial eta squared, was $\eta^2 = 0.26$, indicating a moderate to large effect.

Table 2. MANOVA Results

Multivariate Statistic	Value	F	Sig.	Partial η^2
Wilks' Lambda	0.742	8.965	0.000	0.26

Further analysis using multiple regression was conducted to examine the partial effects of each independent variable. The results indicate that PBL had a significant effect on cognitive outcomes ($\beta = 0.602$, $p = 0.001$, $R^2 = 0.36$), indicating that 36% of the variance in cognitive outcomes was explained by PBL. Its effect on affective outcomes was also significant but smaller ($\beta = 0.318$, $p = 0.032$, $R^2 = 0.18$).

In contrast, animated videos showed a stronger influence on affective outcomes ($\beta = 0.641$, $p < 0.001$, $R^2 = 0.41$), explaining 41% of the variance. The effect on cognitive outcomes was significant but weaker ($\beta = 0.295$, $p = 0.041$, $R^2 = 0.16$).

Table 3. Partial Regression Results

Independent Variable	Dependent Variable	Beta	Sig.	R^2
PBL (X_1)	Cognitive Outcomes	0.602	0.001	0.36
PBL (X_1)	Affective Outcomes	0.318	0.032	0.18
Animated Video (X_2)	Affective Outcomes	0.641	0.000	0.41
Animated Video (X_2)	Cognitive Outcomes	0.295	0.041	0.16

To further clarify the differential effects, a comparison of effect sizes shows that PBL contributes twice as much to cognitive outcomes compared to affective outcomes (36% vs. 18%). Conversely, animated videos contribute more strongly to affective outcomes than to cognitive outcomes (41% vs. 16%). This quantitative comparison confirms that each instructional approach has a distinct domain-specific strength.

Overall, the findings indicate that both instructional approaches are effective, but they demonstrate different patterns of influence. PBL is more effective in enhancing cognitive outcomes, whereas animated videos are more effective in improving affective outcomes. These results provide empirical support for the presence of differential effects in multi-grade elementary classrooms.

DISCUSSION | مناقشة

The findings of this study demonstrate that Problem-Based Learning (PBL) and animated videos have a significant simultaneous effect on students' affective and cognitive outcomes in

multi-grade elementary classrooms. The multivariate results confirm that instructional models and media play a crucial role in shaping learning quality (Lutfiah et al., 2024). This finding reinforces the perspective that instructional strategies must be aligned with intended learning outcomes, particularly in complex settings such as multi-grade classrooms that require adaptive and efficient approaches (Arnaz et al., 2024).

The stronger effect of PBL on cognitive outcomes can be explained through its underlying constructivist mechanism. PBL engages students in problem orientation, investigation, and reflection, which activate higher-order cognitive processes such as analysis, synthesis, and evaluation. According to Astuti et al. (2025) explain that these processes facilitate deeper conceptual understanding by encouraging students to actively construct knowledge rather than passively receive information. This aligns with constructivist theory, which posits that knowledge is formed through active interaction with the environment. For elementary students in the concrete operational stage, PBL provides meaningful and experience-based learning that supports cognitive elaboration and retention (Alqahtani & Mohammad, 2021).

In contrast, animated videos demonstrate a stronger influence on affective outcomes due to their ability to stimulate both emotional engagement and attentional processes. From a cognitive-affective perspective, animated visuals attract attention through motion, color, and narrative elements, which trigger initial interest and curiosity (Putri et al., 2022). At the same time, auditory-visual integration reduces cognitive load, allowing students to process information more comfortably. This combination creates a positive emotional learning experience, which enhances motivation, interest, and engagement. Therefore, the effectiveness of animated videos in the affective domain is not merely due to visual appeal but also because they activate emotional-cognitive pathways that support sustained learning involvement (Wijaya & Putra, 2022).

The differential effects observed in this study indicate that each instructional approach operates through distinct mechanisms. PBL primarily strengthens deep cognitive processing, while animated videos enhance emotional readiness and engagement (Fitria & Hamzah, 2024). This distinction explains why PBL contributes more significantly to cognitive outcomes, whereas animated videos show stronger effects on affective outcomes. Such findings support the argument that learning models and media should not be treated as interchangeable, but rather as complementary components with specific functional roles (Putri et al., 2022).

From a practical perspective, the integration of PBL and animated videos should be designed strategically rather than applied simultaneously without structure. According to Nurfadillah et al. (2026) explain that one effective approach is to use animated videos as an **initial stimulus phase**to activate students' interest and prior knowledge, followed by PBL activities that guide students toward deeper exploration and problem-solving. For example, teachers can begin a lesson with a short animated video presenting a contextual problem, then organize students into groups to investigate and propose solutions through PBL stages. This sequence allows affective engagement to serve as an entry point for cognitive development (Situmorang & Tegeh, 2024).

In multi-grade classrooms, this integration becomes particularly relevant. According to Afriani & Dantes (2023) explain that animated videos can function as a shared instructional tool to align students' understanding across grade levels, while PBL enables differentiated learning through group-based problem-solving adjusted to students' abilities. This combination helps teachers manage instructional complexity more effectively by balancing engagement and

independence (Sutrisno & Dewi, 2025).

Furthermore, the findings highlight the importance of considering both affective and cognitive domains simultaneously. According to Supriyadi & Wulandari (2023) explain that learning effectiveness cannot be fully understood when only one domain is measured. Affective engagement serves as a gateway to cognitive achievement, as students who are emotionally involved are more likely to participate actively and sustain their learning efforts (Huang & Hew, 2018). Thus, the synergy between emotional and cognitive processes forms the foundation of meaningful learning.

This study also contributes to the literature by providing empirical evidence of differential effects in a multi-grade classroom context, which has received limited attention in previous research. The use of multivariate analysis strengthens the validity of these findings by capturing the interaction between multiple outcome variables.

However, this study has several limitations. The relatively small sample size and the focus on a single school context may limit the generalizability of the findings. Additionally, external factors such as teacher competence and learning environment were not examined in depth. Future research is recommended to involve larger and more diverse samples, incorporate mixed-method approaches, and explore longitudinal effects to better understand the sustainability of these instructional impacts.

Overall, this study confirms that effective learning requires a balanced integration of instructional models and media. The differential effects identified provide a strong empirical basis for evidence-based pedagogical decision-making. By strategically combining PBL and animated videos, educators can optimize both cognitive and affective learning outcomes in multi-grade elementary classrooms (Astuti et al., 2025).

CONCLUSSION | خاتمة

This study confirms that Problem-Based Learning (PBL) and animated videos have differential effects on students' affective and cognitive outcomes in multi-grade elementary classrooms. PBL is more effective in enhancing cognitive outcomes through problem-solving and knowledge construction processes, while animated videos play a stronger role in fostering affective outcomes, particularly in terms of students' interest, attention, and engagement. The significant simultaneous effect of both approaches highlights the importance of integrating instructional models and media to achieve balanced learning outcomes.

These findings imply that teachers should strategically align instructional approaches with learning objectives. PBL is recommended when the focus is on developing higher-order thinking and conceptual understanding, whereas animated videos are more suitable for increasing motivation and emotional engagement. A structured combination of both approaches can optimize learning effectiveness, especially in complex multi-grade classroom settings.

Future research should focus on developing and testing integrative instructional models that systematically combine PBL and animated videos, examining their long-term effects through longitudinal designs, and exploring their applicability across diverse educational contexts. Additionally, further studies are needed to investigate moderating variables such as student characteristics, teacher competence, and learning environments to provide a more comprehensive understanding of instructional effectiveness.

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