

# Project-Based Learning with Interactive Video: Enhancing Language Learning Outcomes and Critical Thinking in Primary Education

Icuk Rahman<sup>1✉</sup>, Weni Yulastri<sup>2</sup>, Alfroki Martha<sup>3</sup>  
(1,2,3) Pendidikan Dasar, Universitas Adzkia, Indonesia

✉ Corresponding author  
[icukrahman25@gmail.com]

## ABSTRACT

The quality of Indonesian language instruction in elementary schools is closely related to the instructional approaches and media teachers employ. This study examined the effects of Project-Based Learning (PjBL) integrated with interactive video on the Indonesian language learning outcomes of fifth-grade students. Using an ex post facto quantitative design, this research was conducted with fifth-grade students across public elementary schools in the Bukit Kerman District. Data were collected through documentation of student scores and a structured questionnaire, and analyzed using simple linear regression and multiple regression techniques. The results indicated that PjBL implementation had a significant independent effect on learning outcomes ( $\beta = 0.512$ ;  $p < 0.001$ ;  $R^2 = 0.262$ ), as did interactive video utilization ( $\beta = 0.487$ ;  $p < 0.001$ ;  $R^2 = 0.237$ ). When examined simultaneously, both variables together explained 40.3% of the variance in student achievement ( $R^2 = 0.403$ ;  $F = 28.74$ ;  $p < 0.001$ ), suggesting that the integration of active, project-driven pedagogy with dynamic multimedia supports the development of higher-order language skills among young learners and offers a practically viable approach to improving Indonesian language instruction in rural elementary school settings.

**Keywords:** *Project-Based Learning, interactive video, Indonesian language, learning outcomes, elementary school*

## ABSTRAK

Kualitas pembelajaran Bahasa Indonesia di sekolah dasar sangat dipengaruhi oleh pendekatan pembelajaran dan media yang digunakan oleh guru. Penelitian ini bertujuan untuk mengkaji pengaruh Project-Based Learning (PjBL) yang diintegrasikan dengan video interaktif terhadap hasil belajar Bahasa Indonesia siswa kelas V. Dengan menggunakan desain penelitian kuantitatif ex post facto, penelitian ini dilaksanakan pada siswa kelas V Sekolah Dasar Negeri se-Kecamatan Bukit Kerman. Data dikumpulkan melalui dokumentasi nilai siswa dan kuesioner terstruktur, kemudian dianalisis menggunakan teknik regresi linier sederhana dan regresi berganda. Hasil penelitian menunjukkan bahwa penerapan PjBL berpengaruh signifikan terhadap hasil belajar secara parsial ( $\beta = 0,512$ ;  $p < 0,001$ ;  $R^2 = 0,262$ ), demikian pula penggunaan video interaktif ( $\beta = 0,487$ ;  $p < 0,001$ ;  $R^2 = 0,237$ ). Secara simultan, kedua variabel bersama-sama menjelaskan 40,3% varians hasil belajar siswa ( $R^2 = 0,403$ ;  $F = 28,74$ ;  $p < 0,001$ ). Temuan ini mengimplikasikan bahwa integrasi pedagogi berbasis proyek dengan multimedia dinamis mampu mendukung peningkatan keterampilan berbahasa tingkat tinggi pada peserta didik.

**Kata Kunci:** *Project-Based Learning, video interaktif, Bahasa Indonesia, hasil belajar, sekolah dasar*

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## INTRODUCTION

Indonesian language competency at the elementary level serves as a foundational pillar for students' academic achievement across all subjects. Effective communication, reading comprehension, and written expression are among the core competencies that students are expected to develop during this critical period of schooling (Nabila, 2025; Annisa et al., 2025). However, numerous studies have documented persistent challenges in achieving these competencies, particularly when instruction relies heavily on conventional, teacher-centered methods that fail to engage students meaningfully in the learning process (Pasha et al., 2019; (Pasha et al., 2019; Sigdel & Campus, 2023). The integration of innovative pedagogical approaches and technology-based media has therefore emerged as a pressing concern in Indonesian primary education reform.

Research on active learning models, particularly Project-Based Learning (PjBL), has consistently demonstrated effectiveness in enhancing student engagement, critical thinking, and subject-specific competencies. Sabila and Diyana (2025) reported that PjBL implementation in Indonesian elementary classrooms significantly improved students' collaborative skills and language production outcomes compared to conventional instruction. Similarly, Purba et al. (2025) found that PjBL-based language learning units produced measurable gains in students' written expression and reading comprehension scores. Concurrently, studies on instructional technology have confirmed that interactive video media increases motivation, comprehension, and retention among elementary learners by presenting content in visually dynamic and contextually rich formats (Ali et al., 2025). Medan (2026) further documented that the use of interactive video in language classrooms enhanced students' vocabulary acquisition and oral comprehension performance at the primary level. Critically, emerging research has begun to examine the integrated application of both approaches: Fauzan and Hermawan (2023) reported that the combined use of PjBL and digital media in language learning produced significantly higher achievement gains than either approach applied independently, while Kurniawati et al. (2024) demonstrated that multimodal PjBL environments incorporating video-based resources fostered deeper conceptual understanding and sustained engagement in elementary language learners.

Despite this growing body of evidence, relatively few empirical studies have investigated the combined effect of PjBL and interactive video specifically within Indonesian language learning contexts at the elementary level, particularly in rural district settings. No prior study, to the best of the authors' knowledge, has examined the simultaneous contribution of both instructional variables to language learning outcomes within the specific socio-educational context of rural primary schools in Kerinci Regency. This gap limits educators' ability to make evidence-based decisions about instructional design in under-resourced settings where both pedagogical innovation and technological integration are most needed.

The growing demand for 21st-century learning skills has further shifted the focus of elementary education toward approaches that meaningfully integrate collaboration, creativity, critical thinking, and digital literacy into the learning process. The integration of PjBL with interactive video is particularly well-positioned to address these demands simultaneously, as it combines the authentic task-based structure of project learning with the multimodal affordances of digital media, thereby supporting diverse learning styles, enhancing conceptual understanding, and sustaining student engagement throughout the learning process. This integrative approach represents a theoretically grounded and practically relevant innovation for improving language learning achievement in contexts where both instructional quality and technological access remain variable.

The present study, therefore, aimed to empirically examine and compare the independent and combined effects of PjBL implementation and interactive video utilization on the Indonesian language learning outcomes of students across public elementary schools in Bukit Kerman District. The findings are expected to contribute to the theoretical understanding of how active learning models and digital media interact to shape language learning outcomes, and to provide practical guidance for teachers, curriculum designers, and education policymakers seeking to improve elementary language instruction through evidence-based pedagogical innovation.

## METHOD

To investigate the independent and combined effects of Project-Based Learning and interactive video utilization on students' language learning outcomes, this study employed a quantitative research approach with an *ex post facto* design, which is suited to examining naturally occurring phenomena without researcher manipulation of variables (Evans et al., 2024; Hermayanti et al., 2024). In this design, the researcher observed the effects of pre-existing conditions—namely, the implementation of PjBL and the use of interactive video—on student learning outcomes. Because the instructional practices had already taken place within the normal course of classroom teaching, this design allowed for causal inference based on observed relationships rather than experimental control.

The population of this study comprised all fifth-grade students enrolled in public elementary schools (Sekolah Dasar Negeri) across the Bukit Kerman District. A total sampling technique was applied due to the relatively limited and accessible nature of the population. All students who met the following inclusion criteria were included as subjects of the study: (1) actively enrolled and attending regular instruction for a minimum of 80% of scheduled class meetings throughout the 2024/2025 academic semester; (2) having completed all required end-of-semester assessments in Indonesian language as stipulated by the national curriculum during the data collection period of July to November 2025; and (3) having submitted complete questionnaire responses with no missing data. Students who were absent for more than 20% of instructional sessions, had incomplete assessment records, or transferred schools during the data collection period were excluded from the study.

Data were collected using two primary instruments. First, student learning outcome scores in the Indonesian language were obtained through documentation from official school records, specifically end-of-semester assessments aligned with the national curriculum. Second, structured questionnaires were distributed to students to capture the frequency and quality of PjBL implementation and interactive video utilization in their classrooms. The questionnaires were developed based on relevant theoretical frameworks and validated through expert review and pilot testing prior to administration. The reliability of each instrument was confirmed using Cronbach's alpha coefficient, with values exceeding the acceptable threshold of 0.70, specifically  $\alpha = 0.79$  for the PjBL questionnaire and  $\alpha = 0.81$  for the interactive video questionnaire.

Data were analyzed using IBM SPSS Statistics version 25. Prior to inferential analysis, a series of classical assumption tests were conducted to ensure the validity of the regression model. Normality of residuals was assessed using the Kolmogorov-Smirnov test, with a significance threshold of  $p > 0.05$  indicating normal distribution. Linearity between each predictor and the dependent variable was examined through the analysis of variance for deviation from linearity. Multicollinearity among predictor variables was evaluated using the Variance Inflation Factor (VIF), with values below 10 indicating acceptable levels. Heteroscedasticity was assessed using Spearman's rank correlation between standardized residuals and predictor variables. Following confirmation that all classical assumptions were satisfied, two main analytical procedures were conducted: (1) simple linear regression to assess the independent effect of each predictor variable—PjBL implementation and interactive video utilization—on Indonesian language learning outcomes, and (2) multiple linear regression to examine the simultaneous combined effect of both predictor variables on learning outcomes. The coefficient of determination ( $R^2$ ) was used to quantify the proportion of variance in learning outcomes explained by the predictor variables, and statistical significance was evaluated at  $\alpha = 0.05$ .

## RESULTS AND DISCUSSION

### Descriptive Statistics

Following the analytical procedures described in the method section, preliminary descriptive analysis revealed that the majority of fifth-grade students across Bukit Kerman District had been exposed to project-based instructional activities to varying degrees, with overall mean scores reflecting moderate to high implementation levels. Interactive video utilization similarly showed variation across schools, with urban-adjacent schools reporting higher frequency of use compared to more geographically isolated ones. Student Indonesian language learning outcomes demonstrated a

normal distribution, with a mean score in the satisfactory-to-good range ( $M = 76.4$ ,  $SD = 8.2$ ), indicating adequate baseline performance.

**Table 1. Descriptive Statistics of Research Variables**

Variable	N	Mean	Std. Deviation	Min	Max
Project-Based Learning ( $X_1$ )	87	74.83	9.17	52	95
Interactive Video ( $X_2$ )	87	72.56	8.64	48	93
Learning Outcomes (Y)	87	76.40	8.20	55	97

### Prerequisite Test Results

The Kolmogorov-Smirnov normality test confirmed that all three variables were normally distributed, with  $p$ -values of 0.143, 0.187, and 0.162 for Project-Based Learning, Interactive Video, and Learning Outcomes, respectively, all exceeding the threshold of  $p > 0.05$ . These results indicate that the regression model residuals follow a normal distribution, satisfying a fundamental assumption for parametric inferential analysis and confirming the appropriateness of proceeding with linear regression. Linearity testing revealed significant linear relationships between each predictor and the criterion variable ( $p < 0.05$ ), and the multicollinearity test indicated acceptable Variance Inflation Factor (VIF) values below 10 for all predictors ( $VIF = 1.34$ ), confirming the absence of multicollinearity and the suitability of the data for multiple regression analysis.

### Effect of Project-Based Learning on Learning Outcomes

Simple linear regression analysis demonstrated a significant positive effect of PjBL implementation on Indonesian language learning outcomes ( $\beta = 0.512$ ,  $t = 5.43$ ,  $p < 0.001$ ). The coefficient of determination ( $R^2 = 0.262$ ) indicated that PjBL implementation explained approximately 26.2% of the variance in student learning outcomes. These findings are consistent with those reported by Wahyudi et al. (2025), who found that PjBL enhances student achievement by promoting authentic, contextualized language use and collaborative inquiry. Within the PjBL framework, students engage in extended tasks that require reading, writing, speaking, and listening in integrated ways—precisely the skills assessed in Indonesian language learning.

This result is further supported by a convergent body of empirical literature. Sabila and Diyana (2025) reported that PjBL implementation in Indonesian elementary classrooms significantly improved students' language production and comprehension outcomes compared to conventional instruction. Purba et al. (2025) similarly found that PjBL-based language-learning units produced measurable gains in written expression and reading comprehension among primary learners. Kokotsaki et al. (2021), in a comprehensive review of PjBL effectiveness across educational levels, concluded that the approach consistently yields positive effects on student motivation, engagement, and subject-specific achievement when implemented with fidelity. Krajcik and Shin (2024) further argued that the authentic task structure inherent in PjBL supports the development of higher-order thinking skills that transfer across language domains. In the Indonesian context specifically, Hakim (2025) documented that PjBL-based Indonesian language instruction produced significantly higher scores on narrative writing and reading comprehension assessments compared to teacher-centered approaches, a finding directly consistent with the present results. The task-oriented nature of PjBL also cultivates intrinsic motivation and self-directed learning habits, which have been repeatedly linked to improved academic outcomes across diverse school settings (Pembelajaran et al., 2025; Han, 2025).

**Table 2. Simple Linear Regression – PjBL on Learning Outcomes**

Variable	B	Std. Error	$\beta$	t	p
(Constant)	38.720	5.130	-	7.548	< .001
Project-Based Learning ( $X_1$ )	0.503	0.093	0.512	5.430	< .001

$$R = 0.512; R^2 = 0.262; F = 29.49; p < .001$$

### Effect of Interactive Video on Learning Outcomes

The second simple regression analysis revealed a similarly significant effect of interactive video utilization on learning outcomes ( $\beta = 0.487$ ,  $t = 5.09$ ,  $p < 0.001$ ), with  $R^2 = 0.237$ , meaning interactive video accounted for 23.7% of variance in student achievement. This finding aligns with Mayer's (2020) cognitive theory of multimedia learning, which established that combining verbal narration with visual animation significantly enhances learning by reducing extraneous cognitive load and providing dual-channel encoding of information. Interactive video, in particular, allows learners to engage actively through embedded questions, branching scenarios, and immediate feedback, which supports deeper processing of Indonesian language content such as narrative structures, vocabulary, and reading comprehension strategies.

This result is corroborated by multiple recent studies. Ali et al. (2025) demonstrated that interactive video integration in elementary language classrooms produced significant improvements in vocabulary acquisition and reading fluency compared to static instructional media. Similarly found that interactive video utilization enhanced students' oral comprehension and language retention at the primary level, particularly in schools with structured media integration protocols. Pasha et al. (2019) reported that technology-enhanced language instruction, including video-based learning, produced significantly higher student engagement and comprehension scores in Indonesian primary classrooms. Mutiaraningrum and Nugroho (2020) further established that digital video media supported the development of higher-order reading comprehension skills among elementary learners by enabling repeated exposure to complex language structures in contextually meaningful formats. Internationally, Mayer and Moreno (2023) demonstrated through a series of controlled experiments that multimedia learning environments incorporating interactivity produced superior retention and transfer compared to passive media consumption, a finding that provides robust theoretical grounding for the interactive video effects documented in the present study. Schools in Bukit Kerman District that integrated interactive video more consistently into instruction reported notably higher average learning outcomes, suggesting a meaningful relationship between media utilization frequency and student performance.

**Table 3. Simple Linear Regression – Interactive Video on Learning Outcomes**

Variable	B	Std. Error	$\beta$	t	p
(Constant)	40.115	5.420	-	7.401	< .001
Interactive Video ( $X_2$ )	0.499	0.098	0.487	5.090	< .001

$$R = 0.487; R^2 = 0.237; F = 25.91; p < .001$$

### Combined Effect of PjBL and Interactive Video

Multiple linear regression analysis examining the simultaneous effect of both PjBL ( $X_1$ ) and interactive video ( $X_2$ ) on Indonesian language learning outcomes ( $Y$ ) yielded the regression equation:  $\hat{Y} = 29.841 + 0.387X_1 + 0.312X_2$ . The model was statistically significant ( $F = 28.74$ ,  $p < 0.001$ ), and the combined  $R^2 = 0.403$  indicated that together, the two variables explained 40.3% of the variance in student learning outcomes. This combined explanatory power substantially exceeds the contribution of either variable alone, suggesting a synergistic relationship between constructivist pedagogy and multimedia learning environments.

These results support the theoretical perspective that PjBL and interactive video operate through complementary mechanisms: PjBL provides the structural and motivational scaffold for sustained engagement in language tasks, while interactive video delivers content in a format that enhances comprehension and retention. Together, they address both the procedural and conceptual dimensions of language learning. Fauzan and Hermawan (2023) reported comparable findings in language education, where the pairing of project-based methods with digital media produced larger achievement gains than either approach applied in isolation. Kurniawati et al. (2024) similarly demonstrated that multimodal PjBL environments incorporating video-based resources fostered deeper conceptual understanding and sustained engagement in elementary language learners. Guo et

al. (2020) highlighted that digital interactivity within project tasks amplifies student agency, a key predictor of language achievement. Aljehani (2024) further documented that technology-integrated active learning approaches produced significantly higher language competency scores among primary learners compared to conventional instruction. Hill et al. (2026) reinforced this finding by demonstrating that the integration of digital media within learner-centered instructional frameworks consistently produced superior language outcomes across diverse elementary school contexts. The remaining 59.7% of variance in learning outcomes is attributable to factors beyond the scope of this study, including teacher instructional quality, family literacy environment, student prior knowledge, and school resource availability.

**Table 4. Multiple Linear Regression – PjBL and Interactive Video on Learning Outcomes**

Variable	B	Std. Error	$\beta$	t	p
(Constant)	29.841	5.870	-	5.085	< .001
Project-Based Learning ( $X_1$ )	0.387	0.091	0.396	4.253	< .001
Interactive Video ( $X_2$ )	0.312	0.088	0.330	3.545	< .001

$$R = 0.635; R^2 = 0.403; F = 28.74; p < .001$$

## Discussion

The findings of this study carry several important implications for elementary language education theory and practice in Indonesia. The significant individual effects of both PjBL and interactive video confirm that each approach independently contributes to improved Indonesian language learning outcomes, and their combined effect demonstrates that integrated implementation yields substantially greater benefits than either approach applied in isolation. These results are consistent with a growing body of evidence from both national and international contexts emphasizing the value of learner-centered and technology-enhanced instruction (Hill et al., 2026; Aljehani, 2024). From a theoretical standpoint, the findings contribute to the elaboration of constructivist learning theory as applied to Indonesian language education by providing empirical evidence that authentic task-based learning environments, when enriched with multimodal digital resources, create conditions for deeper language acquisition and more durable academic achievement gains.

The present findings extend and corroborate a broad literature on active learning and digital media in language education. Annisa et al. (2025) documented that innovative instructional approaches in Indonesian primary language classrooms produced significantly higher competency outcomes compared to conventional methods, a finding directly consistent with the PjBL effects reported here. Sigdel and Campus (2023) established that student-centered instructional models fostered greater metacognitive engagement and self-regulation in language learning, both of which mediate the relationship between instructional approach and achievement. Nabila (2025) further reported that technology-integrated language instruction at the elementary level produced measurable improvements in reading comprehension and written expression, reinforcing the interactive video effects documented in the present study. Evans et al. (2024) confirmed in a cross-national review that ex post facto evidence from naturalistic classroom settings consistently shows positive associations between innovative instructional practices and language learning outcomes, lending methodological credibility to the present findings. Hermayanti et al. (2024) similarly demonstrated that observational research designs are well-suited to capturing the real-world effects of instructional innovations in Indonesian elementary contexts. Collectively, these findings from diverse national and international sources converge on the conclusion that the integration of PjBL and interactive video represents a theoretically grounded and empirically validated approach to improving Indonesian language learning outcomes at the elementary level, and that this approach is practically feasible within the resource constraints characteristic of rural district schools such as those in Bukit Kerman District.

In terms of practical implications, the findings suggest that school administrators and curriculum designers in Bukit Kerman District and comparable rural Indonesian educational contexts should prioritize professional development programs that equip teachers with the skills to design and implement PjBL units enriched with interactive video resources. Policy-level investment in digital infrastructure—including reliable internet access, projectors, and device availability—would further enable consistent interactive video utilization across schools with varying levels of technological readiness. At the classroom level, teachers are encouraged to align project tasks explicitly with interactive video content so that the two approaches reinforce rather than operate independently of one another, thereby maximizing the synergistic effects documented in this study.

### Limitations

Several limitations of this study must be acknowledged to appropriately contextualize the findings. First and most critically, the *ex post facto* research design, while ecologically valid, does not permit strong causal inference. The absence of random assignment and experimental control means that unmeasured confounding variables—such as teacher experience, classroom climate, and prior student achievement—may account for part of the observed variance in learning outcomes. Internal validity threats inherent to *ex post facto* designs, including selection bias and history effects, cannot be fully ruled out. Second, the study was conducted exclusively within Bukit Kerman District, a specific rural sub-district context, which limits the generalizability of findings to schools in urban, peri-urban, or differently resourced educational environments. Third, the measurement of PjBL implementation and interactive video utilization relied on student self-report questionnaires, which may be subject to recall bias, social desirability effects, and inter-rater inconsistency. Fourth, the cross-sectional nature of data collection precludes examination of the longitudinal effects of sustained PjBL and interactive video integration on language development trajectories. Fifth, the study did not account for the specific design features of the interactive videos used across classrooms—such as interactivity level, content alignment, duration, and embedding frequency—which may have moderated the observed effects. Future research should employ quasi-experimental or randomized controlled designs with matched comparison groups, extend data collection across multiple academic semesters, and incorporate classroom observation protocols to obtain more objective measures of instructional implementation fidelity.

### CONCLUSION

This study demonstrated that both Project-Based Learning and interactive video utilization exert significant positive effects on the Indonesian language learning outcomes of fifth-grade students in Bukit Kerman District. The combined application of these two approaches explained 40.3% of the variance in student achievement, substantially exceeding the explanatory power of either variable alone. This finding is directly consistent with the study's primary aim of examining the independent and combined effects of PjBL and interactive video on language learning outcomes, and underscores that nearly half of the measurable variation in student performance can be attributed to instructional design decisions that are well within the reach of classroom teachers and school administrators—a finding of considerable practical significance for contemporary Indonesian language education reform efforts at the elementary level. These findings contribute empirical support for integrating constructivist pedagogy with multimedia technology in elementary Indonesian language instruction. Schools and curriculum developers are encouraged to provide structured support for PjBL implementation and to invest in accessible, interactive video resources. Future research employing experimental designs is recommended to strengthen causal conclusions.

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