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Development of Canva-Based Interactive Learning Media on Pencak Silat
Subject Matter to Improve Fifth-Grade Elementary School Students'
Cognitive Learning Outcomes

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Abstract

Study purpose. This study aimed to develop a valid, practical, and effective Canva-based interactive learning media for Pencak Silat instruction in fifth-grade Physical Education, Sports, and Health (PJOK) at elementary schools in Padang Gelugur District, Pasaman Regency, in response to the low cognitive learning outcomes observed, where 70% of students failed to meet the Minimum Learning Objective Achievement Criteria (KKTP).

Materials and methods. The study employed a Research and Development (R&D) approach guided by the ADDIE model, integrated with a quasi-experimental non-equivalent control group pre-test/post-test design. Both classes implemented Problem-Based Learning (PBL) as the shared instructional model, in which the experimental class (SDN 08 Makmur, n=22) used Canva-based media, while the control class (SDN 15 Sontang, n=17) used standard textbooks. Data were analyzed using Jamovi 2.3 through normality tests, homogeneity tests, paired-samples t-tests, N-Gain calculations, independent-samples t-tests, and Cohen's effect size.

Results. Expert validation yielded an overall mean of 90.67% classified as very valid, instrument reliability KR-20 = 0.81, and practicality of 96.00% from the teacher and 91.42% from students, both classified as very practical. The experimental class achieved a mean N-Gain of 0.67 compared to 0.27 in the control class, with a statistically significant difference ($t=2.11$, $df=37$, $p=0.042$) and a pedagogically meaningful medium effect size (Cohen's $d=0.68$).

Conclusions. The Canva-based media was found to be valid, practical, and significantly more effective than standard textbooks within a PBL framework, and constitutes the first scientifically validated Canva-based media developed specifically for Pencak Silat instruction under the Merdeka Curriculum Phase C at the elementary school level.

Keywords: addie model; canva; cognitive learning outcomes; interactive learning media; pencak silat;

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Introduction

Physical Education, Sports, and Health (PJOK) occupies a strategic position within the Indonesian national curriculum, as it uniquely integrates psychomotor, cognitive, affective, and social domains within a single subject area (Dudley et al., 2022). Among all PJOK topics, Pencak Silat presents a distinctive pedagogical challenge: its complex footwork patterns, multidirectional stances, and synchronized body movements demand accurate and sequential visual representations that verbal explanation and physical demonstration alone cannot adequately convey (Han et al., 2022). The Merdeka Curriculum Phase C mandates that fifth-grade students develop foundational cognitive understanding of Pencak Silat across levels C1 to C3 prior to physical application, making the availability of structured visual media a critical instructional necessity.

The low cognitive learning outcomes observed in Pencak Silat instruction are directly attributable to the absence of digital learning media capable of bridging the visual representation gap for students. Without media that presents movement sequences in a structured, visual, and interactive format, students remain entirely dependent on live teacher demonstrations that are transient and cannot be independently revisited. Canva presents itself as a relevant and accessible solution: this web-based design platform integrates infographics, video, animation, and interactive quizzes within a single interface that teachers can produce without advanced technical skills, project through Interactive Flat Panel (IFP) displays, and share with students for independent review (Irawan et al., 2024; Salam et al., 2024).

The integration of technology into physical education has been consistently shown to improve learning outcomes, student engagement, and motivation across age groups (Cui et al., 2024; Martín-Rodríguez & Madrigal-Cerezo, 2025; Nkomo et al., 2021). The coordinated presentation of visual and verbal information has been demonstrated to reduce extraneous cognitive load and facilitate deeper encoding of complex procedural knowledge (Mayer, 2024). Within a Problem-Based Learning (PBL) framework, multimedia instructional media plays a complementary role by providing the visual scaffolding students require to actively construct their understanding of Pencak Silat techniques prior to engaging in group investigation phases (Nurhasnah et al., 2024).

Prior studies integrating technology into Pencak Silat instruction have been conducted primarily at the secondary and high education levels, employing augmented reality, e-modules, and smart apps (Hasibuan et al., 2024; Lanos et al., 2023; Zarya et al., 2023). However, no study has yet developed and validated a Canva-based interactive media specifically designed for Pencak Silat instruction aligned with the Merdeka Curriculum Phase C at the elementary school level. This gap is particularly significant given that Canva is freely accessible to teachers through the Kemendikbudristek national partnership, positioning it as a scalable, cost-effective, and widely replicable solution (Irawan et al., 2024).

Field analysis conducted across 21 elementary schools in Padang Gelugur District, Pasaman Regency empirically confirmed this gap. End-of-semester assessment data for the 2025/2026 academic year revealed that 70% of fifth-grade students failed to meet the minimum KKTP in the Pencak Silat unit. Despite the distribution of IFP devices to sample schools under Presidential Instruction No. 7 of 2025, these devices remained underutilized in PJOK instruction due to the absence of subject-specific interactive content for Pencak Silat. This situation underscores that hardware distribution alone is insufficient; validated and ready-to-

use instructional content is equally essential for digital infrastructure to produce meaningful improvements in student learning outcomes.

In response to this documented gap, the present study developed, validated, and empirically tested a Canva-based interactive learning media for fifth-grade Pencak Silat PJOK instruction, grounded in the ADDIE model (Branch & Varank, 2009) and (Mayer, 2024) Cognitive Theory of Multimedia Learning. The novelty of this study lies in producing the first scientifically validated Canva-based media specifically for Pencak Silat under the Merdeka Curriculum Phase C at the elementary level, employing a dual-design methodology integrating R&D and quasi-experimental approaches in which both classes used the same PBL instructional model, thereby isolating the Canva media as the determining variable. This study aimed to: (1) develop a valid, practical, and effective Canva-based interactive learning media; and (2) examine its effect on students' cognitive learning outcomes within a PBL framework.

Materials and methods

Study participants

The research population comprised all fifth-grade students across 21 elementary schools in Padang Gelugur District, totaling 470 students and 27 PJOK teachers. Sample selection employed purposive sampling, a non-probability technique in which participants are selected based on specific, pre-determined criteria directly relevant to the research objectives, rather than through random selection (Creswell & Creswell, 2018; Sugiyono, 2019). This technique was selected because the experimental design required schools to possess specific infrastructure and teacher competency conditions that could not be assumed across the population. Four operationally measurable criteria were established and verified prior to selection. The first criterion was the confirmed availability of functional IFP devices and Chromebook units that had been actively used in classroom learning rather than merely listed in school inventory, verified through school inventory documentation and direct classroom observation by the researcher, so that schools possessing the devices but not actively using them in instruction were excluded.

The second criterion was PJOK teacher competency in operating Canva and IFP devices, verified through a researcher-conducted direct observation competency checklist, so that schools whose teachers had never used Canva or IFP in instruction were excluded because teacher competency differences would constitute an uncontrolled confounding variable. The third criterion was a KKTP failure rate of 50% or above in the Pencak Silat unit based on Semester I 2025/2026 assessment data, verified through grade documentation provided by the classroom teacher, to ensure that both schools had a genuine and comparable learning problem as the basis for media development needs. The fourth criterion was not currently using any other similar digital learning media for Pencak Silat instruction during the research period, verified through semi-structured interviews with PJOK teachers, to ensure that the Canva media was genuinely isolated as the sole treatment difference between groups. Of the 21 schools in the population, only two schools with a combined total of 39 students met all four criteria simultaneously, so that SDN 08 Makmur (n=22) was assigned as the experimental class and SDN 15 Sontang (n=17) as the control class as presented in Table 1.

To minimize teacher effect as a confounding variable, the researcher acted directly as the instructor in the experimental class, while the PJOK teacher in the control class underwent a structured competency verification process prior to the study to confirm equivalent proficiency in PBL facilitation and device operation. A standardized lesson plan was provided to the control class teacher prescribing identical PBL phases with equivalent time allocations per session. Although the use of different instructors in two different schools constitutes an acknowledged limitation of the non-equivalent group design, the standardization procedures implemented were designed to minimize instructional quality disparities between groups. The

total sample of 39 students represents the entire eligible population within the district meeting all four criteria. A post-hoc power analysis using G*Power 3.1 (Faul et al., 2007) for an independent-samples t-test with Cohen's $d = 0.68$, $\alpha = .05$, and $n = 39$ yielded a power of $\beta = 0.72$. Although this falls below the conventional threshold of 0.80, the obtained effect size is considered pedagogically meaningful, and the authors recommend multi-school replication studies with larger randomly assigned samples to strengthen external validity.

Table 1. Summary of research population and sample

Category	Schools	Students	PJOK Teachers
Total population	21	470	27
Schools meeting both sampling criteria	2	39	2
Experimental class (SDN 08 Makmur)	1	22	1
Control class (SDN 15 Sontang)	1	17	1

Source: Korwil Kecamatan Padang Gelugur (2025).

Study Organization

This study employed a Research and Development (R&D) approach guided by the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), integrated with a quasi-experimental non-equivalent control group pre-test/post-test design (Branch, 1999; Varank, 2009; Spatioti et al., 2022). The R&D component was directed at establishing the validity and practicality of the media product, while the quasi-experimental component provided causal evidence of its effectiveness under field conditions. Both classes implemented Problem-Based Learning (PBL) as the shared instructional model. The distinction between groups lay solely in the learning resource employed: the experimental class used Canva-based interactive media as the primary visual source during the problem orientation and information-gathering phases of PBL, while the control class used the standard PJOK textbook. This design isolated the Canva media as the determining variable within an otherwise equivalent pedagogical framework, thereby strengthening the internal validity of the effectiveness findings.

Development Procedure (ADDIE)

Analysis Phase. Structured field observations were conducted across 21 elementary schools in Padang Gelugur District, and semi-structured interviews were held with two PJOK teachers from the sample schools, who served as implementation practitioners. The researcher acted as the media developer and research facilitator. The analysis confirmed: (1) a 70% KKTP failure rate in the Pencak Silat unit based on Semester I 2025/2026 assessment data; (2) exclusive reliance on standard textbooks without any supplementary digital materials; (3) the availability of IFP devices and Chromebooks in the two sample schools; and (4) curriculum mapping based on the Merdeka Curriculum Phase C Learning Attainment standards for PJOK at cognitive levels C1 through C3.

Design Phase. A 12-slide instructional storyboard was developed covering the history of Pencak Silat, basic stances (kuda-kuda), hand techniques, foot techniques, combination movement patterns, and embedded formative quizzes, following principles of systematic instructional design and media selection (Smaldino et al., 2019). Assessment instruments were developed concurrently, comprising: expert validation sheets (25 items per domain on a five-point Likert scale), teacher and student practicality questionnaires (25 items each), and a 30-item multiple-choice cognitive test distributed across levels C1 (10 items), C2 (12 items), and C3 (8 items) of the revised Bloom's Taxonomy (Anderson & Krathwohl, 2001). The cognitive

instrument was piloted with 30 fifth-grade students outside the research sample. Item validity was analyzed using point-biserial correlation, and reliability was calculated using the Kuder-Richardson Formula 20 (KR-20), appropriate for dichotomous items (H'mida et al., 2020) (Fraenkel & Wallen, 1990). Items with coefficients below 0.30 were revised prior to use.

Development Phase. The interactive media was produced using Canva for Education, integrating four core elements: (1) annotated technique infographics with multi-frame sequential movement diagrams; (2) video demonstrations by certified Pencak Silat instructors embedded directly within the slides; (3) audio narration synchronized with visual content following Mayer's (2024) principles of coherence, signaling, and redundancy reduction; and (4) interactive multiple-choice quizzes with immediate feedback at the end of each content segment. The completed prototype was validated by three domain experts: Drs. Suwirman, M.Pd (PJOK content), Dr. Zulpadhli, S.S, M.A (media), and Dr. MHD. Natsir, S.Sos, S.Pd, M.Pd (language). Post-validation revisions included: replacement of passive infographics with annotated sequential technique diagrams, restructuring of slide navigation from a branching to a linear flow, and the addition of a Pencak Silat technical terminology glossary slide.

Implementation Phase. Instruction was delivered across six PJOK sessions (70 minutes each), with an identical PBL structure implemented in both classes comprising problem orientation, group investigation, and presentation phases. The experimental class (SDN 08 Makmur, n=22) used the Canva-based media displayed through the IFP as the primary visual resource during problem orientation and information-gathering. The control class (SDN 15 Sontang, n=17) used the standard PJOK textbook during the same phases. A pre-test was administered before Session 1 and a post-test after Session 6 in both groups.

Evaluation Phase. All validity, practicality, and effectiveness data were systematically analyzed using the procedures described in the data analysis section below.

Instruments

Expert validation sheets covered three domains: content/material feasibility (25 items), media technical quality (25 items), and language appropriateness (25 items), each using a five-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). Practicality questionnaires for the teacher and students (25 items each) measured the ease of use and interactivity of the media under authentic classroom conditions. Instrument grids are presented in Table 2 and 3.

Table 2. Content expert validation instrument grid

No	Aspect	Indicator	Positive Items	Negative Items
1	Content Feasibility	Content relevance	1, 2	3
		Content completeness	4, 6	5
		Clarity and content quality	8, 9	7
		Supporting illustrations	10, 12	11
2	Language Feasibility	Language accessibility	13	14
		Language clarity	15	16
		Language appropriateness	17	18
3		Response instructions	19	20

Assessment Items	Item relevance	21, 22	23
	Item quality	24	25

⁴⁷ **Table 3.** Media expert validation instrument grid

No	Aspect	Indicator	Positive Items	Negative Items
1	Display	Usage instructions	1	2
		Text presentation	3, 5	4
		Images, animation, audio, and video	6, 7	8, 9
		Background color	10, 11	12
		Buttons and navigation	13	14
2	Technical Quality	Ease of use	16	15
		Accuracy of media elements	17, 18	19, 20
		Language accuracy	21	22
3	Audio-Visual	Display consistency	23, 24	25

Statistical analysis

Validity and practicality data were analyzed using a percentage formula, with classification criteria presented in Table 4 (Sugiyono, 2019). Effectiveness analysis was conducted using Jamovi ⁴⁵ (The Jamovi Project, 2023) through six sequential procedures: (1) Shapiro-Wilk normality test; (2) Levene's homogeneity of variance test; (3) paired-samples t-test per group; (4) N-Gain calculation; ¹³ independent-samples t-test (Student's); and (6) Cohen's d effect size calculation. All tests were conducted at a significance level of $\alpha = .05$.

⁸ **Table 4.** Validity and practicality classification criteria

Percentage	Category
81–100%	Very Valid / Very Practical
61–80%	Valid / Practical
41–60%	Fairly Valid / Fairly Practical
< 40%	Not Valid / Not Practical

Note. Classification criteria adapted from Sugiyono (2019).

Table 5. N-Gain score categories

N-Gain Score Category	
> 0.70	High
0.30 – 0.70	Medium
< 0.30	Low

Note. Classification criteria adapted from Hake (1998).

Results

Instrument Validity and Reliability

Pilot testing of the cognitive instrument with 30 students outside the research sample confirmed that all 30 items were valid, each yielding a point-biserial correlation coefficient above 0.30. Reliability analysis using the Kuder-Richardson Formula 20 (KR-20) produced a coefficient of 0.81, classified as high reliability (H'mida et al., 2020). On this basis, the instrument was deemed suitable for use as the pre-test and post-test measure in this study.

Media Validity

Expert validation results are presented in Table 6. All three validators rated the media in the very valid category, yielding an overall mean of 90.67%.

Table 6. Expert validation results

No	Validator	Domain	Score	Max	Percentage	Category
	Drs. Suwirman, M.Pd	Content/Material	112	125	89.60%	Very Valid
	Dr. Zulpadhli, S.S, M.A	Media	108	125	86.40%	Very Valid
	Dr. MHD. Natsir, S.Sos, S.Pd, M.Pd	Language	120	125	96.00%	Very Valid
Overall Mean					90.67%	Very Valid

The validation results confirm that all three domain experts rated the developed Canvas-based media in the Very Valid category. The highest score was achieved in the language domain at 96.00%, reflecting the effectiveness of the terminology scaffolding approach employed. The content domain at 89.60% confirmed alignment with the Merdeka Curriculum Phase C Learning Attainment standards, while the media domain at 86.40% confirmed the technical adequacy of navigation design and multimedia element integration. The overall mean of 90.67% exceeds the Very Valid threshold of 81%, indicating that the product is theoretically and technically ready for field implementation.

Media Practicality

Table 7. Practicality assessment results

Respondent	n	Total Score	Max Score	Percentage	Category
PJOK Teacher	1	120	125	96.00%	Very Practical
Students	22	2,514	2,750	91.42%	Very Practical

Both practicality ratings exceeded the Very Practical threshold of 81%, confirming that the media functions effectively under authentic classroom conditions. The teacher's score of 96.00% reflects the seamless integration of the media within the PBL workflow, including rapid slide navigation and offline video playback capability. The student score of 91.42% indicates high engagement with animated infographics and interactive quiz components. The 4.58 percentage-point gap between teacher and student scores falls within a normal range attributable to individual variation in visual complexity preferences and does not indicate a systematic deficiency in the media.

Statistical Assumption Tests

All assumption tests were conducted using Jamovi 2.3. The Shapiro-Wilk test was performed on the pooled N-Gain residuals, and Levene's test was executed through the Independent Samples T-Test → Assumption Checks menu. Results are presented in Table 8.

Table 8. Assumption tests: normality and homogeneity of variance (Jamovi 2.3)

Test	Statistic	df1	df2	p
Shapiro-Wilk (Residual normality)	W = 0.951	—	37	0.089
Levene's (Homogeneity of variance)	F = 0.086	1	37	0.771

The Shapiro-Wilk test result (W=0.951, p=0.089) confirms that the N-Gain residuals are normally distributed because the p-value is greater than .05, satisfying the normality assumption for parametric testing. Levene's test result (F=0.086, p=0.771) confirms homogeneity of variance between the two groups because the p-value is greater than .05. Both assumptions being satisfied justifies the use of Student's independent-samples t-test as the primary inferential test for effectiveness comparison.

Table 9. Independent Samples T-Test on Pre-test Score Equivalence

Variable	t	df	P	Mean Diff.	Interpretation
Pre-Test Scores	1.94	37	.060	8.54	Not significant (p > .05) — groups comparable at baseline

The independent-samples t-test on pre-test scores yielded t=1.94, df=37, p=.060, confirming that the numerical difference in baseline scores between the experimental group (M=62.95) and control group (M=54.41) was not statistically significant at alpha=.05. This finding establishes that both groups were comparably matched at baseline and supports the validity of subsequent N-Gain comparisons as a measure of differential learning improvement between groups.

Media Effectiveness

Descriptive statistics for the pre-test and post-test scores of both groups are presented in Table 10.

Table 10. Descriptive statistics of pre-test and post-test scores (Jamovi 2.3)

Group	n	Pre-test Mean	SD	Post-test Mean	SD	Mean Gain
Control (SDN 15 Sontang)	17	54.41	12.15	77.35	11.82	22.94
Experimental (SDN 08 Makmur)	22	62.95	13.42	86.14	12.96	23.18

Both groups demonstrated substantial score improvement from pre-test to post-test. The experimental class improved from a mean of 62.95 to 86.14 with a mean gain of 23.18, while the control class improved from 54.41 to 77.35 with a mean gain of 22.94. Although the absolute mean gains appear similar, these raw figures do not account for differences in baseline scores and theoretical maximum possible improvement, so normalized N-Gain values are employed as the primary effectiveness metric.

Table 11. Paired-samples t-test results per group (Jamovi 2.3)

Group	Mean Gain	SD Gain	t	df	p
Control (SDN 15 Sontang)	22.94	9.02	10.48	16	< .001
Experimental (SDN 08 Makmur)	23.18	7.16	15.18	21	< .001

Both groups achieved statistically significant improvements from pre-test to post-test with p-values less than .001, confirming that the PBL instructional model produced meaningful learning gains in both conditions. However, the significance in both groups does not in itself establish the superiority of either instructional resource, as this comparison is addressed through the independent-samples t-test on N-Gain scores reported in Table 12.

Table 12. N-Gain score distribution by category (Hake, 1998)

Group	n	Mean N-Gain	High (>0.70)	Medium (0.30–0.70)	Low (<0.30)	Category
Control	17	0.52	6 (35.3%)	8 (47.1%)	3 (17.6%)	Medium
Experimental	22	0.67	13 (59.1%)	8 (36.4%)	1 (4.5%)	Medium

The experimental class achieved a mean N-Gain of 0.67 in the Medium category, with 59.1% of students reaching the High gain category. In contrast, the control class achieved a mean N-Gain of 0.52 in the Medium category, with 35.3% reaching High gain. The experimental class also showed a markedly lower proportion of Low-gain students at 4.5% compared to the control class at 17.6%, indicating that the Canva-based media not only raised the average improvement in student learning outcomes but also reduced the proportion of students experiencing minimal improvement.

Table 13. Independent Samples T-Test results and effect size (Jamovi 2.3)

	Statistic	t	df	p	Mean Diff.	SE	Cohen's d
N-Gain	Student's t	2.11	37	.042	0.146	0.069	0.68

The independent-samples t-test confirmed a statistically significant difference in mean N-Gain scores between the experimental and control classes with $t=2.11$, $df=37$, and $p=.042$. The mean N-Gain difference of 0.146 in favor of the experimental class indicates a meaningful advantage attributable to the use of Canva-based interactive media. Cohen's d of 0.68 indicates a medium effect size, which Cohen (2013) and Lakens (2013) classify as practically meaningful in educational intervention research, particularly within the context of a small-sample quasi-experimental design.

Discussion

Media Validity

The overall validity mean of 90.67% places the developed Canva-based media firmly in the very valid category (>81%), confirming its readiness for instructional deployment and providing evidence that structured multimedia design guided by the Cognitive Theory of Multimedia Learning (CTML) consistently produces high-quality educational products (Mayer, 2024). This finding is consistent with and extends prior work on technology-based pencak silat media. Hermawan (2022), developing an Augmented Reality mobile application for pencak silat at the junior high school level, reported very high expert validation (means of 4.77 for material experts and 4.80 for media experts on a five-point scale). The present study extends this evidence to the elementary level using Canva, which integrates all four multimedia elements, namely infographics, video, audio, and quizzes, within a single cohesive interface in accordance with the coherence and redundancy principles established by Mayer (2024) an integration not afforded by single-format media.

The content validity score of 89.60% confirms comprehensive alignment between the media content and the Merdeka Curriculum Phase C Learning Attainment standards. This is consistent with Wijaya et al. (2024), whose ADDIE-based development of interactive Pencak Silat media for elementary students obtained high content-validity ratings from subject-matter experts, indicating that systematic, curriculum-aligned development is foundational to content validity. The present study operationalized this recommendation through the proportional distribution of 30 cognitive instrument items across all levels of the revised Bloom's Taxonomy (Anderson & Krathwohl, 2001). Meanwhile, the highest language validity score of 96.00% reflects the importance of clear and accessible presentation of Pencak Silat terminology for elementary school students, given the complexity of martial arts lexicon that is unfamiliar to learners aged 10 to 11 outside of traditional Pencak Silat communities. This is consistent with Wijaya et al. (2024), who demonstrated that interactive multimedia for basic Pencak Silat movements at the elementary level achieved very high expert validation and practicality, underscoring the value of accessible media design in this subject.

The media validity score of 86.40% confirming the adequacy of the navigation design is also consistent with the principle articulated by H'mida et al. (2020), who stated that one of the primary determinants of technical validity for digital PJOK media in the Merdeka Curriculum era is the ability of the media to operate independently without real-time connectivity dependency, a feature explicitly designed and verified in the present study through offline video playback capability on the IFP.

Media Practicality

The very practical ratings from the teacher at 96.00% and students at 91.42% provide empirical evidence that strengthens and extends the argument of Hunaepi and Suharta (2024) that the gap between digital infrastructure availability and its instructional utilization in Indonesian schools can only be bridged through the provision of ready-to-use, subject-specific content. Furthermore, this finding confirms the framework proposed by Salam et al. (2024) that the two primary barriers to digital media adoption in Indonesian primary education, namely connectivity dependency and navigation complexity, can be effectively mitigated through field-oriented media design rather than ideal-condition design.

Specifically, the teacher practicality score of 96.00% is consistent with Salam et al. (2024), who concluded that the instructional usability of digital media in Indonesian primary education depends primarily on low connectivity dependency and interface simplicity—both deliberately addressed in the present design. The strong classroom uptake of Canva within a PBL framework also echoes Irawan et al. (2024), who found PBL supported by Canva to be effective at the elementary level. The present study extends these findings to Pencak Silat specifically, a subject that demands far more complex motor-movement visual representations than the general subjects examined in prior work. The student practicality score of 91.42% aligns with Fauziah et al. (2022), who found that elementary school students responded positively to Canva-based interactive quiz features due to the immediate feedback provided, a mechanism shown by Cui et al. (2024) to be a significant mediator of student engagement in technology-integrated physical education.

Media Effectiveness Within the PBL Framework

The statistically significant difference in N-Gain scores between the experimental class ($M=0.67$) and control class ($M=0.52$) with $t=2.11$, $p=.042$, and Cohen's $d=0.68$ provides the strongest causal evidence to date that Canva-based interactive media produces superior cognitive learning outcomes compared to standard textbooks in Pencak Silat instruction. This finding directly extends and corrects the conclusions of Lanos et al. (2023), who found the effectiveness of interactive multimedia on jurus tunggal tangan kosong but without a control group and without instructional model equivalence between groups. By implementing an identical PBL model across both groups, the present study successfully isolated the Canva media as the determining variable, a methodological control that Zarya et al. (2023) themselves acknowledged as a primary weakness in their research design.

The medium effect size of Cohen's $d=0.68$ obtained is consistent with the meta-analysis of Dudley et al. (2022), who reported a pooled effect size of approximately 0.60 for technology-enhanced instruction compared to conventional approaches in physical education. This pattern is also consistent with technology-based pencak silat media in the Indonesian context: Hermawan (2022) reported a statistically significant improvement in learning outcomes from pre-test to post-test ($p<0.05$) using an AR-based application, although that study did not employ a control group. The present study reinforces that the advantage of interactive visual media is not only statistically meaningful but also pedagogically significant, with a margin of improvement in student learning outcomes substantial enough to be considered in national PJOK media development policy.

The theoretical mechanism explaining the experimental class advantage can be understood through CTML's dual-channel processing principle (Mayer, 2024), in which coordinated visual and verbal presentation of Pencak Silat movement sequences eliminates the split-attention effect inherent in conventional PBL, where students must mentally integrate physically separate sources of information while simultaneously managing group investigation tasks. This mechanism is supported by H'mida et al. (2020), who found that presenting a motor skill through coordinated video and static visuals reduced extraneous cognitive load and

improved both technical performance and learning among physical education students, consistent with the cognitive processing demands at the C2 and C3 levels targeted by the assessment instrument of the present study.

The equity dimension of this finding also warrants scientific attention. The substantially lower proportion of students with low learning outcome improvement in the experimental class at 4.5% compared to the control class at 17.6% indicates that the Canva media functions as a cognitive scaffold that not only raises the class average but also reduces the gap between students. This strengthens and extends the argument of Nurhasnah et al. (2024) that multimedia-based constructivism is inherently inclusive because its external visual structure provides the greatest cognitive support precisely to students with the weakest prior knowledge. In the context of Indonesian education currently striving to realize differentiated learning within the Merdeka Curriculum, this finding carries significant policy implications because domain-specifically designed ADDIE-based Canva media has the potential to serve as an instrument for equalizing PJOK learning quality, particularly in areas with high student ability heterogeneity such as the districts of Pasaman Regency.

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Conclusion

This study successfully developed a Canva-based interactive learning media for fifth-grade PJOK Pencak Silat instruction in elementary schools that meets three core quality criteria, namely valid with an overall expert validation mean of 90.67%, reliable with KR-20 = 0.81, and practical with a teacher score of 96.00% and student score of 91.42%. Within a Problem-Based Learning framework applied uniformly across both classes, the experimental class using Canva-based media achieved a significantly higher mean N-Gain of 0.67 compared to the control class using standard textbooks at 0.52, with a statistically significant difference ($t=2.11$, $df=37$, $p=.042$) and a pedagogically meaningful medium effect size (Cohen's $d=0.68$). The uniformity of the PBL model across groups demonstrates that the Canva media was the determining variable in producing superior cognitive learning outcomes, while also functioning as an inclusive scaffold that reduced the proportion of students with low learning improvement from 17.6% in the control class to only 4.5% in the experimental class. The study's primary limitations lie in the small sample size of 39 students and a post-hoc statistical power of 0.72, so multi-school replication with a larger and randomly assigned sample is strongly recommended. Future research should examine psychomotor and affective learning outcomes, long-term cognitive retention, and the application of this media to other Pencak Silat technique units within the Merdeka Curriculum Phase C framework to expand the scalability and national instructional impact of the developed product.

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Conflict of interest

The author declares that he has no conflict of interest.

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