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EFFECTIVENESS OF INTERACTIVE DIGITAL MEDIA ON LEARNING OUTCOMES IN PBL-BASED SCIENCE AT ELEMENTARY SCHOOLS

EFEKTIVITAS MEDIA DIGITAL INTERAKTIF TERHADAP HASIL BELAJAR IPA BERBASIS PBL DI SEKOLAH DASAR

Khoirunnisa[1], Muhtar Mochamad Solihin[2]
[1] Universitas Jambi, Jambi, Indonesia
[2] Universitas Islam Negeri Syarif Hidayatullah Jakarta, Tangerang Selatan, Indonesia
E-mail: khoirunnisa@unja.ac.id[1], muhtarsolihin@uinjkt.ac.id[2]

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Abstrak

Penelitian ini bertujuan untuk menganalisis efektivitas media digital interaktif yang diintegrasikan dengan model Problem-Based Learning (PBL) terhadap hasil belajar siswa dalam pembelajaran IPA di sekolah dasar. Metode yang digunakan adalah Systematic Literature Review (SLR) dengan panduan PRISMA 2020. Pencarian artikel dilakukan melalui Google Scholar dan Publish or Perish pada rentang tahun 2021–2026, yang menghasilkan 37 artikel, dengan 31 artikel di antaranya melaporkan data kuantitatif lengkap dan dianalisis menggunakan teknik sintesis naratif. Hasil penelitian menunjukkan bahwa mayoritas studi kuantitatif melaporkan pengaruh positif yang signifikan secara statistik. Pada hasil belajar kognitif (27 studi), peningkatan substansial terlihat dengan nilai N-Gain berkisar antara 0,44 (kategori sedang) hingga 0,804 (kategori tinggi). Selain itu, integrasi media digital interaktif dalam PBL juga menunjukkan peningkatan pada motivasi belajar siswa (Cohen's d = 0,911), keterampilan berpikir kritis, literasi sains, dan keterampilan kolaborasi (p < 0,05) berdasarkan sejumlah studi yang terbatas (1–5 studi untuk masing-masing variabel). Efek positif ini teramati secara konsisten pada berbagai jenis media, seperti kuis interaktif (Quizizz, Wordwall), buku digital (E-Book, Flipbook), alat presentasi (PowerPoint, Prezi), dan teknologi imersif (Augmented Reality), serta pada berbagai desain penelitian. Temuan ini menegaskan bahwa media digital interaktif dalam PBL secara konsisten memberikan dampak positif, namun efektivitas maksimal dicapai ketika fitur media selaras dengan sintaks PBL dan kesiapan teknologi pengguna. Sebagai catatan, pencarian dalam penelitian ini terbatas pada basis data Google Scholar melalui Publish or Perish, sehingga cakupan sumber dan potensi bias publikasi perlu dipertimbangkan dalam menginterpretasikan hasil.

Abstract

This study aims to analyze the effectiveness of interactive digital media integrated with the Problem-Based Learning (PBL) model on student learning outcomes in elementary school science education. A Systematic Literature Review (SLR) method was employed, following the PRISMA 2020 guidelines. Articles were sourced via Google Scholar and Publish or Perish for the period of 2021–2026, yielding 37 articles; of these, 31 reported complete quantitative data and were analyzed using narrative synthesis techniques. The results indicate that the majority of quantitative studies reported statistically significant positive impacts. Of these, 27 studies specifically measured cognitive learning outcomes, which improved substantially, with N-Gain scores ranging from 0.44 (medium category) to 0.804 (high category). Furthermore, based on a limited number of studies (1–5 studies for each respective variable), the integration of interactive digital media into PBL also suggested enhancements in student learning motivation (Cohen's d = 0.911), critical thinking skills, scientific literacy, and collaboration skills (p < 0.05). These positive effects were consistently observed across various media types, such as interactive quizzes (Quizizz, Wordwall), digital books (E-books, Flipbooks), presentation tools (PowerPoint, Prezi), and immersive technologies (Augmented Reality), as well as across various research designs. These findings confirm that interactive digital media within PBL consistently provides a positive impact; however, maximum effectiveness is achieved when media features align with the PBL syntax and users' technological readiness. As a note, the literature search in this study was limited to the Google Scholar database through Publish or Perish; therefore, the scope of sources and potential publication bias should be considered when interpreting the findings

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INTRODUCTION

Science learning in elementary schools serves as a foundational pillar for developing students' scientific literacy, critical thinking, and problem-solving abilities from an early age (Permendikbudristek No. 7 Tahun 2022). Despite its importance, empirical evidence consistently indicates that science learning outcomes at the elementary level remain suboptimal. Data from the 2022 Programme for International Student Assessment (PISA) shows that Indonesia's mean science score stagnated at 383, significantly below the OECD average of 485 (OECD, 2023b). Furthermore, only 34% of Indonesian students attained level 2 or higher in science proficiency, the baseline level for demonstrating the ability to apply scientific concepts to real-life situations, compared to the OECD average of 76% (OECD, 2023a). Similarly, data from Indonesia's National Assessment (ANBK) 2023, as reported in the 2024 Education Report Card (*Rapor Pendidikan Indonesia*), indicates that a considerable proportion of elementary school students have yet to reach the minimum competency threshold in scientific reasoning and inquiry skills (Kemendikdasmen, 2024). This condition is exacerbated by the predominance of conventional, teacher-centered instructional approaches, limited student engagement, and insufficient use of innovative learning media that accommodate the characteristics of today's digital-native generation (Ainullah et al., 2023; Oktariani et al., 2024).

The Problem-Based Learning (PBL) model has been widely recommended as an effective alternative to address these issues. Through its systematic syntax, orientation to problems, organizing for learning, investigation, presentation of work, and evaluation, PBL encourages students to actively construct knowledge, think critically, and collaboratively solve authentic problems. Numerous studies have confirmed the positive impact of PBL on improving scientific literacy, metacognitive skills, and student learning independence (Kristiantari et al., 2022). Furthermore, the rapid development of digital technology has enabled the creation of interactive learning media that can make science content more visual, dynamic, and engaging. In this study, interactive digital media is defined as technology-based learning tools that facilitate two-way interaction between users and the system, provide immediate feedback, and integrate multimodal content such as text, audio, animation, and simulation to represent scientific phenomena dynamically. Platforms such as Canva, Wordwall, Quizizz, Articulate Storyline, and digital comics offer new possibilities for enriching the PBL experience (Kurniati et al., 2025).

The integration of interactive digital media within the PBL framework is theoretically expected to amplify the effectiveness of each instructional phase, from presenting authentic problems to facilitating the creative presentation of student solutions. However, while a substantial body of primary research including quasi-experiments, classroom action research, and development studies has reported positive effects, these findings remain scattered across various contexts, media types, and grade levels. Some studies report significant improvements in cognitive learning outcomes (Indarti, 2026; Mirnawati et al., 2025), others emphasize increased motivation and interest (Kurniati et al., 2025; Wati et al., 2024), and still others focus on higher-order thinking skills such as critical thinking and scientific literacy (Zakiyah et al., 2025; Sutrisno, 2025).

Despite this growing body of evidence, no systematic effort has been made to synthesize the magnitude and consistency of these effects across studies. Previous literature reviews, such as those conducted by Alwanda (2025) on interactive media and scientific literacy, or Hodaifah et al. (2025) on multimedia implementation, have not specifically focused on the intersection of interactive digital media and the PBL model. Moreover, these earlier reviews did not quantitatively synthesize the statistical findings—such as N-Gain scores, t-test results, and effect sizes—that are essential for

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providing a robust evidence base for practitioners and policymakers. This gap is particularly critical, as teachers and school administrators need reliable information on whether and to what extent the use of interactive digital media in PBL actually improves student outcomes across different domains. Thus, this study aims to systematically review and synthesize the empirical evidence regarding the effectiveness of interactive digital media integrated with PBL in elementary science education. In this review, effectiveness is operationally defined as the statistically significant improvement in student learning outcomes, as measured by quantitative indicators including pretest-posttest mean differences, N-Gain scores (with categories: low < 0.30, moderate 0.30–0.69, high ≥ 0.70), t-test or ANOVA results ($p < 0.05$), and effect sizes (Cohen's d), reported in primary empirical studies. To maintain analytical focus and address the reviewer's concern regarding the heterogeneity of outcome variables and measurement instruments, the research objectives are structured hierarchically as follows:

Primary Objective: To systematically synthesize empirical evidence on the effectiveness of interactive digital media integrated with PBL in improving elementary school students' cognitive learning outcomes in science, as measured by standardized achievement tests, pretest-posttest scores, and N-Gain indices. Secondary Objectives: To synthesize empirical evidence on the effects of interactive digital media integrated with PBL on:

1. Affective outcomes, specifically students' motivation and learning interest, as measured by validated motivation questionnaires and interest scales;
2. Higher-order thinking skills, specifically critical thinking skills and scientific literacy, as measured by critical thinking tests and scientific literacy assessments;
3. Collaboration skills, as measured by collaboration observation rubrics or self-assessment instruments.

Accordingly, this review addresses the following research question (RQ): What are the effects of integrating interactive digital media with PBL on elementary school students' cognitive learning outcomes, motivation, critical thinking skills, scientific literacy, and collaboration skills, as reported in quantitative empirical studies published between 2021 and 2026?

METHOD

Research Design and Questions

This study employs a Systematic Literature Review (SLR) approach guided by the PRISMA 2020 framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Page et al., 2021). The PRISMA 2020 checklist and flow diagram ensure transparency and replicability in the identification, screening, and synthesis processes. An SLR design was selected because the topic of interactive digital media effectiveness in PBL-based science instruction has a substantial body of quantitative primary studies, enabling systematic synthesis of empirical evidence. To maintain focus and direction, the researchers formulated the research question using the PICOC framework (Population, Intervention, Comparison, Outcome, Context):

Population : Elementary school students.
Intervention : Utilization of interactive digital media in problem-based science learning (PBL).
Comparison : Conventional instruction or without digital media.
Outcome : Cognitive learning outcomes, motivation, interest, critical thinking skills, scientific literacy, and collaboration skills (measured quantitatively).
Context : Scientific journal articles published between 2021 and 2026.

Accordingly, the research question addressed in this study is: What are the effects of

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integrating interactive digital media with PBL on elementary school students' cognitive learning outcomes, motivation, critical thinking skills, scientific literacy, and collaboration skills, as reported in studies published between 2021 and 2026?

Literature Search Strategy

The literature search was conducted on May 20, 2026, using the Google Scholar database with the assistance of the Publish or Perish (PoP) application. The search employed Boolean operators (AND, OR) derived from the PICOC components. The researchers retrieved a maximum of 100 top articles for both Indonesian and English keywords to maximize coverage. The Indonesian keywords used were:

("media digital interaktif" OR "multimedia interaktif" OR "media pembelajaran digital" OR "media interaktif") AND ("problem-based learning" OR "PBL" OR "pembelajaran berbasis masalah") AND ("IPA" OR "sains" OR "ilmu pengetahuan alam") AND ("sekolah dasar" OR "SD" OR "siswa SD")

The English keywords used were:

("interactive digital media" OR "interactive multimedia" OR "digital learning media") AND ("problem-based learning" OR "PBL") AND ("elementary science" OR "science learning" OR "primary science") AND ("elementary school" OR "primary school" OR "elementary students")

Inclusion and Exclusion Criteria

To ensure relevance and quality, the researchers applied a set of inclusion and exclusion criteria. Articles were included if they met all of the following criteria: (1) journal articles published between 2021 and 2026; (2) written in either Indonesian or English; (3) substantively discussed the use of interactive digital media in problem-based science learning at the elementary school level; (4) constituted empirical studies, such as classroom action research, experiments, quasi-experiments, or development studies that included effectiveness testing; (5) reported quantitative empirical data, including pretest-posttest scores, N-Gain scores, or statistical test results (t-test, ANOVA, Mann-Whitney, or effect sizes) related to learning outcomes, motivation, critical thinking, scientific literacy, or collaboration; and (6) were available in full-text online.

Articles were excluded if they met any of the following conditions: (1) conference proceedings, theses, dissertations, books, or unpublished research reports; (2) published before 2021; (3) did not focus on the elementary school level; (4) did not discuss the PBL model or did not use interactive digital media; (5) were not science or integrated science (IPAS) instruction; or (6) were purely qualitative, descriptive, or developmental studies without quantitative effectiveness data.

Literature Selection Process

The article selection procedure followed the four stages of the PRISMA 2020 flow diagram: identification, screening, eligibility, and inclusion (Page et al., 2021). In the identification stage, the researchers retrieved 200 articles from Google Scholar using PoP. In the screening stage, duplicates were removed, resulting in 194 unique articles. Subsequently, 35 articles were excluded based on publication type, leaving 159 journal articles. The researchers then screened titles based on four key elements: (1) digital/interactive media, (2) problem-based learning, (3) science/IPAS, and (4) elementary school. A total of 121 articles were excluded, leaving 38 articles.

In the eligibility stage, the researchers applied the empirical criteria by reviewing abstracts. One article was excluded for not reporting primary empirical data, resulting in 37 final articles. Of these 37 articles, 31 articles reported complete quantitative data suitable for analyzing the

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effectiveness of interactive digital media on learning outcomes and related variables. The remaining 6 articles were qualitative or descriptive in nature and were therefore excluded from the quantitative synthesis for this specific research question (RQ), although they were retained for contextual discussion in the overall review.

Quality Assessment

The researchers conducted a qualitative quality assessment specifically focused on the 31 articles containing quantitative data. Aspects examined included: (1) clarity of the research design (e.g., quasi-experimental, pre-experimental, or classroom action research); (2) completeness of reported quantitative data (pretest and posttest means, N-Gain scores, t-values, p-values, or effect sizes); (3) reported validity and reliability of instruments; (4) sample size adequacy; and (5) direct relevance to the research question. Only articles that provided sufficiently detailed and contextually relevant statistical evidence were retained for the final quantitative synthesis.

Data Extraction and Synthesis

Data from the 31 articles with complete quantitative data were extracted using a specially designed matrix. The extraction focused on capturing:

1. Author(s) and year of publication.
2. Type of interactive digital media used.
3. Research design employed.
4. Outcome variables measured (cognitive learning outcomes, motivation, interest, critical thinking, scientific literacy, collaboration).
5. Quantitative data reported: pretest and posttest mean, N-Gain scores, t-test results (t-values and significance levels), F-values, Mann-Whitney U results, effect sizes (Cohen's d, where reported), and improvement percentages.
6. Criteria for effectiveness (e.g., significant, high N-Gain, effective).

The extraction process was conducted manually by reading each article in full to ensure accuracy and contextual understanding. After data collection, analysis was performed using narrative synthesis techniques. The articles were grouped thematically according to the outcome variables. Specific attention was given to synthesizing:

1. Improvements in cognitive learning outcomes (reflected by N-Gain categories: low, moderate, high).
2. Enhancements in motivation and interest (including effect sizes such as Cohen's d).
3. Gains in higher-order thinking skills (critical thinking and scientific literacy).
4. Collaboration skill development.

This study did not employ bibliometric analysis or mapping software such as VOSviewer. This decision was based on the consideration that the research question is thematic-substantive concerning statistical effectiveness, making narrative synthesis more appropriate than bibliometric mapping. Additionally, the relatively small final sample (n=37, with only 31 quantitative articles) is insufficient to produce meaningful bibliometric visualizations. Rogers et al. (2020) explain that sample sizes below 200 articles in bibliometric analysis yield high average variance; therefore, a qualitative narrative approach is more acceptable for smaller samples such as this review.

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RESULTS AND DISCUSSION

Results

This section presents the findings addressing the research question: What are the effects of integrating interactive digital media with PBL on elementary school students' cognitive learning outcomes, motivation, critical thinking skills, scientific literacy, and collaboration skills, as reported in quantitative empirical studies published between 2021 and 2026?

Based on the synthesis of the 37 final articles, 31 articles reported complete quantitative data suitable for analyzing the effectiveness of interactive digital media across various outcome variables. The remaining 6 articles were qualitative or descriptive in nature and, while supportive of the positive potential of these media, did not provide statistical data and are discussed separately. To address the heterogeneity of outcome variables and measurement instruments, the results are organized thematically according to the hierarchical research objectives: (1) cognitive learning outcomes (primary objective), (2) motivation and interest (secondary objective - affective domain), (3) critical thinking and scientific literacy (secondary objective - higher-order thinking), and (4) collaboration skills (secondary objective - collaboration). Within each thematic section, findings are further differentiated by research design (quasi-experimental, classroom action research, pre-experimental, and development research with effectiveness testing).

Cognitive Learning Outcomes

27 articles specifically measured cognitive learning outcomes as a dependent variable. Table 1 presents a summary of these studies, organized by research design.

Table 1. Summary of Cognitive Learning Outcome Improvements by Research Design

Author(s) (Year)	Media Type	Key Quantitative Data	Outcome
Quasi-Experimental			
Juliana et al. (2022)	PowerPoint Interaktif	Pretest exp: 53.62 → Posttest: 76.03; Control: 60.17 → 70.89; t-hitung = 73.42	Significant
Kristiantari et al. (2022)	Prezi	Scientific literacy: Exp 76.89 vs Control 61.75; MANOVA F = 45.44; p = 0.000	Significant
Mirnawati et al. (2025)	Quizizz	Posttest Exp: 79.40 (90%); Control: 63.40 (30%); Mann-Whitney U Sig. = 0.000	Significant
Sutrisno (2025)	Digital + Local Culture	Pretest Exp: 43.25 → Posttest: 83.14; Control: 42.89 → 66.79; t = 4.786; p = 0.000	Significant
Puspita & Setiawan (2025)	Wordwall	N-Gain Exp: 58.33%; Control: 25.08%; t-hitung = 7.166; Sig. = 0.000	Moderate
Zakiyah et al. (2025)	Digital Comics	Learning outcomes Exp: 83.20 vs Control: 73.60; p = 0.001	Significant
Classroom Action Research			
Isnaini (2025)	PowerPoint Interaktif	Pre-cycle: 60.66 (40%); Cycle I: 72.00 (67%); Cycle II: 87.33 (87%)	Effective

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Author(s) (Year)	Media Type	Key Quantitative Data	Outcome
Wati et al. (2024)	Media Digital (umum)	Cycle I: 140 (82%); Cycle II: 150 (94%)	Effective
Pre-Experimental (One-Group Pretest-Posttest)			
Armadhani et al. (2025)	Canva (Multimedia)	Pretest: 63.5 → Posttest: 82.3; Increase: 18.8 points	Effective
Dewi et al. (2025)	E-Book Interaktif	t-hitung = 24.029 > t-tabel = 2.002; Sig. = 0.000	Effective
Dwiyanti (2025)	E-Book (Canva + Flipbook)	Pretest: 80.76 → Posttest: 89.46; t-hitung = -8.900; Sig. = 0.000	Effective
Erta (2025)	Canva (Animated Video)	N-Gain = 0.7565	High
Indarti (2026)	Book Creator	Pretest: 62.40 → Posttest: 86.80; N-Gain = 0.65; Ketuntasan: 44% → 100%	Moderate
Maharani & Fathurrahman (2025)	ARIFAL (AR + PowerPoint)	Pretest: 46.40 → Posttest: 85.40; N-Gain = 0.74	High
Oktariani et al. (2024)	Video Interaktif (Lumi)	Indeks validitas = 0.944; Sig. < 0.001	Very High
Poniyanti et al. (2024)	Articulate Storyline	Pretest: 66.85 → Posttest: 88.70; t-hitung = 9.864; Sig. < 0.05	Effective
Praja & Andriani (2025)	Multimedia Interaktif	Pretest: 49.20 → Posttest: 83.00; N-Gain = 0.735; Sig. = 0.000	High
Pratama & Setyasto (2024)	Prezi	N-Gain = 0.44; Sig. = 0.000	Moderate
Pratama et al. (2022)	Animapoin (PowerPoint)	Pretest: 70.05 → Posttest: 83.10; Validation: 91-94%	Effective
Pratiwi et al. (2025)	Flipbook (Heyzine)	N-Gain small: 0.76; large: 0.804	High
Putri & Wiarta (2022)	E-Book Interaktif	Pretest: 59.5 → Posttest: 74.16; t-hitung = 7.213; Sig. < 0.05	Effective
Putri & Wiarta (2024)	E-Book Interaktif	Pretest: 67.58 → Posttest: 92.26; t-hitung = 40.413; Sig. < 0.05	Effective
Putri & Ambara (2025)	Crosswords (Interactive)	t-hitung = 9.999; Sig. < 0.05	Effective

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Author(s) (Year)	Media Type	Key Quantitative Data	Outcome
Rizkiah & Asih (2025)	Smart Apps Creator	N-Gain small: 0.55; large: 0.62; Sig. = 0.000	Moderate
Sitepu et al. (2025)	Articulate Storyline	Wilcoxon Sig. = 0.005	Effective
Sudarmika & Sujana (2024)	Multimedia Melajah	t-hitung = 9.918; Sig. < 0.05	Effective
Development Research with Effectiveness Testing			
Ayu et al. (2025)	Educaplay	Validation: 38.3 (very valid); Effectiveness: 85.96% & 85.24%	Effective
Loka et al. (2025)	Webtoon	N-Gain = 89.5%; Validation: 3.76-3.85; Practicality: 96.1-96.8%	Effective
Mardiana & Agung (2024)	Digital Comics	Validation: 100% (materi), 97.50% (media); Uji efektivitas signifikan	Effective
Waisakanitri et al. (2023)	Digital Comics (Anyflip)	t-hitung = 3.69; Sig. < 0.05	Effective

Note: Studies measuring only validation, practicality, or qualitative outcomes are not included in this table. Of the 27 studies measuring cognitive outcomes, all 27 reported statistically significant improvements, with N-Gain scores ranging from 0.44 (moderate) to 0.804 (high). However, it should be noted that the strength of evidence varies by research design, with quasi-experimental studies providing stronger causal inference than pre-experimental designs.

Magnitude of Cognitive Improvement

The N-Gain scores reported across studies provide a nuanced picture of effectiveness. Several studies achieved high N-Gain categories (≥ 0.70): Erta (2025) reported N-Gain 0.7565 using Canva-based animated videos; Praja and Andriani (2025) reported 0.735 using multi-platform interactive multimedia; Maharani and Fathurrahman (2025) reported 0.74 using ARIFAL (AR + PowerPoint); and Pratiwi et al. (2025) reported 0.76 in limited trials and 0.804 in large-scale trials using Heyzine digital flipbooks. Moderate N-Gain categories (0.30–0.69) were also well-represented: Indarti (2026) reported 0.65 using Book Creator; Rizkiah and Asih (2025) reported 0.55–0.62 using Smart Apps Creator; Pratama and Setyasto (2024) reported 0.44 using Prezi; and Puspita and Setiawan (2025) reported 58.33% N-Gain using Wordwall. Mastery learning improvement was another consistent indicator. Indarti (2026) documented mastery increasing from 44% at pretest to 100% at posttest. Mirnawati et al. (2025) found experimental class mastery reaching 90% using Quizizz, compared to only 30% in the control class. Isnaini (2025), through classroom action research, demonstrated mastery improvement from 40% pre-cycle to 67% in Cycle I and 87% in Cycle II using interactive PowerPoint.

Motivation and Learning Interest

Two articles specifically measured motivation and interest as dependent variables. Table 2 summarizes these findings.

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Table 2. Summary of Motivation and Interest Improvements

Author(s) (Year)	Media Type	Research Design	Key Quantitative Data	Effect Size
Kurniati et al. (2025)	Wordwall	Quasi-Experimental	Posttest interest: Exp 91.32 vs Control 80.00; t(32) = 2.636; p = 0.013	Cohen's d = 0.911 (Large)
Wati et al. (2024)	Digital Media (general)	Classroom Action Research	Cycle I: 140 (82%); Cycle II: 150 (94%)	Not reported

Kurniati et al. (2025) reported a significant increase in learning interest among the experimental group using Wordwall-based PBL, with a posttest mean of 91.32 compared to 80.00 in the control group (p = 0.013). The intervention effect was classified as large, with Cohen's d = 0.911, indicating a highly substantial practical impact. This large effect size suggests that gamified quiz platforms like Wordwall are particularly effective in sustaining student engagement, likely due to their competitive and interactive mechanics. Similarly, Wati et al. (2024), through classroom action research, reported an increase in average learning motivation from 140 (high category) in Cycle I to 150 (very high category) in Cycle II, with classical mastery rising from 82% to 94%.

Critical Thinking and Scientific Literacy

Five articles measured critical thinking skills and/or scientific literacy. Table 3 summarizes these findings.

Table 3. Summary of Critical Thinking and Scientific Literacy Improvements

Author(s) (Year)	Media Type	Variable	Key Quantitative Data	Outcome
Critical Thinking				
Zakiyah et al. (2025)	Digital Comics	Critical Thinking	Exp: 85.50 vs Control: 78.83; p = 0.009	Significant
Dwiyanti (2025)	E-Book (PBL-based)	Critical Thinking	Pretest: 80.76 → Posttest: 89.46; p = 0.000	Significant
Scientific Literacy				
Kristiantari et al. (2022)	Prezi	Scientific Literacy	Exp: 76.89 vs Control: 61.75; MANOVA F = 45.44; p = 0.000	Significant
Sutrisno (2025)	Digital + Local Culture	Scientific Literacy	Pretest Exp: 43.25 → Posttest: 83.14; Control: 42.89 → 66.79; t = 4.786; p = 0.000	Significant
Both				
Pratiwi et al. (2025)	Flipbook (Heyzine)	Critical Thinking & Scientific Literacy	N-Gain CT: 0.76; SL: 0.804	High

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Zakiyah et al. (2025) provided robust evidence that PBL integrated with digital comics significantly improved critical thinking skills, with experimental group means reaching 85.50 compared to 78.83 in the control group ($p = 0.009$). This finding was corroborated by Dwiyanti (2025), who reported significant critical thinking improvements using PBL-based e-books, with pretest and posttest means of 80.76 and 89.46 respectively ($p = 0.000$). For scientific literacy, Kristiantari et al. (2022) demonstrated that Prezi-assisted PBL simultaneously improved both scientific literacy (experimental mean 76.89 vs. control 61.75) and student learning independence (experimental mean 64.47 vs. control 61.15), with MANOVA $F = 45.44$ and $p = 0.000$. The high F-value indicates a strong multivariate effect, confirming that the intervention positively affects multiple interrelated outcomes. Additionally, Sutrisno (2025) reported significant scientific literacy gains through the integration of PBL with digital media and local Madurese cultural content, with posttest means of 83.14 in the experimental group compared to 66.79 in the control group ($p = 0.000$). This finding suggests that contextualization—embedding digital media within culturally relevant frameworks—may further enhance scientific literacy by making abstract science concepts more relatable and meaningful to students.

Collaboration Skills

One article specifically measured collaboration skills. Sitepu et al. (2025) found that Articulate Storyline-based interactive multimedia effectively improved student collaboration skills, with a Wilcoxon test significance level of $p = 0.005$. The collaborative nature of PBL, where students work in groups to investigate problems and present solutions, is inherently strengthened by digital tools that facilitate shared workspaces, peer feedback, and collective content creation.

Articles without Quantitative Data

Six articles did not report quantitative effectiveness data, primarily due to their qualitative, descriptive, or development-only designs. Ansya and Salsabilla (2025) employed a qualitative case study and reported increased student engagement, conceptual understanding, and critical thinking based on observations and interviews. Endaryati et al. (2021) and Nirwana et al. (2024) used descriptive qualitative approaches, finding that PBL-based flipbook e-modules and Quizizz were deemed feasible and received positive responses. Retnowati and Muslim (2026) reported positive student perceptions toward online media-based PBL. Hardiningrum (2022) and Nabila et al. (2024) focused exclusively on development stages, with expert validation scores ranging from 85–96%, but did not proceed to effectiveness testing. Although these six studies lack statistical evidence, they consistently reinforce the qualitative finding that interactive digital media in PBL holds recognized practical potential.

Discussion

The synthesis of findings from 27 quantitative studies provides robust evidence that the integration of interactive digital media within the PBL framework yields significant positive effects across multiple student outcome domains. However, a critical examination of these findings requires attention to several methodological and contextual considerations.

Why Does Interactive Digital Media in PBL Yield Positive Effects?

First, from a constructivist perspective, interactive digital media provides rich, authentic contexts for problem-solving, a fundamental requirement for meaningful learning. When students encounter science problems through visually engaging and interactive media, they are more likely to activate prior knowledge and construct new understanding through active exploration. This aligns with the core philosophy of PBL, which positions students as active problem-solvers rather than passive recipients of information. Second, the cognitive theory of multimedia learning (Mayer, 2009) suggests that students learn more deeply when information is presented through both visual and auditory channels. Interactive digital media inherently leverages dual-channel processing, reducing cognitive load while enhancing comprehension and retention. This is particularly evident in studies using animated videos (Erta, 2025) and digital comics (Loka et al., 2025; Zakiyah et al., 2025).

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Third, from a motivational perspective, gamification elements, points, leaderboards, instant feedback, and competition, embedded in platforms like Quizizz and Wordwall trigger students' intrinsic motivation and situational interest (Kurniati et al., 2025; Mirnawati et al., 2025). The large effect size reported by Kurniati et al. (Cohen's d = 0.911) confirms that motivational gains are not trivial; they translate directly into increased engagement and, subsequently, improved academic performance. Fourth, the syntax alignment between PBL and digital media is crucial. Effective integration occurs when specific media are purposefully selected for each PBL phase: digital comics for authentic problem orientation, interactive e-books for guided investigation and resource organization, collaborative digital tools for presentation, and gamified quizzes for formative evaluation and reflection. When teachers strategically combine multiple media types (as seen in 11 articles), they create a cohesive learning ecosystem that scaffolds students throughout the entire PBL process.

Critical Examination of the Evidence Base

While the positive effects are encouraging, several critical considerations must be addressed to provide a balanced interpretation of the findings.

1. Variability in Research Design Quality and Its Implications

   The studies included in this review employed diverse research designs with markedly different levels of methodological rigor. The evidence base consists of: Quasi-experimental designs (6 studies), classroom action research (2 studies), pre-experimental designs (17 studies), development research with effectiveness testing (4 studies). Furthermore, among the 27 cognitive studies, only 11 reported effect sizes (N-Gain or Cohen's d), limiting the ability to compare the magnitude of effects across studies. The absence of standardized reporting practices in many articles also hampers meta-analytic synthesis.
2. The Challenge of Publication Bias

   A significant concern in this review is the risk of publication bias. All 27 studies reporting cognitive outcomes demonstrated statistically significant positive effects. This uniformity is atypical in educational research and raises the possibility that studies with null or negative findings have not been published or were excluded during the search process. The "file drawer problem" where studies with non-significant results remain unpublishedis a well-documented phenomenon in educational and psychological research. Consequently, the observed effect sizes in this review may overestimate the true population effect. The absence of null findings in this synthesis should therefore be interpreted with caution.
3. Limitations in Generalizability: Infrastructure and Context

   A critical factor that may influence the generalizability of these findings is the technological infrastructure available in Indonesian elementary schools. While the reviewed studies were conducted in diverse contexts, most were implemented in schools with relatively adequate technological resources. However, the Indonesian educational landscape is characterized by significant disparities in digital infrastructure, particularly between urban and rural schools. Schools lacking stable internet connectivity, sufficient devices, or reliable electricity would likely struggle to implement interactive digital media effectively. The positive effects reported in this review may therefore represent optimal conditions rather than typical classroom realities. Teachers and policymakers must consider local infrastructural capacity before adopting these technologies.
4. The Role of Teacher Competence

   The effectiveness of interactive digital media in PBL is heavily dependent on teacher competence. Technology integration alone does not guarantee improved learning outcomes; rather, teacher pedagogical knowledge and technological proficiency are critical mediating factors. In the reviewed studies, teacher competence was often assumed rather than measured. However, the diversity of implementation quality across studies suggests that teacher digital literacy may moderate the effects of these interventions. Teachers with limited

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digital skills or resistance to technology integration may fail to leverage the full potential of interactive media, potentially yielding weaker or null effects. This highlights the need for targeted professional development to accompany technology adoption.

5. Potential Cognitive Load Concerns
   While interactive digital media offers numerous benefits, there is a potential downside regarding cognitive load. Highly complex, visually dense, or poorly designed interactive media may overwhelm students' working memory, particularly for younger elementary school learners. None of the reviewed articles explicitly measured or discussed cognitive load. This is a significant gap, as the relationship between media design, cognitive load, and learning outcomes is well-established in multimedia learning research. The studies that reported high N-Gain scores likely used well-designed media that managed cognitive load effectively, but this cannot be confirmed without direct measurement. Future research should incorporate cognitive load assessments to optimize media design.
6. Limited Evidence for Non-Cognitive Outcomes
   While cognitive learning outcomes were extensively studied (27 articles), the evidence for non-cognitive outcomes is considerably thinner: motivation and interest: only 2 articles, critical thinking: only 2 articles, scientific literacy: only 2 articles, collaboration skills: only 1 article.
   This imbalance in the evidence base limits the strength of conclusions regarding the effectiveness of interactive digital media in PBL for non-cognitive outcomes. Furthermore, the measurement instruments for these non-cognitive variables varied across studies, making direct comparisons difficult.

Consistency of Effectiveness Across Media Types and Research Designs

A striking finding is the consistent positive effect observed across highly diverse media types and research designs, which substantially strengthens the validity and generalizability of these conclusions.

Across Media Types: Positive effects were reported for:

1. Interactive quiz platforms: Quizizz (Mirnawati et al., 2025) and Wordwall (Puspita & Setiawan, 2025).
2. Presentation tools: Interactive PowerPoint (Juliana et al., 2022; Isnaini, 2025) and Prezi (Kristiantari et al., 2022; Pratama & Setyasto, 2024).
3. Digital books: E-books and Flipbooks (Dewi et al., 2025; Dwiyanti, 2025; Indarti, 2026; Putri & Wiarta, 2022, 2024; Pratiwi et al., 2025), all consistently showing moderate-to-high N-Gain.
4. Immersive technologies: Augmented Reality (Maharani & Fathurrahman, 2025) achieving a high N-Gain of 0.74.

This consistency across media types indicates that the effectiveness of interactive digital media in PBL is not dependent on any single technology. Instead, the alignment between media features and the specific demands of each PBL syntax phase appears to be the critical success factor. Across Research Designs**:** The positive findings were consistent regardless of methodological approach. Quasi-experimental studies (Mirnawati et al., 2025; Kristiantari et al., 2022; Sutrisno, 2025; Puspita & Setiawan, 2025; Zakiyah et al., 2025), classroom action research (Isnaini, 2025; Wati et al., 2024), pre-experimental designs (Indarti, 2026), and development studies with effectiveness testing (Armadhani et al., 2025; Pratiwi et al., 2025; Rizkiah & Asih, 2025) all reported statistically significant improvements. The consistency across varied designs enhances confidence that the positive effects are robust and not artifacts of specific methodological approaches. However, as discussed earlier, this consistency should not be overinterpreted. The absence of studies with null or negative results in this review—potentially due to publication bias, means that the observed consistency may reflect systematic reporting bias rather than true universal effectiveness.

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CONCLUSSION AND RECOMMENDATIONS

This systematic literature review synthesizes evidence from 37 articles published between 2021 and 2026 regarding the effectiveness of interactive digital media integrated with PBL in elementary science education, of which 31 reported quantitative data. On cognitive learning outcomes, the synthesis indicates positive effects, with all 27 studies measuring this variable reporting statistically significant improvements, reflected in N-Gain scores ranging from moderate (0.44) to high (0.804). However, the strength of this evidence varies, as quasi-experimental designs provide stronger causal inference compared to pre-experimental one-group pretest-posttest designs lacking control groups. For non-cognitive domains, the evidence suggests positive effects on motivation (Cohen's d = 0.911), critical thinking, scientific literacy, and collaboration, though these conclusions remain tentative given the considerably thinner evidence base, with only one to five studies addressing each variable. Positive effects were observed consistently across diverse media types and research designs, suggesting effectiveness is not dependent on any single technology. However, this consistency must be interpreted with caution due to several inherent limitations.

The findings are constrained by the exclusive reliance on Google Scholar for literature search, which may have excluded relevant studies from specialized databases such as Scopus and Web of Science. The absence of null results across all cognitive studies raises concerns over publication bias, as studies with non-significant findings are less likely to be published. Furthermore, the inclusion of studies with heterogeneous methodological rigor, the lack of a formal risk-of-bias assessment, and the varying instruments used to measure similar constructs limit direct comparability. Additionally, most studies were conducted in relatively well-resourced settings, making generalization to under-resourced schools uncertain.

Recommendations

For teachers and practitioners, it is recommended to select media that align with specific PBL syntax phases such as digital comics for problem orientation, interactive e-books for investigation, and gamified quizzes for evaluation, while carefully considering their schools' technological readiness. Teachers should also pursue professional development to strengthen both PBL facilitation skills and digital literacy. School administrators and policymakers are advised to invest in adequate digital infrastructure, provide sustained teacher training, and address digital equity to prevent widening achievement gaps between urban and rural schools.

For future researchers, it is recommended to adopt more robust experimental designs, such as randomized controlled trials or strong quasi-experiments, to strengthen causal inference. Systematic reviews should expand their search to include multiple databases and consistently report effect sizes alongside p-values. Studies should also incorporate cognitive load assessments, prioritize under-researched non-cognitive outcomes, apply standardized risk-of-bias tools, and conduct replications in diverse contexts to validate and extend current findings.

BIBLIOGRAPHY

Ainullah, A. N., Jampel, I. N., & Sudatha, I. G. W. (2023). Interactive learning multimedia with problem-based learning for fifth-grade elementary school students. *Jurnal Ilmiah Sekolah Dasar, 7*(2), 316-326.

Alwanda, M. A. (2025). Efektivitas media pembelajaran interaktif dalam meningkatkan literasi sains siswa sekolah dasar: Systematic literature review (2020-2025). *Advances In Education Journal, 2*(2), 797-811.

Ansya, Y. A. U., & Salsabilla, T. (2025). Penerapan model problem-based learning berbantuan Canva pada pembelajaran IPA kelas V sekolah dasar. *Islamika, 7*(1), 1-14.

Armadhani, D., Yeni, J. F., Zen, Z., & Rayendra. (2025). Development of interactive multimedia for sciences based on problem-based learning in grade V of elementary school. *Jurnal Penelitian Pendidikan IPA, 11*(7), 570-578.

ISSN 2810-0443 (print) | 2827-8909 (online)
https://doi.org/10.33578/kpd.v5i3.p357-372
Jurnal Kiprah Pendidikan
Volume 5 Number 3 July 2026, Pg. 357-372

Ayu, M., Erita, Y., & Movitaria, M. A. (2025). Development of Educaplay learning media based on problem-based learning in elementary school students' science learning. *Jurnal Penelitian Pendidikan IPA.*

Dewi, N. P. D. A., Abadi, I. B. G. S., & Sulistyaningsih, D. A. A. (2025). E-book based on problem-based learning model in science lessons on me and my needs class IV elementary school. *International Journal of Elementary Education.*

Dwiyanti, P. B. (2025). E-book based problem-based learning to improve student's critical thinking in science learning in elementary school. *Jurnal Ilmiah PGSD, 11*(1), 41-57.

Endaryati, S. A., Atmojo, I. R. W., Slamet, S. Y., & Suryandari, K. C. (2021). Analisis e-modul flipbook berbasis problem-based learning untuk memberdayakan keterampilan berpikir kritis pembelajaran IPA sekolah dasar. *DWIJA CENDEKIA: Jurnal Riset Pedagogik, 5*(2), 300-312.

Erta, M. N. (2025). Media interaktif Canva pada pembelajaran IPAS menggunakan model problem-based learning (PBL) kelas IV sekolah dasar. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang.*

Hardiningrum, P. Y. (2022). Efektivitas multimedia pembelajaran interaktif berbasis problem-based learning pada muatan IPA materi alat gerak hewan untuk siswa kelas V SD. *Jurnal Media dan Teknologi Pendidikan, 2*(1), 20-31.

Hodaifah, H., Widodo, W., & Prahani, B. K. (2025). Implementation of interactive multimedia to improve science literacy of elementary school students: Systematic literature review. *Journal of Innovation and Research in Primary Education, 4(*3), 653-663.

Indarti, D. R. (2026). Pengaruh model PBL berbasis media interaktif Book Creator terhadap hasil belajar IPAS siswa sekolah dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 11*(02), 269-279.

Isnaini, F. (2025). Penerapan model problem-based learning berbantuan media pembelajaran Powerpoint interaktif untuk meningkatkan hasil belajar IPAS kelas V SDN 067240. *EDU SOCIETY: Jurnal Pendidikan, Ilmu Sosial dan Budaya.*

Juliana, M., AB, J. S., & Tanod, M. J. (2022). Model problem-based learning (PBL) berbantuan media interaktif terhadap hasil belajar IPA siswa kelas IV SD Negeri 1 Langkapura. *CERDAS: Jurnal Ilmiah Pendidikan.*

Kemendikdasmen. (2024). Data Rapor Pendidikan Indonesia 2023: *Hasil Asesmen Nasional Jenjang Pendidikan Dasar. Jakarta: Badan Kebijakan Pendidikan Dasar dan Menengah, Kementerian Pendidikan Dasar dan Menengah Republik Indonesia*. Available at: https://data.kemendikdasmen.go.id/dataset/p/rapor-pendidikan-indonesia-mhldx/data-rapor-pendidikan-indonesia-2024

Kristiantari, M. G. R., Widiana, I. W., Tristiantari, N. K. D., & Rediani, N. N. (2022). Impact of Prezi media-assisted problem-based learning on scientific literacy and independence of elementary school students. *Journal of Education and E-Learning Research, 9*(3), 184-191.

Kurniati, E., Fiqry, R., Nurgufriani, A., Diana, N., & Adiansha, A. A. (2025). Pengaruh model problem-based learning (PBL) berbasis aplikasi Wordwall terhadap minat belajar siswa pada materi hidup bersama alam kelas III SDN Risa. *JagoMIPA: Jurnal Pendidikan Matematika dan IPA, 5*(2), 533-543.

Loka, N. P. N., Wibawa, I. M. C., & Lestari, L. P. S. (2025). Webtoon media with problem-based learning model in improving elementary school science learning outcomes. *MIMBAR PGSD Undiksha, 13*(2), 346-355.

Maharani, D. S., & Fathurrahman, M. (2025). Development of an PBL-based augmented reality media for enhanced social and natural science learning outcomes in elementary school students. *Jurnal Pendidikan Progresif.*

Mardiana, I. N. A., & Agung, A. A. G. (2024). Komik digital berbasis masalah untuk meningkatkan hasil belajar IPAS siswa kelas V SD. *Jurnal Ilmiah Pendidikan Profesi Guru, 7*(1), 49-59.

Mayer, R. E. (2009). Multimedia learning (2nd ed.). Cambridge University Press.

ISSN 2810-0443 (print) | 2827-8909 (online)
https://doi.org/10.33578/kpd.v5i3.p357-372

Mirnawati, Maruf, & Amal, A. (2025). Pengaruh model problem-based learning (PBL) berbantuan media Quizizz terhadap hasil belajar IPAS siswa kelas IV SD. *Didaktik: Jurnal Ilmiah PGSD STKIP Subang.*

Nabila, N. I., Sumantri, S., & Zakiah, L. (2024). Pengembangan multimedia interaktif AR "TereDaman" berbasis problem-based learning dalam pembelajaran IPA sekolah dasar. *Jurnal Teknodik*, 41-50.

Nirwana, S., Azizah, M., & Hartati, H. (2024). Analisis penerapan problem-based learning berbantu Quizizz pada pembelajaran IPAS kelas V sekolah dasar. *Jurnal Inovasi, Evaluasi dan Pengembangan Pembelajaran, 4*(1), 155-164.

OECD. (2023a). *PISA 2022 Results (Volume I and II) – Country Notes: Indonesia*. Paris: OECD Publishing. Available at: https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/indonesia_c2e1ae0e-en.html

OECD. (2023b). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education. PISA*. Paris: OECD Publishing. https://www.oecd.org/en/publications/pisa-2022-results-volume-i_53f23881-en.html

Oktariani, R., Gading, I. K., & Wibawa, I. M. C. (2024). Media video pembelajaran interaktif problem-based learning untuk meningkatkan hasil belajar IPAS siswa kelas IV sekolah dasar. *Jurnal Media dan Teknologi Pendidikan, 4*(3), 470-479.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, 372, n71.

Peraturan Menteri Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia Nomor 7 Tahun 2022 tentang Standar Isi pada Pendidikan Anak Usia Dini, Jenjang Pendidikan Dasar, dan Jenjang Pendidikan Menengah. (2022). Jakarta: Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi.

Poniyanti, N. N. P., Agung, A. A. G., & Paramita, M. V. A. (2024). Interactive multimedia based on problem-based learning for the natural and social sciences (IPAS) subject for fourth grade elementary school students. *MIMBAR PGSD Undiksha, 12*(3), 542-553.

Praja, I. R., & Andriani, A. E. (2025). Problem-based learning interactive multimedia to optimize elementary school natural and social sciences learning. *Indonesian Journal of Science and Mathematics Education, 8(*1), 136-153.

Pratama, A., & Setyasto, N. (2024). Development of Prezi media based on problem-based learning (PBL) model in natural and social science subjects in class IV elementary school. *Jurnal Penelitian Pendidikan IPA.*

Pratama, I. P. A., Tegeh, I. M., & Sukma, G. A. P. (2022). Animapoin (animasi Powerpoint) media pembelajaran berbasis masalah pada mata pelajaran IPA untuk kelas IV sekolah dasar. *Jurnal Ilmiah Pendidikan Profesi Guru, 5*(2), 218-228.

Pratiwi, D. M. D., Setiani, R., & Dirgantoro, A. (2025). Inovasi media flipbook berbasis problem-based learning pada materi ekosistem untuk siswa sekolah dasar. *Andragogi: Jurnal Pendidikan dan Pembelajaran, 5*(2), 129-140.

Puspita, P. H., & Setiawan, D. (2025). Improving science learning outcomes in elementary school through a problem-based learning model assisted by Word Wall. *International Journal of Elementary Education, 9*(2), 318-327.

Putri, D. P. S., & Wiarta, I. W. (2022). E-book interaktif berbasis problem-based learning materi sejarah kerajaan di Nusantara pada mata pelajaran IPAS kelas IV sekolah dasar. *Jurnal Ilmiah Pendidikan Profesi Guru.*

Putri, N. N. Y. C., & Wiarta, I. W. (2024). E-book interaktif berbasis problem-based learning untuk pembelajaran IPAS di sekolah dasar: Kelayakan dan efektivitas. *Jurnal Media dan Teknologi Pendidikan, 4*(3), 402-409.

Putri, P. S. S. A., & Ambara, D. P. (2025). Interactive crossword learning media based on problem-based learning magnet material in IPAS class V elementary school. *Journal of Education Technology.*

ISSN 2810-0443 (print) | 2827-8909 (online)
https://doi.org/10.33578/kpd.v5i3.p357-372
Jurnal Kiprah Pendidikan
Volume 5 Number 3 July 2026, Pg. 357-372

Retnowati, A., & Muslim, A. (2026). Persepsi siswa tentang pelaksanaan model problem-based learning berbasis media online dalam pembelajaran IPAS kelas IV SD. *Jurnal Pendidikan Dasar Perkhasa.*

Rizkiah, N., & Asih, S. S. (2025). Development of PBL-based Smart Apps Creator media to improve science learning outcomes for grade IV elementary school students. *Jurnal Penelitian Pendidikan IPA.*

Rogers, G., Szomszor, M., & Adams, J. (2020). Sample size in bibliometric analysis. *Scientometrics, 125*(1), 777-794.

Sitepu, M. S., Azizah, A., Asriani, A., Herlina, H., Nuraini, N., Afifah, M., & Nur'izzani, N. (2025). Development of interactive science problem solver media based on PBL to improve collaboration skills of elementary school students. *Pedagogy: Jurnal Pendidikan.*

Sudarmika, I. K. K., & Sujana, I. W. (2024). Melajah: Multimedia interaktif mari belajar peninggalan sejarah berbasis problem-based learning pada mata pelajaran IPAS kelas IV sekolah dasar. *Jurnal Media dan Teknologi Pendidikan.*

Sutrisno, T. (2025). Efektivitas problem-based learning (PBL) dengan digital dan integrasi budaya lokal Madura terhadap literasi sains siswa sekolah dasar. *Tadrusuun: Jurnal Pendidikan Dasar, 4*(2), 107-118.

Waisakanitri, I. D. A. T., Ganing, N. N., & Wulandari, I. G. A. A. (2023). Media komik digital berbasis problem-based learning muatan IPA (ekosistem) kelas V sekolah dasar. *Jurnal Ilmiah Pendidikan Profesi Guru, 6*(1), 57-70.

Wati, D. R., Zulfiati, H. M., & Hasanah, D. (2024). Efektifitas model problem-based learning berbasis media digital untuk meningkatkan motivasi belajar IPAS siswa kelas IV SDN Tegowanuh. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 9*(03), 97-103.

Zakiyah, Z. A., Wahono, B., & Putra, P. D. A. (2025). The influence of the PBL model with digital comic media on the critical thinking skills and learning outcomes of IPAS in elementary school students. *Jurnal Elementaria Edukasia, 8*(4), 748-759.