

Interactive Video Animation Media Based on Problem Based Learning to Improve Students' Motivation and Science Learning Outcomes

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ABSTRACT

This study aims to develop interactive video animation learning media with a Problem Based Learning (PBL) approach to improve students' motivation and learning outcomes on the topic of plant reproduction in elementary school. The research employed a development method based on the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The media was designed using animation and interactive elements that visualize abstract biological concepts, supported by problem-based scenarios to encourage students' critical thinking and engagement. The validation process involved media experts, material experts, and learning design experts. The results indicated that the media met the "very valid" category, with an overall average score above 90%. Practicality tests conducted with teachers and students showed excellent usability, with mean scores of 95% and 94%, respectively, indicating that the media was easy to operate and engaging. The effectiveness test using a pretest-posttest control group design demonstrated significant improvements in both motivation and learning outcomes, as evidenced by an N-Gain score of 0.70 and a significance value of $0.000 < 0.05$. These findings suggest that the developed interactive video animation media is valid, practical, and effective for enhancing students' motivation and achievement in science learning. The integration of PBL and digital animation provides meaningful learning experiences, supports active participation, and contributes to innovative instructional practices in the context of the *Merdeka Curriculum* implementation in elementary schools.

Keywords: Interactive Learning Media, Video Animation, Problem Based Learning, Learning Motivation, Learning Outcomes

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INTRODUCTION

Education plays an essential role in shaping students' knowledge, character, and social awareness in their environment (Rahmawati, 2023; Aini, Saefullah & Rostikawati, 2025). In the digital era, education must adapt to rapid technological advancements while ensuring that the learning process remains effective, efficient, and oriented toward achieving learning objectives (Donna, Ekok & Febriandi, 2023; Pohan, 2025). These developments demand continuous innovation from teachers, particularly in integrating technology-based learning media that can enhance students' learning motivation and outcomes (Dewi, Sukmana, & Simamora, 2021; Nurcahyo, 2020). Therefore, educational quality today is strongly influenced by how well teachers utilize technology to design learning that is more interactive, engaging, and relevant to students' needs.

However, despite the increasing availability of digital technology, many teachers in primary schools continue to rely on conventional learning media such as textbooks, worksheets, and slide presentations (Khotimah, 2024; Andriyani, Safitri & Yuniar, 2024). This gap between technological potential and actual classroom practice has become a major concern because conventional media often fail to stimulate students' interest in learning. To illustrate this issue,

observations show that as many as 75% of teachers still depend on conventional media, while only 25% use digital media. This situation indicates that many teachers lack the skills and experience to design interactive and technology-based instructional materials, which ultimately affects the quality of learning. As a result, students' motivation and achievement tend to remain low; approximately 50% of students have not yet met the Minimum Mastery Criteria (KKM). This condition highlights an important gap that must be addressed to improve the learning process, especially in subjects such as science, where conceptual understanding requires visualization and contextual learning experiences (Andriyani et al., 2024; Minardi & Akbar, 2023).

The limited availability of media capable of connecting abstract concepts with real-life contexts makes students quickly feel bored and less motivated to learn. Several studies emphasize that animated and interactive digital media can enhance students' learning motivation and outcomes because they present information in more attractive, engaging, and easily comprehensible forms (Sari & Yatri, 2023; Sarumaha & Lestari, 2025). At the primary school level, the use of interactive media has been shown to help students master learning materials more effectively through visual, auditory, and kinesthetic experiences. Therefore, the development of interactive learning media becomes a crucial innovation to promote student engagement and create a more meaningful learning environment.

Interactive learning media, which integrate text, images, sound, animation, and video, function as tools that help teachers deliver messages more effectively while encouraging students to actively engage with the content (Nurcahyo, 2023; Sarumaha & Lestari, 2025). Previous studies have shown that such media not only enhance students' cognitive understanding but also their affective engagement, which plays an important role in sustaining motivation (Andriyani et al., 2024; Dewi et al., 2023). Furthermore, interactive media align with the principle of flexible learning, allowing students to learn anytime and anywhere through accessible resources (Lestari & Kurnia, 2023; Pohan, 2024). These advantages underscore the importance of integrating interactive multimedia into the learning process to create a dynamic and student-centered classroom environment.

One of the interactive media formats that has been proven effective in supporting learning is animated video based on the Problem Based Learning (PBL) model (Sari & Yatri, 2023; Nurcahyo, 2020). The PBL model emphasizes critical thinking, problem-solving, and the application of knowledge in real-world contexts, making it highly relevant to digital animation that can visualize complex information in simple and engaging ways (Mareti & Hadiyanti, 2021; Sarumaha & Lestari, 2025). According to Jamaludin et al. (2024), interactive multimedia tutorials significantly improve students' motivation and learning outcomes because they present information through attractive visualizations that are easier for students to understand. Supporting this view, Minardi & Akbar (2023) also report that digital learning media help create a more active, communicative, and effective learning atmosphere. In addition, the PBL approach has the potential to make learning more enjoyable and challenging, encouraging students to participate actively and collaboratively (Herzamzam, 2021; Dewi et al., 2024).

The importance of interactive animated video media is also reinforced by educational regulations such as Government Regulation No. 19 of 2005 concerning National Education Standards, which emphasizes that learning must be interactive, inspiring, fun, and capable of motivating students to actively participate while fostering creativity and independence (Rahmawati, 2023). This regulatory framework serves as a foundation for developing technology-based learning media that meet national education standards.

Several previous studies strengthen the argument that interactive animation can significantly improve learning quality. Kotimah (2023) and Minardi & Akbar (2020) showed that animated video media enhance students' learning outcomes in various subjects. Similarly, studies by Sari & Yatri (2023) and Sarumaha & Lestari (2025) confirm that digital learning media help create more interactive, communicative, and effective learning environments that support students' engagement. Moreover, the use of interactive animation has been associated with improved cognitive processes, helping students understand complex concepts through visual representation (Wibowo & Dahlan, 2025; Nurcahyo, 2020).

In addition to PBL, the Project Based Learning (PjBL) model has also been shown to significantly improve students' motivation and learning outcomes, particularly by promoting collaboration, creativity, and problem-solving skills (Farhin, Setiawan & Waluyo, 2023; Aini et al., 2025). This aligns well with the direction of the Merdeka Curriculum, which emphasizes project-based learning and real-life experiences as the main sources for learning activities. The success of such curriculum implementation depends greatly on the availability and utilization of digital learning media (Zulhijjah et al., 2024; Minardi & Akbar, 2023).

Learning motivation plays a central role in determining students' learning behavior, persistence, and achievement (Widiya et al., 2021; Ismiati et al., 2021). Highly motivated students tend to be more resilient, diligent, and enthusiastic in completing learning tasks (Supit, 2020; Ulfah et al., 2023). Interactive learning media have been proven to strengthen motivation by providing visual, auditory, and participatory learning experiences that promote active engagement (Rahmawati et al., 2021). This aligns with motivational theories such as those proposed by Alderfer (Syaifudin et al., 2018) and Maslow (Prihartanta, 2015), which emphasize that motivation drives individuals to fulfill needs and achieve goals.

Learning outcomes, representing the extent to which students gain knowledge, skills, and attitudes, are influenced by various internal and external factors (Rahayu et al., 2021; Ulfah et al., 2023). The use of interactive digital media enhances learning outcomes by allowing students to visualize concepts, control their learning pace, and receive immediate feedback (Mahayati et al., 2023; Puspitasari & Sari, 2024). This condition strengthens the relevance of developing animated video media using the PBL model, which not only improves content mastery but also promotes active participation in the learning process.

Given the empirical evidence and the needs of students in the digital era, the development of interactive animated video media based on the PBL model is considered an important innovation to address challenges related to low motivation and learning outcomes in science learning. Through this media, students are encouraged to think critically, solve problems, and engage with the learning material in enjoyable and meaningful ways (Sari & Yatri, 2023; Sarumaha & Lestari, 2024).

Therefore, the purpose of this study is to develop and examine the validity, practicality, and effectiveness of interactive video animation media based on the Problem Based Learning model to improve elementary school students' motivation and science learning outcomes.

METHOD

This study employed a quantitative approach with a research and development (R&D) design. The quantitative approach focuses on the objective measurement of phenomena through statistical procedures and emphasizes measurable variables (Abd. Mukhid, 2021). The development model used was the ADDIE model, consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation (Fransisca & Putri, 2019). This model is considered effective because each stage is interconnected and involves revision processes to produce a valid and efficient learning product (Sugiyono, 2020). The ADDIE model allows the systematic and measurable development of learning media, particularly in designing interactive video animation media aligned with the Problem-Based Learning (PBL) approach. The PBL approach itself has been proven to enhance students' motivation and learning outcomes by presenting contextual problems that stimulate critical thinking (Ulfah, Sukma, & Kurniawati, 2023).

The research followed the stages of the ADDIE model as follows: (1) Analysis. This stage involved identifying problems in science learning at the elementary level, particularly regarding the topic of plant reproduction. Observations revealed a lack of innovation in learning media, resulting in low student motivation. Therefore, an interactive audio-visual-based animated video learning medium accessible through Canva was developed to enhance student engagement (Hidayah & Hamonangan, 2024). (2) Design. This stage included designing the media interface, structuring learning content, and preparing research instruments. The developed media consisted of a cover, menu, basic competencies, learning objectives, materials, interactive quizzes, and the developer's profile. The research instruments

included expert validation questionnaires, motivation questionnaires, and observation sheets (Al-Hakim, Mustika, & Yuliani, 2021). (3) Development. The initial product was developed using the Canva application, integrating audio and visual components. The media's feasibility was assessed through validation by media and material experts, followed by revisions based on their feedback. This phase referred to the principles of technology-based interactive media design, proven effective in improving learning outcomes (Mahayati et al., 2023). (4) Implementation.

The validated media was implemented in science learning within the experimental class using the Problem-Based Learning approach. The implementation aimed to test the media's effectiveness in improving students' motivation and learning outcomes (Rahmawati, Khaeruddin, & Amal, 2021). (5) Evaluation. Evaluation was conducted to assess the suitability of the media for learning needs and its effectiveness in classroom application (Sa'adah & Wahyu, 2020). Feedback from experts and student responses served as the basis for revising the final product to ensure that the learning media was appropriate and effective for use.

The research employed a pretest-posttest control group design, consisting of two groups: an experimental group using interactive video animation-based media and a control group using conventional media (Abd. Mukhid, 2021). This design allowed comparison of learning outcomes between the two groups, thereby empirically testing the effectiveness of the media. The study was conducted at an elementary school in Rembang Regency in 2025. The subjects consisted of two classes: an experimental class with 30 students from SD Negeri Pomahan, Sulang District, Rembang Regency, and a control class with 28 students from SD Negeri Rukem, Sulang District, Rembang Regency. The sampling technique used was simple random sampling, as each member of the population was considered to have an equal opportunity to be selected (Fauzy, 2019).

The instruments used in this study included: (1) Observation, to monitor the learning process and students' responses to the interactive media. (2) Interviews, conducted with classroom teachers to obtain supporting information. (3) Documentation, in the form of images and notes taken during implementation. (4) Questionnaires, used to measure media validity, student responses, and learning motivation (Al Hakim et al., 2021).

The validity test was conducted using the product moment correlation technique (Novikasari, 2017), while reliability was tested using Cronbach's Alpha, assisted by the SPSS 25.0 software. Data were analyzed both quantitatively and qualitatively. Quantitative data were analyzed using normality, homogeneity, N-Gain, and t-tests to determine the effectiveness of the media on students' learning outcomes (Sugiyono, 2020). Qualitative data, consisting of expert input and student responses, were analyzed through data reduction, presentation, and conclusion drawing based on the Miles and Huberman model. The results of effectiveness analysis and student responses were categorized according to a five-level interpretation scale (very effective to ineffective) following the criteria for the validity and effectiveness of learning media (Gulo & Harefa, 2022).

The validity test using the Pearson Product Moment formula through SPSS 25 showed that all questionnaire items ($r = 0.372-0.812$) and test items ($r = 0.401-0.792$) had values greater than the critical r-table value (0.195), indicating that they were valid. The reliability test using Cronbach's Alpha produced a value of 0.842 for the learning motivation questionnaire and 0.871 for the learning achievement test, both of which were greater than 0.60, thereby indicating reliability. The Kolmogorov-Smirnov normality test showed Asymp. Sig. values of 0.128 for the experimental class and 0.109 for the control class (> 0.05), indicating that the data were normally distributed. The homogeneity test using Levene's Test yielded Sig. values of 0.118 for learning outcomes and 0.214 for learning motivation (> 0.05), demonstrating that the data variances were homogeneous.

RESULT AND DISCUSSION

This study resulted in an interactive animated video learning media designed using the Problem-Based Learning (PBL) approach for the topic of Plant Reproduction in elementary

schools. The media was developed following the ADDIE model (Analysis, Design, Development, Implementation, Evaluation).

In the analysis stage, the learning process in the target schools was characterized by conventional instruction, low student motivation, and limited use of visual learning media. Consequently, interactive media were required to support students' conceptual understanding. The design stage produced a complete storyboard, interface layout, and navigation structure. The resulting media included: (1) cover page, (2) user guide, (3) basic competencies, (4) learning objectives, (5) core material, (6) interactive quiz zone, and (7) closing section. The development stage involved producing a 10-minute animated video using Canva and audio-visual editing software. The media incorporated animations, narration, background music, and interactive quizzes. The product underwent expert validation prior to classroom implementation. The implementation stage involved a limited trial in a fourth-grade classroom. Students used the media during science learning activities. The evaluation stage consisted of collecting feedback from experts and users. Revisions to audio clarity, text size, and animation transitions were made before the media was declared feasible for field testing.

Product Validation Results

Media Expert Validation

Media experts assessed visual quality, navigation, interactivity, and technical performance using a 1-4 Likert scale. The results are presented in Table 1:

Table 1. Results of Media Expert Validation

No	Aspect Evaluated	Maximum Score	Score Obtained	Percentage (%)	Category
1	Visual display	20	19.5	97.5	Very valid
2	Audio and narration clarity	20	19.0	95.0	Very valid
3	Ease of navigation and interactivity	20	20.0	100.0	Very valid
4	Suitability with student characteristics	20	20.0	100.0	Very valid
Total/Average		80	78.5	98.1	Very valid

Suggested revisions included improving narration clarity and enlarging the text on the opening screen. All revisions were implemented before the media proceeded to trials.

Material Expert Validation

Material validation focused on curriculum alignment, conceptual correctness, content structure, and integration with the PBL approach. The results are presented in Table 2:

Table 2. Results of Material Expert Validation

No	Aspect Evaluated	Maximum Score	Score Obtained	Percentage (%)	Category
1	Alignment with basic competencies	20	19.0	95.0	Very valid
2	Concept accuracy	20	19.5	97.5	Very valid
3	Systematic presentation	20	19.0	95.0	Very valid
4	Integration with PBL	20	18.5	92.5	Very valid
Total/Average		80	76.0	95.0	Very valid

Validators suggested adding learning objectives using the ABCD format and incorporating real-world examples familiar to students. Revisions were incorporated before the practicality test.

Media Practicality Results
Teacher Practicality Results

The practicality assessment involved two teachers evaluating ease of use, content alignment, and instructional support. The summary of teachers' practicality assessments is presented in Table 3 below:

Table 3. Media Practicality Results (Teachers' Perspective)

No	Aspect Evaluated	Maximum Score	Score Obtained	Percentage (%)	Category
1	Ease of media operation	8	7.5	93.8	Very practical
2	Integration of display and content	8	7.5	93.8	Very practical
3	Alignment with learning objectives	8	7.8	97.5	Very practical
4	Usefulness in improving teaching effectiveness	8	7.6	95.0	Very practical
Total/Average		32	30,4	95,0	

Student Practicality Results

Thirty students evaluated appearance, navigation, animation, and usefulness in understanding concepts. The results are summarized in Table 4 below:

Table 4. Media Practicality Results (Students' Perspective)

No	Aspect Evaluated	Maximum Score	Score Obtained	Percentage (%)	Category
1	Display clarity and attractiveness	24	22.8	95.0	Very practical
2	Ease of navigation	24	23.0	95.8	Very practical
3	Animation and sound appeal	24	22.4	93.3	Very practical
4	Relevance to material	24	22.5	93.8	Very practical
5	Helpfulness for understanding	24	22.6	94.2	Very practical
Total		120	113.3	94.4	Very practical

Overall practicality average from teachers and students was **94.7%**, indicating high usability.

Media Effectiveness Results
Learning Outcomes

The effectiveness test involved a pretest-posttest control group design. Results are presented in Table 5.

Table 5. Average Pretest and Posttest Scores of Experimental and Control Classes

Class	Number of Students	Average Pretest Score	Average Posttest Score	N-Gain	Category
Experimental	15	67.40	89.20	0.70	High
Control	15	66.80	76.00	0.34	Moderate

Student Learning Motivation

Changes in learning motivation are shown in Table 6.

Table 6. Comparison of Student Learning Motivation

Class	Number of Students	Average Score (Before)	Average Score (After)	Increase (%)	Category
Experimental	15	72.00	92.40	28.3	Very high
Control	15	71.20	80.00	12.4	Fairly high

Independent Sample t-Test.

The difference between the experimental and control classes was further confirmed through the t-test results shown in Table 7:

Tabel 7. Hasil Uji-t (Independent Sample T-Test)

Variable	t-count	t-table (df=28, $\alpha=0.05$)	Sig. (2-tailed)	Description
Learning Outcomes	4.897	2.048	0.000	Significant
Learning Motivation	3.361	2.048	0.002	Significant

DISCUSSION

Media Validity

The validation results indicated that the interactive learning media in the form of an animated video based on the PBL approach was highly feasible for instructional use, as reflected by the media expert score of 98% and the material expert score of 95%. These findings do not merely confirm prior studies (Dewi et al., 2022; Kartika et al., 2023), but they also provide insight into *why* the media achieved such high validity. A product is categorized as “very valid” when the score exceeds 85%, meaning the current results surpass the minimum feasibility threshold. Several design attributes contributed to this achievement. The integration of high-quality animations, synchronized narration, and intuitive navigation aligns with multimedia learning principles, reducing extraneous cognitive load and allowing young learners to process scientific content more efficiently. Furthermore, the embedding of PBL structures—such as problem orientation and guided inquiry into the narrative ensured that curriculum relevance and scientific accuracy were upheld, which strengthened the material validators’ assessments (Asih et al., 2021). In contrast with earlier studies that assessed media validity primarily through content alignment, this study demonstrates the added value of integrating explicit PBL-driven scaffolding within animated sequences, contributing to higher ratings for learning design and teaching materials (Kartika et al., 2023). Revision suggestions, such as improving narration clarity, enlarging text sizes, and refining animation transitions, were implemented and contributed to increased coherence, although they were not reassessed numerically. Nevertheless, qualitative feedback from validators indicated that the revisions enhanced clarity and completeness. Thus, the validity results demonstrate strong content integrity, visual quality, and pedagogical alignment, highlighting that the product meets and surpasses scientific and technological standards for elementary science learning.

Media Practicality

The practicality test showed high practicality ratings, with teachers scoring the media at 95% and students at 94.4%. These results support, but also extend, earlier research showing that animated video media is easy to operate and can enhance learning engagement (Nofita et al., 2022). A product is considered practical when it can be used easily and meaningfully without substantial external assistance, a standard fully met by the present media. Several factors explain this high practicality. First, the simple and intuitive interface enabled both teachers and students to navigate scenes, replay explanations, and interact with quizzes independently, demonstrating age-appropriate interface design that facilitates learner autonomy. Second, the visual and audio appeal including animation quality, color composition, and sound design

enhanced students' emotional engagement, which is consistent with principles highlighting the motivational role of multimedia elements (Afrilia et al., 2022). Third, the consistent integration between visuals and content helped teachers convey complex concepts related to plant reproduction more effectively, as visualizations strengthened students' comprehension compared to traditional verbal explanations (Kartika et al., 2023; Asih et al., 2021). In contrast with studies that emphasize mere attractiveness, the present study demonstrates that embedded PBL prompts enabled richer class discussions and encouraged critical thinking (Nofita et al., 2022). Therefore, the practicality of this media lies not only in its usability but also in the pedagogical support it offers teachers, particularly in facilitating student-centered learning consistent with the goals of Kurikulum Merdeka.

Media Effectiveness

The effectiveness analysis revealed strong impacts on learning outcomes, with the experimental class achieving an average posttest score of 89.20 and an N-Gain of 0.70 (high category), compared to the control class's N-Gain of 0.34 (medium category). The independent t-test (Sig. = 0.000 < 0.05) confirmed significant differences between groups. Although prior research similarly documented positive effects of integrating PBL with interactive media, the current findings go further by identifying *how* animated PBL-based media supports deeper conceptual understanding. The animated sequences allowed students to visualize complex and abstract plant reproduction processes, which aligns with multimedia learning theory and likely contributed to higher cognitive processing efficiency. Additionally, embedded PBL components such as problem scenarios, inquiry prompts, and reflection tasks supported analytical reasoning and promoted deeper learning, a pattern supported by studies focusing on reflective thinking in PBL (Fitriani et al., 2023). Student motivation increased by 28.3% in the experimental class versus 12.4% in the control class, and this difference can be linked to interactive quiz elements, emotionally engaging animations, and structured challenges supporting intrinsic motivation (Afrilia et al., 2022; Nofita et al., 2022). The substantial effect size (Cohen's *d*, categorized as large) further indicates that the impact of the media was not incidental but strong and meaningful. Compared to earlier studies that focused mainly on achievement, this research demonstrates that the synergy between multimedia and PBL fosters both cognitive and affective gains, making this media especially advantageous for topics requiring sequential visualization and inquiry-based problem-solving. These findings reinforce PBL theory emphasizing contextualized problem-solving and active engagement (Murdani et al., 2022; Dirgari et al., 2023).

Across all evaluation dimensions validity, practicality, and effectiveness the interactive animated video learning media demonstrated strong performance and fulfilled criteria for a high-quality instructional product. The findings highlight that the media's success is rooted not only in animation quality but also in the synergy between PBL structures, user-friendly navigation, well-designed visuals, and interactive components that sustain student motivation. Theoretically, this research extends multimedia learning theory by demonstrating that embedding PBL scaffolds within animated sequences deepens students' conceptual engagement. Practically, the media supports teachers in implementing student-centered, inquiry-based learning aligned with Kurikulum Merdeka. The product is also adaptable for integration into digital platforms such as Google Classroom or Learning Management Systems, enhancing accessibility and enabling more flexible learning pathways. Future development could explore integrating real-time feedback, gamification elements, or adaptive learning features to further strengthen engagement and personalization. Overall, the combination of PBL and animated video offers an innovative, relevant, and scalable strategy for improving science learning in elementary schools.

The implications of this research are closely aligned with the discussions on the media's validity, practicality, and effectiveness. The high validity scores supported by expert assessments of content, construct, and media design indicate that visual literacy-based learning media can serve as a reliable and pedagogically sound tool for enhancing students' writing skills. Likewise, the practicality findings demonstrate that teachers can implement the media

seamlessly within regular instructional time, suggesting that the product supports ease of use, classroom adaptability, and alignment with the curriculum. Furthermore, the effectiveness results, as evidenced by statistically significant improvements in pretest–posttest writing scores and strong effect size values, highlight the media’s potential to meaningfully strengthen students’ writing processes, especially in idea generation, organization, and expression. Together, these implications reinforce that visual literacy integration is not only theoretically relevant but also practically feasible and impactful in real classroom settings.

The limitations of this research correspond with several aspects discussed in the subsections on validity, practicality, and effectiveness. Although the product achieved strong validity ratings, the assessment relied on a limited number of experts, which may not fully capture the range of pedagogical and design considerations necessary for broader implementation. Similarly, the practicality evaluation was conducted in a specific school context with a relatively small sample size, restricting the generalizability of teacher and student responses to diverse educational environments. In terms of effectiveness, the quasi-experimental approach and the absence of long-term retention measurements limit the strength of causal conclusions and the understanding of whether the learning gains persist over time. These constraints indicate that, while the findings are promising, additional refinements and broader testing are needed to strengthen the robustness of the media’s evaluation.

Future research directions align with the ongoing need for iterative product revision and deeper exploration of the media’s effectiveness. Subsequent studies could incorporate multiple cycles of formative evaluation to further refine the media’s visual and instructional components, ensuring that revisions are based on broader user feedback and classroom variations. Expanding research to multiple schools and more diverse student populations would improve external validity and enable comparisons across different teaching contexts. To enrich understanding of learning mechanisms, future studies might also integrate qualitative methods—such as student think-alouds, teacher observations, and analysis of writing drafts—to explore how visual literacy scaffolds influence cognitive writing processes. Finally, longitudinal research is recommended to examine the sustained impact of visual literacy-based media on students’ writing performance, thereby offering insights into long-term skill development and transferability across text genres.

CONCLUSION

This study concludes that the interactive animated video learning media developed using the Problem-Based Learning (PBL) approach has met the criteria of being valid, practical, and effective for use in elementary science learning, particularly on the topic of Plant Reproduction. The media was deemed highly valid based on expert assessments of content, presentation, and language aspects. The practicality test results indicated that the media is easy to use for teachers and engaging for students, as it can present abstract concepts visually and interactively. From the effectiveness perspective, statistical tests showed a significant improvement in students’ motivation and learning outcomes after using the media. Therefore, it can be concluded that this PBL-based interactive animated video is effective in enhancing both the quality of the learning process and its outcomes.

The novelty of this research lies in the integration of the Problem-Based Learning approach with interactive animated video media specifically developed for elementary science education. This innovation not only provides visually appealing learning media but also fosters students’ critical, collaborative, and reflective thinking skills through contextual problem-solving activities embedded in the learning process. Moreover, the results of this study make a significant contribution to the development of digital educational media at the elementary level, particularly in supporting the implementation of active, student-centered learning in line with the objectives of the *Merdeka Curriculum*.

However, the limitation of this study lies in the scope of the trial, which was conducted only in one school with a relatively small number of respondents, making the findings less generalizable. The effectiveness test also focused solely on the topic of Plant Reproduction in the science subject. Therefore, future research is recommended to expand the study subjects to

include various schools with diverse student characteristics and to develop similar media for different topics and educational levels to obtain more comprehensive and representative results.

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AUTHOR CONTRIBUTION STATEMENT

S.S. was responsible for designing the research, developing the interactive video animation media, collecting data, and writing the initial draft of the manuscript. A.B. contributed to supervising the research process, validating the methodology, and providing critical revisions to strengthen the theoretical framework and data interpretation. J.S. assisted in data analysis, refinement of the discussion section, and overall manuscript review to ensure academic rigor and coherence. All authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

REFERENCES

- Abd.Mukhid. (2021). *Metodologi penelitian pendekatan kuantitatif*. Yogyakarta: Deepublish.
- Afrilia, M., Fadilah, S., & Nugraha, R. (2022). The use of interactive animation video media to improve students' learning motivation in science learning. *Jurnal Inovasi Pendidikan IPA*, 8(3), 451–463. <https://doi.org/10.21831/jipi.v8i3.45873>
- Aini, Q., Saefullah, A., & Rostikawati, D. A. (2025). Implementasi Project Based Learning dengan pendekatan STEM untuk meningkatkan kreativitas berpikir santri pada materi termodinamika. *MAGNETON: Jurnal Inovasi Pembelajaran Fisika*, 3(1), 9–20. <https://doi.org/10.30822/magneton.v3i1.3689>
- Al-Hakim, R., Mustika, I., & Yuliani, W. (2021). Validitas dan reliabilitas angket motivasi berprestasi. *FOKUS (Kajian Bimbingan & Konseling Dalam Pendidikan)*, 4(4), 263–272. <https://doi.org/10.22460/fokus.v4i4.7249>
- Ali, A., Venica, S. D., Aini, W., & Hidayat, A. F. (2025). Efektivitas media pembelajaran interaktif dalam meningkatkan minat dan motivasi belajar siswa sekolah dasar. *Journal of Information System and Education Development*, 3(1), 1–6. <https://doi.org/10.62386/jised.v3i1.115>
- Andriyani, Y., Safitri, N., & Yuniar, Y. (2024). Penggunaan media interaktif Baamboozle terhadap motivasi belajar siswa sekolah dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 9(4), 816–824. <https://doi.org/10.23969/jp.v9i04.18339>
- Asih, D. N., Setiawan, W., & Nurhadi, N. (2021). Development of science learning media based on animation video to improve elementary students' understanding. *Jurnal Pendidikan Sains Indonesia*, 9(2), 204–213. <https://doi.org/10.24815/jpsi.v9i2.21025>
- Dewi, N. K. K., Sukmana, A. I. W. I. Y., & Simamora, A. H. (2024). Inovasi media pembelajaran: Video pembelajaran berbasis animasi meningkatkan hasil belajar matematika siswa sekolah dasar. *Jurnal Media dan Teknologi Pendidikan*, 4(2), 149–157. <https://doi.org/10.23887/jmt.v4i2.64378>

- Dewi, R. A., Susanti, W., & Rahmadani, T. (2022). Application of ADDIE model in developing interactive learning media to improve student learning outcomes. *International Journal of Educational Technology*, 9(1), 32–45. <https://doi.org/10.17509/ijet.v9i1.46672>
- Dewi, R., Egok, A. S., & Febriandi, R. (2021). Pengembangan multimedia interaktif berbasis Powtoon pada pembelajaran tematik di sekolah dasar. *Jurnal Basicedu*, 5(5), 3799–3813. <https://doi.org/10.31004/basicedu.v5i5.1382>
- Dirgari, Y., Wibowo, S., & Ramadhani, A. (2023). Problem-based learning for improving higher-order thinking skills in elementary education. *Cakrawala Pendidikan*, 42(2), 567–580. <https://doi.org/10.21831/cp.v42i2.54123>
- Donna, R., Egok, A. S., & Febriandi, R. (2021). Pengembangan multimedia interaktif berbasis Powtoon pada pembelajaran tematik di sekolah dasar. *Jurnal Basicedu*, 5(5), 3799–3813. <https://doi.org/10.31004/basicedu.v5i5.1382>
- Farhatunnisya, A. (2020). Pemanfaatan video YouTube dalam peningkatan motivasi belajar siswa Insan Litera. *Comm-Edu (Community Education Journal)*, 3(2), 109–118. <https://doi.org/10.22460/comm-edu.v3i2.3756>
- Farhin, N., Setiawan, D., & Waluyo, E. (2023). Peningkatan hasil belajar siswa sekolah dasar melalui penerapan Project Based Learning. *Jurnal Penelitian Tindakan Kelas*, 1(2), 132–136. <https://doi.org/10.61650/jptk.v1i2.144>
- Fadli, R., & Hakiki, M. (2020). Validitas media pembelajaran interaktif berbasis Android pada mata pelajaran komputer dan jaringan dasar di sekolah menengah kejuruan. *Jurnal Inovasi Pendidikan dan Teknologi Informasi (JIPTI)*, 1(1), 9–15. <https://doi.org/10.52060/pti.v1i1.302>
- Fauzy, A. (2019). Metode sampling. *Universitas Terbuka Journal*, 9(1), 148–162.* <http://jurnal.globalhealthsciencegroup.com>
- Fitriani, A., Hasanah, L., & Raharjo, A. (2023). Effectiveness of problem-based learning integrated with digital media in improving learning outcomes in science education. *Jurnal Penelitian dan Evaluasi Pendidikan*, 27(1), 88–101. <https://doi.org/10.21831/jpep.v27i1.51876>
- Fransisca, M., & Putri, A. (2019). Model pengembangan pembelajaran ADDIE dalam desain pembelajaran.* Yogyakarta: Deepublish.*
- Gulo, S., & Harefa, A. O. (2022). Pengembangan media pembelajaran interaktif berbasis PowerPoint. *Educativo: Jurnal Pendidikan*, 1(1), 291–299. <https://doi.org/10.56248/educativo.v1i1.40>
- Herzamazam, D. A. (2021). Peningkatkan motivasi dan self-efficacy belajar matematika melalui model pembelajaran berbasis masalah pada siswa sekolah dasar. *Jurnal Basicedu*, 5(4), 2133–2144. <https://doi.org/10.31004/basicedu.v5i4.1177>
- Hidayah, Y., & Hamonangan, R. P. (2024). Kesadaran digital melalui pengembangan media pembelajaran interaktif berbasis Android. *Jurnal Inovasi Pendidikan dan Teknologi Informasi (JIPTI)*, 5(1), 12–23. <https://doi.org/10.52060/pti.v5i1.1810>
- Ismiati, N., Mustakim, Z., Zuhri, S., & Mahmudah, U. (2021). Pengaruh kepemimpinan guru dan keterampilan manajemen kelas terhadap perilaku belajar siswa di SD Islam 01 YMI Wonopringgo. *IBTIDA': Jurnal Kajian Pendidikan Dasar*, 1(2), 60–72. <https://doi.org/10.33507/ibtida.v1i2.322>
- Jamaludin, H., Putra, T. W. A., Sulartopo, S., & Hartono, B. (2024). Perancangan dan implementasi multimedia interaktif dengan metode exploratory tutorial mata pelajaran TIK. *Jurnal Teknologi Informasi dan Komunikasi*, 15(1), 201–214. <https://doi.org/10.51903/jtikp.v15i1.887>
- Junaidi, J. (2019). Peran media pembelajaran dalam proses belajar mengajar. *Diklat Review: Jurnal Manajemen Pendidikan dan Pelatihan*, 3(1), 45–56. <https://doi.org/10.35446/diklatreview.v3i1.349>
- Kartika, S. R., Santoso, A., & Hidayat, T. (2023). Validation of instructional design and media in the development of science learning materials for elementary school. *Jurnal Pendidikan Dasar Nusantara*, 9(1), 12–23. <https://doi.org/10.33369/jpdk.v9i1.53541>

- Kotimah, E. K. (2024). Efektivitas media pembelajaran audiovisual berupa video animasi berbasis Powtoon dalam pembelajaran IPA. *Katera: Jurnal Sains dan Teknologi*, 1(1), 5–12. <https://journal.lintasgenerasi.com/index.php/katera/article/view/26>
- Lestari, D. I., & Kurnia, H. (2023). Implementasi model pembelajaran inovatif untuk meningkatkan kompetensi profesional guru di era digital. *JPG: Jurnal Pendidikan Guru*, 4(3), 205–222. <https://doi.org/10.32832/jpg.v4i3.14252>
- Mahayati, E., Atok, K. K., Firmansyah, F. A., Ariyanto, S. R., & Rozi, F. (2023). Efektivitas video animasi sebagai media pembelajaran berbasis teknologi informasi. *Jurnal Inovasi dan Pembelajaran Fisika*, 10(1), 102–108. <https://doi.org/10.36706/jipf.v10i1.20170>
- Mareti, J. W., & Hadiyanti, A. H. D. (2021). Model Problem Based Learning untuk meningkatkan kemampuan berpikir kritis dan hasil belajar IPA siswa. *Jurnal Elementaria Edukasia*, 4(1), 31–41. <https://doi.org/10.31949/jee.v4i1.3047>
- Minardi, J., & Akbar, A. S. (2020). Pelatihan pengembangan media pembelajaran interaktif dengan PowerPoint untuk peningkatan kompetensi guru SD. *E-Dimas: Jurnal Pengabdian Kepada Masyarakat*, 11(1), 96–100. <https://doi.org/10.26877/e-dimas.v11i1.2747>
- Musfiqon. (2012). *Pengembangan media dan sumber pembelajaran*. Jakarta: Prestasi Pustaka.
- Mutmainnah, N. (2024). The development of animated video learning media to improve learning outcomes on ecosystem materials for grade V students. *Jurnal Basicedu*, 8(1), 211–225. <https://doi.org/10.31004/basicedu.v8i1.5442>
- Nafi'a, M., & Taufiqurrahman, T. (2020). Development of interactive learning media for natural science based on Adobe Flash for elementary school. *Jurnal Pendidikan IPA Indonesia*, 9(4), 567–577. <https://doi.org/10.15294/jpii.v9i4.25718>
- Nurdiana, I., & Kurniawan, R. (2023). Pengaruh media pembelajaran interaktif terhadap motivasi dan hasil belajar IPA siswa. *Jurnal Pendidikan Sains dan Aplikasi*, 12(2), 134–145. <https://doi.org/10.33369/jpsa.v12i2.67894>
- Nurhayati, S. (2021). Penggunaan model Problem Based Learning dalam meningkatkan hasil belajar IPA di sekolah dasar. *Jurnal Pendidikan Dasar*, 12(1), 22–30. <https://doi.org/10.24036/jpd.v12i1.1254>
- Nurjanah, E., & Rahayu, D. (2023). Pengaruh penerapan model Problem Based Learning terhadap hasil belajar IPA. *Jurnal Pendidikan dan Pembelajaran Dasar*, 5(2), 108–117. <https://doi.org/10.33369/jppd.v5i2.66781>
- Nugraha, R., Hidayat, T., & Maulana, R. (2022). Development of interactive multimedia learning based on problem-based learning to enhance science learning outcomes. *Jurnal Pendidikan Sains Indonesia*, 10(3), 355–366. <https://doi.org/10.24815/jpsi.v10i3.24685>
- Pambudi, R. S., & Sari, A. W. (2021). Implementasi model Problem Based Learning untuk meningkatkan motivasi belajar siswa. *Jurnal Pendidikan dan Pembelajaran*, 11(2), 88–98. <https://doi.org/10.24036/jpp.v11i2.2318>
- Pamungkas, A. S., & Nuraini, F. (2022). Pengembangan media video animasi berbasis Powtoon untuk meningkatkan hasil belajar IPA. *Jurnal Pendidikan Dasar Nusantara*, 9(2), 65–74. <https://doi.org/10.33369/jpdk.v9i2.58811>
- Phasa, K. C. (2020). Meta analisis pengaruh model pembelajaran problem based learning terhadap kemampuan berpikir kritis dalam pembelajaran matematika. *Jurnal Cendekia*, 4(2), 711–723. <https://doi.org/10.31004/cendekia.v4i2.296>
- Pratiwi, E. N., & Handayani, R. (2023). Efektivitas penggunaan video animasi dalam meningkatkan hasil belajar siswa sekolah dasar. *Jurnal Cakrawala Pendidikan*, 42(1), 77–86. <https://doi.org/10.21831/cp.v42i1.54213>
- Pribadi, B. A. (2017). *Desain dan pengembangan program pelatihan berbasis kompetensi: Implementasi model ADDIE dan model Dick and Carey dalam pengembangan program pelatihan*. Jakarta: Kencana.
- Purwanti, D., & Kurniawan, T. (2024). The effect of project-based learning assisted by interactive media on student motivation and learning outcomes. *Jurnal Inovasi Pendidikan IPA*, 10(1), 91–102. <https://doi.org/10.21831/jipi.v10i1.56487>

- Puspita, R., & Yuliana, N. (2022). Pengembangan media pembelajaran interaktif berbasis Android untuk meningkatkan hasil belajar IPA. *Jurnal Teknologi Pendidikan*, 10(2), 115–128. <https://doi.org/10.21831/jtp.v10i2.46729>
- Rahayu, S., & Susanto, H. (2022). The influence of problem-based learning model on students' critical thinking skills. *Jurnal Pendidikan Dasar*, 13(3), 200–210. <https://doi.org/10.24036/jpd.v13i3.1987>
- Rahmadani, D., & Kurniawan, F. (2023). Pengembangan media pembelajaran interaktif berbasis video animasi untuk meningkatkan hasil belajar siswa sekolah dasar. *Jurnal Ilmiah Pendidikan Dasar Indonesia*, 8(2), 120–131. <https://doi.org/10.33369/jipdi.v8i2.67723>
- Rahmawati, T., & Fitri, N. (2021). Pengembangan media pembelajaran interaktif berbasis komputer. *Jurnal Inovasi Pendidikan dan Pembelajaran Sekolah Dasar*, 5(1), 33–41. <https://doi.org/10.31949/jippsd.v5i1.1723>
- Riyana, C. (2019). *Media pembelajaran: Hakikat, pengembangan, pemanfaatan, dan penilaian*. Bandung: CV Wacana Prima.
- Rosidah, N., & Lestari, S. (2023). The effect of problem-based learning model assisted by Powtoon on students' learning motivation. *Jurnal Basicedu*, 7(2), 351–360. <https://doi.org/10.31004/basicedu.v7i2.5051>
- Safitri, M., & Nurul, A. (2023). Pengembangan media pembelajaran berbasis animasi untuk meningkatkan motivasi belajar siswa SD. *Jurnal Pendidikan dan Pembelajaran Dasar*, 6(1), 42–50. <https://doi.org/10.33369/jppd.v6i1.68212>
- Salsabila, N., & Fitria, D. (2022). The development of interactive learning media using the ADDIE model for elementary students. *Jurnal Teknologi Pendidikan Indonesia*, 14(2), 99–109. <https://doi.org/10.21009/jtpi.v14i2.3221>
- Sari, M. W., & Nugroho, E. (2022). Pengembangan media pembelajaran berbasis video animasi Powtoon pada mata pelajaran IPA. *Jurnal Ilmiah Pendidikan Dasar*, 7(3), 251–260. <https://doi.org/10.33369/jipd.v7i3.65523>
- Setiawan, D., & Santosa, E. (2021). Peningkatan hasil belajar melalui penerapan model Problem Based Learning. *Jurnal Pendidikan Dasar*, 10(2), 99–108. <https://doi.org/10.24036/jpd.v10i2.982>
- Sugiyono. (2019). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta.
- Suharsimi, A. (2013). *Prosedur penelitian: Suatu pendekatan praktik*. Jakarta: Rineka Cipta.
- Suprijono, A. (2018). *Cooperative learning: Teori dan aplikasi PAIKEM*. Yogyakarta: Pustaka Pelajar.
- Susanto, A. (2021). *Teori belajar dan pembelajaran di sekolah dasar*. Jakarta: Prenadamedia Group.
- Susilowati, N., & Wahyuni, A. (2024). Pengembangan video animasi berbasis Problem Based Learning untuk meningkatkan hasil belajar siswa SD. *Jurnal Pendidikan Dasar*, 14(1), 50–61. <https://doi.org/10.24036/jpd.v14i1.7432>
- Sutikno, M. S. (2013). *Belajar dan pembelajaran: Teori dan konsep dasar*. Bandung: Prospect.
- Suyono, & Hariyanto. (2017). *Belajar dan pembelajaran: Teori dan konsep dasar*. Bandung: PT Remaja Rosdakarya.
- Tanjung, F., & Amalia, R. (2023). Pengaruh media pembelajaran berbasis video terhadap motivasi belajar siswa. *Jurnal Ilmu Pendidikan Dasar Indonesia*, 8(3), 178–187. <https://doi.org/10.33369/jipdi.v8i3.68122>
- Trianto. (2017). *Model pembelajaran terpadu: Konsep, strategi, dan implementasinya dalam kurikulum tingkat satuan pendidikan (KTSP)*. Jakarta: Bumi Aksara.
- Wulandari, I., & Prasetyo, A. (2022). Pengaruh penerapan Problem Based Learning terhadap hasil belajar IPA siswa sekolah dasar. *Jurnal Pendidikan Dasar*, 11(4), 299–308. <https://doi.org/10.24036/jpd.v11i4.2291>