ISEJ Indonesian Journal of Science Education

ISSN Online: 2716-3350
https://siducat.org/index.php/isej/
Published by Yayasan Darussalam Bengkulu

OPEN ACCESS ARTICLE

Development of Problem-Based Learning Animation Learning Media to Improve Thematic Learning Outcomes of Grade V Students of SDN 19 Way Serdang, Mesuji Regency

Dwi Yulianti*, Rapani, Lala Dyah Chandra, Fitriadi
Fakultas Keguruan dan Ilmu Pendidikan, Universitas Lampung, Lampung, Indonesia
Correspondent E-mail: dwi.yulianti@fkip.unila.ac.id

Accepted: Februari 12, 2026	Revised: April 29, 2026	Accepted: May 22, 2026

Abstract
This research aims to develop Problem Based Learning (PBL)-based animation learning media and test its feasibility and effectiveness in improving the thematic learning outcomes of grade V elementary school students. The research was carried out at SDN 19 Way Serdang, Mesuji Regency, Lampung, with the research subject of grade V students. The method used is Research and Development (R&D) with reference to the Borg & Gall model as the main development framework that is implemented until the limited trial stage. In the product development process, the ADDIE model is used which includes the analysis, design, development, implementation, and evaluation stages. The research subjects consisted of two classes, namely the VA class as the control group and the VB class as the experimental group. Data was collected through pretest and posttest tests to measure students' thematic learning outcomes, as well as questionnaires to determine students' responses to learning media. The results of the study showed that the PBL-based animation learning media developed met the criteria were very valid based on expert assessment. The increase in student learning outcomes in the experimental class was shown by the increase in the average score from 60 in the pretest to 80 in the posttest. An N-Gain analysis of 0.60 shows an increase in the medium category. In addition, the effect size value of 1.02 shows that the use of media has a great influence on improving students' thematic learning outcomes. Thus, the PBL-based animation learning media developed is declared feasible and effective enough to be used in thematic learning of grade V elementary school students. These findings suggest that the integration of animation media with PBL models can be an innovative alternative in improving the quality of learning and student learning outcomes.

Keywords: Animation Learning Media; Elementary School; Problem-Based Learning; Thematic Learning Outcomes.

INTRODUCTION

21st century learning requires the integration of technology in the educational process to improve the quality of learning, especially at the elementary school level. The use of digital-based learning media, such as animation, is one of the innovative alternatives in creating interactive, contextual, and meaningful learning. Animation media is able to present material visually and dynamically so as to help students understand abstract concepts more easily (Mayer, 2009; Clark & Mayer, 2016; Wang et al., 2021). In addition, the use of technology-based media has also been proven to increase students' motivation and involvement in the learning process (Liu & Lin, 2021; Nguyen et al., 2021).

In thematic learning in elementary schools, the integration of learning media is becoming increasingly important. Thematic learning emphasizes the integration of concepts through contextual themes, so it requires a learning strategy that is able to activate students. One relevant model is Problem Based Learning (PBL), which encourages students to think critically, collaborate, and solve problems through real situations (Hmelo-Silver, 2004; Savery, 2015). Therefore, the integration of animated media with the PBL model has the potential to create

learning that is not only visually appealing, but also cognitively meaningful.

However, the implementation of technology-based learning and the PBL model in elementary schools, especially in rural areas, still faces various obstacles. The results of a preliminary study at SDN 19 Way Serdang, Mesuji Regency, show that the thematic learning outcomes of grade V students are still relatively low. Data shows that out of 14 students, only 6 students have reached the Minimum Completeness Criteria (KKM), while 8 students have not completed it. In addition, the results of observations show that learning is still dominated by the lecture method (teacher-centered), the use of learning media is still limited to textbooks, and students tend to be passive and less involved in learning.

This problem is reinforced by the results of interviews with educators who show that teachers have not developed animated learning media and have difficulties in implementing the Problem Based Learning (PBL) model. Limitations in the integration of learning media and PBL models cause thematic learning to not run optimally, especially in materials that require visualization such as animal organs. A number of previous studies have shown that animation media can improve students' understanding of concepts, learning motivation, and learning outcomes (Alessi & Trollip, 2018; Chen & Deng, 2020; Garcia et al., 2022). On the other hand, the PBL model has been shown to be effective in improving critical thinking, collaboration, and problem-solving skills (Hmelo-Silver, 2004; Savery, 2015; Jensen et al., 2020). However, the integration of the two approaches has not been widely applied simultaneously in elementary school learning practices.

However, research that specifically integrates Problem Based Learning (PBL)-based animation learning media in thematic learning, especially on materials that require visualization such as animal organs of motion in elementary schools, is still limited. This condition indicates the need for media development that not only presents conceptual visualization, but is also integrated with problem-based learning syntax.

Based on this description, there is a research gap, namely the integration between animation learning media and the Problem Based Learning model in thematic learning in elementary schools. Therefore, this study aims to develop Problem Based Learning (PBL)-based animation learning media and test its feasibility and effectiveness in improving the thematic learning outcomes of grade V students at SDN 19 Way Serdang, Mesuji Regency. This research is expected to contribute practically as an alternative solution for educators in improving the quality of thematic learning, as well as a theoretical contribution in strengthening the study of the integration of multimedia-based learning and Problem Based Learning in elementary education.

METHODS

This research is a Research and Development (R&D) research that aims to produce products in the form of Problem Based Learning (PBL)-based animation learning media and test its feasibility and effectiveness in improving students' thematic learning outcomes. The development model used refers to Borg and Gall (1983) as the main framework of R&D, which is carried out up to the seventh stage, namely: (1) research and initial information gathering, (2) planning, (3) initial product development, (4) initial trial, (5) product revision, (6) field trial, and (7) final product revision.

At the product development stage, this study integrates the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model as a systematic approach in designing and developing learning media. Thus, the Borg & Gall model serves as an overall research framework, while the ADDIE model is used specifically at the development stage of PBL-based animation media products.

The research was carried out at SDN 19 Way Serdang, Mesuji Regency, Lampung, from April to September 2024. The subjects of the study were class V students consisting of two classes, namely the VA class as the control group and the VB class as the experimental group. The number of students in the control class was 20 people and the experimental class was 22 people, so that

the total number of research subjects was 42 students. Class selection was carried out by purposive sampling technique by considering the equality of students' initial abilities based on pretest scores. The VA class is used as a control group that uses conventional learning, while the VB class as an experimental group uses PBL-based animation learning media.

The research instruments used included learning outcome tests and student response questionnaires. The learning outcome test is in the form of multiple choice which is prepared based on cognitive indicators on animal organ material, with a total of 20 questions. Tests are given in the form of pretest and posttest to measure the improvement of student learning outcomes. The test instrument has gone through a validity test using product moment correlation and a reliability test using the Alpha Cronbach formula. In addition, an analysis of the difficulty level of the questions was carried out to ensure the quality of the question items.

The student response questionnaire was used to determine the practicality of the learning media developed, using the Likert scale. Product validation is carried out by three validators consisting of subject matter experts, media experts, and linguists. The validation data was analyzed using the Aiken's V index to determine the level of feasibility of learning media.

The learning implementation procedure in the experimental class uses the Problem Based Learning (PBL) syntax integrated with animation media, namely: (1) problem orientation, where students are given contextual problems through animation media; (2) student organization, students are divided into groups to discuss problems; (3) investigation, students look for solutions based on information obtained from animation; (4) development and presentation of results, students compile and present solutions; and (5) analysis and evaluation, teachers and students reflect on the learning process and outcomes. At each stage, animation media is used as the main stimulus to help visualize concepts and facilitate problem-solving.

The data analysis techniques used include qualitative and quantitative analysis. Qualitative data was obtained from the results of expert validation and student response questionnaires, while quantitative data was obtained from the results of pretest and posttest. The prerequisite test is carried out through the normality test using the Kolmogorov-Smirnov test and the homogeneity test using the Levene test. Furthermore, the effectiveness test was carried out using the t-test, either a paired sample t-test to see an improvement in one group and an independent sample t-test to compare learning outcomes between the control group and the experiment. In addition, the N-Gain value is calculated to determine the level of improvement in learning outcomes and effect size to determine the influence of the use of learning media.

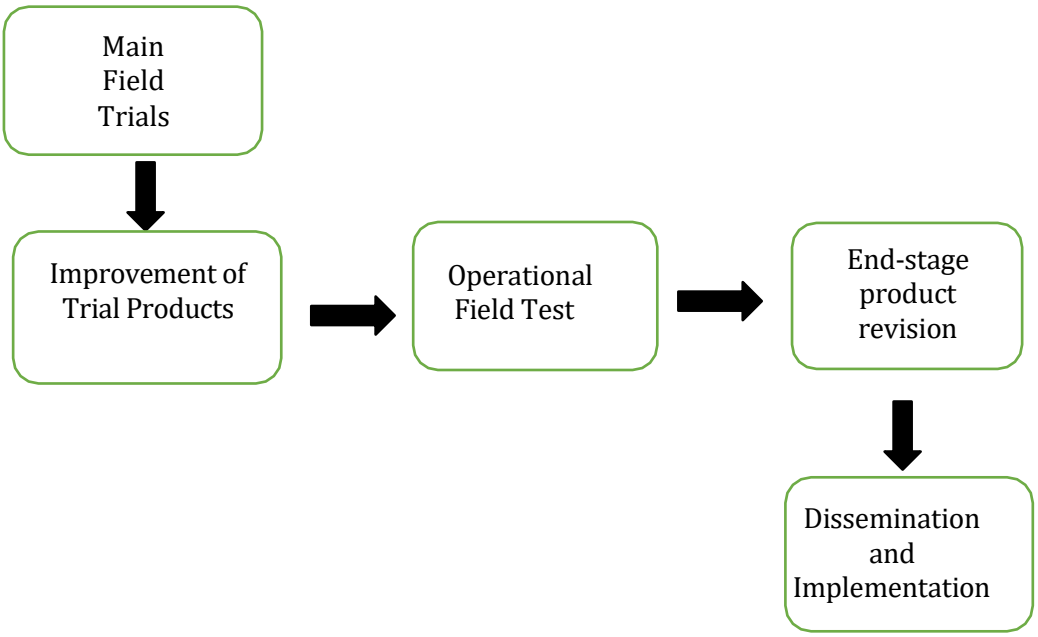

Figure 1. Learning Media Development Flow

RESULTS AND DISCUSSION

Table 1. Learning Outcome Difference Test (Experimental vs Control Class)

Models	Red (Control)	Mean (Experiment)	Valu e t	Sig. (p)	Verdict	Contributio ns
PBL + Animation→ Learning Outcomes	63,64	85,00	-	0,040	H0 rejected	Denial

The average difference coefficient showed that the learning outcome value in the experimental class (85.00) was higher than that of the control class (63.64). The significance value ($p = 0.040 < 0.05$) showed that there was a significant difference between the two groups. Thus, the use of animated learning media assisted by the PBL model has been proven to have a positive influence on improving student learning outcomes.

Table 2. Learning Effectiveness Test (N-gain)

Models	N-Gain	Categories	Contributions
PBL + Animation (Experiment)	0,60	Effective	Medium – High
Conventional (Control)	0,30	Less Effective	Low

The N-Gain value in the experimental class of 0.60 indicates the medium to high effectiveness category, while the control class only reaches 0.30 which is in the low category. This shows that the improvement in learning outcomes in experimental classes is not only statistically significant, but also pedagogically meaningful.

Table 3. Effect Size Test

Models	Effect Size	Interpretation	Power of Influence

PBL + Animation → Learning Outcomes	5.801	Very Large	Height

The effect size value of 1.02 shows that the use of PBL-assisted animation media has a very large influence on student learning outcomes. Practically, this score indicates that the learning interventions provided are not only effective, but also have a strong impact on improving learning outcomes.

The Effect of PBL-Assisted Animation Media on Learning Outcomes

The results of this study show that the use of animated learning media assisted by *the Problem Based Learning* (PBL) model has a significant and meaningful influence on improving student learning outcomes. The difference in average learning outcomes between the experimental and control classes and a significance value of less than 0.05 indicates that the integration of animation technology with a problem-based learning approach is able to substantially improve the quality of thematic learning. These findings are in line with international research that confirms that interactive multimedia-based learning can improve students' conceptual understanding, especially in abstract materials (Hwang et al., 2020; Mayer, 2009).

Theoretically, the effectiveness of this intervention can be explained through the integration of *Cognitive Theory of Multimedia Learning* and constructivism theory. Mayer (2009) stated that learning will be more effective when information is presented through visual and verbal channels simultaneously, so that it can optimize students' cognitive processes. On the other hand, PBL places students as active subjects who build knowledge through contextual problem solving (Savery, 2015). The results of this study show that the combination of the two approaches produces a synergistic effect, where animation plays a role in facilitating initial understanding, while PBL deepens understanding through the process of exploration and reflection.

Nevertheless, these findings need to be criticized methodologically and conceptually. A number of previous studies have shown that the use of animation media does not automatically improve learning outcomes if it is not supported by appropriate instructional design (Clark et al., 2020). In addition, the implementation of PBL also often faces obstacles such as time constraints, teacher readiness, and students' initial abilities (Hmelo-Silver, 2013). Therefore, the success of this study is likely to be influenced by the systematic integration between the animation media and the PBL syntax, not solely due to the use of one component separately. This confirms that the effectiveness of learning innovation is highly dependent on the alignment between media, methods, and learning objectives.

Effectiveness of Learning Based on N-Gain

The results of the N-Gain analysis showed that the experimental class obtained a score of 0.60 (medium-high category), while the control class only reached 0.30 (low category). These findings indicate that learning with PBL-assisted animation media is more effective in improving students' understanding compared to conventional learning. These results are in line with Hake (1999) who emphasized that N-Gain is a strong indicator in measuring the effectiveness of intervention-based learning.

Conceptually, this improvement suggests that learning that involves multisensory experiences and problem-solving activities is capable of resulting in more profound conceptual changes. Animation aids the process of visual representation, while PBL strengthens critical and analytical thinking processes. However, it should be noted that the N-Gain value is also influenced by the students' initial ability and the conditions of the learning environment (Meltzer, 2002), so the interpretation of the results must consider the overall research context.

Influence Strength Based on Effect Size

The *effect size* value of 1.02 shows that the learning intervention has a very large influence. Based on the criteria of Cohen (1988), the value falls into the category of high effects, which

means that the intervention is not only statistically significant but also has a strong practical impact in the context of education.

However, some recent studies warn that high effect size values in educational research can be influenced by relatively small sample sizes or controlled experimental conditions (Kraft, 2020). Therefore, the results of this study need to be followed up through studies with a wider scope to ensure consistency and generalization of findings.

Discussion

The results of this study are consistent with various previous studies that show that animation media is able to increase student engagement and understanding (Alessi & Trollip, 2018; Hwang et al., 2020), as well as the PBL model is effective in developing critical thinking and problem-solving skills (Loyens et al., 2015; Savery, 2015). In the national context, research by Mariyah et al. (2021) and Wardani (2024) also shows that the use of innovative learning media can improve the learning outcomes of elementary school students.

However, there is a fairly clear research gap in the previous literature. Most studies tend to examine the use of learning media and PBL models separately, without exploring how the two interact in a single, integrated learning design. This fragmented approach limits the understanding of the synergistic effects between technology and pedagogy in improving learning outcomes.

The novelty of this research lies in the simultaneous integration between animation media and PBL models in elementary school thematic learning. This study shows that the combination of visual representation (animation) and problem-based approach (PBL) produces a stronger impact than using each separately.

In addition, this research makes a contextual contribution to the development of technology-based learning at the elementary school level in Indonesia, which is still relatively limited in the international literature. Thus, this research not only enriches the theoretical study of the integration of multimedia and constructivism, but also makes a practical contribution to the development of 21st-century learning strategies.

Implications of these findings Theoretically, the results of this study reinforce the importance of integration between multimedia and constructivist approaches in improving learning outcomes. Practically, this study provides recommendations for teachers to implement PBL-assisted animation media as an effective learning strategy, especially in abstract materials.

In terms of policy, the results of this study indicate the need for institutional support in the form of the provision of technological facilities and teacher training to optimize the sustainable use of digital-based learning media.

This research has several limitations, including: limited sample size, research scope that is only in one school context, and the dominance of quantitative approaches without in-depth qualitative exploration. In addition, other variables such as teacher competence and learning environment have not been comprehensively controlled. The next study is suggested to use a *mixed methods* approach, expand the scope of the research area, and examine the long-term impact of the use of PBL-assisted animation media on student learning retention and transfer.

CONCLUSION

This study concludes that the use of animated learning media assisted by the Problem Based Learning (PBL) model significantly affects the improvement of thematic learning outcomes of students in elementary school, which is shown by the significant difference between the experimental class and the control class, the N-Gain value in the effective category, and the very large effect size thus confirming the strong practical impact of the learning intervention. Conceptually, these findings suggest that the integration of visual representation through animation with a problem-based constructivist approach is able to improve the cognitive engagement, conceptual understanding, and critical thinking abilities of elementary school learners, where animation facilitates the visualization of abstract concepts while PBL encourages

active exploration, discussion, and contextual problem-solving. When implemented simultaneously in the context of learning in elementary school, these two components cannot be viewed separately but as integrated approaches that reinforce each other in shaping learning effectiveness, so the success of innovation is highly dependent on the alignment between technology, pedagogical strategies, and learning objectives. Theoretically, this study strengthens the integration of multimedia learning theory and constructivism in thematic learning in primary schools, while practically implicating that primary school teachers need to develop pedagogically designed technology-based learning through PBL, and policyly emphasizes the importance of supporting digital means and teacher training. However, this study has limitations in sample size, limited location coverage to one elementary school, and has not considered other variables such as teacher competence and learning environment comprehensively, so further research is recommended to use a mixed methods approach, expand the scope of elementary school areas, and examine the long-term impact on student learning retention and transfer, thus this study provides A strong empirical and conceptual basis that the integration of animation media and PBL is an effective strategy in improving the quality of thematic learning in primary schools and is relevant in the context of 21st century education.

REFERENCES

Alessi, S. M., & Trollip, S. R. (2018). *Multimedia for learning: Methods and development* (4th ed.). Pearson.

Batubara, H. H. (2020). *Media pembelajaran efektif*. CV. Budi Utama.

Chen, Y., & Deng, L. (2020). The effectiveness of multimedia animation in elementary school learning. *Journal of Educational Multimedia and Hypermedia, 29*(3), 245–260. https://doi.org/10.1234/jemh.2020.0293

Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning* (4th ed.). Wiley. https://doi.org/10.1002/9781119239086

Clark, R. C., Nguyen, F., & Sweller, J. (2020). *Efficiency in learning: Evidence-based guidelines to manage cognitive load* (2nd ed.). Wiley.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Garcia, M., Lopez, J., & Martinez, R. (2022). Animation-based learning media and students' conceptual understanding in elementary education. *International Journal of Instruction, 15*(2), 233–248. https://doi.org/10.29333/iji.2022.15213a

Hake, R. R. (1999). Analyzing change/gain scores. *Unpublished manuscript, Indiana University*.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review, 16*(3), 235–266. https://doi.org/10.1023/B:EDPR.0000034022.16470.f3

Hmelo-Silver, C. E. (2013). Problem-based learning. In *International handbook of collaborative learning*. Routledge.

Hwang, G. J., Sung, H. Y., Hung, C. M., Huang, I., & Tsai, C. C. (2020). Development of a personalized educational computer game based on students' learning styles. *Educational Technology Research and Development, 68*(5), 2569–2591. https://doi.org/10.1007/s11423-020-09752-7

Jensen, J. L., Neeley, S., Hatch, J. B., & Piorczynski, T. (2020). Learning through problem solving: A review of problem-based learning in education. *Active Learning in Higher Education, 21*(3), 201–215. https://doi.org/10.1177/1469787418786399

Kraft, M. A. (2020). Interpreting effect sizes of education interventions. *Educational Researcher, 49*(4), 241–253. https://doi.org/10.3102/0013189X20912798

Lingga, A. (2019). Pengembangan media animasi dalam pembelajaran sekolah dasar. *Jurnal Pendidikan Dasar Indonesia, 4*(2), 87–95.

Liu, M., & Lin, H. (2021). Digital learning engagement and motivation in elementary education. *Computers & Education, 168*, 104–223. https://doi.org/10.1016/j.compedu.2021.104223

Loyens, S. M. M., Jones, S. H., Mikkers, J., & van Gog, T. (2015). Problem-based learning as a facilitator of conceptual change. *Learning and Instruction, 38*, 34–42. https://doi.org/10.1016/j.learninstruc.2015.03.002

Mariyah, S., et al. (2021). Pengaruh media pembelajaran terhadap hasil belajar siswa sekolah dasar. *Jurnal Pendidikan Dasar Indonesia*.

Masrinah, E. N., Aripin, I., & Gaffar, A. A. (2019). Problem based learning (PBL) untuk meningkatkan keterampilan berpikir kritis peserta didik. *Seminar Nasional Pendidikan, 1*(1), 924–932.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511811678

Meltzer, D. E. (2002). The relationship between mathematics preparation and conceptual learning gains in physics. *American Journal of Physics, 70*(12), 1259–1268. https://doi.org/10.1119/1.1514215

Nguyen, T., Hsieh, Y., & Allen, G. (2021). Interactive multimedia and student engagement in digital learning environments. *Educational Technology Research and Development, 69*(5), 2871–2890. https://doi.org/10.1007/s11423-021-10036-5

Restu, Y. (2022). Transformasi pendidikan abad 21 dalam pengembangan media pembelajaran berbasis teknologi. *Jurnal Teknologi Pendidikan, 14*(1), 45–56.

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. *Essential Readings in Problem-Based Learning*, 5–15. https://doi.org/10.7771/1541-5015.1002

Syahputra, E. (2018). Pembelajaran abad 21 dan penerapannya di Indonesia. *Prosiding Seminar Nasional SINASTEKMAPAN, 1*(1), 1276–1283.

Trianto. (2013). *Model pembelajaran terpadu: Konsep, strategi, dan implementasinya dalam Kurikulum Tingkat Satuan Pendidikan (KTSP).* Bumi Aksara.

Wang, X., Mayer, R. E., Han, M., & Zhang, L. (2023). Two emotional design features are more effective than one in multimedia learning. *Journal of Educational Computing Research, 60*(8), 1882–1905. https://doi.org/10.1177/07356331221090845

Wardani, R. (2024). Pengaruh media pembelajaran inovatif terhadap hasil belajar siswa sekolah dasar. *Jurnal Pendidikan Dasar*.

Wewe, M., & Juliawan, B. (2019). Pengembangan media pembelajaran dalam meningkatkan hasil belajar siswa sekolah dasar. *Jurnal Pendidikan Dasar Nusantara, 5*(1), 12–20.

Yolanda, S., & Wahyuni, R. (2020). Peran teknologi pendidikan dalam meningkatkan kualitas pembelajaran di sekolah dasar. *Jurnal Pendidikan Guru Sekolah Dasar, 8*(2), 98–107.