



Development of Google Sites-Based Multimedia for Fourth-Grade Pancasila Education

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Abstract

Background of study: Digital infrastructure is increasingly available in elementary schools, but its pedagogical use remains uneven, particularly in Pancasila Education where abstract values must be connected to students' everyday school experiences.

Aims and scope of paper: This study developed and evaluated Google Sites-based learning multimedia for fourth-grade Pancasila Education on the application of Pancasila values in the school environment.

Methods: A Research and Development design using the ADDIE model was employed. The product was grounded in Cognitive Load Theory and the Cognitive Theory of Multimedia Learning and was evaluated through expert validation, practicality responses, and descriptive pretest-posttest indicators involving three validators, three teachers, and 73 students from three elementary schools.

Result: The multimedia achieved an average validity score of 91.33% (Very Valid). Teacher and student practicality scores were 97.78% and 97.61%, respectively (Very Practical). Mean achievement increased from 69 to 92, with 95.89% learning mastery and an N-Gain of 74.58% (High).

Conclusion: Within this descriptive R&D design, the product met the stated feasibility criteria and was accompanied by substantial improvement in learning scores. Structured content and simple non-linear navigation appear appropriate for organizing Google Sites-based multimedia for elementary Pancasila Education.

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INTRODUCTION

Digital transformation has expanded opportunities for schools to provide more flexible, contextual, and resource-rich learning, yet access to technology does not automatically translate into meaningful classroom use (UNESCO, 2023). In Indonesia, the Merdeka Belajar policy direction also emphasizes contextual and differentiated learning while strengthening student character (Hikmah et al., 2025). At the elementary level, many schools already have access to information and communication technologies, although their instructional use remains uneven (Badan Pusat Statistik, 2024). A similar issue is evident in Pancasila Education, where digital resources are not consistently used as learning media despite the availability of supporting infrastructure (Kemendikbudristek, 2024). The central issue, therefore, is not simply whether technology is available, but whether it is pedagogically designed to support specific learning purposes.

This issue is particularly relevant to Pancasila Education because learning is expected to support not only conceptual knowledge but also students' understanding of national, moral, and civic values in situations that are meaningful to them (Anggraeni et al., 2025). Related work has also emphasized the need for elementary learning experiences that connect literacy, character, and meaningful classroom activity (Hamidah et al., 2025). Preliminary observations conducted for this study in five elementary schools showed that fourth-grade Pancasila Education was still dominated by lectures and printed books, with limited visualization and systematic use of digital media despite the availability of smart TVs, projectors, and internet access. An analysis of two teaching modules also indicated that learning media had not been consistently integrated into instructional planning.

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Under these conditions, abstract Pancasila values may remain largely verbal unless students encounter examples and activities that connect the concepts with recognizable school situations. The gap between curricular aims and students' actual learning experiences provides a concrete rationale for designing a more suitable form of instructional presentation.

The needs analysis further indicated that the required solution was not merely digital access, but learning media that students and teachers could use with minimal technical burden. The preliminary student questionnaire produced an average score above 3.5 on a 1-4 scale for interest and enthusiasm toward digital multimedia, while teachers indicated readiness to use multimedia but reported limitations in the time and technical skills required to design it. Previous work similarly shows that web-based media can support Pancasila learning when content and activities are organized around students' learning needs (Dewi et al., 2023). Multimedia can integrate text, images, video, and quizzes within one learning environment, allowing information to be represented in complementary forms (Mardianti et al., 2024). Interactive multimedia has also been developed in Pancasila Education to focus students' attention on learning activities and content (Oktaviandi & Masniladevi, 2025). However, adding multimedia elements does not necessarily improve learning when information is dense, poorly organized, or difficult to navigate. The design challenge is therefore to combine multimedia functions with a presentation structure that controls unnecessary processing demands.

This concern positions Cognitive Load Theory and the Cognitive Theory of Multimedia Learning as design foundations rather than outcomes directly measured in the study. Cognitive Load Theory explains that working memory is limited, so poorly organized or excessive information can create processing demands that do not contribute to learning (Sweller, 2024). This consideration is especially relevant for elementary learners who may require clearer organization when verbal and visual information is presented together (Fajtriandiah et al., 2025). The Cognitive Theory of Multimedia Learning complements this view by emphasizing coherence, relevance, and the organization of words and visuals so that cognitive resources remain directed toward learning-relevant information (Mayer, 2024). Previous evidence also suggests that appropriately designed visual media can support elementary students' understanding of abstract concepts (Wati et al., 2025). On this basis, content sequence, navigation, and multimedia integration were treated as interrelated design decisions rather than independent technical features.

Google Sites was selected because it can organize pages, learning materials, videos, worksheets, and quizzes within a single web-based environment and a visible menu structure (Wulandari et al., 2025; Darniyanti et al., 2023; Napitu, 2023). Previous elementary-school studies have reported positive outcomes related to contextual learning needs, information literacy, and the use of Google Sites as a learning platform (Kurniawati & Ramadan, 2025; Hafizah et al., 2025; Wahyuningsih & Lidyasari, 2025). Other studies have developed Google Sites to support web-based learning and student achievement across different subjects (Ningsih et al., 2023; Nuraeni et al., 2023). In Pancasila Education, similar products have been developed for different grade levels and learning topics (Aini & Zuardi, 2025; Maturrahmi et al., 2025; Sugianto et al., 2025). These studies establish Google Sites as a feasible multimedia container, but they do not consistently make students' cognitive characteristics an explicit basis for organizing content and navigation. This distinction matters because the educational value of a platform depends on the pedagogical decisions that shape how students encounter and process information.

The literature also shows that Google Sites development studies commonly emphasize product validity, practicality, motivation, or achievement outcomes, while the connection among design decisions, the value-laden content of Pancasila Education, and information-processing principles is less consistently articulated (Apriono et al., 2025; Kurniawati & Ramadan, 2025; Sakinah et al., 2025; Isky et al., 2025). Several studies focus on science, language, or social studies, so the characteristics of Pancasila Education are not always central to the design rationale (Darniyanti et al., 2023; Wati et al., 2025; Hafizah et al., 2025). At the same time, existing Google Sites studies in Pancasila Education show that the platform can support digital learning but leave room for designs that explicitly connect content structure and navigation with Cognitive Load Theory and the Cognitive Theory of Multimedia Learning. The research gap therefore does not lie in using Google Sites as a new platform. It lies in how the platform is pedagogically structured for learning about the application of Pancasila values and then evaluated through validity, practicality, and descriptive learning-outcome indicators.

Testing the product in three schools also provides evidence about the consistency of its use across more than one classroom context.

Accordingly, this study aimed to develop and evaluate the feasibility of Google Sites-based multimedia for fourth-grade Pancasila Education on the application of Pancasila values in the school environment. Development followed the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model because it provides a systematic sequence linking needs analysis, product design, development, implementation, and evaluation (Sofiati et al., 2025). Product feasibility was examined through validity, practicality, and descriptive effectiveness indicators established in the study. Theoretically, the study translates cognitive-load and multimedia-learning principles into concrete decisions about content sequence and navigation. Practically, it provides an example of a web-based multimedia design for elementary Pancasila Education while keeping conclusions within the limits of a descriptive R&D design.

METHOD

Research Design

This study employed a Research and Development (R&D) design using the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model to produce Google Sites-based learning multimedia and evaluate its feasibility in successive stages (Rahayu, 2025; Siregar & Rhamayanti, 2025). Quantitative and qualitative descriptive data were used in complementary ways. Quantitative data described validity, practicality, learning mastery, and N-Gain, whereas qualitative comments from validators, teachers, and students informed product revision. No inferential hypothesis testing was conducted. Accordingly, pretest-posttest results were interpreted as descriptive indicators of score change during implementation rather than as evidence of a causal treatment effect.

Participants and Setting

A preliminary study was conducted in five elementary schools to identify instructional conditions, student needs, media use, and curriculum alignment. Product implementation was then conducted on July 20-23, 2026, at SDN 08 Surau Gadang, SDN 09 Surau Gadang, and SDN 28 Air Tawar Timur. The implementation involved three teachers and 73 fourth-grade students: 24 students from SDN 08 Surau Gadang, 23 from SDN 09 Surau Gadang, and 26 from SDN 28 Air Tawar Timur. The schools were selected based on their implementation of the Merdeka Curriculum, availability of multimedia-supporting facilities, and willingness to provide research permission. These criteria ensured that the web-based product was tested in settings with the minimum infrastructure required for implementation.

Ethical Considerations

The study was conducted after research permission had been obtained from the participating schools. Findings are reported at the school or group level, and no individual student identities are presented in this manuscript. The available study records do not report a separate institutional ethics approval number, parental consent procedure, or student assent procedure; consequently, no such information is asserted here.

Instrumentation

Data were collected using expert-validation sheets, teacher and student practicality questionnaires, a learning-achievement test, and qualitative feedback from validators and users (Ismawati et al., 2023; Nuraeni et al., 2023). The validation instruments covered content, language, and media aspects and were developed with reference to Cognitive Load Theory, the Cognitive Theory of Multimedia Learning, curriculum-content alignment, language readability, and display quality (Afifah et al., 2022; Nisrina et al., 2022; Sweller, 2024; Mayer, 2024; Zega et al., 2022). The practicality questionnaires assessed ease of use, implementation, and user engagement (Yunita et al., 2024). Learning outcomes were measured with 10 multiple-choice items administered at pretest and posttest to describe changes in students' understanding before and after multimedia use (Jatawitika et al., 2024). The posttest items differed from the pretest items to reduce recall effects. Separate evidence of equivalence in difficulty between the two test forms was not reported. All questionnaire items used a five-point Likert scale and were converted to percentages for interpretation.

Instrument Quality and Feasibility Criteria

Product feasibility was evaluated sequentially through validity, practicality, and descriptive effectiveness indicators. Three validators assessed content, language, and media, and the resulting scores were converted into percentages and interpreted using categories applied in related instructional-media development studies (Daryanes et al., 2023). The product proceeded to field implementation after reaching the valid category. Practicality was analyzed on the same percentage basis and interpreted using criteria consistent with previous development research (Nuraisyah et al., 2024). Separate reliability coefficients for the questionnaires and achievement test were not reported; therefore, interpretation of instrument quality is limited to the documented expert-validation procedures and descriptive criteria.

Procedures and Time Frame

The development procedure followed the five ADDIE stages. During Analysis, the researchers conducted a preliminary study to identify student characteristics, learning needs, existing media use, and curriculum alignment. During Design, the menu structure, interface, and multimedia storyboard were prepared with reference to Cognitive Load Theory, the Cognitive Theory of Multimedia Learning, and Contextual Teaching and Learning. During Development, the Google Sites product was constructed, reviewed by content, language, and media validators, and revised until it was considered suitable for field use. During Implementation, the product was used in the three schools, practicality questionnaires were completed by teachers and students, and pretest and posttest data were collected on July 20-23, 2026 (Sekarsari & Maharani, 2025). During Evaluation, validity, practicality, learning scores, and user feedback were used to guide final refinement of the product.

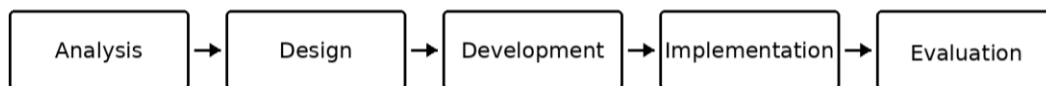


Figure 1. ADDIE-based multimedia development flow

Data Analysis

Data analysis was descriptive and matched to the type of evidence collected. Expert-validation and practicality scores were converted into percentages and interpreted according to validity and practicality categories used in related development studies (Daryanes et al., 2023; Nuraisyah et al., 2024). Descriptive effectiveness was assessed using two indicators: the percentage of students reaching the learning-mastery threshold of at least 80 and the normalized gain (N-Gain) calculated from pretest and posttest scores. N-Gain categories followed the criteria applied by Pujiastuti and Haryadi (2024). Because the study did not use inferential testing or a comparison group, pretest-posttest differences were treated as descriptive score changes within the implementation group and were not used to infer a causal effect.

RESULTS AND DISCUSSION

Results

The needs analysis identified three conditions that directly informed multimedia development. First, observations in five elementary schools indicated that fourth-grade Pancasila Education was still dominated by lectures and printed books, with limited visualization and systematic digital-media use despite the availability of smart TVs, projectors, and internet access. Students also experienced difficulty when learning abstract Pancasila values. Second, an analysis of two teaching modules showed that learning media were not consistently integrated into instructional planning. Third, the needs questionnaire indicated high student interest and enthusiasm toward digital multimedia, with an average score above 3.5 on a 1-4 scale, while teachers expressed readiness to use multimedia but reported design-related constraints. Together, these findings guided the content characteristics, menu structure, and presentation format of the product.

The resulting product was Google Sites-based learning multimedia for the topic of applying Pancasila values in the school environment, developed through the five ADDIE stages (Romadhan et al., 2026). Content was organized progressively from the first to the fifth principle of Pancasila within a single learning environment to minimize unnecessary movement across separate resources. The

navigation structure was non-linear and included eight menus: Home, User Guide, Learning Outcomes, Materials, Video, Worksheet, Quiz, and Researcher Profile, as shown in the sitemap in Figure 2 and the home-page interface in Figure 3. This organization reflects structured information presentation in Cognitive Load Theory (Sweller, 2024) and coherence between words and visuals in the Cognitive Theory of Multimedia Learning (Mayer, 2024). The product was then validated before field implementation.

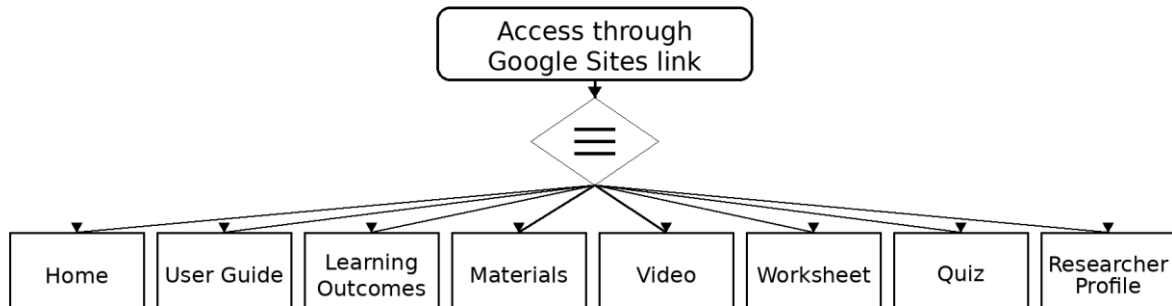


Figure 2. Sitemap of the multimedia navigation structure

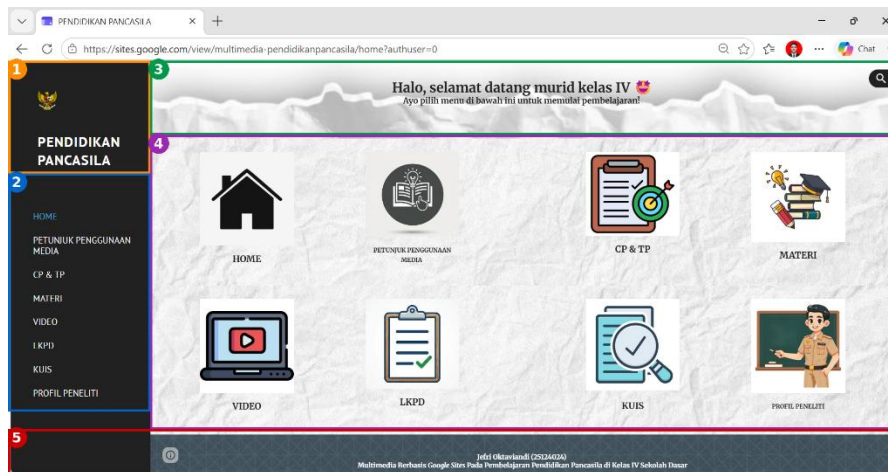


Figure 3. Home-page interface of the developed multimedia

Expert validation produced an average multimedia validity score of 91.33%, categorized as Very Valid. Content validity reached 85.33%, language validity 96.67%, and media validity 92.00% (Table 1). Content and media were validated in two rounds, whereas the language aspect reached the Very Valid category in the first round. The content score increased from 30.67% in the initial assessment to 85.33% after revision based on validator feedback, while the media score increased from 58.00% to 92.00%. These changes indicate that the most substantial revisions concerned content accuracy and depth as well as display-related aspects before field implementation.

Table 1. Summary of multimedia validity scores

No.	Validation Aspect	Validity Score	Category
1	Content	85.33%	Valid
2	Language	96.67%	Very Valid
3	Media	92.00%	Very Valid
Average		91.33%	Very Valid

During implementation, both teachers and students rated the multimedia as Very Practical across the three schools. The mean teacher practicality score was 97.78%, while the mean student practicality score was 97.61% (Table 2). Teacher ratings ranged from 94.66% to 100%, and student ratings ranged from 97.38% to 98.02%. The narrow range across schools indicates relatively consistent user experiences within the implementation settings examined. Practicality data were collected on July 20-23, 2026, during multimedia use by the 73 participating students.

Table 2. Summary of practicality results

Respondent	SDN 28 Air Tawar Timur	SDN 08 Surau Gadang	SDN 09 Surau Gadang	Average	Category
Teacher	100%	98.66%	94.66%	97.78%	Very Practical
Student	97.38%	97.44%	98.02%	97.61%	Very Practical

Descriptive effectiveness indicators were calculated from learning mastery and the N-Gain of pretest-posttest scores for 73 students (Table 3). The mean score increased from 69 on the pretest to 92 on the posttest. Seventy of the 73 students reached the minimum score of 80, resulting in a combined mastery rate of 95.89%. The combined N-Gain was 74.58%, categorized as High. At the school level, N-Gain values were 70.09% at SDN 28 Air Tawar Timur, 82.35% at SDN 08 Surau Gadang, and 73.68% at SDN 09 Surau Gadang. These results describe score changes during implementation without inferential testing or comparison with a control group.

Table 3. Summary of descriptive effectiveness results

School	Mean Pretest	Mean Posttest	Mastery	N-Gain	N-Gain Category
SDN 28 Air Tawar Timur	59	88	88.46%	70.09%	High
SDN 08 Surau Gadang	72	95	100%	82.35%	High
SDN 09 Surau Gadang	77	94	100%	73.68%	High
Combined	69	92	95.89%	74.58%	High

At the individual level, 50.68% of students were in the High N-Gain category, 35.62% were in the Moderate category, and 13.70% were in the Low category. Several students in the Low category had already obtained pretest scores of 90-100, which mathematically limited the amount of improvement available to them. This pattern indicates a ceiling effect for part of the sample and should be considered when interpreting individual N-Gain values. Initial achievement also differed across schools, with mean pretest scores of 59, 72, and 77. N-Gain was therefore used as a descriptive indicator of change rather than as stand-alone evidence of a causal multimedia effect.

Discussion

Taken together, the validity, practicality, and learning-score evidence indicates that the developed multimedia met the feasibility criteria established in this study. These findings must be interpreted within the descriptive R&D design because the study did not include a comparison group or inferential hypothesis testing. The strength of the evidence lies in the convergence of three forms of evaluation collected at different ADDIE stages rather than in a claim that Google Sites caused the observed learning improvement. This interpretation is consistent with the role of ADDIE as a development framework in which analysis, validation, implementation, and evaluation iteratively inform product quality (Rahayu, 2025; Siregar & Rhamayanti, 2025). The findings therefore support the feasibility of the product in the settings in which it was implemented.

The average validity score of 91.33% indicates that the revised content, language, and media components reached a high level of feasibility according to the validators. The largest changes occurred in content and media, suggesting that these aspects required more substantial revision than language. Comparable development studies have also reported high validity for Google Sites or related digital learning media, including Mawaddah et al. (2025), Sugianto et al. (2025), Aini and Zuardi (2025), Maturrahmi et al. (2025), and Kurniawati and Ramadan (2025). The language score, which reached 96.67% in the first round, may indicate that readability and grade-level language were more stable than content depth and technical presentation. However, each validation aspect was assessed by one validator, so the percentages primarily represent expert judgment within the specific validator configuration used in this study. High validity therefore supports initial product feasibility but does not replace the need for broader evidence of rating consistency in future work.

The very high practicality ratings from teachers and students indicate that the multimedia could be used with few major operational difficulties during implementation. Non-linear navigation allowed users to move among menus according to instructional needs, while the integration of materials, video, worksheets, and quizzes reduced the need to switch among multiple platforms. This pattern is consistent with the high practicality reported by Mawaddah et al. (2025) and Kurniawati and Ramadan (2025), and it exceeds the ranges reported in several other development studies,

including Sakinah et al. (2025), Aini and Zuardi (2025), Sugianto et al. (2025), and Maturrahmi et al. (2025). Even so, the student questionnaire item on navigation clarity obtained 94.79%, which was lower than several other practicality indicators. This difference suggests that students' direct interaction with menu structures remains an important design consideration even when overall practicality is very high. For elementary users, simple navigation functions as part of instructional usability rather than as a purely visual feature.

The increase in mean score from 69 to 92, the 95.89% mastery rate, and the 74.58% N-Gain indicate substantial improvement during multimedia use. The N-Gain was close to the 75.67% reported by Sakinah et al. (2025) and the 73.84% reported by Mayada and Widodo (2025), higher than values reported by Sugianto et al. (2025) and Maturrahmi et al. (2025), and lower than the range reported by Isky et al. (2025). Such variation suggests that learning-outcome indicators in development studies are sensitive to sample characteristics, content, initial scores, test form, and implementation conditions. In this study, mean pretest scores differed across schools at 59, 72, and 77, which created unequal room for improvement. These starting differences help explain why school-level N-Gain did not correspond linearly with posttest scores. Because no control group was used, the increase should be interpreted as a pattern accompanying implementation rather than as an estimate of the multimedia's net causal effect.

From a theoretical perspective, the findings support the use of Cognitive Load Theory and the Cognitive Theory of Multimedia Learning as design principles, but they do not constitute direct tests of either theory. Content was sequenced progressively, menu options were visibly grouped, and textual and visual materials were placed within a structured environment, consistent with the idea that dispersed or irrelevant information can impose unnecessary demands on working memory (Sweller, 2024). The integration of words and visuals also reflects the coherence principles emphasized in multimedia learning theory (Mayer, 2024). Wati et al. (2025) provide related empirical context by showing how visual media can support the learning of concepts that are otherwise difficult to represent concretely. Nevertheless, this study did not measure mental effort, intrinsic load, or extraneous load. Its theoretical contribution therefore lies in translating cognitive and multimedia principles into observable design decisions, not in demonstrating that learning gains occurred through a measured reduction in cognitive load.

The Pancasila Education context gives these design decisions additional significance because students are learning not only facts but also how values are recognized and applied in familiar situations. Integrating learning materials, video, worksheets, and quizzes within one site enables the same value to be encountered through explanation, visual examples, and activity. This logic is consistent with work by Anggraeni et al. (2025) and Dewi et al. (2023), which positions digital media as a means of supporting Pancasila learning and the application of values. Kurniawati and Ramadan (2025), Aini and Zuardi (2025), and Isky et al. (2025) likewise show that Google Sites can be used for elementary Pancasila Education. The present study differs by explicitly connecting content organization and navigation to information-processing principles from the design stage and then evaluating the resulting product through validity, practicality, and score changes across three schools. Its novelty therefore lies more convincingly in the integration of pedagogical design rationale and product evaluation than in the use of Google Sites itself.

Implications

The findings suggest that Google Sites can serve as a practical environment for organizing Pancasila Education when content sequence, navigation, and learning activities are designed around elementary students' needs. Teachers require more than access to a digital platform; they also need design decisions that limit unnecessary information, maintain menu consistency, and connect visual elements with learning objectives. The relatively consistent practicality results across the three schools indicate that the product model can be considered in settings with adequate devices and internet access. The study also illustrates how Cognitive Load Theory and the Cognitive Theory of Multimedia Learning can be operationalized as design considerations without claiming that cognitive load itself was measured.

Limitations

Several limitations constrain interpretation of the findings. The study involved 73 students from three schools selected partly on the basis of facility readiness, which limits generalization to

schools with different infrastructure. Each validity domain was assessed by one validator, separate reliability coefficients for the questionnaires and achievement test were not reported, and equivalence in difficulty between the different pretest and posttest forms was not established. The study also used no comparison group, no inferential testing, and no delayed posttest. Limited access to individual devices, incomplete video documentation of implementation, dependence on internet connectivity, and the absence of direct cognitive-load measurement further restrict conclusions about mechanisms and longer-term learning effects.

Suggestions

Future research should extend the content to the application of Pancasila values in family and community settings and examine the product in schools with more varied technological conditions. Comparative or quasi-experimental designs could provide stronger evidence about learning effects, while direct measures of cognitive load could test whether the intended design principles are associated with students' processing demands. Instrument quality should also be strengthened through documented reliability analysis, broader expert validation, and evidence that pretest and posttest forms are equivalent in difficulty. A delayed posttest would help determine whether score improvements are retained beyond the immediate implementation period.

CONCLUSION

This study developed Google Sites-based multimedia for fourth-grade Pancasila Education on the application of Pancasila values in the school environment using the ADDIE model and drawing on Cognitive Load Theory and the Cognitive Theory of Multimedia Learning as design foundations. The product achieved an average validity score of 91.33%, practicality scores of 97.78% from teachers and 97.61% from students, a learning-mastery rate of 95.89%, and an N-Gain of 74.58%. Mean student achievement increased from 69 on the pretest to 92 on the posttest across the three implementation schools. Within the limits of a descriptive R&D design without a control group or inferential testing, these results indicate that the multimedia met the study's feasibility criteria and was accompanied by substantial improvement in learning scores. The findings support progressive content organization and simple navigation as useful design features for elementary Pancasila Education, while direct claims about cognitive-load mechanisms require further empirical testing.

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AUTHOR CONTRIBUTIONS STATEMENT

JO conceptualized and designed the study, developed the multimedia product, collected and analyzed the data, and drafted the manuscript. UR supervised the research process and critically reviewed the manuscript. YE contributed to the design of the validation instruments and provided manuscript feedback. R contributed to methodological refinement and reviewed the final manuscript. All authors read and approved the final manuscript.

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