



Development an Interactive Physics Learning Based on Google Sites Integrated with Local Wisdom

Isabel Coryunitha Panis^{1*}, Egidius Dewa¹, Oktavianus Ama Ki'i¹

¹ Department of Physics Education, Universitas Katolik Widya Mandira, Kupang, Indonesia.

Received: January 21, 2026

Revised: February 26, 2026

Accepted: March 25, 2026

Published: March 31, 2026

Corresponding Author:

Isabel Coryunitha Panis

isabelcoryunithapanis@unwira.ac.id

DOI: [10.29303/jppipa.v12i3.14344](https://doi.org/10.29303/jppipa.v12i3.14344)

 Open Access

© 2026 The Authors. This article is distributed under a (CC-BY License)



Abstract: The limited availability of interactive physics learning media that meaningfully integrate local wisdom remains a challenge in contextual science instruction. This study aimed to develop a Google Sites-based interactive physics learning design integrated with the local wisdom of the Manggarai gong and to determine its feasibility for classroom use. The study employed a Research and Development approach using a modified Borg and Gall model, covering needs analysis, initial product design, expert validation, and revision. The product was designed with a structured learning sequence consisting of contextual orientation, pretest, learning objectives, sound wave materials, virtual simulations, ethnoscience-based cultural integration, posttest, and student reflection. Data were analyzed using Aiken's V to assess content validity across material and media aspects. The results showed that all validation indicators achieved Aiken's V values ranging from 0.83 to 1.00, exceeding the acceptable validity threshold of 0.80. These findings indicate strong expert agreement on content relevance, conceptual accuracy, media quality, and the appropriateness of integrating local wisdom into physics learning. In conclusion, the developed learning design is content-valid and feasible for use, with minor revisions required before practicality and effectiveness testing

Keywords: Design; Development; Google sites; Local wisdom; Physics

Introduction

Conventional physics instruction often remains teacher-centered, abstract, and weakly connected to students' sociocultural environment, which can reduce motivation, engagement, and conceptual understanding. In many classrooms, physics is still presented as a set of formulas detached from students' everyday experiences, causing learners to perceive the subject as difficult, impersonal, and irrelevant. At the same time, digital learning innovations are expanding rapidly, yet their use does not automatically guarantee meaningful learning. When digital media are designed without contextual and cultural relevance, they may improve access to content but still fail to foster deep understanding and personal connection to the material. Therefore, current physics education needs not only digital innovation, but also pedagogical designs that

connect scientific concepts with learners lived realities and local cultural knowledge. Conventional learning approaches that lack interactivity and a lack of connection between the material and local cultural experiences lead to low student motivation and engagement in the learning process (Erayani & Jampel, 2022; Alioon & Delialioğlu, 2019).

Integrating digital learning technology and local wisdom is an innovative strategy that has the potential to address these issues. The use of Google Sites as an interactive learning platform enables dynamic presentation of material through the integration of multimedia, simulations, videos, interactive quizzes, and online collaboration (Vidiana et al., 2024). Meanwhile, the use of local wisdom contexts in the development of teaching materials can bridge abstract scientific concepts with students' real-life experiences and strengthen local cultural identity (Astuti et al., 2024;

How to Cite:

Panis, I. C., Dewa, E., & Ki'i, O. A. Development an Interactive Physics Learning Based on Google Sites Integrated with Local Wisdom. *Jurnal Penelitian Pendidikan IPA*, 12(3), 22-31. <https://doi.org/10.29303/jppipa.v12i3.14344>

Ramadani, 2025). This paradigm shift necessitates the development of innovative pedagogical approaches that integrate scientific concepts with the richness of local wisdom, thus fostering more meaningful and engaging learning experiences for students (Ilhami et al., 2019). Physics, as the foundation of scientific inquiry, plays a crucial role in shaping our understanding of nature and technological advancements. However, traditional physics teaching methods often fail to connect abstract concepts to students' lived experiences, hindering their ability to appreciate the relevance and application of physics in everyday life (Diani et al., 2021). Integrating local wisdom into physics learning provides a unique opportunity to bridge this gap, making learning more understandable, memorable, and impactful (Anikarnisia & Wilujeng, 2020). Learning will be more effective if it is interactive, inspiring, and challenging, thus motivating students to participate actively and providing space for initiative, creativity, and independence (Sekarini & Arty, 2019). Science is not just about mastering facts, concepts, or principles, but also about the process of discovery. Mastery of concepts in science learning will be more meaningful if students discover these concepts themselves based on the context of their everyday lives (Haryadi & Nurmalita, 2021). One common problem in physics education is building meaningful contexts for concepts that are sometimes somewhat abstract or counterintuitive, especially when these concepts are also connected to mathematical descriptions, as is often the case in physics (Sabín, 2024). That activity can give students the impression that physics is a dry, impersonal, and irrelevant discipline. Science education is based on local wisdom, connecting it to everyday phenomena and providing theoretical support for better understanding.

The novelty of this study lies in the integrative design it proposes. This research does not merely use Google Sites as a delivery tool, nor does it simply insert local culture as decorative content. Susanti et al. (2023); Fitriana et al. (2024) said that e-modules can be an effective learning medium in increasing understanding and facilitating students' critical thinking skills. Instead, it develops a Google Sites-based interactive physics learning design in which Manggarai Gong is positioned as the central contextual framework for understanding sound-related physics concepts. Abdjul (2023) said that Google Sites learning media was effective for use in the learning process at school. Waraga et al. (2023) and Maryani et al. (2022) said that Google Sites assisted learning device developed meets the valid, practical, and effective criteria to be suitable for use in science learning in schools. Thus, the study offers a more systematic integration between digital pedagogy, physics content, and local wisdom. In addition, this research is novel because it evaluates the product not

only in terms of media feasibility, but also in relation to students' conceptual understanding and learning interest. In this way, the study contributes not only a digital product, but also an evidence-based model for contextual, culture-responsive, and interactive physics learning. Kurnia et al. (2025) said therefore, the Google Sites-based interactive learning media is valid, practical, and effective for use in the Physics learning process. Developing interactive learning designs that utilize digital platforms like Google Sites has enormous potential to transform physics education. Google Sites provides a versatile and user-friendly environment for creating dynamic and engaging learning resources, enabling educators to incorporate multimedia elements, interactive simulations, and collaborative activities (Iskandar et al., 2023). In addition, the integration of local wisdom into interactive learning platforms plays a vital role in creating a sense of connectedness and cultural relevance that can enhance student motivation and engagement in the learning process (Syahfitri, 2024). Through Google Sites-based media, students can explore the characteristics of the sounds produced by gongs through multimedia displays, interactive simulations, and project-based activities (Halimatusyadiah & Disman, 2023). This approach brings scientific concepts closer to students' real-life experiences, and strengthens the connection between science and local culture (Sapulete et al., 2023; Mukti et al., 2022). The focus of this research lies in the integrative approach between Google Sites-based digital technology and the systematic contextualization of physics material through local wisdom in interactive learning design. According to Suherman et al. (2025) and Nurwina et al. (2025) that Google sites can improve problem solving skills in literacy course in physics learning. The feasibility study of this research includes user needs analysis, learning design validity testing, and effectiveness testing on students' understanding and learning interests. According to Nurmila et al. (2023) and Lelfita et al. (2025) in the world of contemporary education, the need to cultivate not only a deep understanding of fundamental scientific principles but also a deep appreciation of the local cultural heritage where learning takes place has gained significant momentum. The use of the Manggarai Gong in learning not only strengthens students' conceptual understanding of physics material but also fosters a sense of pride in local culture, supports contextual learning based on local wisdom and ethnoscience (Anikarnisia & Wilujeng, 2020; Dwipayana et al., 2020). In addition to being an innovative pedagogical strategy, this approach also provides a solution to the impersonal nature of digital learning, by creating a more humanistic, contextual, and affectively meaningful learning experience (Nurjanah et al., 2024; Halimatusyadiah &

Disman, 2023). Thus, the integration of local wisdom through Gong Manggarai not only strengthens scientific literacy, but also students' cultural literacy in a single interactive learning model.

Method

This research will be conducted in 2 (two) Junior High Schools in Kupang City, consisting of one public school and one private school: SMP Katolik Rosa Mystika and SMP Negeri 9 Kota Kupang, located in Kupang, NTT. Selected based on the availability of digital learning support facilities and openness to the integration of local wisdom in learning. This location selection also considers the diversity of student backgrounds that reflect contextual representations of local culture relevant to the research objectives.

This research design uses Research and Development (R&D) approach with the aim of developing an interactive physics learning design based on Google Sites that is integrated with local wisdom. The development model used refers to the Borg and Gall development model that has been modified to suit the context of learning media development. The research stages consist of: (1) Potential and Problems. The initial stage is a needs assessment of the physics learning process taking place in schools, specifically identifying problems related to the use of learning media and the integration of local wisdom. Data is obtained through observation, interviews, and literature studies. (2) Information Collection. At this stage, various supporting information is collected for design development, such as interactive learning theories, digital media development principles, physics content according to the curriculum, and the potential of local wisdom relevant to physics material. (3) Initial Product Design. Based on the results of the needs analysis and supporting information, an initial product design is prepared in the form of an interactive physics learning tool based on Google Sites. The design includes page structure, material content, learning activities, and the integration of local wisdom elements (for example, traditional tools, local games, or local natural phenomena related to physics concepts). (4) Product Design Validation. The initial product was validated by physics material experts, digital learning media experts, and local culture/wisdom experts. Validation was conducted through questionnaires and discussions to assess the suitability of the content, appearance, and integration of local culture. (5) Product Design Revision. Based on the validation results, revisions were made to refine the learning design to make it more effective, attractive, and appropriate to student characteristics and the local context. (6) Limited Trial. The product was trialed on a limited basis on a small group of students to determine student responses,

ease of use, and the initial effectiveness of the media developed. Data was obtained through questionnaires, observations of learning activities, and interviews. (7) Advanced Product Revision. Based on the results of the limited trial, improvements and refinements were made to the product to increase the quality and effectiveness of the media. (8) Field Trial. The product was tested more widely on a larger group in several classes/schools to test the consistency of the product's effectiveness in supporting physics learning. Data collection was conducted through questionnaires, pretest-posttest, and interviews. (9) Final Revision and Final Product. The final product was developed based on feedback from field trials and refined into a Google Sites-based interactive physics learning design that is ready for widespread use. (10) Product Dissemination. The final product will be disseminated to physics teachers through workshops and publication of research results as a form of contribution to improving the quality of contextual and digital-based physics learning. The result of this research expected to make a tangible contribution to the world of education, particularly in the development of more innovative and contextual digital-based learning media. This research aligns with the focus areas and strategic research plan of Widya Mandira Catholic University Kupang, which emphasizes the development of technology-based education and the preservation of local culture.

The research implementation period is planned to last for one year, namely from April 2025 to April 2026, covering all stages from needs analysis, learning design development, expert validation, to limited trials and field trials. Research Subjects and Objects. The research subjects are 200 seventh grade junior high school students, consisting of 100 students from public schools and 100 students from private schools, and involving physics teachers as implementation partners in the learning media trial process. In addition, physics material experts, digital learning media experts, and local cultural experts are also involved in the learning design validation process. The object of the research is an interactive physics learning design based on Google Sites integrated with local wisdom, which was developed as an innovative means to improve the understanding of physics concepts while strengthening local cultural values in the learning process. Data collection techniques in this study include: 1) Observation of the learning process, 2) Expert validation questionnaire, 3) Interviews with teachers and students, 4) Pretest and posttest to measure effectiveness, 5) Documentation. Data were analyzed descriptively qualitatively and quantitatively. Qualitative data were analyzed by data reduction, data presentation, and drawing conclusions. Quantitative data were analyzed using descriptive statistics (e.g., percentage of feasibility,

effectiveness gain value). The research scheme includes indicators, processes, and outputs for the topic "Development of Interactive Physics Learning Design Based on Google Sites Integrated with Local Wisdom" with an R&D (Research and Development) approach:

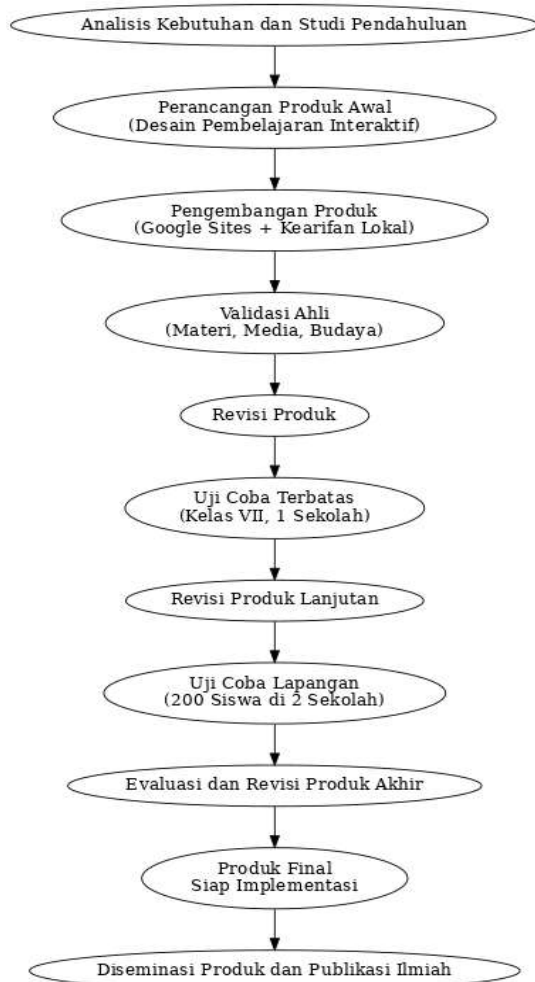


Figure 1. Diagram research flow

Result and Discussion

Research Results

The results of the development research show that the Research and Development (R&D) process has produced a product in the form of an interactive physics learning design based on Google Sites that is integrated with the local wisdom of the Manggarai gong. In the early stages of development, a needs analysis revealed that physics learning in schools is still dominated by abstract and less contextual presentation of material, and has not utilized the potential of local wisdom as a learning resource. This finding became the basis for designing an interactive learning design that emphasizes the integration of the concept of sound waves, digital visualization, and the local cultural context that is close to the experience of students.

Based on the analysis results, an initial product design was developed in the form of interactive learning media with a systematic learning flow structure, including contextual orientation, pretest, formulation of learning objectives, presentation of core material, virtual simulation, strengthening ethnoscience through the context of the Manggarai gong, posttest, and student responses. This flow is represented in the form of a development flowchart that serves as a pedagogical framework for the media. The initial product was then realized in the Google Sites platform with the integration of text, images, simulations, videos, and interactive quizzes designed to support conceptual scaffolding and meaningful learning based on local context.

The initial product design was developed in the form of interactive learning media based on Google Sites which is arranged modularly and systematically as shown in Figure 1. This product includes components of contextual orientation, initial diagnostics, learning objectives, presentation of core material, virtual simulation, reinforcement of ethnoscience through the context of the Manggarai gong, evaluation, and student reflection. Each component is designed to build students' cognitive flow gradually and support meaningful learning through the integration of physics concepts and local wisdom.



Figure 2. Initial product design structure



Figure 3. Home appearance of interactive physics learning design based on google sites integrated with local wisdom



Figure 4. Display of interactive physics learning design simulation based on google sites integrated with local wisdom

After the initial product was developed, the next stage was expert validation to assess the feasibility of the

learning design. The expert validation results showed that the Google Sites-based interactive physics learning design integrated with local wisdom had a high level of content validity. Based on the analysis using the Aiken V index, all indicators in the material and media aspects obtained a V value ≥ 0.80 , with a value range between 0.83–1.00. This indicates a strong level of agreement between validators regarding the relevance, accuracy, and feasibility of each indicator assessed. The indicators with the highest scores were in the aspects of ease of use of the interface and integration of culture-science, which indicated that the media was not only conceptually valid, but also easy to use and contextual for junior high school students. Thus, quantitatively, the developed learning media was declared valid in terms of content and worthy to proceed to the next stage of development research.

Although all indicators met the criteria for high content validity, the validator still provided a number of minor and constructive recommendations for improvement. These notes primarily concerned strengthening cultural authenticity through the inclusion of local sources or informants, adding a glossary of physics and cultural terms, enriching exploratory activities and reflective quizzes, and optimizing the Manggarai visual nuances and media responsiveness on mobile devices. These recommendations do not indicate fundamental weaknesses in the product, but rather serve as a basis for improvements to optimize the media pedagogically, technically, and culturally. Taking into account the quantitative validation results and qualitative input, the learning design was deemed valid and suitable for use with minor revisions before implementation in the practicality and effectiveness testing phase.

The expert validation results show that the interactive physics learning design based on Google Sites integrated with local wisdom has a high level of content validity. Based on calculations using the Aiken V index, all indicators in the material and media aspects obtained a V value ≥ 0.80 , with a range of 0.83–1.00, which reflects a strong level of agreement between validators regarding the relevance and appropriateness of each component assessed. This value indicates that the learning content has represented the concept of sound wave physics correctly, contextually, and in accordance with the characteristics of junior high school students, and is supported by a functional and easy-to-use media design. Theoretically, a V value close to 1 indicates a high expert consensus on the suitability of the items with the constructs being measured, so that the product can be declared valid in content and worthy to proceed to the next stage in development research (Aiken, 1985).

Table 1. Summarizes the Validation Results Using Aiken's V

Statement Items	V1	V2	V3	V4	V5	V6
Material Aspect						
Accurate historical material of the Manggarai gong based on reliable local literature/sources	5	4	5	4	5	5
The physics explanation (waves, frequency, amplitude, resonance, interference) is conceptually correct.	4	5	4	5	4	4
Integration between cultural aspects and balanced physics concepts	5	5	5	5	5	4
Examples of exploration (simulations, audio-images) help understanding abstract concepts.	4	5	5	4	4	5
Language according to the level of junior high school students	5	4	4	5	5	4
Relevant and authentic gong image and audio links	5	4	4	4	4	5
The material provides space for cultural & scientific reflection.	5	5	5	5	5	4
The flow of the material is logical and easy to follow.	4	5	4	5	5	5
Scientific data/assumptions are explained contextually	4	5	4	4	4	5
The material encourages students to see the relationship between science and culture.	3	5	5	5	5	4
Media Aspect						
The layout (grid layout, white space, section division) is neat and comfortable to read.	4	5	4	5	5	5
Colors, fonts, and visual styles are consistent and reflect cultural themes.	5	4	4	4	4	5
Interactive elements (audio, animation) run smoothly and responsively.	4	5	4	4	5	5
External links work well on various devices	4	5	4	5	4	4
Instructions for use are clear and easy to understand	4	4	5	4	5	5
Page loading speed is quite fast	5	5	4	5	5	5
Images and audio loaded without errors	4	5	5	5	5	5
Interactions (vibration animations, audio controls) work as designed.	5	4	4	4	5	5
The interface is easy for students to use	5	5	5	5	5	5
Aesthetic, attractive and motivating media for students to learn	4	5	4	5	5	5

Discussion

Interactive learning is an educational approach that emphasizes active student involvement in the learning process. This approach focuses not only on information transfer but also on creating collaborative, exploratory, and contextual learning experiences (Musniar et al., 2025). Forms of interactivity in learning include the use of simulations, educational games, group projects, online discussions, and the use of digital technology designed to strengthen student active participation in learning activities (Cao et al., 2023). Interactive learning design is believed to foster deeper conceptual understanding, encourage the development of critical thinking skills, and enhance student learning autonomy. In the context of physics learning, this approach is highly relevant given the abstract nature of physics material and it is often difficult to grasp through conventional lecture methods. Active learning experiences enable students to build understanding through direct engagement with the material, rather than simply passively receiving information. The application of digital technology further strengthens the effectiveness of interactive learning. Various studies have shown that digital technology can increase the appeal and effectiveness of science learning, including physics (Clark & Mayer, 2023). Technology enables the presentation of material through visualization of complex concepts, such as simulations of the laws of motion, visualization of sound waves, and animations of electromagnetic phenomena (Kiswanto, 2024). This

innovation helps students understand abstract concepts in a more concrete and enjoyable way.

Learning that implements the use of Google Sites web-based platform allows users to create and manage sites easily without programming skills (Faizah & Fathurrahman, 2024). In the world of education, Google Sites functions as an interactive learning medium because it supports the integration of various types of multimedia content, such as text, video, images, animations, online quizzes, and simulations (E. Supriatna, 2025). The advantages of Google Sites lie in its ease of access, content flexibility, and integration with other Google services such as Google Forms, Google Docs, and Google Drive (Melinia et al., 2024). This makes it easier for teachers to create adaptive and collaborative teaching materials, while also providing space for students to actively engage in learning activities. This platform also supports blended learning and flipped classrooms, as it allows students to access materials before, during, and after face-to-face learning. A study by Febrian and Nasution shows that the use of Google Sites in learning can increase student engagement through an attractive and responsive interface, as well as provide an interactive and meaningful learning experience (Febrian & Nasution, 2024). Purba et al. (2024) also stated that Google Sites significantly helps students' understanding of complex physics concepts through multimedia-based presentation of materials (Purba et al., 2024). Thus, Google Sites serves not only as a repository of materials, but also as an active learning

space that supports student exploration and collaboration.

Local wisdom serves as a repository for the accumulation of knowledge, values, practices, and culture of a community that is passed down from generation to generation. In the context of education, the integration of local wisdom aims to connect subject matter to students' real lives, making learning more contextual, meaningful, and relevant (Anikarnisia & Wilujeng, 2020; Ismawati et al., 2020). Educationally, Zaenudin et al. (2025) findings emphasize the importance for policymakers and education practitioners to systematically implement curricula and learning strategies that integrate technology and multicultural values, so that an inclusive and adaptive learning environment can be realized. In physics learning, local wisdom can be utilized as a context to explain various scientific concepts such as the laws of motion, pressure, force, sound, and energy. For example, the concepts of momentum and force can be explained through traditional games such as stilts, while the principles of sound waves can be understood through traditional musical instruments such as the gong or kolintang. This approach not only enriches students' conceptual understanding but also fosters a sense of pride in local culture. The culturally responsive teaching approach has proven effective in increasing student motivation, engagement, and learning outcomes (Villegas & Lucas, 2002; Lasminawati et al., 2023). Teachers can design project-based learning by exploring local culture, such as making props from traditional materials or examining scientific phenomena in traditional ceremonies. This encourages students to see science as an integral part of their daily lives. Putri's study showed that using examples of local wisdom in science learning increased students' motivation and understanding of scientific concepts (Putri et al., 2025). Similarly, Mulyadi et al stated that the ethnoscience approach, namely the integration of science and local culture, is able to form students' scientific and cultural identities simultaneously (Muliadi et al., 2024). Although the use of digital technology in learning has grown rapidly, the use of Google Sites specifically integrated with local wisdom in physics learning remains very limited. Several studies, such as Syahfitri's, show that locally-based digital learning designs can increase student engagement and motivation (Syahfitri, 2024). However, research that systematically combines interactive physics learning design through Google Sites with local wisdom content remains an underexplored niche. Research by Supriatna confirms that web-based interactive media can facilitate concept visualization and enhance students' critical thinking skills (D. Supriatna et al., 2024). Therefore, the use of Google Sites in physics learning based on local culture is expected to bridge the

gap between abstract scientific content and the concrete realities of students' lives. This integration also provides a solution to overcome the impersonal nature of digital learning. When students are only exposed to rigid, content-oriented material without social interaction or cultural context, their motivation to learn tends to decrease. The incorporation of local wisdom into digital design allows students to feel the cultural relevance of learning, thus creating a more humanistic and meaningful learning experience.

Conclusion

Based on the research data above, the main finding of this study is that the developed learning product has demonstrated strong content validity, as indicated by the quantitative validation results and supported by the validators' qualitative feedback. The product can therefore be considered feasible for use as a contextual physics learning resource, particularly in learning environments that integrate cultural content and local knowledge into the physics teaching process. At the same time, the validators' recommendations—such as strengthening cultural authenticity through local sources, adding a glossary of physics and cultural terms, enriching exploratory tasks and reflective quizzes, and refining Manggarai-specific visual nuances—show that the product is not only valid, but also has clear potential for further pedagogical improvement. Practically, this product may help teachers design more meaningful, culturally relevant, and conceptually accessible physics learning experiences, while also supporting students' engagement, contextual understanding, and connection between physics concepts and their everyday cultural environment. However, this study is limited to the validation stage and has not yet examined the product's practicality and effectiveness in actual classroom implementation. In addition, the findings are still based on expert judgment and qualitative suggestions, so they cannot yet fully represent students' responses, learning outcomes, or implementation challenges in diverse instructional settings. Therefore, further research is recommended to conduct field trials in real classroom contexts in order to test the product's practicality, effectiveness, student acceptance, and its impact on the overall physics learning process.

Acknowledgments

The authors say thank you are to the Universitas Katolik Widya Mandira and all colleagues who have supported the completion of this article.

Author Contributions

I.C.P: conceptualization, writing original draft preparation, methodology, editing, review, curation; E.D:

conceptualization, methodology, editing, review, curation; O.A.K: editing and curation.

Funding

This research received Internal funding from LPPM Universitas Katolik Widya Mandira.

Conflicts of Interest

The authors declare no conflict of interest.

References

- Abdul, T. (2023). The Effectiveness of Google Sites-Assisted Learning Media on Vibration, Waves, and Sound Materials. *Jurnal Penelitian Pendidikan IPA*, 9(8), 5859–5863. <https://doi.org/10.29303/jppipa.v9i8.3879>
- Aiken, L. R. (1985). Three Coefficients for Analyzing the Reliability and Validity of Ratings. *Educational and Psychological Measurement*, 45(1), 131–142. <https://doi.org/10.1177/0013164485451012>
- Alioon, Y., & Delialioğlu, Ö. (2019). The effect of authentic m-learning activities on student engagement and motivation. *British Journal of Educational Technology*, 50(2), 655–668. <https://doi.org/10.1111/bjet.12559>
- Anikarnisia, N. M., & Wilujeng, I. (2020). Need assessment of STEM education based based on local wisdom in junior high school. *Journal of Physics: Conference Series*, 1440(1), 012092. <https://doi.org/10.1088/1742-6596/1440/1/012092>
- Astuti, S., Syarifuddin, S., & Vianty, M. (2024). Development of Local Wisdom-Containing Teaching Materials Based on Fliphtml5 Descriptive Text Material at SMP Negeri 2 Lahat: A Needs Analysis. *Indonesian Journal of Education and Learning*, 4(4), 1440–1448. <https://doi.org/10.53299/jppi.v4i4.778>
- Cao, C., Song, H., & Yang, S. (2023). A Review of Research on the Effect of Digital Learning on Foreign Language Learning Motivation. *Lecture Notes in Education Psychology and Public Media*, 29(1), 176–180. <https://doi.org/10.54254/2753-7048/29/20231448>
- Clark, R. C., & Mayer, R. E. (2023). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & sons.
- Diani, R., Yanti, Y., Hartati, N. S., Fujiani, D., Hasanah, I. F., & Alamsyah. (2021). Islamic Literacy-Based Physics E-Module with STEM (Science, Technology, Engineering, and Mathematics) Approach. *Journal of Physics: Conference Series*, 1796(1), 012098. <https://doi.org/10.1088/1742-6596/1796/1/012098>
- Dwipayana, P. A. P., Redhana, I. W., & Juniartina, P. P. (2020). Analysis of the Needs for Developing Interactive Multimedia Based on Local Cultural Context for Junior High School Science Learning. *Indonesian Journal of Science Educators and Learning*, 3(1), 49–60. <https://doi.org/10.31004/basicedu.v5i2.881>
- Erayani, L. G. N., & Jampel, I. N. (2022). Meningkatkan Kemampuan Literasi Sains dan Kemampuan Metakognitif Siswa melalui Model Problem Based Learning Berbantuan Media Interaktif. *Jurnal Penelitian Dan Pengembangan Pendidikan*, 6(2), 248–258. <https://doi.org/10.23887/jppp.v6i2.48525>
- Faizah, L. N., & Fathurrahman, M. (2024). Utilization of Differentiated Learning Media Based on Google Sites in Science Learning in Elementary Schools. *School Journal*, 8(2), 288–295. <https://doi.org/10.24114/js.v8i2.56992>
- Febrian, M. A., & Nasution, M. I. P. (2024). The Effectiveness of Using Google Sites as a Collaborative Learning Medium: Theoretical and Practical Perspectives. *Al-I'tibar Journal of Islamic Education*, 11(2), 152–159. <https://doi.org/10.30599/jpia.v11i2.3590>
- Fitriana, E., Djono, D., & Sumaryati, S. (2024). Possibilities for using e-modules in vocational high schools to facilitate critical thinking skills. *IJORER: International Journal of Recent Educational Research*, 5(3), 656–665. <https://doi.org/10.46245/ijorer.v5i3.595>
- Halimatusyadiah, H., & Disman, D. (2023). The benefits of interactive media websites through google sites on learning outcomes of elementary school students. *Jurnal Lingua Idea*, 14(1), 92–108. <https://doi.org/10.20884/1.jli.2023.14.1.8305>
- Haryadi, R., & Nurmala, R. (2021). Development of Contextual Physics Teaching Materials to Improve Student Learning Motivation. *SPEKTRA Journal of Science Education Studies*, 7(1), 32. <https://doi.org/10.32699/spektra.v7i1.168>
- Ilhami, A., Riandi, R., & Sriyati, S. (2019). Implementation of science learning with local wisdom approach toward environmental literacy. *Journal of Physics: Conference Series*, 1157, 022030. <https://doi.org/10.1088/1742-6596/1157/2/022030>
- Iskandar, A., HA, A., Hanafi, H., Maruf, N., Fitriani, R., & Haluti, A. (2023). *Creative and Innovative Learning in the Digital Era*. Indonesian Digital Innovation Scholars Foundation.
- Ismawati, R., Juliyanto, E., Prajoko, S., & Rahayuningsih, E. (2020). Instilling The Conservation Character Through Reconstruction of Scientific Knowledge Based on Local Wisdom. *Indonesian Journal of Science and Education*, 4(1), 35.

- <https://doi.org/10.31002/ijose.v4i1.1434>
- Kiswanto, H. (2024). Development of Augmented Reality Learning Media in Applied Physics Courses Based on IMO Course Module 7.04. *Journal of Physics Education Research*, 9(4), 190–198. Retrieved from <https://jipfi.uho.ac.id/index.php/journal/article/view/123>
- Kurnia, U., Rahmi, U., Bentri, A., & Ridwan. (2025). Development of Interactive Learning Media Based on Google Sites In Physics Learning for Class XI. *Jurnal Penelitian Pendidikan IPA*, 11(10), 214–221. <https://doi.org/10.29303/jppipa.v11i10.12329>
- Lasminawati, E., Kusnita, Y., & IW, M. (2023). Improving Learning Outcomes with the Culturally Responsive Teaching Model Problem Based Learning Approach. *Journal of Science Education Research*, 2(2), 44–48. <https://doi.org/10.62759/jsr.v2i2.49>
- Lelfita, Susanti, E., Erlinda, N., & Febriandi, R. (2025). Design of Physics Learning Media Using Mind Map-Based Cloud Persentation in Optical Instruments Material. *Jurnal Penelitian Pendidikan IPA*, 10(12), 10980–10989. <https://doi.org/10.29303/jppipa.v10i12.7126>
- Maryani, Nisak, M. S., & Supriadi, B. (2022). Implementation of Google Sites Web-Based Learning Media to Improve Problem Solving Skills for High School Students the Subject of Sound Waves. *Jurnal Penelitian Pendidikan IPA*, 8(4), 2430–2438. <https://doi.org/10.29303/jppipa.v8i4.2037>
- Melinia, S., Ismet, & Yusup, M. (2024). Development of Physics Module Based on Ethnoscience with the Local Wisdom of House Limas Palembang to Improve Thinking Ability. *Jurnal Penelitian Pendidikan IPA*, 10(11), 8319–8327. <https://doi.org/10.29303/jppipa.v10i11.8654>
- Mukti, H., IW, S., & IBP, A. (2022). Integration of Ethnoscience in Science Learning. *JPGI (Journal of Indonesian Teacher Researchers)*, 7(4), 356–362. <http://dx.doi.org/10.24014/jnsi.v8i1.35997>
- Muliadi, A., Wazni, M. K., Suhirman, S., & Kusuma, D. W. C. W. (2024). Effectiveness of Ethnoscience Learning Based on Sasaknese Traditional Games: Preservice Teacher's Perception. *Jurnal Penelitian Pendidikan IPA*, 10(9), 7200–7208. <https://doi.org/10.29303/jppipa.v10i9.10298>
- Musniar, A., Arafah, K., & Palloan, P. (2025). Development of Physics Teaching Materials Based on Local Wisdom to Improve Students' Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 11(2), 274–283. <https://doi.org/10.29303/jppipa.v11i2.9999>
- Nurjanah, R., Purnamasari, S., & Rahmaniar, A. (2024). Analysis of the Implementation of Local Potential in Natural Science Learning. *Journal of Mathematics and Natural Sciences Educators*, 14(1), 48–56. <https://doi.org/10.37630/jpm.v14i1.1476>
- Nurmila, Abdjul, T., & Uloli, R. (2023). Development of Learning Media Using Smart Apps Creator Based on Local Wisdom in Work and Energy Materials. *Jurnal Penelitian Pendidikan IPA*, 9(12), 11603–11612. <https://doi.org/10.29303/jppipa.v9i12.5818>
- Nurwina, A., Yani, A., & Arsyad, M. (2025). Development of Physics Teaching Materials Based on Google Sites to Improve Students' Collaboration Skills. *Jurnal Penelitian Pendidikan IPA*, 11(7), 359–370. <https://doi.org/10.29303/jppipa.v11i7.11871>
- Purba, J., Sigiro, M., & Silaban, B. (2024). Development of Google Sites Web-Based Physics Learning Media with a Multi-Representation Approach to Measure Physics Concept Mastery Ability. *Journal of Educational Science Studies*, 5(3), 750–765. <https://doi.org/10.55583/jkip.v5i3.1097>
- Putri, H. K., Rusilowati, A., Supriyadi, S., Widiyatmoko, A., Negoro, R. A., & Teasy, Y. (2025). The Implementation of Local Wisdom-Based Teaching Material to Increase Students' Literacy and Numeracy. *Unnes Science Education Journal*, 14(2), 268–279. <https://doi.org/10.15294/usej.v14i2.24474>
- Ramadani, I. (2025). Integration of Teaching Materials Based on Kajang Local Wisdom in Improving Critical Thinking Skills. *Indonesian Journal of National Service*, 6(1), 274–284. Retrieved from <https://journal.stmiki.ac.id/index.php/jpni/article/view/1184>
- Sabi'n, J. (2024). Promoting Abstract Thinking and Scientific Argumentation in the Teaching of Physics. *Physics Education*, 59. <https://doi.org/10.1088/1361-6552/ad4f3e>
- Sapulete, H., Priakusuma, A., EM, S., IDA, P., & Mere, K. (2023). The Effectiveness of Using Google Site Media in Improving Student Learning Outcomes. *Journal on Teacher Education*, 5(1), 94–100. <https://doi.org/10.31004/jote.v5i1.16986>
- Sekarini, R. P., & Arty, I. S. (2019). Contextual-based Science Outdoor Learning to Improve Student Curiosity. *Journal of Physics: Conference Series*, 1233, 012103. <https://doi.org/10.1088/1742-6596/1233/1/012103>
- Suherman, D. S., Novitra, F., Oktavia, R., Yumna, H., & Asrizal. (2025). Development of Interactive E-Modules for Literacy Courses in Physics Learning Assisted by Google Sites to Improve Students' Problem-Solving Skills. *Jurnal Penelitian Pendidikan IPA*, 11(12). <https://doi.org/10.29303/jppipa.v11i12.13463>
- Supriatna, D., Sepriyanti, D., & Hartono, R. (2024).

- Development of Google Site Web-Based Learning to Improve Learning Outcomes of 5th Grade Students at SDN Ciherang 01: Indonesia. *Journal of Educational Technology*, 13(2), 62–79. <https://doi.org/10.29303/jppipa.v11i2.10277>
- Supriatna, E. (2025). The Effect of Using Canva-Based Interactive Media in Science Learning on Critical Thinking Skills of Grade VI Elementary School Students. *Scientific Journal of Elementary Education*, 10(01). Retrieved from <https://journal.unpas.ac.id/index.php/pendas/article/view/21523/10746>
- Susanti, E., Septiana, S., Meilinda, S., & Rosa, I. M. (2023). The Effectiveness of Using Google Sites-Based E-Modules to Optimize Critical Thinking Skills: Student Perceptions Analysis. *Jurnal Penelitian Pendidikan IPA*, 9(12), 10555–10561. <https://doi.org/10.29303/jppipa.v9i12.5887>
- Syahfitri, J. (2024). The Utilization of Local Wisdom-based Interactive Digital Module to Improve Students' Critical Thinking Skills. *International Journal of STEM Education for Sustainability*. <https://doi.org/10.53889/ijses.v4i1.305>
- Villegas, A. M., & Lucas, T. (2002). Preparing Culturally Responsive Teachers. *Journal of Teacher Education*, 53(1), 20–32. <https://doi.org/10.1177/0022487102053001003>
- Waraga, S. S., Abdjul, T., & Odja, A. H. (2023). Development of Google Sites-Assisted Learning Devices on Vibrations and Waves Material. *Jurnal Penelitian Pendidikan IPA*, 9(8), 6101–6110. <https://doi.org/10.29303/jppipa.v9i8.4275>
- Zaenudin, & Aziza, W. (2025). Technology-Based Education Innovation and Multicultural Approach to Students' Character Development and Social Competence. *Journal of Educational Technology*, 480–490. Retrieved from <https://ejournal.undiksha.ac.id/index.php/JET/article/view/96099/35208>