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Development of a Nearpod-Based Digital Teaching Module Containing Sui Wu'u Ngada Local Wisdom to Improve Analytical Thinking Skills

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Abstract – *This study addresses the urgent need for interactive and contextual digital learning media that can foster higher-order thinking skills in physics, especially in culturally rich regions such as Ngada Regency, Indonesia. The study aimed to develop and evaluate a Nearpod-based digital teaching module incorporating Sui Wu'u Ngada local wisdom to improve senior high school students' analytical thinking skills in thermodynamics. Using a research and development (R&D) approach with the ADDIE model (analysis, design, development, implementation, and evaluation), the module was designed with interactive features (e.g., quizzes, drag-and-drop tasks, videos, and local case-based activities) and culturally grounded contexts derived from Sui Wu'u practices. The module was implemented through guided learning with 32 grade XI students at Citra Bakti High School, supported by physics teachers. Data were analyzed using descriptive qualitative and quantitative methods, including expert validation, student response questionnaires, and pretest–posttest assessments of analytical thinking skills. The results showed that the developed module received a "very valid" rating, with an expert mean score of 4.72, and demonstrated "very practical" usability based on student responses (88%), indicating it was engaging, easy to use, and culturally relevant. Effectiveness testing indicated a significant improvement in analytical thinking skills, with an N-gain value of 0.67 (medium–high category). The novelty of this study lies in systematically integrating the specific local wisdom of Sui Wu'u Ngada into an interactive Nearpod digital module for thermodynamics learning, which remains rarely documented in regional physics education contexts. In conclusion, the Nearpod-based Sui Wu'u module is feasible, practical, and effective for improving students' analytical thinking and contributes to physics education by providing an empirically supported model for culturally responsive, technology-enhanced learning in secondary education schools.*

Keywords: analytical thinking; local wisdom; nearpod module; sui wu'u Ngada; thermodynamics

I. INTRODUCTION

In the 21st-century era of education, advances in information technology have affected all levels of society, including teachers and students (Suprianto, 2023). The utilization of educational

technology is expected to facilitate various aspects of learning, including access to learning resources, interaction, and assessment (Suarga et al., 2023). Accordingly, students are increasingly required to demonstrate higher-order thinking skills, digital literacy, collaboration, and readiness to face global challenges (Patiño et al., 2023). In this context, teachers are expected to design learning experiences that not only deliver concepts but also promote higher-order thinking through relevant and innovative educational technologies (Vermeulen & Volman, 2024).

The rapid development of science and technology has also driven significant changes in learning processes at schools, particularly at the Senior High School level (Aldilla et al., 2023). One essential competency to develop is analytical thinking, namely the ability to decompose complex problems into simpler components, identify relationships among components, and formulate and evaluate arguments and solutions logically (Assegaf & Sontani, 2016). However, previous research indicates that students' achievement in analytical thinking across different levels often remains in the low-to-moderate category, suggesting the need for systematic and contextual learning interventions (Gelu et al., 2020).

In physics learning, analytical thinking is fundamental because students are expected to analyze phenomena, connect concepts, and solve problems logically and systematically (Loyens et al., 2023). Nevertheless, classroom practice still frequently relies on conventional approaches, less-engaging media, and limited opportunities for active student involvement, which may contribute to students' relatively low levels of analytical thinking. Alongside digital development, interactive learning media offer an alternative to improve learning quality (Sofa et al., 2025). One example is Nearpod, which allows teachers to integrate digital teaching materials with interactive activities such as quizzes, polls, simulations, audio, and videos to encourage active participation and enable real-time monitoring of students' understanding (Ahmad et al., 2023; Said et al., 2024). This approach aligns with the student-centered learning paradigm, which positions students as active agents in the learning process (Foa & Gelu, 2024). At the same time, education is also expected to strengthen cultural identity and national character (Asmayawati et al., 2024).

Local wisdom represents cultural values that can be integrated into learning to enhance contextual relevance and increase the meaningfulness of materials for students (Kua et al., 2024). This integration is particularly relevant for science learning because local wisdom often contains elements of scientific processes and empirical practices (Erlangga et al., 2022). As a part of community culture and identity, local wisdom therefore has strong potential to serve as a context for physics learning (Eveline et al., 2023). From an axiological perspective, learning that incorporates local values is expected not only to develop students' understanding of physics but also to foster awareness of identity and the environment, thereby supporting character development (Saputra, 2024).

However, the effectiveness of learning technology is not determined solely by technological features but also by the relevance of content and cultural contextualization. Integrating local wisdom into teaching modules has been shown to increase learning relevance, support cultural identity, and strengthen students' motivation, especially in communities with rich cultural heritage (Asmayawati et al., 2024). In Ngada Regency, East Nusa Tenggara Province, one distinctive form of local wisdom is preserved pork, locally known as *Sui Wu'u*. This tradition involves preserving meat (e.g., pork) using a mixture of corn flour and salt, followed by smoking or storage in bamboo containers (Mawo et al., 2021). Ethnographic and local studies suggest that the rituals and practices surrounding *Sui Wu'u* encompass social values (e.g., care and mutual cooperation), historical narratives, and symbolic meanings that can serve as contextual resources for designing meaningful learning activities (Rubak et al., 2023).

The incorporation of *Sui Wu'u* local wisdom into physics teaching modules offers several pedagogical advantages. First, materials linked to students' socio-cultural environment may increase affective and cognitive engagement, thereby encouraging students to observe, inquire, and think critically, key components of analytical thinking. Second, contextualizing thermodynamic concepts through local practices can help students connect abstract concepts to real situations, such as heat transfer, phase changes, and force and pressure, which can be illustrated through traditional food processing and storage. Third, learning materials based on local wisdom may strengthen cultural pride and support the preservation of local knowledge through modern educational media (Pilendia, 2024). In parallel, ongoing digital development continues to open opportunities to provide more engaging and interactive learning experiences (Gelu & Bakti, 2024).

Despite this potential, the systematic development of digital teaching modules that combine Nearpod's interactive features with local wisdom content remains limited, particularly in physics education within regional contexts such as Ngada Regency. In practice, many available digital modules still emphasize basic text, images, and videos (Anggraini, 2018), whereas interactive platforms can offer richer learning experiences (Patmaniar et al., 2024). Several studies in Indonesia have reported that Nearpod-based media development across various subjects yielded products that are valid, practical, and effective (Feri & Zulherman, 2021). However, empirical studies that use local wisdom as learning content to improve analytical thinking, particularly through Nearpod-based digital modules, remain scarce. This gap highlights the need for planned research that not only produces a digital teaching module but also evaluates its content validity, practicality, and effectiveness in improving students' analytical thinking skills.

Several studies have explored the development of Nearpod-based learning modules and the incorporation of local wisdom into teaching materials. However, no research has reported on

integrating Nearpod technology specifically with the local wisdom of *Sui Wu'u* from Ngada. Previous studies tend to focus on Nearpod's effectiveness in general or examine local wisdom-based modules in print or digital formats without maximizing Nearpod's interactive features. As a result, there is limited empirical evidence on how effectively embedding *Sui Wu'u* local wisdom into a Nearpod-based digital module can enhance students' analytical thinking skills in physics lessons. Therefore, this study aims to develop a Nearpod-based digital teaching module that incorporates *Sui Wu'u* Ngada local wisdom for high school physics instruction on thermodynamics, with a focus on fostering analytical thinking skills. The research aims not only to develop a valid and practical educational tool but also to evaluate its effectiveness in improving students' analytical thinking.

II. METHODS

This study used a research and development (R&D) approach (Meliza & Eliyasni, 2023) to create a Nearpod-based digital teaching module that integrates *Sui Wu'u* Ngada local wisdom. The aim was to assess the module's effectiveness in enhancing students' analytical thinking skills. The development process followed the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. This structured approach ensured systematic creation and evaluation of the educational tool.

The research procedure is summarized in the flowchart shown in Figure 1. Data sources included primary and secondary data. Primary data were collected from 32 eleventh-grade students at Citra Bakti High School in Ngada Regency who used the module, physics teachers who implemented the learning, expert validators (material experts, media experts, and cultural or local-wisdom experts), and Ngada traditional figures who provided information about local wisdom's substance and practices. Secondary data were gathered from curriculum documents, scientific articles and journals, and relevant prior data on student learning outcomes.

Data collection techniques were applied based on the needs of each development stage. During the analysis phase, data were gathered through document analysis, in-depth interviews with teachers and traditional leaders, and initial classroom observations (Yolanda & Basri, 2021). The needs assessment was conducted through learning observations, semi-structured interviews with teachers and students, and a needs questionnaire to identify learning challenges, student characteristics, and the need for local-wisdom-based digital media (Aldilla et al., 2023).

Product validation was conducted by material experts, media experts, and local-wisdom experts using validation sheets to assess content suitability, language, presentation, and the integration of local values. Product trials were conducted in two phases, namely limited trials and

field trials. During these trials, data were collected using (1) analytical thinking skills tests administered as pretests and posttests, (2) student response questionnaires, and (3) observation sheets assessing the implementation of learning activities during the use of the Nearpod-based digital teaching module.
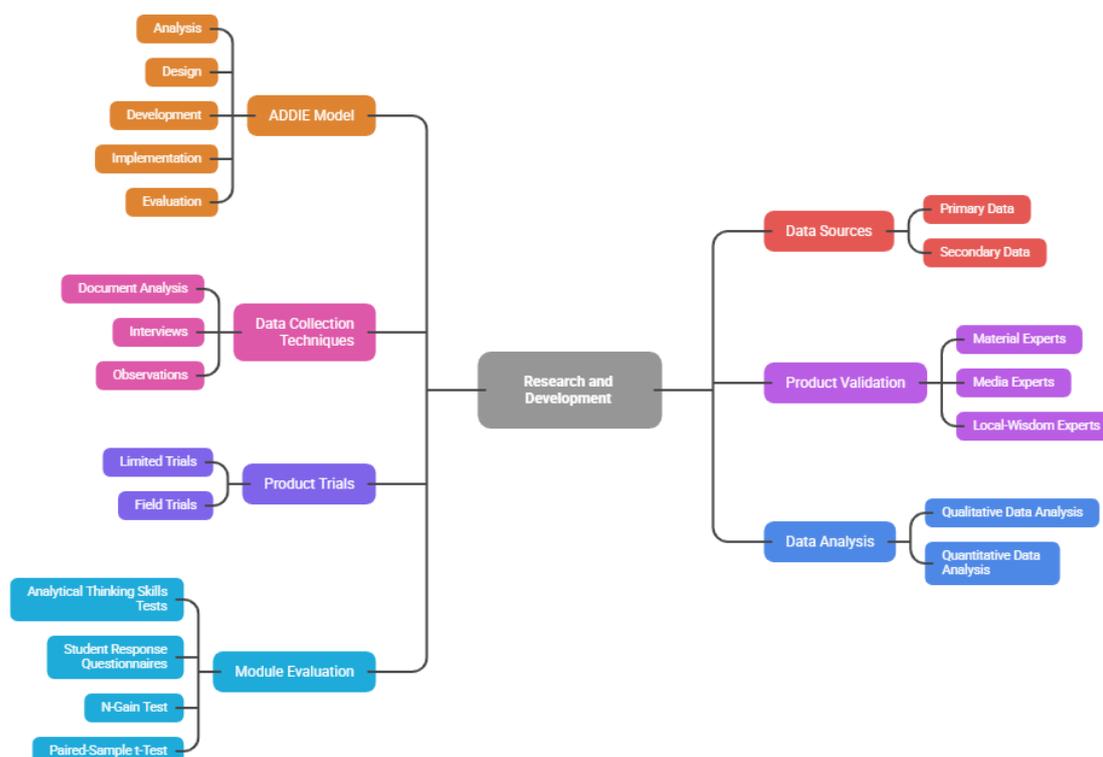

Figure 1. Research flowchart

Qualitative data collected from observations, interviews, and validator feedback were analyzed descriptively using data reduction, data display, and conclusion drawing. These findings served as the foundation for revising the product. Validation data were also analyzed using descriptive quantitative methods, including calculation of mean scores. The mean scores were then categorized into feasibility levels. The module was deemed feasible if it met the criteria of being either valid or very valid.

Module practicality was determined based on the percentage of students who responded. Module effectiveness was evaluated by measuring improvement in analytical thinking skills using the N-gain test. The module was categorized as effective when the N-gain value was in the medium or high category. In addition, a paired-sample t-test was employed to support the statistical interpretation of the pretest–posttest results.

III. RESULTS

During the analysis stage, this study identified students' needs and examined the cultural traits of *Sui Wu'u* Ngada. It also explored teachers' requirements for interactive digital modules. The analysis revealed that none of the students had previously used a Nearpod-based digital module. Additionally, 76% of students found it difficult to understand abstract physics concepts without linking them to their daily lives. This information highlights the importance of culturally relevant and user-friendly digital learning tools.

The Design stage resulted in a storyboard, interactive learning flow, a content map, and the integration plan for local wisdom elements (e.g., *Sui Wu'u* images) into the module, as illustrated in Figure 2. The Development stage involved constructing the module on the Nearpod platform, incorporating interactive videos, drag-and-drop activities, simple simulations, formative quizzes, and local case-based analytical tasks. The module addressed thermodynamics content aligned with the applicable curriculum. The Implementation stage was conducted with 32 eleventh-grade students at Citra Bakti High School in Ngada Regency through guided learning activities using the school's Chromebook devices. The Evaluation stage included expert validation, readability considerations, and effectiveness testing focusing on students' analytical thinking skills.
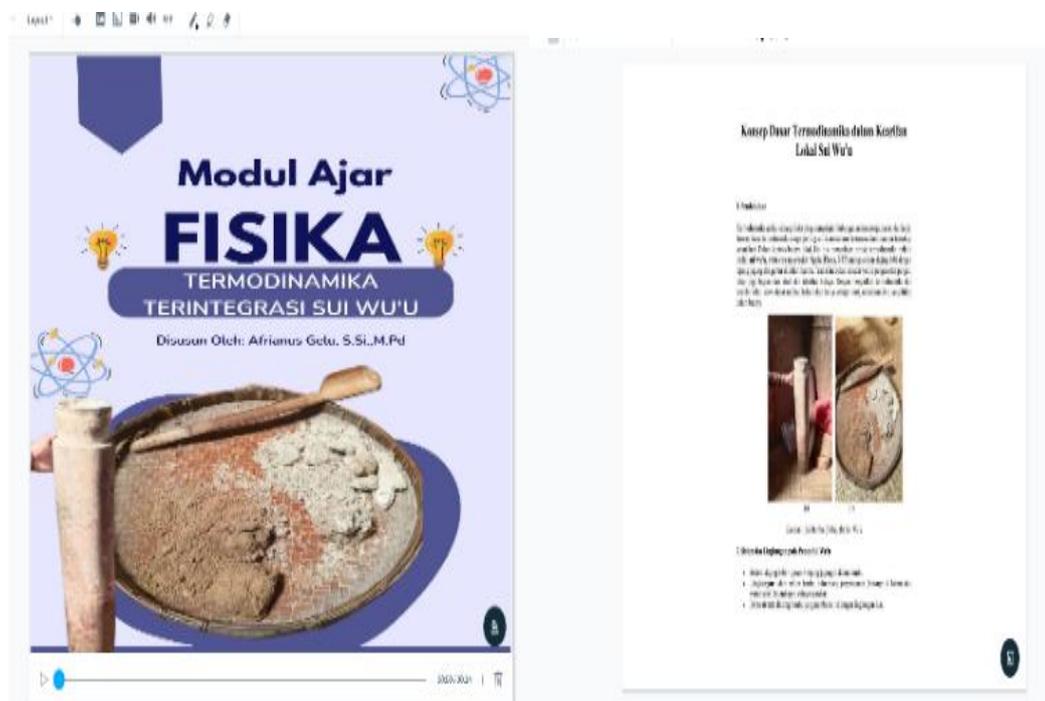

Figure 2. Teaching module design using Nearpod

1. Validity of the developed module

Expert validation was conducted by three validators: a material expert, a media expert, and a cultural expert. The validation instrument assessed content suitability, display design, quality of interactivity, cultural accuracy, and curriculum alignment. The validation results from all experts are summarized in Table 1.

Table 1. Expert validation results

Rated aspect	Materials expert	Media expert	Cultural expert	Category
Content eligibility	4.7	-	-	Very good
Display design	-	4.6	-	Very good
Interactivity	-	4.8	-	Very good
Accuracy of cultural content	-	-	4.9	Very good
Compliance with the curriculum	4.6	-	-	Very good
Total Average		**4.72**		**Very good**

Overall, the module achieved a mean score of 4.72, indicating that it met the criteria for validity and feasibility. These results suggest that the module content was appropriate for thermodynamics learning, the media design supported usability and engagement, and the integration of *Sui Wu'u* was culturally accurate and aligned with learning objectives.

2. Practicality based on student responses

Module practicality was evaluated using a student response questionnaire administered after students used the module in thermodynamics learning. The respondents were 32 grade XI students. The results are presented in Table 2.

Table 2. Results of the student practicality test

Practical aspects	Score (%)	Category
Attractive appearance	89%	Very practical
Ease of use	87%	Very practical
Relevance to cultural context	91%	Very practical
Interactivity and engagement	85%	Practical
Average	**88%**	**Very practical**

The overall practicality score (88%) indicates that students perceived the module as very practical, particularly in terms of cultural relevance and visual attractiveness. This finding supports the view that interactive digital learning environments are more consistent with students' learning preferences in a technology-rich era, where learners tend to favor visual, interactive, and exploratory formats (Suryani et al., 2020; Getenet et al., 2024).

At the same time, the implementation of digital learning in many schools, especially in regional or remote areas, often faces constraints such as device availability, limited teacher training, and a shortage of contextual digital learning resources. These conditions can lead

teachers to continue relying on conventional media and underutilize digital platforms to support the development of higher-order thinking (Zae & Gelu, 2024). Therefore, the practicality results in this study are important because they indicate that the developed module was not only usable but also perceived as relevant and engaging by students in the local context.

3. Effectiveness in Improving Analytical Thinking Skills

The effectiveness of the module was evaluated by comparing pretest and posttest results of students' analytical thinking skills. Table 3 presents a comparison of mean scores and N-gain values.

Table 3. Comparison of pretest and posttest scores

Component	Pretest (mean)	Posttest (mean)	N-gain	Category
Analytical ability	54.21	81.34	0.67	Medium–high

The results show an increase from a mean pretest score of 54.21 to a mean posttest score of 81.34, with an N-gain of 0.67, categorized as medium–high. This improvement indicates that the module contributed positively to students' development of analytical thinking. Contextual learning that begins with students' immediate environment can make it easier for learners to relate physics concepts to real-life situations, which supports knowledge construction and conceptual understanding (Ramdani et al., 2021; Rumiati et al., 2021). In addition, many nationally available digital modules remain relatively general and may not sufficiently address local contexts (Lestari et al., 2024); therefore, integrating *Sui Wu'u* provides contextual anchoring that may strengthen meaning-making during learning.

In physics learning, analytical thinking is a crucial competence because it involves identifying variables, examining cause–effect relationships, applying logical reasoning, and drawing inferences from data or observed phenomena (Loyens et al., 2023). These skills are central to addressing 21st-century demands, such as problem-solving, innovation, and evidence-based decision-making (Lu et al., 2021). However, various studies report that Indonesian students' performance in analytical thinking remains relatively low, as reflected in national assessments, PISA, and classroom evaluations, particularly when students face contextual and non-routine problems (Maulidya et al., 2021; Asmayawati et al., 2024). In this regard, the improvement shown in Table 3 provides empirical support that a Nearpod-based digital module enriched with local wisdom content can serve as an effective intervention to enhance analytical thinking in thermodynamics learning.

IV. DISCUSSION

To address these challenges, an instructional solution is required that integrates digital technology with a contextual, student-centered learning approach. Nearpod-based digital teaching modules represent a promising innovation to support this need (Prasetyo & Andayani, 2024). Nearpod provides interactive features such as simulations, polls, quizzes, drag-and-drop activities, interactive videos, and real-time collaboration that facilitate active learning processes and enable teachers to monitor student participation and understanding during instruction (Ahmad et al., 2023). In addition, Nearpod modules are accessible across multiple devices, which supports flexibility in both synchronous and asynchronous learning environments (Pramesti et al., 2023). Therefore, Nearpod can provide an engaging learning experience while also supporting the development of analytical thinking through learning activities that require interpretation, analysis, and evaluation (Aslami, 2021).

The integration of *Sui Wu'u* Ngada local wisdom into a Nearpod-based digital teaching module provides a strategic pedagogical advantage. As a cultural practice that reflects the traditions, knowledge, and lived experiences of the Ngada community, *Sui Wu'u* offers authentic contexts that can be meaningfully linked to physics concepts, particularly thermodynamics. By connecting abstract physics concepts to familiar cultural phenomena, students are more likely to develop conceptual understanding that is not only cognitively meaningful but also socially and culturally grounded. This integration may also foster students' identity formation and appreciation of their cultural heritage (Umamah et al., 2024). Furthermore, this approach aligns with the Independent Learning policy's direction, which emphasizes contextual, flexible, and character-based learning experiences (Gelu et al., 2025).

Despite its potential, the development of Nearpod-based digital teaching modules that incorporate local wisdom remains limited. In practice, some teachers have not yet developed sufficient skills to design digital learning content using an ethnopedagogical approach, resulting in learning materials that emphasize cognitive outcomes without adequately integrating cultural context (Suryawan et al., 2022). Consequently, research focused on developing Nearpod-based digital modules that explicitly highlight *Sui Wu'u* Ngada local wisdom has strong academic and practical urgency, particularly for strengthening contextual learning in regional educational settings.

The findings of this study indicate that analytical thinking skills can be developed effectively through learning designs that are both contextual and interactive. In this module, *Sui Wu'u* local wisdom served not merely as an illustrative example but as a contextual anchor that encouraged students to analyze relationships among concepts, identify patterns within

phenomena, and critically evaluate explanations based on evidence. From a theoretical perspective, these findings support contextual constructivism and culture-based learning, which emphasize that students' local experiences can serve as bridges between abstract scientific concepts and higher-level analytical processes. Thus, a digital teaching module that integrates technology with culturally relevant contexts can strengthen the development of analytical thinking through a synthesis of interactive learning activities, local meaning-making, and structured higher-order cognitive tasks.

Theoretically, this research contributes to the literature on technology-enhanced learning, ethnopedagogy, and the development of analytical thinking skills. In practice, the developed module may serve as a reference for physics teachers in Ngada Regency and other regions in Indonesia when designing culturally responsive, technology-supported teaching materials. In addition, the results may inform policy development and teacher professional training programs, particularly in enhancing teachers' capacity to develop digital modules that integrate local cultural resources into learning designs.

Overall, the development of a Nearpod-based digital teaching module that incorporates *Sui Wu'u* Ngada local wisdom represents a strategic effort to improve the quality of physics learning while simultaneously supporting the preservation of local cultural values. The integration of technology and culture has the potential to create learning experiences that are more meaningful, adaptive, and relevant to students' needs in the digital age (Musa & Al Momani, 2022). Therefore, this study provides an important step toward presenting locally grounded learning innovations that can more optimally develop students' analytical thinking skills.

V. CONCLUSION AND SUGGESTION

The findings indicate that the developed Nearpod-based digital teaching module integrating *Sui Wu'u* Ngada local wisdom achieved a highly valid category, with an expert mean score of 4.72. Students' responses also demonstrated very high practicality (88%), suggesting that the module was perceived as easy to use, engaging, and culturally relevant. In terms of effectiveness, students' analytical thinking skills improved significantly, as reflected by an N-gain of 0.67 (medium–high category). These results suggest that embedding *Sui Wu'u* cultural elements as contextual learning content helps connect thermodynamics concepts with real-life experiences, thereby supporting deeper analytical processes. Overall, the module is feasible to use as an innovative, interactive medium for physics learning and helps enhance students' analytical thinking skills.

This study acknowledges certain limitations. Firstly, the assessment of analytical thinking skills was confined to specific indicators and aspects operationalized within this investigation, and did not encompass all facets of higher-order thinking skills. Secondly, the module was evaluated with a single cohort of 32 grade XI students within a single educational setting, which may constrain the generalizability of the findings to other student populations, schools, and learning environments. Future research should aim to (1) develop and validate more comprehensive assessment instruments that encompass a broader spectrum of higher-order thinking skills, such as critical thinking, creativity, and problem-solving; (2) undertake larger-scale studies with more diverse samples and comparative methodologies; and (3) examine the long-term impacts on learning retention and transfer across physics topics beyond thermodynamics. Notwithstanding these limitations, the present study contributes to the advancement of physics education by providing empirical evidence for the efficacy of integrating interactive digital platforms (Nearpod) with culturally grounded contexts (*Sui Wu'u* local wisdom) as a pragmatic approach to enhance analytical thinking and promote culturally responsive physics learning.

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