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Validity and Practicality of a Science Worksheet Integrating *Boranan* Dance to Train Scientific Literacy on Equilibrium Material

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Abstract

Physics learning in schools can foster essential skills for the current era, one of which is scientific literacy. Scientific literacy involves examining phenomena in students' everyday lives, which can be explored through local wisdom. However, there are still limited studies that integrate local wisdom into physics learning to develop students' scientific literacy. Addressing this gap, the present study aims to develop a student worksheet (LKS) integrated with the local wisdom of the Boranan Lamongan dance to enhance students' scientific literacy. This research describes the feasibility of the developed worksheet in terms of its validity and practicality. The study employed the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). The worksheet was tested on a limited scale in class XI science students at an Islamic Senior High School in East Java. The results show that the integration of local wisdom is feasible for use in physics learning to promote scientific literacy. The validity aspect achieved a PoA score of 84.13% (very valid), while the practicality aspect, assessed through learning implementation, obtained an average score of 96.04% (very practical). Overall, the findings indicate that the student worksheet integrating the Boranan Lamongan dance is feasible as a learning medium to foster students' scientific literacy. Furthermore, this research contributes to the preservation of local culture by incorporating the Boranan dance into physics education.

Keywords: Science literacy, Local wisdom, *Boranan* Lamongan dance, Physics learning, Student worksheet.
SDGs: Goal 4 (Quality Education), Goal 11 (Sustainable Cities and Communities)

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INTRODUCTION

Education in Indonesia can guarantee the survival of the state and nation if it is done consciously to achieve the goals of education, namely to create high-quality human resources (Purwanto, 2009; OECD, 2015). One way to understand the education process in schools is by examining how learning evolves through innovations that respond to students' needs, cultural contexts, and scientific advancement. Innovative learning refers to introducing new strategies or materials into specific social settings to overcome learning challenges (Prastowo, 2011; Khasiah, 2021). Such efforts include the development of culturally relevant student worksheets (Adawiyah et al., 2021). In line with 21st-century learning demands, education today must be adaptive, contextual, and capable of enhancing student engagement and scientific literacy (Suryaningsih et al., 2021). This includes approaches that meaningfully integrate students' cultural environments and local knowledge into science education, enabling them to build understanding from phenomena grounded in daily life (Suryaningsih et al., 2021; Suciati, 2023). However, conventional textbooks remain dominant, despite

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often lacking contextual relevance and practical application (Lathifah et al., 2019). A more effective solution is the development of sub-topic-based student worksheets that align with students' local experiences and support the acquisition of scientific literacy.

In addition to student worksheet as teaching materials for students, a common problem during the implementation of post-pandemic learning is that students tend to be passive and student motivation in learning decreases (Lukita & Sudibjo, 2021). In the world of education itself, it is known that there are two important factors that determine the success or failure of the learning process, namely internal and external factors (Sardiyanah, 2018). Where one of the internal factors that influences learning activities is related to student interest in carrying out learning activities. Low interest is what will affect students' scientific literacy skills. The curriculum may not place enough emphasis on scientific literacy. Less interactive approaches to science learning and the lack of use of interesting learning methods can make students lose interest in scientific literacy (Pratiwi et al., 2019; Hasasiyah et al., 2020). In addition, limited access to quality science literature and science student worksheet can limit the ability of students and the community to access scientific information that can be understood well (Suryaningsih et al., 2021; Rafidah & Rachmadiarti, 2022).

Local wisdom refers to knowledge, values, culture, and practices that are passed down from generation to generation by people in a particular area or community. Integrated local wisdom learning is an educational approach that combines local values and knowledge with the existing formal curriculum. Integrated local wisdom learning helps maintain and pass on local culture to the younger generation (Putri et al., 2023; Surur et al., 2023). It helps maintain the sustainability of unique traditions, languages, arts, and cultural practices. Students will appreciate and understand their own cultural richness, which is an important asset in the era of globalization. Local wisdom-based physics learning is a learning approach that integrates physics concepts with local knowledge, culture, and practices that exist in an area or community (Widyastuti & Prayogi, 2022; Putri et al., 2023). This helps students connect physics to the context of their daily lives, making learning more relevant and meaningful.

The integration of local wisdom in science education, particularly through ethnoscience approaches, has been explored in various contexts. Several studies have emphasized the importance of contextualizing scientific concepts through local cultural practices to enhance student engagement and conceptual understanding (Kriswanti & Supardi, 2020; Ahmadi et al., 2019; Nisa et al., 2015). For instance, Anisa (2017) demonstrated that local potential-based science learning significantly improved students' critical thinking and literacy skills. Similarly, Bakhtiar (2016) showed that learning materials based on Madurese cultural practices enhanced scientific reasoning. However, most of these studies focused on elementary or general science contexts and lacked integration with specific physical science content such as rigid body equilibrium. In contrast to these prior efforts, the present study introduces a Local Wisdom Learning Model that not only integrates *Boranan* Dance as a contextual anchor but also targets the development of scientific literacy using indicators from the PISA 2025 framework. This dual innovation combining a structured learning model with a culturally rooted practice in a physics-specific context distinguishes the current research from earlier works and addresses a notable gap in the literature. Furthermore, the use of *Boranan* Dance, which embodies both aesthetic movement and physical equilibrium, offers a unique opportunity for students to connect abstract physics concepts with tangible, lived experiences, thereby deepening both cultural appreciation and scientific competence (Alhusni & Astutik, 2025; Arjaya et al., 2024).

Lamongan Regency is renowned for its diverse local wisdom passed down through generations, one of which is the *Boranan* Dance, a traditional performance inspired by the life of rice traders known as '*Boranan*'. This dance reflects agricultural symbolism especially rice as a symbol of prosperity and social values such as cooperation and gratitude for the harvest (Yuniar et al., 2024). In the performance, dancers often balance a boran (traditional rice container) on their heads, a practice that has been integrated into physics education through the concept of rigid body equilibrium. This innovative approach has been shown to enhance students' understanding of abstract physics concepts while preserving local culture (Alhusni & Astutik, 2025). From a physics perspective, the dancers' ability to maintain balance illustrates principles of static equilibrium and moment of force, aligning with the ethnophysics learning model that blends cultural elements with science education (Alhusni & Astutik, 2025).

Islamic Senior High School 1 Lamongan is one of the schools that has not implemented comprehensive science literacy. Lack of adequate training in science literacy may feel unsure in teaching complex scientific concepts or less able to integrate the principles of science literacy into everyday learning. In addition, the lack of linking scientific concepts to the local context or everyday reality of students can reduce the relevance of the material and limit their understanding of the world around them. The science literacy ability test in class

X1 Science 4 with 35 test participants got an average score of 43.91, this shows that science literacy skills are very lacking. In the student response questionnaire that has been distributed, 71.40% of those who filled it out were interested in local wisdom on the grounds that local wisdom can help understand the material according to context. As many as 47.60% of those who filled out the student worksheet used from the Ministry of Education and Culture, this made students less able to understand the material contextually according to the local wisdom of their respective regions and the student worksheet used was less appropriate to the needs of students at the school. In addition, 66.70% of students who filled out had never had science literacy learning, this made students less trained in the science literacy skills they had. In an interview with a physics teacher at Senior High School 1 Lamongan, it was found that the school had not implemented integrated local wisdom learning and the implementation of science literacy was less than optimal, so that students did not understand the material with contextual understanding with local wisdom and the science literacy skills possessed by students were less trained.

Therefore, this study aimed to develop and implement a student worksheet based on scientific literacy, focusing on the topic of equilibrium and integrated with the local wisdom of the *Boranan* Lamongan Dance. The developed worksheet is designed to be more engaging for students and to meet the criteria of content validity. Furthermore, it is implemented in classroom settings to evaluate its practicality in supporting effective learning. Through the use of this student worksheet and its integration within a structured learning model, the study seeks to assess both the validity and practicality of the learning material in enhancing students' scientific literacy.

METHOD

This study applied the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) in developing a Student Worksheet (LKPD) based on *Boranan* Lamongan dance local wisdom. The stages included: (1) Analysis identifying learning needs and objectives; (2) Design structuring LKPD, preparing materials, and evaluation plans; (3) Development realizing the product and validating it by subject matter, language, and pedagogy experts using a Likert-scale instrument; (4) Implementation limited trials to assess practicality; and (5) Evaluation formative and summative assessments for refinement. Validation results served as the basis for revising the LKPD to ensure validity and feasibility.

To clarify the position of the validation process in the ADDIE workflow, visual modifications to the original model have been made, as shown in Figure 1. In the figure, the sub-stage ‘Validation’ is explicitly placed under the ‘Development’ phase, illustrating that the expert assessment process occurs before the product is implemented with students.

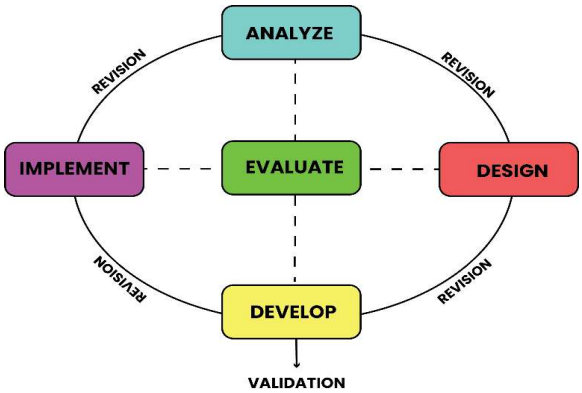


Figure 1. ADDIE Model Research Design

These validation results are then interpreted to determine the overall level of validity of the student worksheet. A worksheet is considered valid if it meets the required criteria across all three domains material, construction, and language with consistent scores from all expert validators. The percentage of agreement or suitability from each validator is calculated using Equation 1, which serves as the formula for converting Likert scale assessments into a standardized percentage score. This percentage then becomes the basis for categorizing the worksheet's validity level (e.g., very valid, valid, reasonably valid, or invalid). The results obtained from this calculation are used to make necessary revisions to the product before it is implemented in the classroom setting. Thus, the validation process not only ensures the instructional accuracy and cultural appropriateness of the worksheet but also functions as a critical quality assurance step embedded within the

Development phase of the ADDIE model. Through this process, the product is refined based on expert feedback to ensure it meets pedagogical standards and effectively supports meaningful learning experiences.

$$Precentage\ of\ Agreement = 100\%\ (1 - \frac{A-B}{A+B}) \quad (1)$$

Description:
A = Frequency of aspects assessed by observers by giving high frequency.
B = Frequency of aspects assessed by observers by giving low frequency.

The percentage of agreement acceptance criteria is if the results obtained are ≥ 75% (Aidil et al., 2023). A student worksheet is declared valid if the Likert scale value receives a score of 3, and is declared reliable if it meets the PoA acceptance criteria of ≥ 75%.

Practicality is the convenience of the evaluation instrument in preparing, using, interpreting or obtaining results, as well as the ease of using it. Student worksheet is declared practical if the implementation of learning using the student worksheet of the local wisdom of *Boranan* Lamongan dance meets the percentage of the eligibility criteria score ≥ 61%. The rate of learning implementation is calculated using Equation 2.

$$Percentage\ (\%) = \frac{Total\ Score\ of\ Data\ Collection\ Results}{Maximal\ Score}\ x\ 100\ \% \quad (2)$$

The calculated percentages are used to determine the practicality of the media developed based on the rate of media practicality categories as in Table 1.

Table 1. Percentage of Practicality

Percentage Score (%)	Category
0 – 20	Very less
21- 40	Not enough
41- 60	Enough
61- 80	Good
80-100	Very good

The practicality of the *Boranan* Lamongan dance–integrated student worksheet is achieved when the implementation meets the minimum threshold of 61% on the practicality rubric, which falls into the "good" category and indicates usability in classroom settings. This benchmark, assessed through a validated observation sheet completed by two external observers and the classroom teacher, covers aspects such as lesson opening, learning process, application of the local wisdom model, evaluation, and lesson closure. Data were analyzed using a Likert scale–based percentage formula to ensure objectivity, and when the score reaches or exceeds 61%, the worksheet is considered practical as it provides instructional clarity, relevant content, and student engagement, thereby qualifying as an effective learning tool consistent with educational research standards. The research matrix, correlation between objective, research instrument, data collection, and data analysis, can be seen in Table 2.

Table 2. Research Matrix

Objective	Instrument Name	Data Collection Technique	Data Analysis Techniques
Describe the validity of student worksheet integrated with local physics wisdom on the material of rigid body equilibrium.	Student worksheet Validation Sheet and Pre-test and Post-test Question Validation Sheet.	Validation method by experts.	Validity analysis of the Likert scale using average and PoA.
Describe the practicality of the local wisdom physics student worksheet on the rigid body equilibrium material that has been developed.	Learning observation sheet.	Responses from teachers and 2 observers.	Practicality analysis of the Likert scale using the percentage formula.

RESULTS AND DISCUSSION

This chapter provides data obtained from research that has been conducted from May 27, 2024 to May 28, 2024 in class XI Science 2 and XI Science 4 of Islamic Senior High School 1 Lamongan. The class has a total of 72 active students, but when the researcher conducted the research during that period there were 4 students who could not participate in the learning fully. The data obtained include the validity score of the integrated student worksheet of the local wisdom of the *Boranan* Lamongan dance.

Design

At this planning stage, it is a stage that is carried out after the analysis of learning and learning media through the preparation of a learning plan that will be implemented and learning media in the form of student worksheet integrated with local wisdom of *Boranan* Lamongan dance. This media planning is carried out through the design of media that will be applied later and adjustments to the material and several indicators to train students' science literacy skills. At this stage, the preparation of learning tools and instruments that will be applied later in learning activities with students is also carried out.

Preparation of learning tools

The preparation of learning devices that will support further research activities is aligned with the learning conditions that are usually implemented at Islamic Senior High School 1 Lamongan, some of the learning devices that will be implemented include:

1. The Teaching Module contains learning activities, students will learn about the equilibrium of rigid bodies. In this case, the emphasis will be on static equilibrium and determining the center of mass (center of gravity) of a rigid body that is integrated into the local wisdom of *Boranan* Lamongan dance. In this learning process, students must master the ability to draw and describe vector diagrams of forces acting on particle points. Learning objective flow 11.8 Applying the concept of moment of inertia, moment of force, and angular momentum to rigid bodies and presenting works that show the phenomenon of equilibrium and center of gravity of rigid bodies. The CP domain of scientific understanding has 2 indicators of achieving learning objectives, namely observing the concept of rigid body equilibrium in the boran in the *Boranan* Lamongan dance and applying the concept of rigid body equilibrium. In the CP domain of science process skills, there are 2 indicators of achieving learning objectives, namely observing the application of the concept of rigid body equilibrium in the boran and presenting the results of observations regarding the application of the concept of rigid body equilibrium in the *Boranan* Lamongan dance.
2. Student Worksheets as a guide for students in carrying out simple experiments related to the material on rigid body equilibrium.
3. Pretest and posttest instruments containing evaluation of learning of teaching materials that have been integrated with the local wisdom of *Boranan* Lamongan dance to train students' science literacy skills.

In addition, the creation of other supporting devices in the form of validation sheets related to the local wisdom student worksheet of *Boranan* Lamongan dance to train students' science literacy skills. This validation sheet is used as an assessment material whether the student worksheet developed is feasible for use in research. Creation of an implementation observation sheet to determine the percentage level of learning implementation. As well as the creation of teaching materials as a reference for student learning in this material.

Initial design of student worksheet

The initial design of the local wisdom student worksheet design was developed through the integration of the local wisdom of the *Boranan* dance originating from Lamongan Regency. In the development of the student worksheet, the discussion focus is on the material on the equilibrium of rigid objects represented through the local wisdom of the *Boranan* dance. The student worksheet that was developed was also integrated through the adaptation of the scientific literacy skills indicators of the PISA Science 2025 Framework. Several indicators of scientific literacy skills that are adapted to the Local Wisdom syntax include: (1) evaluating explanations of a phenomenon/problem based on scientific concepts, (2) evaluating scientific concepts in explaining phenomena/problems, (3) identifying questions/problems to be explored in scientific studies, (4) designing scientific investigations based on problems/phenomena, (5) interpreting scientific data and facts to draw conclusions, (6) evaluating the credibility of scientific information obtained related to personal, local, and global science, (7) making decisions based on credible scientific information, (8) evaluating the design/results of scientific investigations based on problems/phenomena (OECD, 2022).

The developed student worksheet contains several sub-discussions aimed at making it easier for students to understand the material on rigid body equilibrium through local wisdom. In addition to making it easier for students to understand the material, the development of this student worksheet is also intended to train students' science literacy skills. In the early part of the student worksheet, an explanation and introduction are given regarding the local wisdom of the *Boranan* Lamongan dance and the parts contained in the local wisdom. Then, scientific literacy skills are also explained, after explaining these things, they are included in the learning objectives and materials to be taught.

The student worksheet section containing learning materials is explained as simply as possible so that students can also learn easily and enjoyably. For the explanation of the concept, it is equipped with the *Boranan* dance phenomenon which is a form of local wisdom around students to make it easier for them to understand the concept. Several parts of the material explanation are also formed interactively and integrated into scientific literacy indicators that are in accordance with the aim of encouraging students to be able to master scientific literacy skills.

Development

At the development stage, the integrated student worksheet was realized through the application of the ADDIE model, with the aim of training students' scientific literacy skills, particularly on the topic of rigid body equilibrium in *Boranan* Lamongan Dance as illustrated in Figure 2. The worksheet was structured to include key scientific content, literacy-based tasks, guided readings, and formative exercises aligned with the indicators of the PISA 2025 framework. Student worksheets designed to develop scientific literacy offer several advantages in improving the quality of learning. They help students read, interpret, and evaluate scientific texts, thereby reinforcing conceptual understanding while enhancing scientific reasoning and inquiry skills. Through guided and structured activities, students are trained to analyze evidence, draw conclusions, and communicate their ideas clearly. Additionally, the group-based structure of many literacy tasks supports the development of collaborative learning and communication skills essential for 21st-century education.

Figure 2. *Boranan* Lamongan Dance

The worksheet was designed using the Local Wisdom model syntax problem identification, conceptual analysis, investigation, decision-making, and reflection to ensure a coherent pedagogical flow that fosters critical and creative thinking. It integrates structured modules, clear instructions, and concise summaries to support independent or collaborative learning, information retention, and self-directed study. By combining pedagogical design, scientific rigor, and practical usability, the worksheet equips students with both scientific knowledge and literacy competencies, making it a valid, practical, and adaptable instructional tool for diverse educational contexts.

Validity analysis of student worksheet

The integrated local wisdom student worksheet has several advantages, such as flexible use through print media or PDF files, and content delivery that supports students' science literacy skills while incorporating *Boranan* Lamongan dance. However, it also has weaknesses, particularly the limited material coverage since local wisdom integration cannot fully accommodate all physics sub-materials. The worksheet was validated for feasibility by two expert lecturers and one physics teacher using a prepared validation sheet, and the average results of each validation aspect are presented in Figure 3.

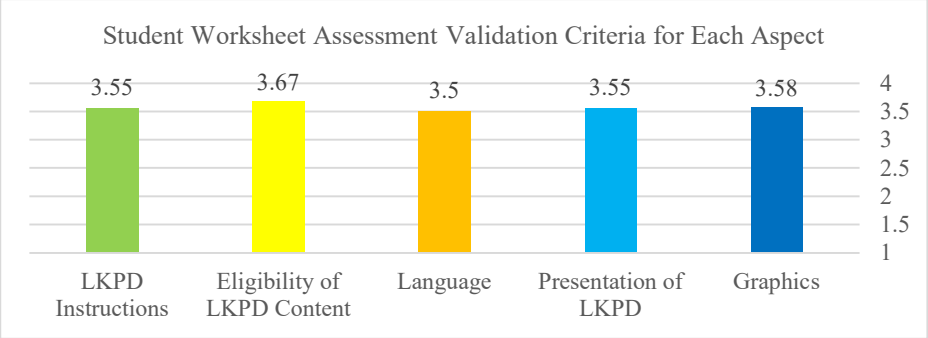


Figure 3. Recapitulation of Validation Criteria for Each Aspect

In Figure 3, it is known that in the aspects of student worksheet instructions, the feasibility of student worksheet content, language, student worksheet presentation, and graphics in the developed local wisdom student worksheet, the average total result is 3.57 which is very valid. So that the developed local wisdom student worksheet can be stated to have very valid results.

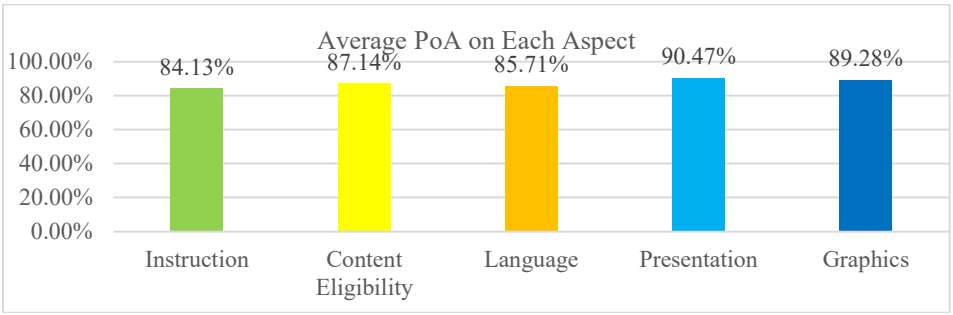
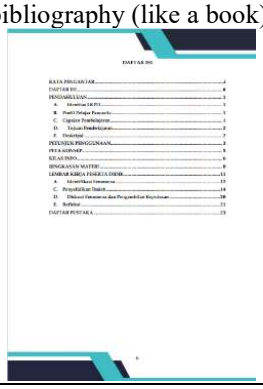
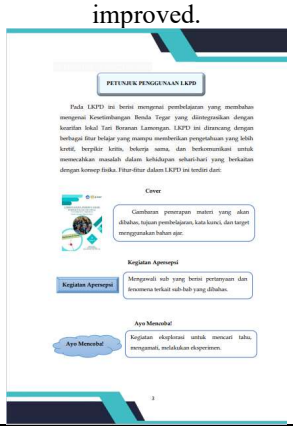


Figure 4. Recapitulation of Average PoA Scores for Each Validation Aspect

In Figure 4, each PoA score obtained in each aspect obtained an average total PoA of ≥ 75% with a value of 87.35%. Judging from these results, the developed student worksheet can be accepted (Aidil et al., 2023). At the validation stage, suggestions and inputs were obtained from the three validators which were used as considerations for making revisions so that the student worksheet can be used properly. Some suggestions given by the validators are shown in Table 3.

Table 3. Results of the Revised Local Wisdom Student Worksheet Developed

Suggestion	Before Revision	Revision Results
Student worksheet is made in 2 types (teacher and student), the teacher type must be accompanied by an answer key.	There is no student worksheet for teachers to use as a reference. 	Student worksheet has been created for teachers to use as a reference. 

Suggestion	Before Revision	Revision Results
Add such things as table of contents, pages, bibliography (like a book).	There are no complete details such as table of contents, pages, bibliography (like a book). 	Already added completeness such as table of contents, pages, bibliography (like a book). 
Check the typography, use of punctuation and there are no instructions for using student worksheet.	There is some typography and use of punctuation. 	The existing typography and punctuation usage have been improved. 

Implementation

At the Implementation stage, learning was carried out at Islamic Senior High School 1 Lamongan using a student worksheet integrated with the local wisdom of *Boranan* Lamongan dance, which had previously been declared very valid by the validators. The study applied a one group pretest-posttest design tested in class XI Science 2 and XI Science 4, chosen based on the recommendation of the physics teacher. The selection of this school in Lamongan Regency was also considered appropriate since students are directly exposed to the local wisdom integrated into learning. The purpose of this implementation analysis was to determine whether learning activities using the integrated worksheet media to train science literacy skills were carried out effectively. The implementation process was observed by the physics teacher of both classes together with two observers who were present during the study, with learning conducted in one meeting (3 × 45 minutes). The detailed percentage data of learning implementation for each observed aspect are presented in Table 4.

Table 4. Results of Observations on the Implementation of Learning Using Local Wisdom Student Worksheet

Observed Aspects	XI Science 2	X1 Science 4	Average
Ability to open learning.	94.45%	97.22%	95.84%
Learning process.	95.84%	95.84%	95.84%
Implementation of learning steps.	88.64%	93.94%	91.29%
Evaluation.	94.45%	100%	97.23%
Ability to close Learning.	100%	100%	100%
Average results of implementation observations			96.04%

Based on Table 4, the implementation of learning using the *Boranan* Lamongan dance integrated worksheet on rigid body equilibrium followed the Local Wisdom model syntax and achieved very practical results, with an average score of 96.04%. The learning opening gained 95.84%, where students' attention was drawn through contextual apperception involving *Boranan* dance phenomena that encouraged problem identification. The learning process also scored 95.84%, supported by clear communication and active

classroom engagement. The implementation of learning steps scored 91.29%, covering phases of contextual problem identification, concept analysis, scientific investigation, discussion and decision-making, and reflection each fostering scientific literacy through evaluating phenomena, analyzing concepts, conducting investigations, interpreting data, and making evidence-based decisions. Evaluation activities achieved 97.23%, as assessments aligned with the teaching module and literacy indicators were conducted effectively. Finally, the closing stage reached 100%, with the teacher summarizing the material and providing opportunities for student questions. These results confirm that the integrated worksheet was implemented successfully in a very practical category.

The integrated student worksheet of *Boranan* Lamongan local wisdom dance for rigid body equilibrium was validated with an average score of 4 (very valid). Validation criteria included instructions, content, language, presentation, and graphics (Nerita et al., 2018). Suggestions from validators included providing teacher and student versions, adding completeness (TOC, pages, bibliography), and improving typography. In the instruction aspect, an average PoA of 84.13% (very valid) was obtained, showing that the instructions, objectives, and activities were clearly presented and aligned with the teaching module (Ningtyas, et al, 2014; Afza, 2016; Hidayati, 2016).

The content feasibility, the worksheet was rated very valid (84.13%) since it presented phenomena related to *Boranan* dance, raised relevant problems, and trained scientific literacy (Mirnawati, 2020; Rafidah & Rachmadiarti, 2022). Language aspect scored 85.71% (very valid), showing appropriate use of Indonesian, clarity, and efficiency (Ningtyas, et al, 2014; Afza, 2016; Hidayati, 2016; Nerita et al., 2018). In presentation, the worksheet scored 90.47% (valid), with clear objectives, systematic structure, and contextual phenomena (Hidyanto et al., 2016; Rafidah & Rachmadiarti, 2022). Meanwhile, graphics obtained 87.28% (very valid), highlighting attractive fonts, layouts, and illustrations that support comprehension (Hunaepi et al., 2019; Putra et al., 2021). Overall, the worksheet validity reached 87.35% (very valid), confirming its feasibility for classroom use (Nisa et al., 2015; Putra, 2021; Aidil et al., 2023).

The practicality of the LKS was assessed through an observation questionnaire validated by experts. Implementation gained an average percentage of 96.04%, with opening and closing activities (95.84%) and learning process (95.84%) well-executed. Students actively engaged when *Boranan* dance was introduced as contextual phenomena, which motivated them to connect culture with rigid body equilibrium (Rahayu & Sudarmin, 2015; Hartini et al., 2017). Communication, voice clarity, and classroom management were rated very good (91.29%). The integration of local wisdom in science learning effectively combined cultural knowledge with scientific concepts, making learning more engaging (Rahayu & Sudarmin, 2015; Hartini et al., 2017). Students identified phenomena, analyzed scientific concepts, conducted investigations, interpreted data, and made decisions, consistent with the syntax of the Local Wisdom learning model (Deta, 2024).

Learning using this model increased student activeness through contextual problem-solving supported by experimental activities in the LKS. The syntax identifying, analyzing, investigating, discussing, and evaluating was consistently implemented (Deta, 2024). Such contextual learning encouraged students to utilize their knowledge and reasoning skills to solve problems related to local wisdom. The model's strength lies in its ease of application, cultural relevance, and ability to foster appreciation for local culture (Lubis et al., 2022; Asrial et al., 2022). It creates more active and enjoyable learning (Toharudin & Kurniawan, 2019; Usmeldi & Amini, 2020), while enhancing scientific literacy by linking concepts to real-life phenomena (Setianingrum et al., 2023; Verawati & Wahyudi, 2024). However, challenges include the difficulty of finding effective cultural-science integration materials, teacher training needs, complex assessment, and possible curriculum resistance (Pamungkas & Harun, 2023; Yasir et al., 2024; Arjaya et al., 2024).

This research aligns with SDG 4 (Quality Education) and SDG 11 (Sustainable Cities and Communities) by promoting inclusive, equitable, and culturally responsive science education (Arjaya et al., 2024; Fairus et al., 2024). Integrating *Boranan* Lamongan Dance into physics learning contextualizes scientific literacy while fostering cultural preservation. The Local Wisdom model demonstrates how global educational standards can harmonize with local traditions, enhancing relevance and transformative learning. For broader applicability, the model should emphasize flexible syntax adaptable to various cultural practices (Deta, 2024). Such adaptability allows the integration of other traditions related to balance, force, or motion, ensuring cross cultural implementation while maintaining conceptual rigor. Thus, the *Boranan* Dance based LKS is not only valid and practical but also supports sustainable education by linking scientific literacy with local wisdom, ensuring cultural respect, and aligning with global educational goals.

This study only integrates *Boranan* Dance into the topic equilibrium of forces and its scope is still limited. The trial was conducted in two classes with a limited number of participants, so the findings cannot be

generalized to a broader context. Another limitation lies in the science literacy assessment instruments, which emphasize cognitive aspects without fully assessing affective and psychomotor dimensions. This condition means that the picture of students' science literacy abilities obtained is not yet comprehensive.

The impact of this research can improvement of students' science literacy, but also in the strengthening of sustainability aspects in line with SDG 11. The integration of *Boranan* Dance in physics learning encourages the preservation of local culture so that it remains alive amid the changing times. In addition, it supports SDG 4 because it creates inclusive, contextual, and meaningful learning for students. Thus, students not only learn scientific concepts but also understand cultural values and their community's identity. Through this approach, science learning plays a role in improving academic competence while preserving culture as part of sustainable development.

CONCLUSION

The developed student worksheet integrating the local wisdom of *Boranan* Lamongan Dance was declared very valid and very practical. Developed through the ADDIE model, it produced two types of products student and teacher versions, complete with answer keys and supporting components such as usage instructions, material summaries, and bibliographies that integrates PISA 2025 scientific literacy indicators and contextualizes equilibrium material through *Boranan* Dance, helping students connect abstract physics concepts with cultural practices. Accessible in both print and digital (PDF), it promotes active, collaborative learning while preserving local cultural heritage. This culturally responsive content supports SDG 4 on Quality Education by fostering inclusive and meaningful learning, while also aligning with SDG 11 through its emphasis on preserving local culture as part of sustainable learning that bridges culture and science. In addition, future research can explore the broader implementation of this worksheet in classroom settings to examine its effectiveness in enhancing students' scientific literacy in real learning environments.

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AUTHOR CONTRIBUTIONS

Hanan Zaki Alhusni: Writing – Original Draft, Data Curation, Investigation, **Utama Alan Deta**: Conceptualization, Methodology, Validation, Supervision, **Binar Kurnia Prahani**: Formal Analysis, Visualization, Writing – Review & Editing, **Titin Sunarti**: Resources, Project Administration, Writing – Review & Editing. All authors have read and approved the final version of this manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare no known financial conflicts of interest or personal relationships that could have influenced the work reported in this manuscript.

DECLARATION OF ETHICS

The authors declare that the research and writing of this manuscript adhere to ethical standards of research and publication, in accordance with scientific principles, and are free from plagiarism.

DECLARATION OF ASSISTIVE TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that generative artificial intelligence (Gen AI) and other AI-assisted tools were used prudently, not excessively, during the research and preparation of this manuscript. Specifically, ChatGPT was used for brainstorming ideas and refining text; Grammarly for grammar and style correction; and ChatPDF for extracting and summarizing information from research literature. All AI-generated material was reviewed and edited for accuracy, completeness, and compliance with ethical and scholarly standards. The authors accept full responsibility for the final content of the manuscript.

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