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Development of Student Worksheets Integrating Local Wisdom on Work and Simple Machines in South Papua

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ABSTRACT

This study aims to develop local wisdom–based student worksheets on the topic of work and simple machines for junior high school students in South Papua. The limited availability of contextual teaching materials that integrate local cultural practices has restricted students' ability to connect physics concepts with real-life experiences. This study employed a Research and Development (R&D) approach using a modified 4D model limited to the development stage. The participants consisted of material experts, media experts, a science teacher, and ten students in a limited trial. Data were collected using validation sheets and practicality questionnaires and analyzed descriptively using percentage criteria. The results indicate that the developed worksheets were categorized as very feasible by material experts (83%) and feasible by media experts (68%). In addition, the worksheets were considered very practical based on teacher responses (89%) and student responses (90%). These findings suggest that integrating South Papuan local wisdom into instructional materials can enhance contextual understanding and student engagement in physics learning. The novelty of this study lies in embedding local cultural practices into learning materials on work and simple machines. Therefore, the developed worksheets are feasible and practical for supporting meaningful science learning.

INTRODUCTION

Science education plays a crucial role in improving the quality of human resources, particularly at the junior high school level. At this stage, students are expected to understand fundamental scientific concepts that are closely related to everyday life, including the topic of work and simple machines. However, science learning often remains abstract and textbook-oriented, making it difficult for students to develop a deep conceptual understanding [1], [2].

Preliminary observations and interviews with science teachers in Merauke indicate that many eighth-grade students experience difficulties in understanding the concepts of work and simple machines. The learning process is still dominated by lecture-based instruction and textbook use, resulting in limited student engagement and difficulty in connecting physics concepts to real-life situations. This condition reflects a mismatch between the contextual nature of the material and the predominantly theoretical learning practices, as also reported in previous studies [3], [4], [5], [6].

One approach that can address this issue is contextual learning, which emphasizes the connection between learning materials and students' real-life experiences. Previous studies have shown that contextual learning can enhance students' motivation, creativity, and learning outcomes [7], [8]. However, most studies still rely on general contexts and have not fully utilized local wisdom as a meaningful learning resource. In fact, integrating local wisdom into science learning can strengthen conceptual understanding by providing authentic and culturally relevant experiences [9], [10].

In South Papua, the local socio-cultural environment offers rich potential as a source of contextual learning. Daily activities such as rowing boats, using traditional tools, and applying simple mechanical principles reflect the concepts of work and simple machines in real-life contexts. Despite this potential, such local wisdom has not been systematically integrated into classroom instruction. This indicates a clear gap between the availability of contextual cultural resources and their implementation in science learning.

The current curriculum policy encourages teachers to develop flexible and contextual teaching materials tailored to students' characteristics [8], [11], [12]. One instructional material that supports active learning is student worksheets, which facilitate student engagement through structured activities such as observing, questioning, experimenting, and concluding. Previous studies have shown that context-based worksheets can improve student participation and conceptual understanding [13], [14].

However, existing studies have not specifically developed student worksheets that integrate South Papuan local wisdom into the topic of work and simple machines at the junior high school level. This gap highlights the need for developing culturally contextualized learning materials that are both feasible and practical. Therefore, this study aims to develop local wisdom–based student worksheets on work and simple machines and to evaluate their feasibility and practicality in supporting science learning.

METHOD

This study employed a Research and Development (R&D) approach to develop a local wisdom–based student worksheet on the topic of work and simple machines. The development process adopted the 4D model, which consists of define, design, develop,

and disseminate stages [15]. However, this study was limited to the develop stage, focusing on producing a worksheet that meets feasibility and practicality criteria.

The research was conducted in August 2025 at a junior high school in Merauke, South Papua. The participants included two material experts and two media experts who evaluated the feasibility of the developed worksheets, one science teacher, and ten eighth-grade students who participated in a limited trial. The relatively small number of participants is appropriate for the initial development stage, which emphasizes practicality testing before wider implementation.

Data were collected through interviews, validation sheets, and questionnaires. Interviews were conducted during the define stage to identify learning conditions and instructional needs. Validation sheets were used by experts to assess the feasibility of the worksheets in terms of content and media aspects. Questionnaires were administered to the teacher and students to evaluate the practicality of the worksheets during the trial phase. All instruments employed a four-point Likert scale ranging from 1 (very poor) to 4 (very good).

The instruments were validated by experts to ensure content validity, referring to their alignment with the intended indicators. Reliability was examined based on the consistency of expert judgments. The results indicated that the instruments were appropriate for measuring feasibility and practicality.

The data were analyzed using descriptive quantitative and qualitative methods. Quantitative data were analyzed by calculating the percentage scores of feasibility and practicality using the following formula:

$$\text{Percentage (\%)} = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100 \qquad \ldots(1)$$

The results of the feasibility assessment were analyzed using percentage scores and interpreted based on predetermined criteria, as presented in Table 1.

Table 1. Feasibility Assessment Criteria

Score percentage (%)	Category
< 40%	Very Low
40% - 59%	Low
60% - 79%	Moderate
80% - 100%	High

Furthermore, the practicality of the developed worksheets was evaluated using similar percentage-based criteria, as shown in Table 2.

Table 2. Practicality Assessment Criteria

Score Percentage (%)	Category
< 40%	Very Low
40–59%	Low
60–79%	Moderate
80–100%	High

Qualitative data in the form of suggestions and feedback from experts, teachers, and students were analyzed to support the revision and improvement of the developed worksheets.

RESULTS AND DISCUSSIONS

Product Development of Student Worksheets

The product developed in this study is a set of student worksheets integrating South Papuan local wisdom into the topic of work and simple machines. The worksheets were designed to facilitate students' understanding by connecting physics concepts with real-life experiences rooted in local cultural practices.

The development process followed the define, design, and develop stages of the 4D model. In the define stage, a needs analysis was conducted through interviews with teachers to identify learning challenges and the lack of contextual teaching materials. In the design stage, the structure of the worksheets was developed, including learning objectives, contextual problem scenarios, guided activities, and evaluation tasks. In the develop stage, the worksheets were validated by experts and revised based on feedback before being tested in a limited trial.

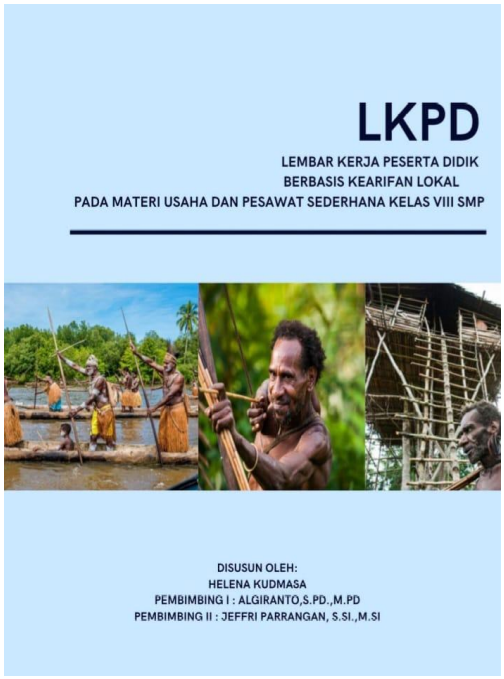

Figure 1. Cover of the developed local wisdom–based student worksheets on work and simple machines

The developed worksheets consist of several key components, including a cover page, contextual learning activities, and structured discussion tasks. As shown in Figure 1, the cover reflects the integration of local cultural elements to attract students' attention and introduce the contextual theme of the learning material.

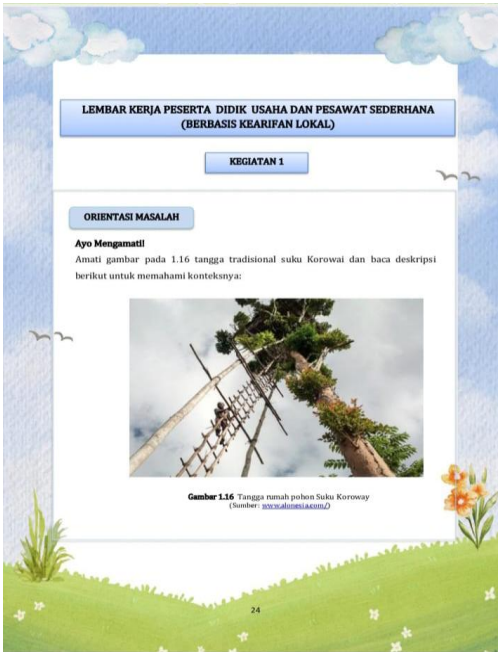

Figure 2. Example of contextual activity integrating South Papuan local wisdom in the student worksheets

As shown in Figure 2, students are guided to observe and analyze real-life situations related to local wisdom. This activity encourages students to connect everyday experiences with the concepts of work and simple machines.

Figure 3. Example of discussion and reflection tasks in the developed student worksheets

As shown in Figure 3, the worksheets include discussion and reflection tasks designed to promote critical thinking and conceptual understanding. These tasks require students to analyze experimental results, answer guiding questions, and relate their findings to real-life applications.

Overall, the developed worksheets are designed to support student-centered learning by integrating local wisdom not merely as contextual illustrations, but as a core mechanism for constructing students' conceptual understanding. The worksheets were revised based on feedback from material and media experts to ensure alignment with content accuracy, instructional design, and visual quality. These revisions resulted in a more structured and user-friendly worksheet design, which enhances its feasibility and practicality for classroom implementation.

Feasibility of Student Worksheets

The feasibility of the developed student worksheets was evaluated by two material experts and two media experts. This validation aimed to assess the suitability of the worksheets before their implementation in science learning on the topic of work and simple machines. The results of the feasibility assessment are presented in Table 3.

Table 3. Feasibility Results of Student Worksheets

Validator	Category	Percentage (%)
Material Expert	High	83
Media Expert	Moderate	68

Based on Table 4, the evaluation by material experts resulted in a score of 83%, categorized as high. This indicates that the worksheets meet the criteria of content appropriateness, conceptual accuracy, and alignment with learning objectives. Meanwhile, the evaluation by media experts yielded a score of 68%, categorized as moderate. This result suggests that although the worksheets are feasible for use, improvements are still needed in visual aspects such as layout, readability, and graphical presentation.

Practicality of Student Worksheets

The practicality of the developed worksheets was evaluated through a limited trial involving one science teacher and ten students. The assessment focused on ease of use, clarity of instructions, and student engagement during learning activities. The results of the practicality assessment are presented in Table 4.

Table 4. Practicality Results of Student Worksheets

Respondent	Category	Percentage (%)
Students	High	90
Teacher	High	89

As shown in Table 4, the worksheets obtained a practicality score of 90% from students and 89% from the teacher, both categorized as high. These results indicate that the worksheets are easy to use, provide clear instructions, and support structured learning

activities. Students were able to engage actively with the tasks and complete them independently.

Discussion

The high feasibility score obtained from material experts indicates that the developed worksheets are well aligned with curriculum requirements and accurately represent the concepts of work and simple machines. The integration of local wisdom plays an important role in bridging abstract physics concepts with students' real-life experiences, which supports meaningful learning.

From a contextual learning perspective, teaching materials that connect scientific concepts with real-world situations can facilitate students' knowledge construction. The integration of local wisdom into the worksheets allows students to learn through familiar contexts, thereby enhancing their conceptual understanding. This finding is consistent with previous studies indicating that local wisdom–based learning materials can improve students' comprehension by relating concepts to their daily lives [16], [17], [18].

However, the moderate score from media experts suggests that improvements in visual design are still required. Elements such as layout organization, typography, and graphical representation need to be enhanced to increase readability and student engagement. Previous studies also emphasize that well-designed instructional materials significantly influence students' learning effectiveness [19], [20].

The practicality results further indicate that the developed worksheets are effective in supporting classroom implementation. High practicality scores from both teacher and students demonstrate that the worksheets are easy to use, engaging, and facilitate active learning. From the perspective of contextual learning theory, this suggests that students are able to interact meaningfully with the material through activities that reflect their real-life experiences.

In addition, the integration of local wisdom enables students to connect physics concepts with everyday practices, making learning more relevant and meaningful. This finding aligns with previous research showing that contextual and culturally relevant learning approaches can enhance student engagement and understanding [13], [14].

Despite these positive findings, this study has several limitations. The limited number of participants restricts the generalizability of the results. Furthermore, this study focused only on the development stage and did not examine the effectiveness of the worksheets in improving learning outcomes. Future research is recommended to conduct large-scale implementation and experimental studies to evaluate the impact of the developed worksheets.

Nevertheless, this study contributes to the development of contextual teaching materials by systematically integrating South Papuan local wisdom into student worksheets. This approach not only supports conceptual understanding but also promotes the preservation of local cultural values in science education.

CONCLUSION AND SUGGESTION

This study successfully developed local wisdom–based student worksheets on the topic of work and simple machines that are feasible and practical for use in junior high school science learning. The feasibility results indicate that the worksheets are conceptually accurate and aligned with curriculum requirements, while the high practicality scores demonstrate their ease of use and effectiveness in supporting student-centered learning. The integration of South Papuan local wisdom enables students to connect physics concepts with real-life experiences, thereby promoting meaningful learning. However, further research is needed to evaluate the effectiveness of the worksheets in improving students' learning outcomes through large-scale implementation. It is recommended that future studies expand the development to other science topics and enhance the visual design to improve instructional quality.

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