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Bridging Local Wisdom and Science Literacy: Development of a Physics Companion Book to Support SDG 4 in Secondary Education

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Abstract—*The development of scientific literacy has become a central goal of physics education in the twenty-first century, particularly in response to persistent gaps in students' ability to apply scientific knowledge to real-life contexts. In Indonesia, students' scientific literacy remains below international benchmarks, highlighting the urgency of developing contextual and culturally relevant learning resources. The purpose of this study is to develop a physics companion book based on Takalar local wisdom to enhance senior high school students' scientific literacy and support the achievement of Sustainable Development Goal 4 (Quality Education). The study employed the Plomp development model, consisting of three main phases: preliminary research, prototyping, and assessment. The preliminary phase involved a needs analysis and a curriculum study to identify opportunities to integrate local culture into physics learning. Experts in content, media, and language designed and validated the book during the prototyping phase. The assessment phase tested the practicality and effectiveness of the book through a limited trial with 95 senior high school students in Takalar. Data were collected using validation sheets, scientific literacy tests, and student response questionnaires. Results indicated a high level of validity (Gregory index V = 1.00) and very positive student responses (77%). Empirical findings show an improvement in students' scientific literacy, with the majority reaching moderate (66%) to adequate levels after implementation. The novelty of this study lies in the systematic integration of local wisdom into a physics companion book using a comprehensive development model, accompanied by empirical evaluation of scientific literacy outcomes and explicit alignment with SDG 4. This research is expected to make a real contribution to the provision of valid, practical, and effective teaching materials to strengthen science literacy, 21st-century skills, and the achievement of SDG 4.*

Keywords: *culture-based learning; local wisdom; physics education; scientific literacy; SDG 4*

I. INTRODUCTION

Twenty-first-century science education requires students not only to master scientific concepts but also to apply them meaningfully in real-life contexts and actively contribute to sustainable development. Scientific literacy has therefore become a core competency, enabling individuals to understand natural phenomena, make evidence-based decisions, and engage critically with socio-scientific issues related to science and technology (Li & Guo, 2021; Sutiani et al., 2021; Vieira & Tenreiro-Vieira, 2016). However, international assessments continue to reveal persistent challenges. The 2022 Programme for International Student Assessment (PISA) results indicate that Indonesian students' scientific literacy remains below the OECD average, reflecting systemic weaknesses in science instruction that prioritize conceptual memorization over contextual understanding (Subali et al., 2023; Trisanti et al., 2025). This condition points out the need for pedagogical innovation that fosters meaningful, contextual, and culturally relevant science learning.

Physics, as a fundamental branch of science, is often perceived by students as abstract and difficult due to its strong emphasis on mathematical formalism and formula-based problem-solving. Such approaches often marginalize the epistemic nature of science as a process of inquiry and interpretation (Drago & Mih, 2015; Valladares, 2021). Scientific literacy, however, extends beyond conceptual knowledge to include the ability to apply scientific understanding within personal, social, and global contexts. Consequently, physics learning should be designed to bridge theoretical constructs with students' everyday experiences, allowing learners to construct meaning through familiar phenomena rather than solely through abstract representations.

One promising approach to achieving this goal is the integration of local wisdom into science education. Local wisdom comprises culturally ingrained knowledge, values, and practices that have developed within communities across generations and are intricately linked to environmental engagement and problem-solving (Martawijaya et al., 2025; Selasih & Sudarsana, 2018; Uge et al., 2019). When integrated into physics learning, local practices, such as traditional technologies, agricultural systems, or community-based resource management, can serve as authentic contexts for explaining physical principles, including force, energy, pressure, and motion. This contextualization enhances conceptual understanding and strengthens students' cultural identity, character development, and appreciation of indigenous knowledge systems.

Takalar Regency in South Sulawesi offers rich potential for contextual physics learning through its local wisdom, including traditional boatbuilding techniques, irrigation systems, and stilt-house architecture, all of which embody fundamental physics principles. Despite this potential, physics instruction in the region largely relies on standardized textbooks that lack local contextualization. Such decontextualized learning materials often result in passive learning environments, reduced student motivation, and limited opportunities for meaningful engagement with scientific concepts. Although previous studies have explored the development of local-wisdom-based teaching materials and reported positive impacts on conceptual understanding and student attitudes (Dewi et al., 2021; Morales, 2015), many of these studies do not explicitly assess scientific literacy as a multidimensional construct. Systematic methodological approaches, such as the Plomp model, are rarely applied, even though they provide a comprehensive stage for producing valid, practical, and effective educational products. In addition, most research stops at expert validation or readability tests, with no quantitative data on the impact of teaching materials on science literacy.

Another critical gap concerns the alignment of physics education research with global educational agendas, particularly the Sustainable Development Goals (SDGs). While SDG 4 emphasizes inclusive, equitable, and quality education that is relevant to both local and global contexts (Boeren, 2019; Unterhalter, 2019), most studies on teaching material development mention SDG 4 only normatively, without operationalizing it as a guiding framework for instructional design and evaluation. Physics learning grounded in local wisdom and aimed at strengthening scientific literacy represents a tangible pathway to implementing SDG 4 by promoting contextual relevance, sustainability awareness, and lifelong learning competencies.

Despite the growing body of literature on culturally responsive science education, significant gaps remain. First, physics teaching materials have not been systematically designed to integrate local wisdom as a means of strengthening scientific literacy. Second, development studies rarely employ comprehensive models such as Plomp's framework that emphasize both theoretical rigor and empirical validation. Third, quantitative evidence demonstrating the effectiveness of physics companion books grounded in local wisdom in enhancing students' scientific literacy remains scarce. Finally, the explicit alignment between instructional development and SDG 4 remains largely underexplored.

To address these gaps, this study develops a physics companion book based on Takalar local wisdom using the Plomp development model. The companion book integrates physics concepts with local cultural phenomena, such as boatbuilding traditions and agricultural irrigation systems, to strengthen students' scientific literacy across dimensions of scientific knowledge, contextual application, and attitudes toward science. Additionally, by promoting quality, contextual, and sustainable education, the book supports the achievement of SDG 4. Beyond scientific literacy, the companion book also supports the development of 21st-century skills, including critical thinking, creativity, collaboration, and communication, and aligns with the Pancasila student profile emphasized in the Independent Curriculum. For physics teachers, the book provides an alternative instructional resource that integrates inquiry-based activities, cultural reflection, and science literacy-oriented tasks (Brown, 2017; Suryawati & Osman, 2018). Therefore, this study aims to develop a physics companion book grounded in local wisdom that is valid, practical, and effective in improving high school students' scientific literacy while supporting the implementation of quality, sustainable education.

II. METHODS

This is a development research project that aims to produce a physics companion book based on local wisdom to improve students' science literacy at the high school level. The development model used is the Plomp framework (Akker et al., 2013), which consists of three main phases: preliminary research, prototyping, and assessment. This model was chosen because it provides a systematic approach in designing, testing, and evaluating educational products to meet valid, practical, and effective criteria. Each stage in the Plomp model is iteratively interconnected, allowing for continuous improvement based on test results and input from experts and users alike.

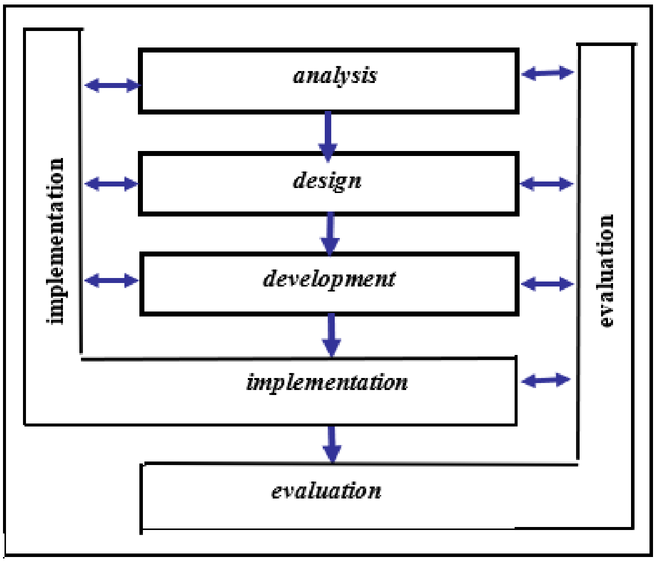

Figure 1. General chart of Plomp models

1. Preliminary research

The first phase, preliminary research, begins with a needs analysis and a literature review to identify physics learning problems and opportunities to integrate local wisdom into teaching materials. The needs analysis was carried out through interviews with physics teachers at one of the State High Schools in Takalar and through classroom observation. The results of the analysis show that the teaching materials used so far have not been able to facilitate contextual learning that is relevant to students' lives in the local environment. Teachers also state that students often struggle to understand abstract concepts in physics because there are few examples from their daily lives.

In addition, a curriculum analysis was conducted to ensure compatibility between the content of the companion books developed and the learning outcomes in the Independent Curriculum. This analysis focuses on class XI physics material that can be contextualized with local Takalar phenomena, such as measurements, energy and work, force dynamics, temperature and heat, waves, and sound. An analysis of students' characteristics, such as their initial ability level, their learning style, and the dominant cultural values in their environment, complements this activity. The results of the preliminary research are also strengthened by literature studies that include science literacy theory (Aristeidou & Herodotou, 2020; Istyadji & Sauqina, 2023), learning based on local wisdom (Martawijaya et al., 2023), and the concept of continuous education (Nousheen et al., 2020; Pauw et al., 2015). This stage resulted in the initial formulation of the design for a physics companion book, oriented to strengthening science literacy by integrating the local cultural values of Takalar as a learning context.

2. Prototyping phase

The second phase, the prototyping phase, focuses on designing and developing a companion book prototype (Camburn et al., 2017). At this stage, the researcher compiles an initial design that includes a content structure, competency map, contextual illustrations, inquiry-based learning activities, and science literacy exercises. Each physics topic is associated with local wisdom phenomena, such as the principle of pressure on traditional boats, the application of force in agricultural activities, and the concept of energy on local waterwheels. This book is compiled by paying attention to the principles of contextual learning, scientific literacy, and the integration of cultural values.

Furthermore, expert validation is conducted to assess the feasibility and suitability of the companion book's content. The validators consist of three experts: physical materialists, learning media experts, and linguists. Each expert assessed aspects of content, presentation, language, and display using a 4-point Likert scale validation instrument. The validation data was analyzed using the Gregory (2015) formula to calculate the agreement index between validators. Validity criteria were determined based on the Gregory index: 0.80–1.00 (very valid), 0.60–0.79 (valid), 0.40–0.59 (moderately valid), and <0.40 (less valid). After the validation process, the researcher revised the prototype based on suggestions and inputs from experts, then produced prototype II, which was declared feasible for field testing. The revision includes improving local illustrations, adjusting the language to be more communicative, and enriching activities that stimulate science literacy. This phase aims to ensure that the products developed meet the validity criteria and are ready to be tested for practicality and effectiveness.

3. Assessment phase

The third phase, the assessment phase, includes limited trial activities to assess the practicality and effectiveness of companion books in improving students' science literacy. The trial was carried out in one of the State High Schools in Takalar involving 95 students of class XI MIPA who were selected purposively (Ahmad & Wilkins, 2025; Campbell et al., 2020). The physics teacher serves as a facilitator in using the companion book during several meetings. The data at this stage includes three main components:

a. Data on students' science literacy results, obtained from science literacy tests compiled according to OECD indicators, covering the dimensions of scientific context and attitudes (Alivernini, 2015; Shaffer et al., 2019). The test is given after students have taken part in learning using companion books. The results were analyzed descriptively and quantitatively to determine the level of students' science literacy, which was classified into six levels (very low, low, moderate, good, high, very high) based on the PISA framework and the improvement of abilities achieved.
b. Student response data were collected using a 4-point Likert-scale questionnaire to measure perceptions of the book's ease, readability, relevance, and appeal. Student responses are categorized as very positive, positive, moderately positive, and less positive.
c. Data on the characteristics of the final product, collected through observation and reflection on the trial's implementation, will be used to describe how the companion book facilitates contextual learning grounded in local wisdom.

Data analysis employed a combination of quantitative and qualitative techniques. Quantitative data, including validation results, science literacy scores, and student responses, were averaged to determine the eligibility and effectiveness categories. Meanwhile, qualitative data from observations and student comments were used to strengthen the interpretation and provide a comprehensive picture of the quality of the developed companion books. The final product is declared eligible for use when it meets three main criteria: has a high level of validity based on the Gregory index $\geq$ 0.80, gets a positive response from at least 80% of the users' students, and shows an increase in students' science literacy outcomes compared to the initial condition.

This stage produces a valid, practical, and effective physics companion book based on local wisdom, which is ready to be used as an alternative learning resource in schools. The methodology applied in this study is not only oriented to product development, but also to the achievement of SDG 4 through contextual and inclusive learning innovations. Thus, this development method is expected to make a real contribution to improving the quality of physics learning and strengthening students' science literacy in Indonesia.

III. RESULTS AND DISCUSSION

1. Characteristics of physics companion books based on local wisdom

The product developed in this study is in the form of a physics companion book based on Takalar local wisdom for high school students. This book acts as an alternative learning medium designed to strengthen students' science literacy skills through a contextual approach rooted in local culture and environment. The structure of the book consists of five main components: (1) an introduction to learning based on local phenomena, (2) a description of physics concepts presented in communicative language, (3) exploratory activities to build conceptual understanding, (4) practice questions and reflection activities based on real contexts, and (5) the integration of cultural values and moral messages that reflect the local wisdom of the Takalar people. The uniqueness of this companion book lies in the use of regional cultural and geographical phenomena as a bridge to understand physical concepts. For example, the discussion of fluid pressure is linked to the activities of fishermen in operating *lepa-lepa* boats. At the same time, the topic of mechanical energy is associated with traditional irrigation systems that utilize water flow in the Takalar agricultural area. This approach not only helps students understand concepts theoretically but also enables them to see the application of science in the lives of their people.

In addition, the book is designed with the principles of readability and visual aesthetics in mind. The layout is simple, with the use of soft colors and authentic local illustrations. The language is scientific yet communicative, making it easy for high school students to understand. Explanation of concepts accompanied by illustrations, tables, and local narratives to facilitate the transition between empirical and conceptual knowledge. This companion book also integrates character education values such as responsibility, cooperation, and concern for the environment. Through this integration, students not only learn the laws of physics but also appreciate the harmony between humans and nature as expressed in local wisdom. This characteristic makes companion books not only a cognitive medium but also a pedagogic tool that combines science, culture, and morality. This approach is in line with the principles of the Independent Curriculum, which emphasizes contextual and meaningful learning. Thus, the companion books developed can be categorized as contextual culture-based learning resources, which at the same time function as a vehicle to strengthen local identity and students' scientific understanding (Umamah et al., 2024).

2. Validity of the physics companion book

The validation process is carried out by two expert validators, consisting of physical material experts and learning media experts. The assessment was carried out on four main aspects, namely format, content, language, and benefits/usability, using a four-point Likert scale. The data was then analyzed using the Gregory formula to measure the level of agreement between validators in assessing the validity of the book's content and construct.

Table 1. Validation results of the Takalar local-wisdom-based physics companion book

Aspects	Number of items	Average score	Validity category	Information
Book format	5	3.4	Valid	The layout, numbering, and typography are clear, with a balanced use of text and illustrations.
Book contents	5	3.5	Highly valid	The physics concepts are accurate, aligned with the learning outcomes, and contextualized within local culture.
Language	5	3.1	Valid	The language is communicative and compliant with Indonesian spelling standards (EYD); an additional glossary of scientific terms is recommended.
Benefits	3	3.5	Highly valid	The book can be used as a guide for teachers and students and supports contextual learning.
Overall	18	3.3	Valid	The book is suitable for use in field trials.

The results of the assessment from two validators show that the physics companion book based on Takalar local wisdom has a very high level of validity. Based on Table 1, the average overall score is 3.3 out of 4, which falls within the valid category. Meanwhile, the results of the calculation of the Gregory coefficient (V = 1.00) show perfect agreement between validators on all assessment items, which means that this product is considered very valid in terms of construct and content.

The format aspect received an average score of 3.4, indicating that the book's structure and appearance met the learning media feasibility standards. Both validators rated the numbering, layout, and balance between text and illustrations. The illustrations used are relevant to the content and support the understanding of physics concepts. The clarity of visual design is also considered to attract students' attention and encourage learning engagement. The content aspect obtained the highest score with an average of 3.5 (very valid). The validator found that the concept of physics was presented accurately and in a contextually relevant way, for example, by using the principles of pressure and style in the lives of fishermen and farmers. The integration between science and cultural context makes the material more meaningful and helps students connect physics theory to everyday experience (Mashoko, 2022; Oladejo et al., 2023). This is in line with the principles of contextual learning in the Independent Curriculum, which emphasizes the meaning of concepts through local experiences (Yasin et al., 2021).

The language aspect obtained an average of 3.1 (valid). The language used is communicative and in line with the cognitive development of high school students. Although validators have suggested the inclusion of a glossary or additional explanation of certain scientific terms, writing and punctuation have adhered to the EYD rules. These recommendations are important for improving clarity of meaning and accommodating students' diverse science literacy abilities. The benefit or usability aspect obtained an average of 3.5 (very valid). Companion books are considered useful because they can help teachers create more targeted and meaningful learning experiences. This book can also be used as an alternative teaching material that supports students' independent learning. The integration of scientific materials with local cultural values has the potential to increase students' motivation to learn and their emotional involvement in the topics studied (Hsiao & Su, 2021; Rahmawati et al., 2020).

The Gregory coefficient yields a value of V = 1.00, indicating that there is no difference in perception among validators regarding the product's feasibility. This perfect agreement shows that both experts share the same views on the construct's validity and the book's content. Thus, the validation results are highly reliable and can be trusted as a basis for proceeding to the implementation stage. According to Gregory's criteria (2015), a value above 0.81 is categorized as "very valid", so this result confirms that the development product has met the academic and pedagogic eligibility criteria.

Overall, the results of this validation show that the physics companion book based on Takalar local wisdom meets the validity requirements in both content and presentation. This book can support physics learning in secondary schools through contextual approaches relevant to students' socio-cultural lives. High validity also confirms that integrating local wisdom into science learning does not diminish the scientific validity of the material but rather strengthens its relevance and attractiveness. Theoretically, these results reinforce the view that context-based science learning is an effective strategy for strengthening science literacy (Dori et al., 2018; Picardal & Sanchez, 2022; Yuliana et al., 2021). In practice, these results support the use of companion books as alternative teaching materials aligned with the SDG 4 policy direction on quality education, which emphasizes education that is relevant, inclusive, and rooted in local values (Bappenas, 2024). Thus, this companion book is declared feasible to use and has the potential to make a significant contribution to improving students' science literacy.

3. Students' scientific literacy achievement

After the validation stage, the companion book was implemented in a pilot group of 95 students in class XI MIPA at SMA. The purpose of the trial is to find out the extent to which companion books can improve students' science literacy. The science literacy test used includes three main indicators, namely: (1) the ability to explain scientific phenomena, (2) the ability to interpret scientific data and evidence, and (3) the ability to apply science concepts in the context of real life. Table 2 presents the results of the science literacy achievement test.

Table 2. Distribution of students' scientific literacy levels after implementation

Score interval	Frequency	Categories
76 – 100	0	High
51 – 75	66	Adequate
26 – 50	28	Medium
0 – 25	1	Low

The results indicate that the majority of students (66) were in the adequate category of scientific literacy, while 28 students were in the moderate category, 1 student was in the low category, and no students reached the high category. Although no students have yet entered the highest category, these results show significant progress compared to the initial learning conditions, which were dominated by the low-to-medium category. This indicates that the use of companion books grounded in local wisdom is effective in improving science literacy. This increase in achievement can be explained through Vygotsky's theory of social constructivism, which emphasizes that conceptual understanding is formed through social interaction and cultural contexts (Erbil, 2020; Shabani, 2016). Through this book, students not only learn physical concepts but also interpret local phenomena from a scientific perspective. For example, they study water pressure through the phenomenon of fish ponds or friction through traditional activities such as swiping bamboo sticks to light a fire.

The local context serves as cognitive scaffolding, helping students construct new meanings from their empirical experiences. Thus, science literacy does not grow only from the ability to calculate, but also from the ability to reflect on the relationship between science and the reality of life. These findings align with the research of Rahmawati et al. (2020), which found that integrating local culture into science learning can increase students' cognitive and affective engagement. In addition, these results confirm the theory that science literacy includes the ability to apply science in social and cultural contexts, rather than simply mastering abstract concepts (Fortus et al., 2022). More critically, the findings of this study suggest that the integration of local wisdom influences students' science literacy not merely by contextualizing content, but by reshaping the cognitive and epistemic processes through which students engage with scientific knowledge. When physics concepts are embedded in familiar cultural practices such as traditional irrigation systems or fishing activities, students are more likely to activate prior knowledge and experiential schemas, which facilitates meaningful learning and conceptual transfer. This mechanism aligns with constructivist learning theory, which posits that knowledge construction is most effective when new information is connected to learners' existing cognitive structures and socio-cultural experiences (Shabani, 2016). In this context, local wisdom serves as an epistemic bridge linking abstract scientific concepts with observable, lived phenomena, thereby enhancing students' ability to explain scientific phenomena, interpret evidence, and apply concepts in real-life situations.

Empirically, this interpretation is consistent with previous studies showing that culturally responsive and context-based science instruction contributes to higher levels of engagement, deeper conceptual understanding, and improved science literacy outcomes (Rahmawati et al., 2020; Dori et al., 2018; Fortus et al., 2022). However, the absence of students in the "high" literacy category indicates that while contextualization through local wisdom effectively supports foundational and intermediate levels of science literacy, more advanced literacy skills, such as the critical evaluation of complex socio-scientific issues, require sustained instructional support, inquiry-based projects, and extended opportunities for scientific argumentation. However, the low percentage of the high category indicates that strengthening science literacy requires sustainability. Further mentoring is needed through project activities, experiments, and reflective discussions to help students reach a more advanced level of scientific thinking.

4. Students' responses

Students' responses to the companion book were collected through a questionnaire comprising statements on ease of use, the attractiveness of the material, relevance to life, and benefits to understanding concepts. The results showed that of the 27 students who responded, 4 (13%) gave a positive response, 23 (77%) gave a very positive response, and no students gave negative or neutral responses. A very positive response reflects that the target user received the companion book well. Students feel that this book presents material that is close to their lives, making it easier to understand. They also assessed that the use of illustrations and examples of local culture made learning more engaging.

One of the students stated that, by reading this book, he realized that many community activities in Takalar actually apply physics principles, such as the balance of fishing boats, the use of water pressure in rice fields, and the friction force on traditional looms. These findings reinforce the view that culture-based learning can increase a sense of belonging to knowledge (Fiharsono et al., 2024; Kana‘iaupuni et al., 2017). Students feel that their culture is valued and recognized in the learning process, so that an intrinsic motivation arises to understand concepts more deeply. From an affective perspective, students' positive responses indicate that this companion book can foster appreciation for both science and culture. This is important because one of the dimensions of science literacy that is often overlooked is awareness of the relationship between science, society, and the environment. Thus, the book is not only cognitively effective but also lays the foundation for scientific attitudes and cultural appreciation, which are integral to 21st-century competence. The findings of this study show that the development of physics companion books based on Takalar local wisdom makes a significant theoretical and practical contribution. Theoretically, this research reinforces the concept that local wisdom can serve as a source of scientific knowledge (Khusniati et al., 2017; Lestari & Suyanto, 2024). This companion book shows that cultural phenomena are not contrary to science but can serve as a basis for explaining scientific concepts in context.

This approach supports context-based learning theory (King & Henderson, 2018; Podschuweit & Bernholt, 2018), which holds that scientific knowledge is easier to understand when it is embedded in students' social and cultural contexts. In addition, the high validity results indicate that integrating local culture does not compromise the accuracy of scientific concepts, making it a relevant model for culture-based learning in Indonesia. From the empirical side, the results of the study show that the use of companion books can increase students' science literacy achievement. The dominance of the sufficient category, with a shift away from the low category, indicates a positive change in how students understand and relate physics concepts to everyday phenomena. These results confirm that a local wisdom-based approach can be a solution to the low science literacy in Indonesia, which has been caused by an education system that is too abstract and independent of social context. From a practical perspective, this companion book can be used as a model for the development of contextual teaching materials for physics teachers in other regions. Teachers can adapt the book's content to the local wisdom of each region without losing its scientific essence.

In addition, this product supports achieving SDG 4, especially the target to improve the quality and relevance of education. By making local culture part of learning, education becomes more inclusive, relevant, and rooted in the social realities of society. The implication of this research is the need for a paradigm transformation in physics teaching in schools. Teachers are no longer the only source of knowledge but rather facilitators who relate the concept of science to the culture and experiences of students. Thus, learning physics not only develops intellectual intelligence but also forms a scientific character grounded in local values and social responsibility.

IV. CONCLUSION AND SUGGESTION

This study developed a physics companion book based on Takalar local wisdom using the Plomp development model to strengthen senior high school students' scientific literacy. The results indicate that the companion books that are compiled have a high level of validity, both in terms of content, language, and presentation. The book serves not only as an additional learning resource but also as a medium that connects physics concepts with the values, practices, and cultural experiences of local communities. This makes the learning process more contextual, meaningful, and in harmony with students' characteristics and social environment. Conceptually, this study shows that integrating local wisdom in science learning can strengthen conceptual understanding, foster ecological awareness, and build students' cultural identity. Learning rooted in the local context has been proven to provide a more relevant, real-life-oriented learning experience, so that science literacy is not only a cognitive ability but also an attitude and perspective towards the world. In practice, this companion book can serve as an alternative teaching resource for implementing the Independent Curriculum, which encourages context- and culture-based learning.

Despite these positive outcomes, this study has several limitations. The field trial was conducted in a single school with a limited number of participants, which restricts the generalizability of the findings. In addition, the effectiveness of the companion book was evaluated over a relatively short implementation period and focused primarily on descriptive measures of scientific literacy. Future research is therefore recommended to involve larger, more diverse samples, extend the duration of implementation, and incorporate experimental or quasi-experimental designs to examine the long-term impacts on higher-order scientific literacy skills. In addition, the digitization of companion books is important for adapting to the needs of 21st-century technology-based learning. Subsequent researchers are also expected to explore how the integration of local cultural values can contribute to the formation of students' scientific character in a more profound way. Nevertheless, this study makes a meaningful contribution to physics education by providing empirically validated evidence that local wisdom can be systematically integrated into physics teaching materials to enhance scientific literacy and support the implementation of quality and sustainable education in alignment with SDG 4.

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