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Needs Analysis For Developing Deep Learning-Based Teaching Materials To Enhance Elementary Students' Science Literacy

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Abstract: Science literacy is an important competency that needs to be developed since basic education to equip students in understanding, applying, and making science-based decisions in daily life. However, the results of international studies show that the science literacy of Indonesian students is still low, one of which is due to the limitations of contextual and meaningful teaching materials. This research aims to analyze the need for the development of Deep Learning-based science teaching materials to improve the science literacy of elementary school students. The research uses a Researchand Development (R&D) approach with the ADDIE model, which is focused on the Analysis stage. The subjects of the study include the Science Learning Outcomes Phase B document for class V, two elementary school teachers, and 28 grade V students at SDN 05 Bengkulu City. Data collection techniques include documentation studies, questionnaires, and semi-structured interviews. Data were analyzed descriptively, quantitatively, and qualitatively, as well as through gap analysis. The results of the study show that the science book in class V has contained indicators of science literacy in the aspects of competence, procedural and epistemicknowledge, and scientific attitudes, but has not presented a local context and science content that is close to students' lives. Teachers and students need teaching materials that are interactive, contextual, flexible, and utilize visual and digital media. These findings indicate that the development of Deep Learning-based science teaching materials that integrate contextual science literacy and innovative learning media is needed to improve concept understanding, scientific process skills, and the ability to apply science in the daily lives of elementary school students.

Keywords: Needs analysis, science literacy, deeplearning, science teaching materials, elementary school.

Introduction

The development of technology and the demands of 21st century competencies have brought significant changes to various aspects of life, including the field of education. In the era of the Industrial Revolution 4.0 towards Society 5.0, students are required to have high-level thinking skills, problem-solving skills, creativity, and literacy to be able to adapt and compete in a global environment (Lase, 2019). One of the basic competencies that need to be mastered from the basic education level is science literacy. According to the Organisation for Economic Co-operation and Development (OECD, 2019), science literacy includes the ability to interpret scientific data and evidence, evaluate scientific investigations, think critically about science and technology issues, and make evidence-based decisions. Science literacy not only helps students understand the natural phenomena around them, but also equips them to become citizens who are able to make rational decisions in their daily lives (Saragih, 2025).

However, the results of an international study by the Programme for International Student Assessment (PISA) show that the science literacy ability of Indonesian students is still relatively low. PISA 2022 data recorded an average science literacy score of 383 points for Indonesian students, far below the OECD country average of 485 points (OECD, 2023). In addition to pedagogical factors, the low science literacy is also

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influenced by the limited resources and learning materials. The OECD (2022) classifies Indonesia as one of the countries with a high level of shortage of educational materials, which has a direct impact on the quality of science learning in elementary schools. This condition shows that there is a gap between the demands of 21st century competencies and the learning practices that take place in schools.

The availability of quality teaching materials is an important factor in achieving science learning goals. Science learning in elementary school should ideally be designed in an inquiry and exploratory manner, thus encouraging students to observe, question, try, reason, collaborate, and conclude scientific phenomena independently (Ansya, & Salsabilla, 2024). However, various national studies show that science teaching materials in elementary schools are still dominated by texts, have minimal experimental activities, lack contextuality, and use language that is difficult for students to understand (Amelia, et al., 2025). This condition causes learning to tend to be memorized and less able to develop students' science literacy optimally.

Responding to these challenges, the Indonesian government in 2025 will officially implement a Deep Learning learning approach in formal education. The Deep Learning approach emphasizes deep understanding of concepts, meaningful learning, and the application of knowledge in real-life contexts (Ministry of Education and Education, 2025). Deep Learning encourages students to think critically, creatively, and reflectively through the exploration of core concepts in a more focused scope of the material (Wibowo, Gunawan, & Mardiana, 2025). In the context of science learning, this approach is in line with the goal of developing science literacy which emphasizes conceptual understanding, science process skills, and scientific evidence-based decision-making.

Despite its great potential, the implementation of the DeepLearning approach in elementary schools still faces various challenges, especially related to the limitations of teaching materials specifically designed to support deep learning and improve students' science literacy. Recent research shows that Deep Learning-based teaching materials that are integrated with inquiry, contextual, and phenomenon-based activities are able to significantly increase student engagement and understanding of science concepts (Triyana & Kuncahyono, 2025; Maulidya, 2025). However, until now, the development of Deep Learning-based science teaching materials for elementary school students is still very limited and has not been evenly applied in schools.

Based on these conditions, a comprehensive needs analysis is needed as the first step in the development of Deep Learning-based teaching materials. This needs analysis includes the identification of teacher needs, characteristics of elementary school students, science literacy competencies that need to be improved, as well as the form and features of teaching materials that are in accordance with the demands of the curriculum and technological developments. Therefore, this study focuses on Analysis of Needs to Develop Deep Learning-Based Teaching Materials to Improve Science Literacy of Elementary School Students. The results of the research are expected to be the basis for the development of innovative teaching materials that are relevant, effective, and sustainable in improving the quality of science learning and science literacy of elementary school students.

Materials and Methods

This research uses a Research & Development (R&D) approach to develop teaching material products. The development model used is ADDIE (Analysis, Design, Development, Implementation, Evaluation), with the research focus only on the Analysis stage. This stage aims to analyze the needs of documents, teachers, and students related to Deep Learning teaching materials to improve science literacy in elementary school students. The subject of the study included the learning outcomes document of IPAS Phase B class V, 2 teachers, and 28 students of class V at SDN 05 Bengkulu City.

The research instruments used consisted of a documentation study to examine aspects of science literacy in learning outcomes in the Independent Curriculum, questionnaires to identify student needs related to Deep Learning and science literacy teaching materials,

and semi-structured interviews with teachers regarding Deep Learning and literacy teaching materials science. Data collection was carried out through the analysis of learning outcomes documents to assess aspects of science literacy, giving questionnaires to students to find out their needs for teaching materials, and interviews with teachers to obtain information related to Deep Learning and science literacy teaching materials.

The data obtained was analyzed using several approaches according to their type. Quantitative data from document analysis and student questionnaires were analyzed descriptively using frequency and averages to determine student needs. Qualitative data from teacher interviews were analyzed thematically by identifying key emerging patterns, themes, and categories. In addition, gap analysis was carried out by comparing ideal needs with real conditions found from documents, questionnaires, and interviews, so that gaps and priorities for the development of teaching materials could be identified.

Results and Discussion

Result

This research began by analyzing the latest Natural and Social Sciences (IPAS) Learning Outcomes (CP) document set by the Education Standards, Curriculum, and Assessment Agency (BSKAP) Number 046/H/KR/2025. The focus of the subjects carried out in this study is on the science subject Phase B class V SD with CP "producing solutions to problems related to the conservation of natural resources as an effort to mitigate climate change". The analysis was carried out to determine the emergence of science literacy reviewed from 4 (four) components, namely the components of context, competence, knowledge, and scientific attitudes. This analysis activity reviewed the indicatorsof each of these components in the elementary school Class V science book. The results of the analysisare shown in table 1.

Table 1. Results of Indicator Emergence Analysis

No	Components	Indicator	Page	Frequence of Occurrence
1	Konten	Personal/local/national context	-	0 times
2a	Competence - Explain the phenomenon scientifically	Remembering and applying appropriate scientific knowledge	43–61	≥10 times
		Make and justify predictions accurately	65–68, 76	≥6 times
		Propose a clear hypothesis	66–68	3 times
2b	Competence - Design and evaluate scientific investigations	Propose a way to explore questions scientifically	51–55, 57–58, 71–78	≥8 times
		Evaluating ways to explore scientific questions	53, 55, 58, 73	≥4 times
2c	Competence - Evaluating scientific evidence and arguments	Analyze, interpret, and draw the right conclusions	65–69, 74–76	≥6 times
		Distinguishing scientific evidence-based arguments from other considerations	69–71	2 times
3a	Content Knowledge	Science-specific content	-	0 times
3b	Procedural Knowledge	The concept of observation-based measurement	55–58, 71–73	≥5 times

No	Components	Indicator	Page	Frequence of Occurrence
3c1	Epistematic Knowledge-Construction and definition of science features	Purpose of science	42–43, 61–62	≥2 times
		Nature of scientific reasoning	63–69	≥4 times
3c2	The role of science constructions and features in justifying science	Scientific statements are backed by data and scientific reasoning	55–56, 73	3 times
		How measurement errors affect confidence levels	73	1 time (implicit)
4	Scientific Attitude	Curiosity	43–45, 51, 65, 73	≥8 times
		Teliti	55–58, 73	≥5 times
		Work together	43–45, 51,53, 71–73	≥6 times
		Responsible	71–74	≥3 times

Based on the results of the analysis that has been carried out, the emergence of each indicator from the aspect of science literacy is sufficient, but there are several things that need to be considered. The content and context presented in the book are not yet local, especially for elementary school students in Bengkulu Province, so they cannot facilitate students' needs for the importance of local content skills and content knowledge that is close to students' daily lives. Furthermore, in the book that is analyzed in the aspect of competence with indicators distinguishing arguments based on scientific evidence from other considerations, the frequency of its occurrence is still very minimal, namely 2 times, even though this ability is a basic part of objective, rational and accountable decision-making both for oneself and the community. Understanding the credibility and accuracy of the scientific evidence data presented gives students the experience that the decisions taken must be objective and not misleading. In addition to the competency aspect, in the aspect of epistemic knowledge in the sub-aspect of the role of construction and scientific features in justifying science, its emergence is still very minimal. This means that the science book class V, especially in natural resource materials, does not provide learning activities that support students to think about scientific statements based on scientific data and reasoning and know that errors in measurement or decision-making will affect the level of trust.

After conducting a needs analysis of the curriculum, an analysis of the needs of teachers and students was carried out. The analysis of teacher needs was carried out by semi-structured interviews with two elementary school teachers who teach science subjects. Based on the results of the interviews, it is known that the need for teaching materials that integrate science literacy and deep learning is very clear. Teachers emphasized that many of the current teaching materials are still conventional, focus on knowledge transfer, and do not support in-depth understanding of concepts. They expect teaching materials that encourage students to think critically, conduct analysis, and be able to connect theories with real phenomena through exploration, discussion, and reflection activities. In addition, teachers also emphasized the importance of the flexibility of teaching materials in order to adapt to the abilities of various students, as well as the use of digital media to strengthen the understanding of abstract concepts. These findings show that the development of teaching materials based on science literacy and deep learning not only improves

students' cognitive abilities, but also strengthens their competence in applying science contextually.

Student needs analysis data obtained from questionnaires given to 28 elementary school students showed a strong preference for interactive and contextual science learning. As many as 89% of students said they enjoyed learning science through experiments or hands-on experiments, while 86% found it easier to understand the material if it was accompanied by pictures, videos, or visual media. In addition, 89% of students like learning that is associated with everyday life, and 82% are interested in learning through discussions or Q&A with friends and teachers. The use of digital media or interactive simulations is also in demand, with 75% of students stating that they like this method. These results indicate the need for teaching materials that not only convey science concepts, but also encourage students to think critically, explore, and reflect on their learning, in accordance with the principles of the deep learning approach while significantly improving science literacy.

Discussion

The results of the analysis show that in the science book class V there is an emergence of science literacy indicators in the aspects of scientific competence, procedural and epistemic knowledge, and scientific attitudes. However, aspects of the local/national context as well as specific science content that are close to the student's environment do not appear at all. This indicates that although aspects of the scientific process are relatively fulfilled, the relevance of the material to students' daily lives, especially in terms of natural resource conservation and climate change mitigation, has not been well worked on.

The literature on science literacy in primary education emphasizes that science literacy should enable students to understand science, apply it in real life, and make decisions or actions based on this understanding for example related to the environment, health, society (Parisu, et al., 2025). If learning materials do not present local context or real-life relevance, then opportunities for students to develop contextual and meaningful science literacy are limited.

Deep Learning-based approaches in learning offer a viable alternative to bridge these weaknesses. Research in elementary school shows that the application of the deep learning approach in science can improve students' science literacy both in terms of understanding concepts, scientific process skills, and scientific attitudes such as curiosity, reflectiveness, and the ability to connect science with the reality of life (Syaifulloh, 2025). In addition, deep learning at the elementary level provides a meaningful, mindful, and joyful learning experience that encourages students' active involvement and deep understanding of concepts (Wijaya, Haryati, & Wuryandini, 2025)

Considering the needs of teachers and students such as the desire for interactive, contextual, flexible learning, the use of visual/digital media, the development of science teaching materials based on deep learning and contextual science literacy is very relevant. Previous research supports the development of innovative learning media, for example, the use of digital-based media to improve students' science literacy has proven to be feasible and liked by students (Handayani, 2021); also, the use of digital picture storybooks shows effectiveness in improving science literacy skills in elementary school students (Gisna & Nurulaeni, 2024).

Contextual approaches that integrate local wisdom have also been proven effective in improving science literacy, such as research that combines problem-based learning models with local wisdom showing an increase in students' scientific literacy (Zainuri, Gunawan & Kosim, 2024). This strengthens the argument that science material with a local context (environment, culture, social conditions) is not only important, but gives deeper meaning to students, because it touches their real lives.

The combination of deep learning approaches, contextual materials (including local content and environmental relevance), and innovative learning media (digital, visual, interactive) becomes a promising formula to produce science teaching materials that effectively improve the science literacy of elementary school students in accordance with the needs revealed from the

curriculum analysis and the analysis of the needs of teachers and students in this study.

However, there are some important notes. First, the literature on the implementation of deep learning in elementary science does show potential, but the number of empirical studies is still relatively limited, meaning that the systematic implementation of teaching materials and evaluation of results needs to be carried out so that the claims of effectiveness can be stronger. Second, the development of local contextual media and teaching materials requires a good understanding of the student environment (local ecosystem, social conditions, culture), as well as the collaboration of teachers, the community, and stakeholders so that the material is relevant and not just a "contextual patch".

Thus, although the IPAS class V book already contains aspects of science literacy in terms of scientific processes and scientific attitudes, the lack of contextual content and real-life relevance hinders the development of meaningful science literacy. Deep learning approaches combined with local contextual materials and innovative learning media offer a way to close these gaps and support the goals of 21st century education, which is to produce students who are scientifically literate, critical, creative, environmentally friendly, and able to apply science in real life.

Conclusions

Based on the analysis of curriculum needs, teachers, and students, it was found that the science books for grade V elementary school have contained several indicators of science literacy, but still lack local context and content that is relevant to students' daily lives, especially related to the conservation of natural resources. Teachers and students show the need for teaching materials that are interactive, contextual, flexible, and utilize visual/digital media. Deep learning has the potential to improve science literacy across the board, integrating concept understanding, scientific process skills, and scientific attitudes. Therefore, the development of science teaching materials based on deep learning and contextual science literacy is expected to strengthen critical thinking skills, problem solving, and the application of science in daily life, while supporting 21st century education in elementary schools.

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