

A NEW TEXTBOOK OF LOCAL WISDOM-BASED LEARNING IN SCIENCE CLASSROOM: AN EXPERT JUDGMENT

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ABSTRACT: Local wisdom-based science learning is increasingly popular in Indonesia. However, there are not enough textbooks that help students learn how to learn science from local wisdom. Most local wisdom textbooks are designed generally for education for sustainable development (ESD) and not as context for learning science. This preliminary study aims to determine the response of students and experts to the draft of local wisdom-based learning textbooks using the instructional design model (IDM). Three science educators (age 35 – 50 years old) and three postgraduate students (age 35 – 45 years old) from a department of natural science education in a university in East Java were involved in expert judgment of this new textbook draft of local wisdom-based learning of science. Data collected through the expert judgment were analyzed

descriptively using categories, such as very good (score 4), good (score 3), medium (score 2), and low (score 1). In addition, we also using eligible and not eligible, and easy, medium, and difficult categories for classifying students' responses. The results show that the textbook of local wisdom-based learning of science were considered very good in the substance and performance, but good for other aspects. In addition, students also responded positively to the draft of local wisdom-based learning textbooks. These results indicate that the developed textbook draft is theoretically valid, so it can be followed up with further empirical practices trials to help students learn science through a productive context of local wisdom in science classes.

INTRODUCTION

Local wisdom in science education research and science education classrooms in Indonesia is increasingly popular. Many seminars and conferences are based on ethnoscience. Some science education study programs involve ethnoscience in their curriculum. Many references to local wisdom in science learning are more

dominant to introduce the importance of local wisdom in science learning. However, the role of local wisdom in science learning is questionable because of the various perceptions that develop in various seminars or conferences. For example, ethnoscience was commonly considered as a science discipline, so it should be included in science curriculum and some as multi-discipline. Among these perceptions is the importance of preserving the local wisdom of education for sustainable development (ESD) so that it needs to be a part of science learning.^{7,12}

Nowadays, ethnoscience has become a subject with mandatory or optional status in various science education study programs, both undergraduate and postgraduate. This perception may be correct but also may be wrong depending on the point of view of each. However, one thing that I find interesting to know is that ethnoscience is a multi-disciplinary study involving many fields of science, such as social sciences, economics, anthropology, philosophy, psychology, natural science, and even theology or religion.^{2,12} Thus, natural science is one of these multi-disciplines. A question is a potential for indigenous knowledge or ethnoscience in the science curriculum because each indigenous community has unique local wisdom. It has different potential relevance to the curriculum science competencies.

From various accessible textbooks, we found that ethnoscience studies are still descriptive, oriented towards ESD efforts in the midst of the threat of extinction due to rapid advances in science and technology and impact all aspects of human life. However, it is very rare to find textbooks that lead readers to understand science scientifically in the context of local wisdom. We are of the view that ethnoscience raises some interesting and essential questions for the science education community, such as science educators and college students. The first question is related to the relevance of ethnoscience to science topics in the curriculum? Second is the feasibility of ethnoscience in terms of scientific criteria because a lot of indigenous knowledge is produced through spiritual studies, not scientific studies. Third, how is the potential of local wisdom as a science learning context? The fourth question is related to studying ethnoscience, whether science or indigenous knowledge of specific ethnic communities. These questions will undoubtedly get various answers because of the different perceptions and perspectives on local wisdom.

Local wisdom is considered as a productive context to learn science.^{2,3} Other perspective considered local wisdom as science discipline, so it should be included in science curriculum. In fact, local wisdom consists of multidisciplinary, such as science, economic, culture, history, psychology, and social science. It seems that there are no guidelines on how to optimize the development of science education based on local wisdom, including how to learn science in the context of local wisdom. Commonly, science is not easy to acknowledge in a local wisdom. Prior relevant knowledge is needed to identify, define, and describe and even to explain embedded science in a local wisdom. Student should have connections with scientific ideas and societal concerns to learn science in the context of local wisdom.

³⁰ That is why the ability to identify and explain aspects of local wisdom science indicates

that students are connected to scientific ideas.¹ Connection with science ideas and societal concerns of local wisdom indicate that a connection with the local wisdom context has also occurred. Therefore, the development of textbooks on the role of local wisdom in science learning is needed as a vehicle to build a paradigm of thinking about the potential of local wisdom in science education.

Science, including physics, chemistry, and biology, is often considered a subject that is quite difficult for students to learn.¹ The students' difficulty in learning is due to science characteristics, which are complex and abstract.^{1, 3, 18} The lack of students' thinking abilities is also less than optimal, and limited prior knowledge,^{3, 8, 11} and learning by teachers is considered less successful in helping students learn.²¹ One of the efforts considered successful in overcoming difficulties in learning science by using a context that is familiar to students.^{6, 14, 20} Local wisdom is a very productive context because it challenging science teacher and student to discover science aspects that are potentially controversies.^{4, 25} Local wisdom is commonly most familiar with local students, so it is potential to become a learning context of science in which science can be presented in real everyday life.² Local wisdom can solve the main challenge of context-based science learning, namely the ability to process transformations across contexts.²² Unfortunately, textbooks that can be used as guides in teaching and learning science based on the context of local wisdom are not yet available adequately. In this study, we developed a textbook of local wisdom-based learning of science learning to guide science educators, teachers, and students in designing local wisdom-based science learning or lectures. An expert judgment was conducted for theoretical validation prior to trying out the textbook draft in science class.

METHODS

The study developed a textbook of science learning based on local wisdom using the IDM (instructional design model) development research design.²⁴ A new textbook of learning science based on local wisdom was considered as a subject in this study. Three science educators (age 35 – 50 years old) and three postgraduate students (age 30 – 40 years old) from a department of science education from a university in East Java were involved as expert judgment of this new textbook of local wisdom-based learning of science. Science educators and postgraduate students judged the new textbook by considering five aspects, that is textbook structure and format, textbook substance or content, language, appearance, and other general consideration of a new textbook in Indonesia. In addition, postgraduate students also asked to respond historic, culture, and science aspects of local wisdom and non-local wisdom. Data were collected through an expert judgment and analyzed descriptively using category very good (score 4), good (score 3), medium (score 2), and low (score 1) category (for expert judgment data), eligible and not eligible category (for student's response on historic, culture, and science aspects of local wisdom data); and

easy (if 3 of 3 students are able to determine learning theory, learning model, and design of science learning), medium (if 2 of 3 students are able to determine learning theory, learning model, and design of science learning), and difficult (if no students are able to determine learning theory, learning model, and design of science learning) category (for student's response on learning theory, learning model, and design of science learning).

RESULTS AND DISCUSSION

The results of this study consist of features of textbook draft (Table 1), expert judgment of textbook (Figure 1), student's response concerning textbook (Table 2 - 3), and strategy to describe science of local wisdom when using textbook drafts (Table 4).

Aspect of context	Strategy	Competence
Indigenous knowledge	Interview and document analysis	Differentiating indigenous knowledge and indigenous science from nonindigenous knowledge
History, culture, and science	Interview, document analysis, and observation	Identifying history and culture aspects of indigenous science development.
Relevance to Science curriculum	Curriculum analysis and indigenous science	Context based learning
Learning theory	Observation, simulation, and literature review	Pedagogical content knowledge
Learning model	Observation, simulation, and literature review	Pedagogical content knowledge
Designing teaching and learning	Workshop	Pedagogical content knowledge

TABLE 1. Features of learning science based on local wisdom

Table 1 shows that the features of teaching materials for science learning based on local wisdom consist of 6 aspects, namely: distinguishing indigenous knowledge and indigenous science from nonindigenous knowledge and indigenous science, identifying aspects of history, culture, and science, analyzing the relevance of local wisdom with the science curriculum, determine learning theories that can be used in science learning based on local wisdom, identify learning models that should be used in science learning based on local wisdom, and design learning. Each aspect is carried out with certain strategies to achieve competence or learning objectives.

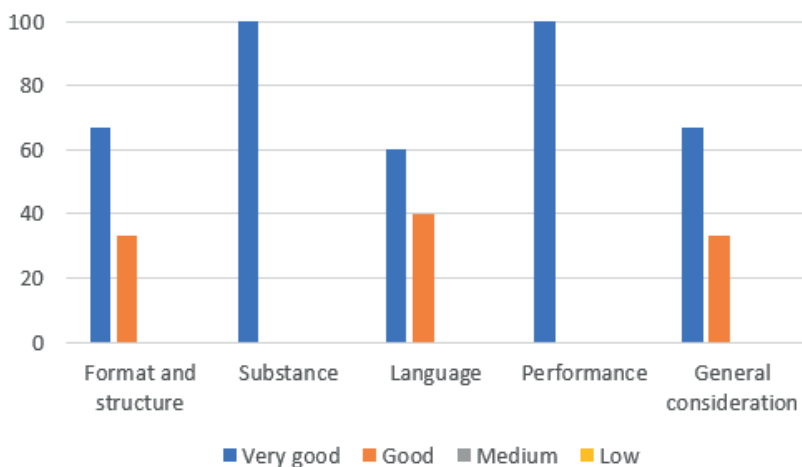


FIGURE 1. Expert judgment of textbook draft

Figure 1 shows that textbook drafts generally get expert ratings with very good categories in all aspects. However, a small number of aspects received an assessment in the good category. The textbook draft of local wisdom-based science learning can be used in the next stage or local wisdom-based science learning.

Students responded to aspects of history, culture, and science of indigenous science (local wisdom in the area which is passed down from generation to generation) and non-indigenous science (local wisdom in the area that is not sourced from the legacy of previous generations from generation to generation). In addition, students also responded to aspects of history, culture, and science of non-local wisdom (local wisdom from other regions) as shown in Table 2.

Aspects of local wisdom	Student's response			Learning science based local wisdom
	History	Culture	Science	
Indigenous science (local wisdom)	√	√	√	Eligible
Non-indigenous science (local wisdom)	√	√	√	Eligible
Non-local wisdom	-	-	-	Not eligible

TABLE 2. Student's ability to explain history, culture, and science of local wisdom and non-local wisdom

Table 2 shows that postgraduate students can explain aspects of history, culture, and science, indigenous and nonindigenous sciences which are still local wisdom but have difficulty explaining non-local wisdom. The local wisdoms (indigenous and non-indigenous science) are more appropriate to be used as a context in science learning than non-local wisdom. Learning science from local wisdom is relatively more straightforward and can be used as a context in science learning.

Aspects of local wisdom	Student's response			Student (n of N)	Category
	LT	LM	DSL		
Indigenous science (local wisdom)	√	√	√	2 of 3 students	Medium
Non-indigenous science (local wisdom)	-	-	-	0 of 3 students	Difficult
Non-local wisdom	-	-	-	0 of 3 students	Difficult

TABLE 3. Student's ability to determine learning theory (LT), learning model (LM), and design of science learning (DSL)

Table 3 shows that students can identify learning theories and models and design science learning based on local wisdom with a moderate category. Students have more potential to develop science learning based on local wisdom than science learning based on non-local wisdom.

The development of the textbook draft in this preliminary study received a positive response from both experts (Figure 1) and postgraduate students in science learning classes based on local wisdom (Table 2 and Table 3). The results show that the draft textbook can be followed up in further tests, namely limited trials and wide-scale trials. This preliminary study is still in the exploration stage of the potential of the draft textbook to be used as a study guide for postgraduate school students for science learning subjects based on local wisdom.

Currently, there are quite a lot of local wisdom-based science learning textbooks, and they are easily accessible. However, almost all of these books are still written in a general context to preserve local wisdom, especially for sustainable development.^{7,9,10,17} Several studies in the context of local wisdom are also more oriented towards sustainable development efforts.¹⁵ In this context, in general, textbooks only describe local wisdom, especially the type and importance of local wisdom from the cultural and economic aspects of indigenous peoples.⁷ From the aspect of learning, especially to become the context of science learning, it has not been the concern of textbook writers. Students in general still find it difficult to design science learning²⁸ based on local wisdom because of the unavailability of adequate guidelines for students. The limited student response to the potential of local wisdom as a science learning context is quite positive.

Local wisdom is seen as a productive science learning context because of familiarity to students, provoke students to learn, and some are controversies.^{2,3,4} In addition to being familiar with students, many local wisdoms contain aspects of science. Context-based learning is beneficial for students to learn science because it can present science in students' real lives.^{3,13} The presentation of science in the context of real-life can motivate student learning and facilitate students to think concretely to observe scientific phenomena in their lives.²⁶ Context-based learning also can help students who are still below the level of their actual thinking ability (BACD) to learn science.²¹

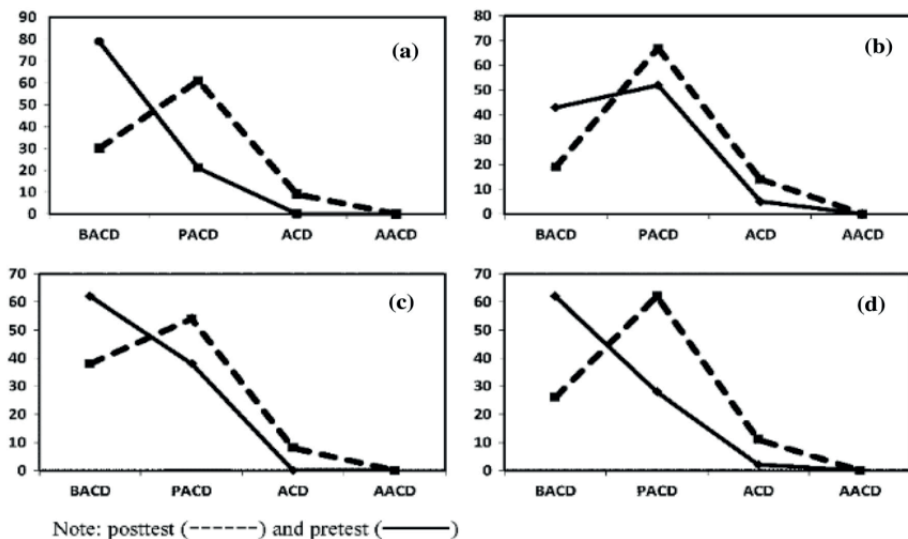


FIGURE 2. Students' percentage in each category of cognitive development before and after intervention²¹

Although it makes it easier for students at the BACD level to learn science, learning based on the context of local wisdom has challenges, namely the ability to transform science from the context of local wisdom to the context of science or vice versa.^{3,22} Scaffolding or advance organizers are needed that can help students learn, such as by providing science learning textbooks based on local wisdom. That is why local wisdom is seen as quite productive as a context for learning science because it is very well known to students so that it is easy to transform across contexts. Many studies show that context-based science learning can help students learn science.^{6,12,14,20} Several studies find that context-based science learning can improve students' scientific literacy,^{16,19,23} including students' logical argumentation skills.^{4,5,27}

Science in local wisdom is not apparent or in a black box,²⁹ so that sometimes it is buried in the history and culture dimension. Science in local wisdom can be categorized as science and not science, especially those resulting from spiritual aspects and cannot be verified by science. That is why learning based on local wisdom, history, and culture analysis is essential to reveal the scientific aspects of local wisdom in science. In learning science-based on local wisdom, students can describe science from two perspectives, namely science according to indigenous peoples and modern science,¹² with the following pattern. Indigenous knowledge of a community can be categorized as science, pseudoscience, and non-scientific knowledge or a part of religion or believe. Student must be able to differentiate science from pseudoscience and non-scientific knowledge using IDEA principle.³¹ A framework used to learn science based on local wisdom.

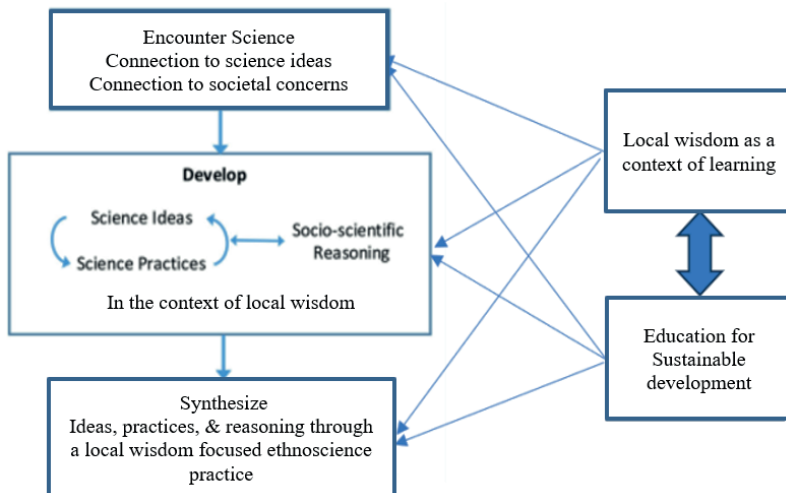


FIGURE 3. A framework of local wisdom-based learning ^{4,31}

Figure 3 shows that learning science based on local wisdom has two main objectives, namely to learn science through the context of local wisdom and education for sustainable development (ESD). As a context of learning, learning science through local wisdom can be done using the IDEA strategy.³¹ By the IDEA strategy, aspects of science will be identified, defined and described first and then used to explain local wisdom, especially ethnoscience. In the ESD concept, learning based on local wisdom is more oriented towards solving problems and projects to improve the quality of life of local communities, preserving local wisdom culture and other social practices.

Indigenous people' explanation	Scientists' explanation
Indigenous science description	Indigenous science description
Interpretation	Interpretation

TABLE 4. Describing indigenous science from indigenous people and scientists

The textbook helps students analyze aspects of history, culture to discover science. In addition, this book also helps readers identify learning theories and learning models involved in designing learning. The textbook can be used to learn science in accordance with the existing curriculum and for the education for sustainable development in Indonesia. Therefore, the developed book is handy for use in science learning based on local wisdom.

CONCLUSION

The draft of the textbook received a high positive response on substance (including content) and performance from both experts and students who were taking local wisdom-based science learning courses. The textbook also helps students learning science contextually. It was suitable for use for further processing, namely trials in local wisdom-based science learning. The expert assessment shows that the draft of the local wisdom-based science learning textbook is quite valid theoretically or from the experts' judgment. Student responses show the potential for practical textbooks (including for learning science contextually and designing a context-based learning of science) to be used in local wisdom-based science learning activities for postgraduate students. In addition to helping local wisdom-based science learning, this book can also be used by students to learn science through local wisdom because it is equipped with theoretical studies, study guides, and even data collection through field studies. However, due to time constraints, this book has not fully tried out in local wisdom-based science learning. Therefore, more try out of using the textbook is still needed to perfect the textbook.

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