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Elaborating Indigenous Science in the Science Curriculum

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Abstract: Local wisdom is marginalized since it is not considered to be in accordance with the demands of Western science. It may be seen to be at odds and limits of scientific knowledge. . This becomes the main problem for indigenous students, who feel alienated from their environment. They confront the challenge of existing in two worlds, the indigenous and the non-indigenous one. This paper combines the theoretical viewpoints of science education and indigenous science to provide a new perspective on science learning. Data were gathered through original document analysis of Java communities, natural science syllabi, and lesson plans. The results of the study indicated that indigenous knowledge in the Javanese community fulfilled competence in science learning that includes attitudinal aspects, knowledge aspects, and skill aspects. It builds an effective connection between what students encounter in the school and their lives beyond the school. Elaborating indigenous knowledge in the science classroom has the potential for establishing meaningful learning and linking the gap of science education pathways that students gain in schools with knowledge of science in society.

Keywords: Indigenous Science, Science Classroom, Javanese Native, Secondary School

Introduction

Much of indigenous knowledge has been marginalized as a result of the demands and development of globalization. The idea of globalization is Westernization in socio-cultural and the dominance of scientific knowledge (Regmi and Fleming 2012). The industrial and modern technological superiority of the West has changed many cultures around the world. Indigenous knowledge has been neglected or even denied; it may be seen to be at the edges of scientific knowledge (Baquete, Grayson, and Mutimucuio 2016). Some people also believe that indigenous knowledge should not be shared because it will deter the non-indigenous population (Aikenhead and Ogawa 2007). The regular science curriculum promotes the official science content and rules of the mind (Aikenhead 2006). The current science curriculum is a reflection of Western philosophies that occasionally neglect the social activity in the real-life environment. For example, in science education, students learn to use a series of laboratory tools and this is different from their original culture. Western science is an ethnoscience; its ethnicity is Euro-American (Aikenhead 1997; Aikenhead and Jegede 1999; Maddock 1981). This problem has an impact on the occurrence of imbalances in societies where cultural values and local wisdom are abandoned, and there is even alienation to the knowledge itself. Students also experience the emergence of a crisis of the natural environment as well as the human environment. This further affects the moral, social, and cultural crisis that has also caused the humanitarian crisis (McInnes 2017; Herusatoto 2012).

In recent years, researchers and educators of science have developed an interest in indigenous knowledge. This interest is driven by their eagerness for social equity and the progress of science in schools based on the cultural identity of each individual. Aikenhead and Ogawa (2007) state that some of the reasons that stimulated the research on indigenous knowledge are that scholars want to expand the containing domain of science and improve the

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supremacy and cultural continuation of native people. Additionally, they want to increase the numbers of educators who are knowledgeable about the cultural influence on student science achievement. This is important so that people learn, observe, remember, and develop social, moral, and emotional responses to their environment (McInnes 2017; Herusatoto 2012). Indigenous communities inevitably show a synergistic relationship with nature in their life. Indigenous knowledge is supported in the education review of the native culture of human rights and the perspective of social justice. The researcher has advanced that science should be based on the pupils' sociocultural context so the students can link school science to their day to day experience at home (Regmi and Fleming 2012). This can help students with their learning process as they will bring ideas to the classroom based on the daily experiences. Native science can help students avoid coming to class with an empty head. Conversely, this will allow the student's thought process to be always full of knowledge related to science. The pupil's mind has evolved through the process of assimilation and accommodation known as preconceptions of science, which have not been realized. When students cannot learn as expected, their learning difficulties can be overcome by presenting the substance more directly and clearly (Shulman 1986). What the student learned must be relatively easy to accept, so the difficulty should not be in the mind of the student (Mestre and Touger 1989). Learning science should emphasize how to start a lesson based on student experience. Everything that the student has experienced or believed can be a source of scientific knowledge.

In the context of education, the most efficient way of strengthening indigenous knowledge is to balance the social fabric of society integrating that knowledge into school science (Regmi and Fleming 2012; Zinyeka 2013; Zinyeka, Onwu, and Braun 2016; Meyer and Crawford 2011; Aikenhead 2006). Indigenous knowledge contributes to other knowledge based on scientific naturalism (McKinley and Stewart 2012). However, it is a challenge for educators and researchers to develop lessons and curricula to stay in synergy with the demands of the times without having to abandon local values as distinctive. Teachers need to recognize that the indigenous knowledge and classroom scientific knowledge can coexist and be resources for each other (Regmi and Fleming 2012). Students demand to cultivate cultural values within a contextual knowledge based on the wisdom of their cultural surrounding. Students should gain knowledge from what they have seen, felt, and executed by observing, measuring, collecting, and classifying (Howe 2002). The contextual learning is what can be used as an approach to teach cultural values to reach the meaningful and the authentic learning.

Theoretical Framework

Science in Secondary School

Science is a way of thinking about the phenomena that occur in nature by using methods and ways of scientific thinking (Howe 2002). Chiappetta and Koballa (2009) postulate that science is a systematic attempt to create, construct, and organize knowledge of natural phenomena that originate from human's curiosity, which is then followed up by an inquiry to seek the most straightforward and most consistent explanations and predictions of natural phenomena. Natural science is about understanding, organizing, and collecting knowledge that predicts and is applied in society. It is a science based on observation and experimentation, prudence in collecting data, substantial evidence, and making individual decisions (Howe 2002). Learning science should be viewed as (1) a process: an inquiry procedure that includes natural phenomena; (2) products: facts, concepts, principles, laws, and theories that interpret and predict natural phenomena; (3) attitude: curiosity about nature that is investigated through persistent, honest, and openness to new possibilities (Lawson 1995). These aspects should be a concern in choosing a strategy or teaching method in science learning so that the learning process can be effective and efficient.

Science is the realm of knowledge that must be factual, conceptual, procedural, and metacognitive (Krathwohl 2002; Suwarto 2010). Factual knowledge is the knowledge of the

essential elements that students must recognize by the discipline. The core elements are delivered following academic science, are easy to understand, and are systematically arranged. Conceptual knowledge connects, associates, and combines different essential elements in a systematic and shared common structure. The theoretical system is an integrated mental formation of experience (Lawson 1995). This knowledge can be a scheme, mental model, or explicit and implicit theories in different cognitive psychology. Procedural knowledge emphasizes how to do something; methods of discovery; and criteria for the use of skills, algorithms, techniques, and methods collectively. Furthermore, an understanding of metacognition is caring, awareness, and responsibility for their learning and thinking. According to the Indonesia science syllabus, natural science learning activities are based on scientific methods that include observing, formulating problems, formulating hypotheses, designing experiments, collecting data, analyzing, summarizing and giving recommendations, and communicating results (Kemendikbud 2017).

The orientation of science curriculum in Indonesia will be interpreted into educational practices with the specific purpose of enabling students to have the fundamental skills for the lives of today and in the future. Indigenizing curriculum refers to the embedding of indigenous knowledge in the curriculum, by incorporating an "indigenous voice" as indigenous people insert their narratives, critique, research, and knowledge (Acton et al. 2017). In the science curriculum, the scientific competencies that must be achieved by secondary students in Indonesia includes (1) fostering religious attitudes and high social ethics in the life of society, the nation, and the state; (2) mastering of knowledge; (3) obtaining the skills or ability to apply knowledge to conduct scientific inquiry, problem-solving, and creative work related to daily life.

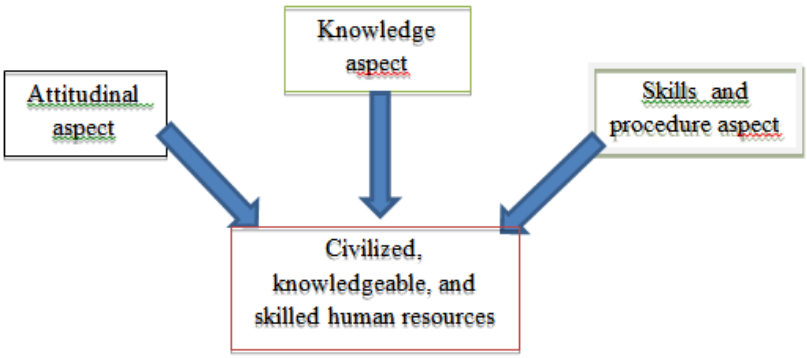

Figure 1: Scientific Competencies for Secondary School
Source: Kementerian Pendidikan dan Kebudayaan 2017

Indigenous Science

Indigenous science is the knowledge that is related to the science contained in the community and has been passed down from generation to generation and integrated into the culture (Snively and Corsiglia 2001). Ogawa (1995, 590) describes indigenous science as "cultural-dependent collective intellectual perceiving of reality" in which collective means held in a sufficiently similar form by people to allow effective communication independent of any particular mind. In indigenous science, education does not only occur within the scope of formal schooling. Indigenous education is the path and the process by which individuals receive knowledge and meaningful learning from their native heritage. Indigenous education has prehistoric roots that date back to the time when groups of indigenous people first came together intentionally (Jacob, Cheng, and Porter 2015). Indigenous education involves knowledge that is generated, obtained and adapted to provide the historical context and is then conveyed through educative means to

other in the form of informal learning. The "meaningful learning" in an indigenous context represents a "wisdom tradition" of understanding by including the emotional, physical, intellectual, and spiritual dimensions of understanding. Indigenous science includes knowledge generated or produced, covered, and adapted to conform to the historical context and needs of indigenous people (Jacob, Cheng, and Porter 2015).

The pattern of indigenous science is closer to the cumulative reflection of a place or region based on natural phenomena that encompass human and non-human through integration that people are part of nature, such as the scientific knowledge embedded in the local culture (Alessa et al. 2016). Ogawa (1995) posits that two levels of science must be distinguished: personal science and sociocultural science. Ogawa was state that the science contained in culture is known as indigenous science. All people involved in indigenous science from low to high levels in a community group are experts. Indigenous science is expressed by ethnosciences, which are the study of knowledge systems developed through the granting of culture to classifying objects, activities, and events.

Indigenous science represents how the local world works through a scientific process that involves objective observation of natural phenomena. Additionally, it classifies and solves problems that are encompassed in all aspects of indigenous culture (Snively and Corsiglia 2000). Characteristics of indigenous science include local development and application, such as testing hypotheses, using systematic experiments, and problem-solving related to the sociocultural dynamics. The body of knowledge, equivalent to the peer-reviewed literature, consists of a continuous living awareness of the conditions (Alessa et al. 2016). Indigenous science is both factual knowledge and the existing practice of indigenous people for survival and adaptation in different environments through natural and sociocultural interactions with the environment (Regmi and Fleming 2012). Although the factual and practical knowledge is different, they both affect one another. Knowledge is not static, but develops and changes and is influenced by internal and external circumstances through interaction with other knowledge in the system. The indigenous knowledge system is an integrated system of knowledge in the form of human competencies and beliefs.

This study discusses the indigenous paradigm of science research. The research question in this study was: How can we elaborate indigenous knowledge and natural science in the science curriculum? This study focused on an example from Javanese culture. The context of this study was secondary school. This study aimed to examine the possibilities of indigenous knowledge to be integrated into the science curriculum.

Method

We conducted a qualitative study in this paper. Data were collected through Javanese original knowledge documents from the Sonobudoyo Museum, Radya Pustaka Museum, and the natural science syllabus in secondary school. These sources provide valuable information to help researchers understand central phenomena in a qualitative study, particularly for document analysis (Creswell 2012). The authors were engaged in work with the Javanese community as part of the indigenous methodology. The main aims of this indigenous methodology were to ensure that research on native issues can be carried out in a more respectful, ethical way from the perspective of Javanese native people.

The data were analyzed using Microsoft Excel to produce the correct information. During data analysis, the researcher identified the signed document that provides useful information about indigenous knowledge in the Javanese native communities that have particular relevance to the research being studied. The significant information then organized and interpreted by creating a comparison table. The researcher also explored the data and developed codes to obtain a general sense of the data. The analysis technique at this stage was implemented using visual content analysis (Johnson and Christensen 2013; Creswell 2012).

Findings

Science education research provides evidence for the cultures of science, school, and students in the diverse field. The "culture of science" means both Western and Indigenous sciences. One of the most likely ways to continue preserving indigenous science and filling the gap that occurs between knowledge of both is verifying differences and similarities between Javanese native science and science classroom as shown in Table 1.

Table 1: Differences and Similarities
between the Science Classroom and Javanese Native Science

Scientific Competencies	*Differences*		*Similarities*
	Science Classroom	*Javanese Native Science*	
Skill	▪ Observation and study of natural phenomena were done through measurement using instruments. ▪ Data collection or evidence was conducted quantitatively, qualitatively, and through mixed methods. ▪ The results were communicated in writing reports, poster/presentations ▪ Predictions were based on empirical evidence. ▪ General recognizing	▪ Observation and study of natural phenomena was done by reading the signs of nature and experience ▪ Collection of natural evidence and signs is conducted qualitatively ▪ The results were communicated orally (*pitutur*), story (*dongeng*) ▪ Predictions were based on natural signs and beliefs (*titen*). ▪ Local recognizing	▪ Examine natural phenomena ▪ Observing ▪ Collecting data/evidence ▪ Communicating ▪ Predicting and verifying ▪ Critical thinking ▪ Recognizing patterns
Attitudinal	▪ Uncertain ▪ Emphasizes empirical strength and dominance over nature ▪ Open-minded	▪ Believing that nature has a role in life and concern for human beings, like a mother to her child ▪ Be kind to everything (*saen*), respect (*tepo seliro*), courteous attitude (*unggah ungguh*) ▪ Closed-mindedness, difficult to accept the renewal of information	▪ Honest ▪ Caring ▪ Responsible ▪ Curiosity ▪ Respect
Knowledge	▪ Separate by discipline ▪ Knowledge is presented mathematically and textually	▪ Unity and integration with other knowledge and applied in everyday life as a way of life and belief ▪ Knowledge is presented orally.	▪ Technology ▪ Art ▪ Culture ▪ Natural science ▪ Mathematics

The organizing principles of Javanese native science involved the physical and spiritual worlds, where observations occurred with the premise that the observer was linked to and held for what was being observed. Those observations were mainly qualitative, lead to harmonizing

with nature for the purposes of survival by maintaining a balance, and emphasize holistic and spiritual power. Because the science classroom stands on the assumption that the observer was not related to the observed phenomenon, quantitative observations were most often expected. These principles emphasized the exercising strength and dominion over nature and the power of reductionism and being part of the whole. Indigenous science and Western science adjust to a pluralist interpretation of science: a rational, empirically based process of understanding natural phenomena that yields and rational perceiving of reality. Both systems of knowledge share rational methods: observing, looking for a pattern, assuming, predicting, confirming, communicating, etc. Practitioners exercise rational and intellectual thought through practical experimentation and measurement to serve empirical data and rational ways of knowing in creative and natural ways. Javanese native science and science classroom shared values and attitudes including justice, honesty, curiosity, open-mindedness, and diligence. Sadler (2009) states that the social environment should take a serious role in teaching and learning activities. Learners can seek synergies between indigenous knowledge and scientific knowledge in schools. Each fundamental mismatch between the knowledge in the homegrown and the classroom version requires being recognized and supported by teachers and students (Rowe and Holland 1990). For example, Javanese students recognize the knowledge of the seasons (*pranata mangsa*) in Javanese society as a farmer tradition, whereas *pranata mangsa* have the concept of science such as the diversity of living things, etc.

There were three aspects of perceiving, including skill, attitude, and knowledge domains in indigenous scientific competencies (see Figure 1). These aspects are standard-based competences. They explain what should be learned about science standards and gives a sufficient number of well-sequenced possibilities that guide learners to a wider knowledge of the aspect (Stephens 2000).

Skill Domain

Indigenous knowledge is deeply rooted in a relationship with the environment as well as in cohesion (Magni 2017). Indigenous knowledge gave learners the opportunity to think about the advocates of life and preserve it from over-exploitation of nature. Learning indigenous knowledge enabled the student to maintain a sustainable use and management of natural resources to protect the environment and to enhance their resilience (Magni 2017). This knowledge taught students to be responsible and critical of social problems. Indigenous knowledge can help foster appropriate resource management and prepare students to be responsible and able to communicate and demonstrate a caring attitude about the human rights of indigenous people, traditional culture, and human intellectual property. The students' ability to observe, adapt, and mitigate has helped indigenous people to face a different and complex circumstance that impacts on their way of existence and regions. Indigenous knowledge can help to establish an attitude of independence because it is directly related to society and more contextual to Javanese lives (Endraswara 2006).

Attitudinal Domain

In the attitude aspect, indigenous knowledge satisfies the demands of behavioral achievement. This is due to the fundamental knowledge of the context of Javanese mythology, which contains the values of the wisdom. Javanese traditional ideas provide much moral and ethical education about nature and human behavior (*gugon tuhon*). They include many ideas that serve as a reference with which to explore philosophy and mythology of Java (Endraswara 2006). The dominant characteristic of a Javanese person's actions tended to be smooth (*saen*), using *unggah-ungguh* (manner) and *tepo seliro* (mutual respect). For example, in *Pranata Mangsa*, Javanese tried to unite the universe with themselves through a belief that Fertile seedlings are cultivated

(*subur tansah tinandur, gemah ripah loh jinawi*) (Badrudin 2014). This knowledge teaches Javanese students to appreciate nature with a good sense and mind to fulfill their needs.

Knowledge Domain

Indigenous knowledge contains knowledge that lasts from generation to generation. Indigenous knowledge can be history, myth, legend, culture, art, music, speech, language writing, scientific discoveries, social networking, and life skills (Jacob, Cheng, and Porter 2015; Ahimsa 2012). Cajete (2000) explained that indigenous knowledge is integrated within the spiritual orientation. Humans have an important role in safeguarding and perpetuating processes in the world, and their behavior manifests in a ritual or belief. Javanese people's thinking is cosmic-mystical, then known as cosmic-biological thinking, meaning that the Javanese describe the circulation of nature that is projected onto the view of thinking that humans are concrete (Kartodirdjo 1982). Javanese mythology is often embodied in the names of figures, places, and actions, using *lambang* (symbols), art forms, stories, *tembang* (song), *candra* (methaphors), proverbs, geometric shapes, special objects, and structures to share the knowledge. In this case, it cannot be seen that science education and learning occur only within the scope of formal schooling, which is limited to the classroom but encompasses the whole of nature and all its phenomena and events that are ongoing.

Factually, indigenous knowledge is highly contextual and directly related to the life of Javanese society, such as *Pawukon* and *Pranata mangsa*. *Pawukon* is the experience of the journey of human life according to its nature that resembles the knowledge of horoscopes in astrology (Kartodirdjo 1982). *Pranata mangsa* is a season calendar that is still used by Java farmers and fishers in work. This knowledge is concerned with the science in society, simple technology, and art and culture and is still used to date (Badrudin 2014). Conceptually, indigenous knowledge can be documented. Indigenous knowledge consists of structured principles and generalization from practices derived from the science of "*titen*" that has been constructed by the Java community. This knowledge has been proven and is still developing in Javanese farmers. The *titen* is a scientific attitude of observing, memorizing, analyzing, and testing hypotheses based on natural phenomena that continue and repeat periodically (Retnowati et al. 2014). Indigenous science exists in the dynamic extent of discussion, where procedures can be points of consideration and findings can be stimulated by different pieces of information. Metacognitive, indigenous knowledge trains the students to know their advantages and disadvantages. Integrating indigenous knowledge makes it possible to use general strategies of thinking and problem-solving. Indigenous knowledge such as *Pranata mangsa* develops strategies and thinking that reflect what, how, and when the approach is used appropriately (Aikenhead and Ogawa 2007).

The three competencies above are then integrated into the syllabus that becomes the reference for the teacher in the learning process. In the natural science curriculum, teachers can enhance and adapt to existing resources, characteristics, and uniqueness of regions or schools according to student potential. For instance, in basic competencies of the science of "analyzing climate change and its impact on ecosystems" knowledge of climate change and the science of inter-communal ordering can be linked and made of additional material. Pranata mangsa is the understanding of the season that is still widely used by Javanese people in farming and agriculture. Pranata mangsa teaches people to behave in a scientific way of reading the sign of nature known as the science of "titen" The "titen" science educates the Javanese people like a scientist, such as observing, recording, analyzing and testing hypotheses based on their knowledge (Retnowati et al. 2014). The knowledge of Pranata mangsa is scientific, as there are climate and seasonal weather based on solar circulars, ecosystems changes, and living adaptations. Climate change can be attributed to current seasonal changes including changes in planting crops such as rice or loss of some plant species as markers of specific seasons such as tubers. Knowledge of Pranata mangsa can be taught and related to the environment, natural

resources, and energy around it in a global context to preserve and utilize its environment as a source of learning.

Organizing and achieving a culturally conscious science curriculum is a collaborative process. It requires an interchange of knowledge and viewpoint in which the classroom teacher begins to learn that native knowledge is considered. It then covers the relation of these native experts and their knowledge of school practices. The integration of indigenous knowledge in natural science learning can be initiated by the teacher. The coach needs to understand experiences of native students and varieties of teaching strategies to build upon the diverse knowledge, cultures, communication styles, skills, attitudes, and learning styles of students. A deep understanding of indigenous science is needed to elaborate indigenous science and natural science curricula in appropriate ways.

The learning community has become an extensive model for teachers and the most important issue within the educational establishment. The term "learning community" refers to the concept of teacher learning in a community setting in which practitioners continually reconsider their existing beliefs and practices, gaining new professional knowledge and skills and constructing a reform agenda that enhances student learning and professional practice (Van Es 2012). There are seven steps that can be used for a teacher to integrate indigenous science in the natural science learning. The first step is identifying material or concepts that are considered to be related to indigenous knowledge. The teacher starts from a consideration of indigenous knowledge. This identification can be made in groups through a professional development idea, which consists of several science teachers in one school or several schools. Secondly, based on the results of identification, the teacher selects one material following the conditions of each school and students as the subject of learners. In short, integrating indigenous science into the class can be implemented by teachers through a forum or group of teachers involving identification of indigenous understanding in the community, then adjusting to the competencies of the achievements and characteristics of each school. The steps teachers can take in elaborating on indigenous science in schooling are as follows:

Table 2: Steps of Elaborating Indigenous Knowledge in the Classroom

Step	*Description*
Step 1	Teacher forms a learning community to collect and identify the indigenous science
Step 2	Teacher selects the appropriate concepts, accomplished by collaboration with the indigenous people who hold the knowledge sought
Step 3	Analysis and connecting specific indigenous science and Western science
Step 4	Implementing the lesson based on appropriate strategies and judgment
Step 5	The group of teachers reflecting the consequence of each knowledge perspective and considering the value
Step 6	The community evaluates the lesson process and focuses on student learning
Step 7	Expanding the possibilities to the resolution of research lesson and future discovery

In the implementation of indigenous knowledge in the science classroom, the teacher concatenates strategies that are culturally convenient. The teacher fixes on pupil understanding, knowledge practically through inquiry processes to guide the student in the expanded study. Here is an example of how to integrate indigenous science through project-based learning into a seventh-grade natural science lesson:

On the climate change issue, students were formed into several small groups. Each group then was given a project to ask the farmers directly: How many types of seasons are known? What is the impact of climate change on farmers? Where is the knowledge of farming known to the indigenous farmer? How did the farmer learn to observe the different seasons? After the

students have conducted field studies, they then analyzed them by linking seasonal changes and seasonal knowledge that farmers have with ongoing global warming. The students were also asked to explain how both modern Western science and indigenous science use observation and inquiry to obtain knowledge. In this case, students were able to integrate original understanding in the community with knowledge of existing science in school. Students results were presented in a class discussion group.

Discussion

A culturally conscious scientific curriculum is one that seeks to build social and cultural knowledge as part of the student's educational experience (Stephens 2000). It should begin with conferring science in the whole of the science knowledge system and confirming that science rules can be converged in the learning process (Retnowati et al. 2014; Stephens 2000). Additionally, it can be achieved by finding the knowledge, correlating that knowledge with school science concepts and skills, and regulating instruction methods to carry out this integration. The elaboration of native knowledge in the school science curricula can link the gap of science education paths that students receive in schools with knowledge of science residing in society. Curricula in Indonesia attempt to acknowledge the importance of considering the relationship between the Javanese perspective and science curricula. In the Javanese community, teachers, knowledge-holders, and researchers have considered various ways of integrating indigenous science and natural science curricula from a culturally responsive perspective. Learning from land place emphasizes a relationship with the land, something uniquely respected in native communities. For example, this occurs in *Pranata mangsa*, a culturally based physical science curriculum for Javanese students. These examples of how culturally conscious education can be established in precise cultural contexts offer insights when considering the integration of indigenous science and school science. The curriculum is informed by Western and indigenous science and combines science content knowledge, pedagogical knowledge, and contextual knowledge (Stephens 2000).

Integrating indigenous science is necessary to counteract the alienation experienced by students. Moreover, the cultural values and knowledge in the community remain preserved. The student can also be involved in the encounter and document native knowledge. They can collect existing information from their parents, indigenous elders, etc. This will help track down indigenous knowledge and can provide groundwork for further school investigation. Through learning indigenous knowledge, students can realize that science is always evolving but that basic knowledge cannot be abandoned. The process of knowledge creation is influenced by the social context, which includes both cultural and intellectual norms by power relationships among those who create and those who makes use of the knowledge (Sterenberg 2013). The integration of indigenous knowledge in science curricula has strong implications for pupils for at least three ideas. The first is that pupils might conceivably enhance all the general primary abilities and intelligence while achieving from and developing an indigenous science base knowledge. The next is that acquisition of the familiar area, regardless of the method, is a meaningful accomplishment. The last is that research of the topic through various learning methods can improve perspective and build a deep understanding (Baquete, Grayson, and Mutimucuio 2016; Stephens 2000).

The current sustainable development program embraces many issues that are directly concerned with indigenous peoples' lives (Magni 2017). Indigenous science is closely related to cultural and global sustainability. In this sense, cultural sustainability aligns with the wider meaning of sustainable development to fit present needs without discrediting the necessities of the future generation, including furthering engagement with and preservation of cultural heritage for future generation (Acton et al. 2017). Its insights are invaluable in applying spiritual relationships with nature. The integration of both fields of knowledge is a way for local knowledge to gain better space and access into school science (Glasson et al. 2010; Baquete,

Grayson, and Mutimucuio 2016), and it also provides a way of encouraging young people to appreciate their cultural and natural value (Hewson and Ogunniyi 2011). Combining both knowledges can help the learners conceptualize experience, develop, and enhance their self-identities and confidence (Shizha 2014). Among the advantage of the elaboration of indigenous and scientific knowledge, Krupnik and Ray (2007, 23) highlight the rise of "understanding of local to regional biological and ecological condition and change into more powerful decision-making on the role of native people."

Indigenous science and Western scientific knowledge frameworks should not be pitted against each other as traditional versus modern. Both kinds of knowledge must be a balanced and remain in harmony with the conditions in the community. The harmony cannot occur unless they both are respected as independent coexisting ways of knowing. Preferably, these two knowledge structures should be viewed as related and contributing to each other's improvement and development (Stephens 2000). Learning about indigenous knowledge sustainability is essential for students' futures. Students can think about the advocates of life and protect the nature from extreme exploitation. School is the place where pupils can bring their cultural experiences that become their habits and ways of knowing (Meyer and Crawford 2011). The learner should be taught appropriate skills and knowledge to undertake responsibilities as members of the community. They can evaluate information based on their indigenous knowledge and school science (Chandra 2014). Indigenous knowledge can help foster appropriate resource management and prepare students to be responsible for nature and care about the human rights of indigenous people, traditional culture, and human intellectual property. In secondary school, pupils can take more complex science concepts and skills and improve their social understanding. They can apply it in actual life, and be more able to investigate and examine the knowledge. In other words, students can receive actual and meaningful learning.

Some of the challenges and obstacles that will be allowed in the integration of indigenous knowledge in the science classroom are as follows. The first is the fact that teachers have been schooled in Western science and hence are more familiar with that modern worldview than that of indigenous knowledge. The second is that the top-down approach in the curriculum was implemented out of the curriculum planning and execution. The third is the lack of clarity on how a science indigenous knowledge curriculum could be achieved. The fourth challenge is that the teacher needs good skills and competency, such as taking extra time, teaching skills, and strategy. In addition, the teacher must have support from stakeholders.

Limitations

The weaknesses of this research are the literature; there are limitations to this information because this knowledge is received from elders. Furthermore, Javanese indigenous science contains traditional beliefs, which are considered inadmissible, unlike science. This makes it harder to assess the true value of indigenous science related to Western science, and it takes time and commitment.

Conclusion

This paper argues that integrating indigenous science in the science classroom is possible for supporting meaningful learning. Integration of indigenous knowledge in school is necessary to fill the gaps between knowledge from society (indigenous) and school. Integrating both kinds of knowledge can be implemented by teachers through a teacher learning community that involves identifying native understanding, then adjusting to the competencies of the achievements and characteristics of each school. Furthermore, indigenous science can help students to think about the advocates of life and protect nature and culture from over-exploitation. This study is expected as a reference for other researchers and teachers to develop indigenous research for cultural sustainability and sustainable development.

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