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Prospect of integrating indigenous knowledge in the teacher learning community

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ABSTRACT

Integrating indigenous knowledge in the science classroom is one approach of maximizing the sociocultural relevance of education. The purpose of this study is to describe the possibility of integrating indigenous knowledge and school sciences through a Teacher Learning Community (TLC) at the secondary school. Data were collected through teaching and learning documents, interviews, and observations of a secondary teacher working group of natural science subjects in the Special Region of Yogyakarta Province in Indonesia. This research finding proposes eight steps to integrate indigenous science within the TLC: collecting and identifying what constitutes indigenous science, selecting natives' science issues of interest, analyzing and connecting the topics to school science, implementing the lessons, reflecting on the consequences of each knowledge, evaluating the lesson process, expanding possibilities for further discovery, and sharing outcomes. The eight steps are sequential and repetitive in the cycle. The indigenous integration knowledge through the TLC is expected to link indigenous knowledge and school science.

Introduction

Much indigenous knowledge is increasingly marginalized and is at risk of being lost. Indigenous science is deemed strange and contrary to scientific principles and is assumed to be irrelevant, unscientific, and outdated (Abah, Mashebe, & Denuga, 2015; Baquete, Grayson, & Mutimucuo, 2016; Cronje, de Beer, & Ankiewicz, 2015). Some people believe that indigenous knowledge should not be shared and studied as it will hamper the education of nonindigenous people (Aikenhead & Ogawa, 2007). Some teachers also recognize that indigenous science is conventional. Education is undertaken uniformly without reconsidering students' uniqueness, background, and potential. Student diversity is thus ignored. The school's instruction is frequently viewed as a legitimate way of explaining the phenomenon (Ogunniyi, 2006, 2007). This leads to social imbalances where cultural values and local wisdom have begun to be abandoned.

Recently, science researchers and educators have been interested in indigenous research. Such attention is fulfilled by the urge for social justice and the achievement of school science (Aikenhead & Ogawa, 2007). Sadler (2009) posited that the social environment should take a severe role in teaching and learning activities. Learners can seek synergy between indigenous knowledge and scientific knowledge in schools. People must learn, observe, remember, and develop social, moral, and emotional responsibility for their environment (Retnowati, Anantasari, Marfai, & Dittmann, 2014). Students need to cultivate cultural values through contextual knowledge based on the experience of the surrounding culture. In other words, the pupils can preserve their cultural effectiveness, social identities can be recognized, and attitude toward science might be changed (De Beer & Whitlock, 2009).

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An innovative approach is required within the context of societies and cultural education, as well as the experience of children's lives, including their daily activities, social and geographic environment, and cultures (Hewson & Ogunniyi, 2011). Indigenous science is unique. The uniqueness is established in the society and is obtained through the accumulation of experiences, simple experiments, and ordinary understanding of the local environment (Warren & Rajasekaran, 1993). The integration of knowledge of both is a way for the local culture to gain a better space and access in school science and a way for the young generation to appreciate their cultural values (Baquete et al., 2016; Glasson, Mhango, Phiri, & Lanier, 2010; Hewson & Ogunniyi, 2011). Shizha (2014) argued that indigenous knowledge is a tool that can help students conceptualize experiences and develop and enhance their self-identities and confidence. The improvement of teachers' expertise needs to be sustained, which will then provide them with opportunities to collaborate in the development of an atmosphere that supports their capacity building and pedagogical growth (Gutierrez, 2016).

The Special Region of Yogyakarta is one of the provinces in Indonesia that preserves local values and Javanese cultural wisdom. The Javanese people are the largest ethnic group in Indonesia and are known as one of the tribes that have strong traditions. Javanese culture is rich in indigenous values and knowledge and has its own methods, structures, paradigms, and analysis to interpret and understand various symbolic meanings. Javanese indigenous knowledge is full of metaphysics and language symbols. They have a set of knowledge that is the basis of thought and history of epistemology and culture and use symbols as a means to convey messages that have been used since prehistoric times. The purpose of this study is to describe the possibility of integrating indigenous knowledge and school sciences through a Teacher Learning Community (TLC) at the secondary school. The research question was: How can indigenous knowledge and school science be integrated through the TLC? This study focuses on the TLC model as the possibility to combine the school's science at the secondary level and indigenous knowledge.

Theoretical framework

In this research, the academic literature was used as a reference to support and provide an explanation on the research findings and as a guide for researchers to answer the research questions.

Nature of the indigenous knowledge framework

Indigenous knowledge is an integrated system of information in the form of human knowledge, beliefs, and behavior (Warren & Rajasekaran, 1993). This involves experiential knowledge and addresses diverse and complex aspects of native peoples and their livelihoods, taking into account their cosmos, spirituality, ontological realities, land, socio-cultural and historical contexts, myths, legends, culture, art, music, word games, speech, writing language, scientific discoveries, life skills, and other education-centered activities (Jacob, Cheng, & Porter, 2015; Mkabela, 2005; Ngara, 2007; Onwu & Mosimege, 2013; Shizha, 2013). Indigenous knowledge concerns the science of society and is passed down from generation to generation and integrated with culture and nature (Snively, Corsiglia, & Cobern, 2000). Such a pattern is more closely related to the cumulative reflection of a place or region based on natural phenomena that integrate humans and nonhumans, as human beings are part of nature (Alessa et al., 2016).

Indigenous science represents how the local world works through a particular culture and scientific process that involves rationally observing and classifying natural events and solving problems threaded in all aspects of indigenous culture (Snively et al., 2000). The characteristics of indigenous science include the development and application of local knowledge, such as testing hypotheses, using systematic experiments, and solving problems related to the ability to compare actual socio-cultural dynamics (Aikenhead, 2006). In other words, fundamental knowledge is not just a theory but also a technology and practice or action used for survival in the past until now (Ogunniyi & Ogawa, 2008). Moreover, processes of science that include thoughtful observation of

natural phenomena, classification, and problem solving are woven into all aspects of indigenous cultures. All persons involved in indigenous science are experts, from low to high levels within a community. In this context, education not only occurs within the scope of formal schooling, which is limited to the classroom; it must also happen in all environments in which students are located.

The philosophical framework of the nature of indigenous knowledge involves aspects as described by Wilson (2001), such as ontology, epistemology, methodology, and axiology.

Ontology or a belief in the nature of reality. Your way of being, what you believe is real in the world. Second is epistemology, which is how you think about that reality. Next, when we talk about research methodology, we are talking about how you are going to use your way of thinking (your epistemology) to gain more knowledge about your reality. Finally, a paradigm includes axiology, which is a set of morals or a set of ethics. (p. 175)

Although one can distinguish the four components, they are not readily separable. The framework was developed using the nature of the science framework by Chiappetta and Koballa (2009). The principles of indigenous knowledge, proposed in the nature of the indigenous knowledge framework, correspond to the general appearance and are not viewed as fixed. They are considered necessary by the author when integrating indigenous knowledge into the TLC. The views on the nature of the indigenous knowledge framework were inferred from numerous authors, and some lines between both knowledge are shown in Table 1.

Studying indigenous knowledge is valuable for educators. Learning and curriculum in schools must continue to work together without having to abandon local values. Students need to cultivate cultural values through contextual learning based on the wisdom of the local culture. Engaging and contextual learning can be used as an approach to instill cultural values so that the meaning and sense of culture can be conserved. From an educational perspective, the incorporation of indigenous knowledge in the school curriculum has a positive effect on students' interest in science, which helps them appreciate the value and maintain the knowledge of the indigenous community (Kasanda et al., 2005; Ng'asike, 2011).

TLC

A TLC consists of several teachers in small groups across grade levels. Group members take responsibility, coordinate with others, and share expertise to build knowledge and advocate teaching and learning and to promote unity with cultural values. The learning community has become an extensive model for teachers and the most crucial issue within the educational establishment. TLC refers to the concept of teachers' perspective in which practitioners continually reconsider their existing beliefs and practices, gain new professional knowledge and skills, and construct a reform agenda that enhances student learning and professional practice (Van Es, 2012). TLCs are established by teachers from the same or different grade levels in a school, who regularly meet to reflect their own and one another's practices to develop, emulate, sustain, and support learning and improvement (Hargreaves, 2013; Horn & Little, 2010). These communities provide an environment for long-term collaboration with colleagues, focusing on teaching practice-related issues (Cochran-Smith & Lytle, 1999).

Table 1. The linkage between Nature of Science (NoS) and Nature of Indigenous Knowledge (NoIK).

Aspect	Some line between NoS and NoIK
A way of knowing	Nature is real, observe, tested, and predicted.
A way of thinking	Understanding of the nature based on trust, curiosity, imagination, cause-effect, and objective
A way of investigation	Experience is fundamental for building a profound observation, formulating hypothesis/predicting, and communicating with the aim to solve a human problem.
A body of knowledge	Knowledge is the result of human experience in the form of fact, skills, and principle

According to Hargreaves and Fullan (2012), three elements make up a teacher's professional capital: human capital, social capital, and decisional capital. Like human capital, teachers need to develop themselves as skilled individuals with expertise. For social capital, teachers must interact and work collaboratively with their social community. This process of collaboration is characterized by authentic decision-making within the group, thus providing opportunities for the development of decisional capital (Cajkler & Wood, 2016). For decisional capital, teachers build their professionalism through opportunities to decide on significant changes in their practice. Participating in a learning community allows teachers to develop their identity as a professional capital, which includes discussing requirements for students and learning from other teachers (Lieberman, 2009).

Learning community activities emphasize collaboration, engagement, community, and collective sense making, among others, from the beginning learning and sustainability based on the principles of collegiality and mutual learning. If teachers participate in the learning community, then they can develop their pedagogical and content knowledge through regular observations and with one another.

Methodology

Setting and Participants

Indonesia is a pluralistic nation consisting of various cultural groups of people and tribes. These tribes live in the areas spread over thousands of islands and provinces in Indonesia such as the Special Region of Yogyakarta. The setting was three secondary schools in the Bantul District, Yogyakarta Special Region. The sample was selected using a purposive sampling area method. The number of participants was nine teachers of natural science subjects, comprised by six females and three males in their 40s. They taught in different classes, grades, and schools. Their background was Javanese culture. Four teachers are graduates of physics education, and five teachers are graduates of biology education. The teachers have teaching experience of more than 10 years and have been certified by the Ministry of Education and Culture of the Republic of Indonesia.

Data collection

Data were gathered through teaching and learning documents (lesson plan and natural science syllabi), interviews, and observations, including teacher planning, lesson implementation, and evaluation. For the interview section, each participant was interviewed twice using a semi-structured interview format to achieve in-depth information about the teacher's views. The following questions were asked during the interview: What do you think about indigenous knowledge? Is it possible to teach indigenous knowledge at the school? What constraints are experienced during the teaching and learning process? Is the instruction arranged in conformity with the needs of students? The semi-structured interviews offer thoughtful questions to the interviewees but were carefully designed to obtain their ideas and opinions, as opposed to directing the respondents toward preconceived choices.

Observations were made on the activities of the learning process conducted by teachers as a follow-up of the interviews. At the time of observations, the researcher recorded teacher activities that included the preparation of learning materials, implementation of educational approaches, student activities during the learning process, teacher behavior toward the students during the learning process, teaching methods and media, and assessment of learning.

The teaching and learning documents, interview data, and observation data provided valuable information to help the researchers understand the central phenomena in a qualitative study (Creswell, 2012). The authors were engaged in work with the Javanese community as part of the indigenous methodology. The main aim of this indigenous methodology was to ensure that research on natives' issues can be carried out in a more respectful, ethical way from the perspective of Javanese native people.



Data analysis

The data were organized into a file folder because of the significant amount of information gathered during the study. Qualitative data were analyzed through six stages: data organization, data exploration and sorting, constructing theme encoding, descriptive analysis, sustainability analysis, and invention interpretation and validation. First, the initial data were collected into a folder or matrix in accordance with the type of data. Data in the form of text, such as documents and observational records, were separately managed from the interview data. Data interviews transcribed into data text. The transcripts were organized and grouped into issues and labels of inference with convincing ideas. Furthermore, all data were classified and grouped to facilitate the restructuring of data. Second, the data underwent initial analysis. This step was followed by exploration and sorting based on appropriately shown ideas. The sorted data were then collected in accordance with similar ideas and given a code. Furthermore, the label data were created to construct themes or categories. The themes that followed the research framework were descriptively analyzed to answer the research questions. The results of the descriptive analysis were re-analyzed to obtain valuable study findings. This sustainability analysis is also a reflection of the study that has been carried out while covering the limitations of research. Lastly, the findings were validated. An examination of the interpretation of the findings was arranged through triangulation. Based on the triangulation process, the researcher found five categories: identifying, analyzing, implementing, evaluating the student learning, and revising the lesson plan. The valid categories were then analyzed and referenced by the results of the research on the TLC to construct a TLC model.

Findings

Findings in the five categories

The findings obtained based on the triangulation of learning documents, interviews, and observations are shown in the following table [Table 2](#).

Identifying

The results of the study show that before conducting learning, the teachers identified the topics to be explained. One science teacher said, “We identified the topics that we’re going to teach, re-studied the syllabus, and connected topics with local knowledge that endured in the community, such as

Table 2. Valid data categories as initial findings.

Themes	Visible activities
(1) Identifying	(a) Identifying the science topic (b) Considering student ability
(2) Analyzing	(a) Planning and key activities (b) Discussing pedagogic and learning challenges (c) Organizing all information into a lesson plan
(3) Implementing	(a) Implementing the lesson in accordance with the lesson design (b) Considering student activities
(4) Evaluating student learning	(a) Discussing student activities (b) Evaluating the learning process (c) Considering students’ obstacles during the science lesson
(5) Revising the lesson plan	(a) Evaluating the previous lesson (b) Revising the lesson plan



climate change and the knowledge of the seasons (*Pranatamangsa*)” (interview, March 23, 2018). 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.

This identification was made by considering the ability of students and teachers, availability of resources, and learning media. Another teacher responded, “Identification needs to be arranged together with the colleagues so that the material taught is right on the learning objective and more contextual” (interview, March 23, 2018). The interviews indicated that teachers considered their ability when they wanted to teach indigenous knowledge because of their little understanding. The participants agreed that indigenous Javanese knowledge was scientific and vital for the learners, but information that was both oral and unwritten caused difficulties in identifying the scientific concepts. Hence, a unique approach, such as forming an indigenous learning community, was needed.

Analyzing

The teachers analyzed the topic more in depth and put it in the lesson plan. They discussed with other teachers in planning lessons. One teacher explained, “In conducting learning analysis and planning, we often asked for opinions from other colleagues. We discussed together to promote effective learning” (interview, April 18, 2018). They prepared and determined the topics and lessons, activities to be carried out by the students during the learning process, challenges that will be faced by students, and appropriate methods and strategies for learning, among others. One teacher stated, “Planning activities are essential for me since it helps to manage the classroom” (interview, March 23, 2018). Moreover, one teacher said, “We often imagined the students’ responses and their activities about the topic of climate change” (interview, April 18, 2018).

Implementing

The results of the study show that the teachers carried out the learning process following the lesson plan. The plan made by the teachers was accessible and emphasized the activities of observing, asking, investigating, reasoning, and communicating. They emphasized the ability to observe through demonstrations or simple experiments, asking questions to the students and arguing about local knowledge, investigating by conducting small group experiments, reasoning to find various solutions to problems, and communicating through class discussions. Teachers controlled and organized classes and provided questions to students. One teacher declared, “students must be able to build and construct his knowledge through self-experience” (interview, April 21, 2018).

Evaluating student learning

In the learning process, the teachers asked the students to discuss the topic, and in the end, the teacher asked about the difficulties or obstacles faced by the students regarding the issues. One of the teachers stated, “I always ask the problems faced by my students to find out whether the point is clear or not” (interview, April 27, 2018). The teacher also made a small note about student activities in a learning journal. This journal contained activities carried out by the teacher during the learning process, student activities, and student participation, among others, as a substance for future teacher evaluation. One teacher stated, “Every teacher was asked to make a learning journal to evaluate the learning process” (interview, May 11, 2018).

Revising the lesson plan

The results of the study indicated that the teachers made corrections in the form of notes or learning journal. These notes were used as a source for bringing up further learning plans or renewing learning in other classes in the same subject. One of the teachers stated, “I make corrections directly, refining the lesson plan that I have made by looking at the learning journals” (interview, April 21, 2018). This finding confirmed that the teachers continued to improve and revise the learning processes.

Proposed model for integrating indigenous knowledge into school science

Based on the explanation, the five initial discoveries can be adopted as the basis for building a new model for the integration of indigenous knowledge. In this study, the researcher promoted eight stages that were sequential and repetitive in the cycle. Figure 1 shows the process of integrating indigenous knowledge through the TLC.

Collecting and identifying indigenous science

Initially, the TLC was formed. This community consisted of several teachers in the same areas of expertise also across grade levels. The TLC has the vision to maintain and preserve indigenous Javanese knowledge and cultural values. The members of the community regularly meet to discuss indigenous science issues in formal or informal arrangements. They collect information by considering their capabilities and their relationship with the Javanese natives. This gathered information was then studied and analyzed among members through some factors, such as the trustworthiness of knowledge, cultural values, and possibilities for integration into classroom science.

Selecting the indigenous science topic of interest

After identification, the teacher group chose one topic that they would most likely teach to students. Some indigenous science topics that can be integrated into science classrooms involve seasons, astronomy, solar system, energy, measurement, living things, and medicine. The aim of selecting issues or concepts was to be more focused and in depth. The choice of topics was based on several considerations: relevance, advantages, and disadvantages to indigenous knowledge, social influence, cultural value contained in the knowledge, students' abilities, resources, timetabling, school infrastructure, and conformity with the school science curricula. Ideally, a research lesson addressed immediate academic and non-academic learning goals to develop the intellect, habits of mind, positive behaviors, personal and social attitudes, and personal qualities. The TLC also brainstormed the selected topics, identified each member's ideas and opinions, reconfirmed the chosen subject, took turns in validating science content, and checked information accuracy using content-based textbooks. In addition, the



Figure 1. Outline of integrating indigenous science in the TLC.



selected topic should not conflict with cultural values, ethics, norms, and beliefs existing in indigenous communities. In this step, the principle of mutual respect was encouraged during the discussion.

Analyzing and connecting the topic of interest of indigenous knowledge and school science

In this step, the chosen topic of interest was brainstormed by examining its suitability with the science curriculum. For example, what necessary competencies does the topic contain? What is the learning objective? How does it correlate with school science? What are the advantages and disadvantages of combining both perspectives of indigenous and school sciences? What is the response of the students in the learning process? Furthermore, the team sought the essential correlation between indigenous knowledge and school science by looking for the similarities and differences of both perspectives. The results of the analysis were organized as a basis for constructing a lesson plan. Lesson plans were arranged in consideration of various aspects, such as basic competencies, learning objectives, learning achievements, teaching methods, challenges in learning, assessment, student character, media, and culture in schools. The community discussion also predicted how the students were likely to respond to the lesson. The group members put themselves in the situation of the students and imagined what it would be like to experience the lesson and its related activities. In short, the TLC modified an existing lesson and tried to make students visibly think of a more meaningful learning experience.

Implementing the lesson based on appropriate strategies and judgment

The learning design produced on the third stage was applied in the science classroom, based on the schedule during the term. One member of the community acted as a model teacher, and the others behaved as observers. The role of the model teacher was to implement the lesson plan in the classroom while the rest observed and recorded student learning activities through assessment rubrics and specific field notes. For example, how did the students behave during the lessons? What are the students' responses to indigenous science? This structured observation took place at intervals and required members to focus on student interaction, activities, and behaviors. In this phase, observers gathered precious evidence related to learning goals during the lesson. All activities were recorded for future reference and became the primary data for reflection in the next stage.

Reflecting on the consequence of each knowledge perspective and considering their cultural value

Soon after the lesson, the TLC held a debriefing to reflect on their experience during their observation of the lesson. The emphasis in this stage was the design and structure of the constructed lesson. The teachers considered the impacts of applying indigenous science to school science and identify the consequences of the two different views. The team considered the suitability of values, ethics, and wisdom contained in the knowledge and reflected on the vision by assessing the learning impact in terms of its history and assuring that the integration was appropriate. Therefore, the reflection in this stage was made by each teacher and the community. At this stage, teachers thought about their broader purpose and practiced long-term support goals. As a part of a learning community, they were not just concerned with a narrow target from today's lesson but also learned from frequent observations and interactions with one another.

Evaluating the lesson process and focusing on student learning

The evaluation at this stage emphasized and focused on student learning activities. The participants shared their observations, assessments, and field note records of the lesson to make several assertions about student learning, such as the extent of students' understanding of indigenous science, whether students could connect indigenous science to school science, improvement points during the learning process, and the students' experience during the learning process. The teachers then provided an opportunity for structured individual reflection on what they had observed, including how the integration of indigenous knowledge in the science classroom affects the learners. The TLC

also tried to find patterns that may reveal insights on student learning. At this stage, the teachers saw students thinking on their own and using their own points of view. The team then used this information to revise the lesson.

Expanding the possibilities for the resolution of the research lesson and future discovery

This stage continued the reflection and evaluation in the fifth and sixth stages. The results from the previous steps were used as the groundwork for determining further improvement and the implementation and integration of indigenous knowledge and school science. Each member identified and suggested what they plan for further research, revised the lesson design, and reconstructed the combination of both areas of knowledge. In this stage, the teachers also changed the approach and method to achieve learning objectives in light of the findings, including evaluating all stages for expanding the new research lesson.

Sharing outcomes and discoveries

The results of the previous stages should be shared with the indigenous community. This stage was completed as a form of responsibility toward the indigenous society. The TLC had a moral responsibility to convey the outcome as a form of mutual respect. Allowing the native community to see the final draft of the work was a fundamental element in continuing the collaboration with them. The primary purpose of this stage was to maintain the continuity of indigenous knowledge and mutual respect. Respect in this case not only referred to saying “thank you” or “please” but also to listening attentively to all the natives’ thoughts and knowledge in the community. In short, there must be reciprocity between the researchers and the indigenous community.

Each step was subjected to further, independent, and more detailed content analysis by researchers and broken down into thematic units of macrostructure activities [Table 3](#).

Discussion and open problems

Science and its methods of investigation are a way of interpreting social and natural realities. It cannot be separated from people’s history, cultural context, and worldview. In this study, three main reasons were given for integrating indigenous knowledge and school science. First, such a system reflects the wisdom and cultural values of native people that were acquired and had existed over centuries. Second, much of valuable indigenous wisdom has been marginalized. Third, science teacher knowledge should be advanced. The integration of indigenous knowledge with school science is a process requiring an alliance of two worldviews that appear to contradict. The integration may seem insurmountable, as the two thought systems have different epistemologies, ontologies, and assumptions (Diwu & Ogunniyi, 2012). However, school science will not replace indigenous science. Indigenous students will continue to have indigenous science in their minds. The integration of native science through a TLC is one of the proposed steps to maintain indigenous cultural values and support students’ interest in indigenous science.

This research proposed eight stages as solutions for keeping and maintaining indigenous knowledge. These steps are interrelated and make up a repetitive cycle. Teachers can influence students’ mind-set to care about their culture and environment. Education is more easily understood as a reciprocal, interactive, and symbiotic learning process. This is a process where individuals receive knowledge and the meaningfulness of their native heritage that is taught from generation to generation and includes experience that is generated or produced, embraced, and adapted to conform to the historical context.

Louis (2007) posited several points to consider in conducting a study of indigenous knowledge, which involves receiving indigenous knowledge, engaging indigenous communities, setting up meeting agendas, and sharing targeted knowledge. Four points proposed by Louis were adopted by researchers and simplified into two aspects for consideration in the TLC: obtaining natives’ expertise in the society and engaging indigenous peoples. Setting up the meeting agenda and sharing the targeted experience

**Table 3.** Macrostructure activities of the teacher learning community (TLC).

Phase	Macrostructure activities
(1) Collecting and identifying indigenous science	(c) Establishing a teacher learning community (d) Collecting indigenous science (e) Considering teacher ability (f) Considering the relationship with the natives
(2) Focusing on the indigenous science topic	(a) Selecting the indigenous topic of interest (b) Clarifying the indigenous science topic (c) Identifying personal ideas and opinions (d) Brainstorming the indigenous topic
(3) Analyzing and connecting indigenous science and school science	(d) Analyzing the concept more deeply (e) Connecting the concept of indigenous science and school science (f) Identifying similarities and differences between the two perspectives (g) Planning and key activities (h) Discussing pedagogic and learning challenges (i) Organizing all information into a lesson plan (j) Confirming all arrangements of the lesson
(4) Implementing the lesson based on appropriate strategies and judgment	(c) Conducting a short meeting before implementing the lesson (d) Implementing the lesson in accordance with the lesson design (e) Considering student activities (f) Observing the lesson implementation
(5) Reflecting on the consequence of each knowledge perspective and considering their cultural value	(a) Reflecting on the consequence of each perspective (b) Considering the concept, its cultural value, and wisdom (c) Reflecting on the consequence from a historical perspective (d) Indicating positive values during the lesson
(6) Evaluating the lesson process, focusing on student learning	(d) Discussing student activities (e) Evaluating the learning process and the impact of integrating both areas of knowledge for learners (f) Ensuring that students compared and connected both fields of knowledge (g) Considering students' obstacles during the science lesson
(7) Expanding the possibilities for the resolution of the research lesson	(c) Revising the research lesson (d) Evaluating previous stages (e) Expanding the new research lesson
(8) Sharing outcomes and discoveries	(a) Sharing outcomes with the indigenous community (b) Allowing the native community to see the final draft of the work (c) Ensuring that the community understands the discoveries

with the indigenous community are eliminated because they are included in the TLC steps and activities. Indigenous knowledge is rhetorical, contextual, and rooted in a distinct place and time. Cajete (1999, p. 23) suggested that indigenous science is the collective heritage of human experience with the natural world. In its most essential form, it is a map of physical reality drawn from the experience of thousands of human generations. For indigenous communities, historical stories, narratives, and practical experience are essential. This is why using perception can elicit relativity, as individual perspectives can change the meaning of knowledge. Teachers cannot use personal perception and impose the conformity of indigenous knowledge with school science. Members of a TLC think



about how to put themselves as researchers and as indigenous people. Indigenous people are a source of information about indigenous knowledge. The involvement of these indigenous people, mainly indigenous elders, serves to validate the knowledge collected by the TLC. Furthermore, involving indigenous seniors in the community is a form of appreciation for their existence. The indigenous people involved are not considered research subjects but rather collaborators or partners.

The community links people, organizations, and systems that are enthusiastic about learning and working across boundaries. Several challenges will be encountered in the integration of indigenous knowledge in the TLC. The first is the fact that teachers have been schooled in Western science and hence are more familiar with that worldview than that of indigenous knowledge. It will be the toughest challenge when integrating indigenous knowledge. The second is the top-down approach, which is implemented within teachers' roles in curriculum planning and implementation.

Limitations

The weakness of this research includes the fact that there is limited research literature on the topic Javanese indigenous knowledge. Javanese native knowledge contains traditional beliefs that are considered inadmissible, unlike science. This makes it harder to assess the accuracy of indigenous science related to classroom science and takes time and commitment to the TLC.

Conclusion

The integration of Javanese indigenous knowledge in a TLC is one of the proposed steps to maintain indigenous cultural values. It involves eight phases: collecting and identifying indigenous science, selecting the topic of interest, analyzing and connecting the topic to school science, implementing the lesson, reflecting the consequences of each knowledge perspective, evaluating the lesson process, expanding the possibilities for further research, and sharing outcomes. The eight steps are sequential and repetitive in the cycle. The integration of indigenous knowledge through a TLC is expected to link indigenous knowledge and science in the classroom. The community can link people, organizations, and systems that are eager to learn and work across boundaries. It also extends space and a structure for members to align around a shared goal and outcome. In the end, this study is expected to be a way to simultaneously and continuously preserve indigenous knowledge and mutually beneficial relationships with aboriginal communities. This research can be further developed by applying the model in schools, its effectiveness, and its impact on teachers and students and the indigenous community.

Disclosure statement

No potential conflict of interest was reported by the author.

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