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Integrating indigenous knowledge in the Philippine elementary science curriculum

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Abstract

This paper introduces the idea of integrating indigenous knowledge (IK) in the elementary level of the K-12 Science Curriculum. The study identifies indigenous knowledge that is practiced by the people and presents instructional strategies that could be used to integrate indigenous knowledge in the science curriculum. These strategies are based on the peoples' experiences of effectively teaching indigenous knowledge to young children in their families and local communities. The results of the study could help make the elementary science curriculum more appropriate and responsive to the needs of learners in various local communities.

Keywords: indigenous knowledge; indigenous science; science curriculum; integration

1. Introduction

Science and modernity have become inseparable. Science has influenced technical processes, economic and political systems, social and educational structures (Nowotny, Scott & Gibbons, 2001; Pawilen & Sumida, 2005). The first challenge is to enable people to participate and be productive in a society that requires science knowledge and scientific skills among the people. Thus, developing a strong science literacy and culture in different communities is important. The second challenge is the need to preserve the cultural identity and cultural heritage of the people as they adapt to the changes brought by technology and science. It is imperative to recognize the influence of culture in developing scientific literacy and technological skills needed in order for the people to fulfill their roles and social functions in a society shaped by science and technology.

This study to integrate IK in the elementary science curriculum is anchored on learner-centered education that values learners' knowledge, attitudes, abilities and skills, and beliefs in the curriculum (Bradsford, et al., 2000). The study supports the idea of making science culturally responsive, relevant, appropriate, and compatible with the

culture of the learners. It highlights the importance of utilizing the local language and respecting the indigenous knowledge of the learners in teaching and learning process. This study adheres to the notion of learning science as a cultural activity where cultural scripts are valued in the curriculum; teaching and learning science as a strategy for transmitting and acquiring culture.

1.1 Why integrate indigenous knowledge in the science curriculum?

The 1987 Constitution of the Republic of the Philippines Article XIV Section 2 recognized the role of the state, among others, to:

- "(1) Establish, maintain, and support a complete, adequate, and integrated system of education relevant to the needs of the people and society"
- "(4) Encourage non-formal, informal, and indigenous learning systems, as well as self-learning, independent, and out-of-school study programs particularly those that respond to community needs"

This constitutional provision shows the enduring commitment of the state to provide quality education that is relevant, accessible, and responsive to the needs of the people. This study to integrate IK in science is supportive to the idea of Shor (1992) on empowering education that embodies the culture, history, social conditions, values system, needs and beliefs of the learners in the curriculum. It aims to connect scientific knowledge with the socio-cultural context of the learners (Nowotny, et al., 2001).

Integrating IK in the elementary science curriculum will endow learners with cultural knowledge, scientific knowledge and life skills they need in everyday life. It is an educational strategy which stimulates the teaching and learning of science concepts based on socio-cultural perspective and context of the learners. It is an example of situated pedagogy that intensifies learners' feeling of ownership of their education (Ignas, 2004, Pawilen, 2006). It offers a curriculum where science is taught in the context of the learners (Pawilen, 2006), and teaches science knowledge to the learners based on their experiences and cultural practices (Hobson, 1998). This is essential in bringing science to where the learners are. Integrating IK in the science curriculum also enables teachers to use cultural and historical artifacts of any ethnic group to demonstrate scientific principles (Marinez, et al. 1988).

In this study, integrating IK in the elementary science curriculum will utilize cultural knowledge, local language, and cultural values integral part of the science curriculum. This will foster meaningful learning of scientific concepts among young learners (Hodson, 1998). Cajete (2004) observed that the creation of a culturally-responsive science curriculum enables the learners to become more creative and critical in expressing their scientific observations and beliefs. It empowers the learners to communicate scientific discoveries and ideas in various ways that are meaningful in their

culture and communities. Hence, integrating IK in the Philippine elementary science curriculum is a noble strategy in making education truly Filipino in context, spirit, and perspective.

1.2. What is indigenous knowledge?

Authors define indigenous knowledge in different ways. For example, Mendoza (2000) discussed indigenous knowledge in relation to origin. Warren (1991) described it as a system of knowledge distinctive to a certain culture handed down from different generations. It serves as a foundation for decision making in various areas such as agriculture, botany, health and medicine, food preparation, governance, education, and management of natural resources (Easton, 2004; Rood and Casambre, 2001; Cajete, 2004; Nakashima and Roue, 2002). This system of knowledge was tested and validated by time and experiences of people (Mendoza, 2000).

IK system has a significant role in the development and growth of young children since they were born. Parents transmit this indigenous knowledge through their stories, songs, and rituals. Young children grow into a social and cultural setting where indigenous knowledge is prominently valued and practiced. This social context of affects how young children think and behave. A segment of IK system is indigenous science that is a broad category that includes knowledge from philosophy and to other fields of knowledge and to various indigenous technologies used by indigenous peoples (Cajete, 2004). Ogawa (1995) claimed that indigenous science is collectively dwelt and experienced by a group people of a certain cultural group. The content and structures of indigenous science are shaped by a trifocal interaction between people, society, and the environment.

Indigenous science helped people in comprehending myriads of phenomena in the world. For example, the farmers developed their understanding of rain patterns, classifying soil, selecting good crops, creating terraces, and building irrigation systems to support agriculture. Fishermen have developed awareness of lunar calendar in catching fish. Using medicinal plants and ethno medicine are also living legacies of the indigenous science that helped people surmount several diseases and illness.

Historically it can be observed that IK has contributed significantly to the development of science and technology. For example, the basics of agriculture, mathematics, astronomy, physics, pharmacology, medicine, food technology, and botany among others, originate from the traditional knowledge and practices. These enable individuals to think that the ancestors were already practicing or applying science in their everyday life (Gribbin, 2001; Mkapa, 2004; Sibisi, 2004). UNESCO (1999) acknowledged the historical and precious impact of indigenous knowledge to the development of science and technology.

A study conducted by the UP-NISMED (1998) in the Philippines successfully linked indigenous knowledge and science by providing scientific explanations to ethnic knowledge of Filipinos in different regions. Pawilen (2005) also did a pioneering study in creating an indigenous science curriculum for Filipino kindergarten children. In 2018 the Department of Education also provided a framework to guide schools and teachers in indigenizing, contextualizing, and localizing the curriculum. This strengthens all efforts of teachers and schools in making the curriculum relevant to the culture and context of the learners. This study supports this program of DepEd by finding ways on how IK could be taught in the elementary science curriculum.

1.3. The Elementary Science Curriculum in the Philippines

The elementary science curriculum in the Philippines continues to evolve in reaction to the evolving context and needs of the Filipinos. It recognizes the important role of science in everyday life. It also recognizes the essential role of science and technology in various aspects of human life: social, political, economic, personal, and moral. The elementary science curriculum also promotes integration of indigenous knowledge and cultural values to contribute in upholding the country's cultural identity (DepEd Science Curriculum Guide, 2013).

The K to 12 Science Curriculum aims to develop scientifically, technologically, and environmentally literate and productive members of the society. Likewise, the science curriculum aims to develop learners who are critical thinkers, problem solvers, responsible keepers of the environment, innovative, creative, informed decision makers, and effective communicators (DepEd Science Curriculum Guide, 2013). The science curriculum is designed around the three domains: (1) understanding and applying scientific knowledge in different contexts, (2) employing scientific processes and skills, and (3) exhibiting scientific attitudes and values. Table 1 shows that different skills that should be developed in the science curriculum.

Table1: Process Skills to be developed in the Elementary Science Curriculum

- Observing
- Drawing conclusions based on evidence
- Comparing
- Measuring
- Inferring and predicting
- Classifying
- Designing simple investigations
- Using appropriate procedure, materials and tools to gather evidence
- Observing patterns
- Determining relationships
- Communicating science ideas and observations

Source: K-12 Science Curriculum Guide 2013

Science concepts and process skills are organized in spiral progression in the K to 12 Curriculum. The content standards, performance standards, and competencies in the curriculum include concepts and topics from the four major science disciplines: Biology or Life Sciences, Physics, Chemistry, and Earth Sciences. This will allow the students to study the role of science in the development of the society vis-à-vis influence of the society in advancing the goals of science and technology.

The elementary science curriculum encourages teachers to teach science using the approaches as shown in Table 2. The approaches are supported by the theories of constructivist learning theory that is prescribed in the Elementary Science Curriculum (DepEd K-12 Science Curriculum Guide, 2013).

Table 2: Approaches in Teaching Science in the Elementary Curriculum

- Multidisciplinary and interdisciplinary approaches
- Science and technology model
- Out-of-classroom experience
- Problem-based instruction
- Inquiry-based instruction
- Project-based learning

Source: K-12Science Curriculum Guide 2013

2. Methodology

The study is qualitative and uses the descriptive research design to examine how IK could be integrated in the elementary science curriculum. Specifically, this study answers the following research questions:

1. What indigenous knowledge can be integrated in the elementary science curriculum?
2. What are the local initiatives done by teachers in integrating indigenous knowledge in the curriculum?
3. What strategies can be done to integrate indigenous knowledge in the elementary science curriculum?

2.1. Data Gathering

The data in this study were gathered from a focused-group discussions and interviews with local folks and teachers from a local community belonging to indigenous group in Northern Luzon. A set of questions was prepared for the focused-group discussion to identify indigenous knowledge practiced by the people. An interview guide was also prepared to help teachers identify strategies they apply in integrating IK in their lessons.

2.2. Participants of the Study

In this study, 20 local elders were invited to discuss the various indigenous knowledge, beliefs, and practices they have in their community. These elders were purposively selected based on their age (must be 70 years old or above) and they were identified as cultural or tribal elders in the community. The study also selected 15 teachers from different local schools to provide ideas and share their experiences and local school initiatives on integrating indigenous knowledge and culture in their classes. These teachers were selected based on their years of experience of teaching in schools belonging to indigenous communities.

2.3. Data Analysis

Thematic analysis was used in analyzing the data gathered from the results of the focus-group discussion and interviews. The process includes: (1) reviewing the result of interview and focus-group discussion; (2) coding by identifying data that are relevant to the study; (3) organizing the data into themes that are relevant to the study; and (4) writing the report based on the research questions of the study.

3. Results and Discussion

The results are presented and organized based on the three research questions explored in this study.

3.1. Indigenous Knowledge that can be Integrated in the Curriculum for Elementary Science

Table 3 identifies some examples of indigenous knowledge observed by the researcher that are practiced by the indigenous people in their communities.

Table 3: Examples of Indigenous Knowledge Practiced in the Community

• Predicting weather conditions by observing animals' behavior and celestial bodies
• Using local plants for herbal medicine
• Chemistry of preserving foods
• Indigenous way of classifying plants and animals
• Indigenous agricultural practices
• Using indigenous technology in daily lives
• Naming of local species of plants and animals
• Indigenous way of classifying different types of soil for planting
• Making drinks from local fruits
• Growing local vegetables
• Telling local stories to children
• Playing indigenous instruments
• Chanting and singing folk songs

These identified indigenous knowledge prove that people in the past have been practicing what we call indigenous science for their survival in everyday life. These indigenous knowledge are comparable to the contents of the elementary science curriculum like (1) uses of plants and animals, (2) growing and taking care of plants and animals, (3) mater and energy, (4) heavenly bodies in the solar system, (5) non-living things, (6) tools and technology, (7) soil, rocks, and minerals. The local literatures and music are likewise tangible and artistic expressions of how indigenous people assess their relationship with their environment, based on their observations and experiences in everyday life (Pawilen & Sumida 2005). These are creative ways for indigenous people to express their observations and appreciations of the various objects, animals, and plants and the various phenomena happening around them (Pawilen, 2017). This makes it possible to teach indigenous knowledge in science. Relating this indigenous knowledge to science could help indigenous people in appreciating learning science.

The researcher also observed that there is a commonality in the indigenous knowledge and practices among indigenous communities in various places and countries. For example, indigenous peoples in other countries, also practice the use of lunar calendar, observing celestial bodies for predicting weather and climate, ethno medicine, and indigenous practices in agriculture.

Table 4 shows examples of beliefs that the indigenous people conserved and revered:

Table 4: Examples of Indigenous Knowledge Beliefs

- The land is god's precious gift from the people.
- The identity of people is interwoven with the land in which they live.
- All living and non-living things depend on each other.
- Human beings should take good care of nature.
- Nature and people are interdependent with each other.

These community beliefs could nurture the development of positive attitudes and values in pursuing science activities and in learning more about scientific issues and phenomena (Pawilen & Sumida, 2005). Iaccarino (2003) rationalized that science is an essential component of the peoples' culture; therefore performing and learning science is wholly influenced by culture.

3.2. Local Initiatives of Teachers to Integrate IK in the Elementary Science Curriculum

The result of the interactive discussion with teachers from different local schools shows that there are already on-going efforts at the classroom and school levels to integrate indigenous knowledge and culture in the curriculum and instruction, but not specific for science only. Table 5 shows the different initiatives of local teachers to integrate indigenous knowledge and culture in their classes.

Table 5: School-Level Initiatives to Integrate IK and Culture at the Curriculum

- Learning through the local language or mother tongue
- Participation in the celebration of IP Month
- School-wide exhibits of cultural artifacts
- Performing local songs and cultural dance

The result shows that there are only a few initiatives done at the school level to integrate IK and local culture. Although the principals are now empowered to innovate at the school level, and localization, contextualization, and indigenization are allowed and encouraged by the Department of Education, it is still a work in progress for the school principals to implement the integration of IK in the curriculum. The school heads also mentioned the need to have funds to implement and sustain the different programs.

Table 6: Teachers' Initiatives to Integrate Indigenous Knowledge in the Curriculum

- Using cultural artifacts as instructional materials
- Teaching indigenous songs, and folk dance,
- Sharing local stories and other literatures
- Using indigenous arts
- Localization of curriculum contents
- Inviting elders as resource speakers

Table 6 shows the different initiatives done by the local teachers in their classes. The result shows that much of the local initiatives on integrating IK and culture are done at the subject level. Majority of the initiatives are on the level of instruction. The local teachers are also encouraged to indigenize, localize, and contextualize but they need guidance in integrating IK and culture in their classes. They need training on different approaches for integrating IK and local culture in the curriculum.

3.3. Strategies for Integrating IK in the Elementary Science Curriculum

The experiences of local folks in sharing the indigenous knowledge of the community to young people provided some important ideas that are useful in teaching science teachers integrate indigenous knowledge in their lessons.

3.3.1. *Panag-sarsarita (Story-telling)* – This model makes use of local literatures such as poems, legends, fables, stories, and music to incorporate indigenous knowledge in the science curriculum. The literatures and music of the people reflects the people's knowledge and views about nature and everyday life events (Pawilen, Arre, & Lindo 2010). Local folks love to tell stories to young children and they are creative storytellers. They could integrate their personal experiences in the stories and songs they share to young children.

3.3.2. *Panag-sukisok (Problem-based Approach to Integration*) – Problem solving is an essential skill in science thus exposing the learners to practical problem solving activities related to their everyday life is a valuable learning experience to them. Problem-solving activities exposed the learners to several challenges and issues in their community. They can use the lessons they learn in school science to find solutions and explanations to the questions and problems they encounter in their homes and in the community.

3.3.3. *Enrichment Curriculum* – Special classes can be conducted for students to learn and appreciate indigenous science integration to the science curriculum. For example, the teacher can organize the class to examine and observe local plant species, ecosystem or plant and animal habitats. They can also discuss local issues and problems that can be understood through science. An example to this is the protection of forests, endangered species of plants and animals, and preservation of the natural habitats.

3.3.4. *Activity-based Curriculum* – Special activities can be included during the annual celebration of Indigenous Peoples' Month. These may include exhibit of different indigenous tools used at home and in agricultural activities, learning indigenous music and arts that are used during planting and harvest seasons, exhibit of different herbal medicinal plants, discussion of child-rearing practices, and listening to stories from local folks.

3.3.5. *Content Integration* – This will contextualize the science curriculum contents to the context and everyday life experiences of the learners. For example, as they study about plants, animals, and earth science, they can focus on the study of local plants, local animals, and the study of physical environment of the community. The students can also examine how local people utilize natural sources like wind, water, and solar energy in everyday life as they discuss topics on energy and force.

3.3.6. *Thematic Approach* – This approach will allow the learners to look at issues and concerns in a holistic way. The themes may include problems, issues, questions, and interests of the learners. It may also focus on the study of different cultural practices and artefacts, local species of plants and animals, physical geography of the community, or indigenous science practices related to agriculture and fold-medicine.

4. Conclusion

The study to integrate indigenous knowledge into the curriculum is always a challenging and noble task for educators. First, there is a need to show to the people that indigenous science is parallel to western or school science. Second, there is a need to show to the people and to the learners that many indigenous practices can have scientific value. Third, there is a need to teach to the learners that their cultural values and attitudes are parallel to scientific values like curiosity in understanding nature and various phenomena, valuing the connection of people and nature, and finding ways to creatively communicate different ideas and new knowledge.

Integrating indigenous knowledge in the science curriculum will enable science to be more significant, appropriate, and responsive to the needs and context of the people. Contrary to some criticisms that indigenous knowledge is inferior to scientific knowledge, the integration of indigenous knowledge to the science curriculum makes learning science meaningful. It will connect the learners to their history and culture and makes them realize that science has always been interwoven in their life since the time of their ancestors.

Finally, the study encourages educators to discover other instructional models that will perfect the teaching of indigenous knowledge in elementary science. Science teachers can explore using cultural artifacts, literatures, music, and arts from indigenous people to teach science in a more meaningful way for the learners.

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