INTEGRATING INDIGENOUS KNOWLEDGE IN THE ELEMENTARY SCIENCE CURRICULUM

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ABSTRACT

This study explored how the indigenous knowledge (IK) can be integrated in the elementary science curriculum in the Philippines. This idea is aligned with the goal to expand the cause of developing strong science literacy to indigenous communities and makes the elementary science curriculum relevant and responsive to the needs and culture of the people. This study explored what indigenous knowledge can be integrated in the elementary science curriculum and what strategies can be used for integrating these IK in the elementary science curriculum. The respondents of this study are selected from teachers and members of a local community in northern Philippines. The result of this study shows that several indigenous knowledge, often called indigenous science, can be integrated in the contents of the elementary science curriculum, and looking at how local folks learn and share their knowledge to people, several strategies were also identified as useful means for teachers in integrating IK in the elementary science curriculum.

INTRODUCTION

Science plays an important role in the development of the society. It is considered one of the pillars of economic progress. Science has determined technical processes, economic systems and social structures; it has also influenced the everyday life of the people (Knight 1986; Nowotny, Scott and Gibbons 2001). In order to enjoy the full benefits of science, it is necessary that all people regardless of race and culture, should develop a strong science literacy and science culture. Consequently, there is a need to have a strong science education program starting in the elementary level. It is important to link science with the daily life experience and culture of the people.

In this study, integrating indigenous knowledge in the elementary science curriculum is explored in a vision to develop a strong science literacy and science culture among the learners. Constructivism advocates the idea that learning should start from what learners already knew and experienced. Therefore, integrating indigenous knowledge to science in the elementary curriculum as proposed in this study is important. It is anchored on the principle and framework of a learner-centered education that pays attention to the knowledge (including indigenous knowledge), skills, attitudes, and beliefs of the learners (Bradsford, et al., 2000). It aims to make science culturally responsive, culturally relevant, culturally appropriate, and culturally compatible where the language and indigenous knowledge of the learners are respected and utilized in the school science curriculum. This study clings to the idea of *teaching*

science as a cultural activity that includes what Stigler and Hiebert (1999) called *cultural scripts* – composed of beliefs, knowledge and views about the world that are shared among the learners.

Why is there a need to integrate indigenous knowledge in the science curriculum?

Ideally, the integration of indigenous knowledge to the science curriculum is an example of what Shor (1992) called as *empowering education* - a kind of education that reflects the learners' culture, social conditions, needs and history; or an example of what Dewey (2001) called *democratic education* – a type of education that enables the learners to perceive meaning in their culture and experience. This type of education brought life learning pathways, culture, worldview, and pedagogy that are liberating, patriotic and genuinely indigenous (SIKAT, 1999).

The integration of indigenous knowledge in the elementary science curriculum is based on the necessity to develop and equip young children of scientific knowledge and skills they need for daily life. It aims to connect scientific knowledge with the socio-cultural context of the learners especially in indigenous local communities. It adheres to the idea that science and society are inseparable (Nowotny, et al., 2001). Science is a part of a history (social and personal) that helped produce decisive transformation in the current image and achievements in the field of science (Kuhn, 1962).

Integrating indigenous knowledge into the elementary science curriculum does not literary mean to completely localize or change the current science curriculum. It aims to promote the understanding of science concepts in a given socio-cultural perspective and context. This kind of situated pedagogy increases the chance for the learners to feel ownership of their education and reduces the conditions that produce their alienation (Ignas, 2004; Shor, 1992). It provides a curriculum that reflects scientific knowledge in the learners' culture, conditions, needs, and history and it develops scientific literacy to all young children regardless of culture, belief and orientation.

Integrating indigenous knowledge in the elementary science curriculum puts the learning of science in a socio-cultural context, and finds patterns of science knowledge in the daily-life experiences and cultural practices of the people (Hobson, 1992). This is important in bringing science in the level of understanding and experience of the learners. It is a way of transforming an idea or natural phenomena from the context of common sense to science (Hodson, 1998). This type of education uses instructional materials based on the culture and history of the minority or ethnic group to illustrate scientific principles and the methodology of science that is used in the present science curriculum of the school (Marinez, et al. 1988).

In this study, integrating indigenous knowledge in the elementary science curriculum has to do with a passion for making cultural knowledge, language, and values a prominent part in the school science curriculum. It nurtures the development of an

affective, intuitive, and soulful understanding of the natural world in the present science curriculum. This researcher believes that learning science should be consistent with indigenous peoples' needs, worldviews, and socio-cultural contexts. Thus, this study aims to present science within the context of cultural knowledge in a way that embodies the culture and traditional knowledge, and demonstrating that science standards can be met in the process. It is a way of connecting universally accepted science to what community people in a certain culture, value and know. Solomon (1994) points out that pupils should develop their knowledge and understanding of the ways in which scientific ideas change through time and how the nature of these ideas and the uses to which they are put are affected by social, moral, spiritual, and cultural contexts in which they are developed. Linking science to people's beliefs and practices are important to foster meaningful learning of scientific concepts (Hodson, 1998; UP-NISMED, 1998).

From the experience of the Alaska Culturally Responsive Science Curriculum (Alaska Native Knowledge Network, 2004), and the observations of Cajete (2004) on the development of native science among native Americans in New Mexico, the creation of a culturally responsive science curriculum for the learners provides powerful implications for learning by using traditional or indigenous knowledge as a way of enhancing cultural foundations and developing scientific knowledge and skills. Hence, integrating indigenous knowledge in the elementary science curriculum in the Philippines promises a bright future for the development of an effective, meaningful, and relevant science curriculum for young Filipino learners.

What is indigenous knowledge?

The term *indigenous* may connote a negative meaning to other people and sometimes associated to old fashion, traditional, or unscientific. However, in this study, the term indigenous particularly *indigenous knowledge* is essential and relevant. It serves as the foundation of knowledge building. It may sound unscientific for it includes beliefs and practices that are mostly superstitious and are products of human imagination, but this type of knowledge is also a product of human ingenuity, creativity, and inventiveness in defining the world (Kwagley, 1996). Indigenous knowledge evolves in relationship to places and is therefore instilled with a *sense of place* (Cajete, 2004). Therefore, the first frame of reference for a science curriculum must be the *place of the community, its environment, its history, and its people* (Pawilen, 2006).

Understanding the indigenous knowledge system and finding ways on how to effectively integrate it in the curriculum, particularly in science, is in line with the view of cultural anthropology of teaching science as cultural transmission and learning science as culture acquisition (Cajete, 1999; Spindler 1987; Wolcott, 1991). This type of education is founded on the way of life, traditions, worldview, culture, and spirituality of the people and it is a pathway of education that recognizes wisdom imbedded in indigenous knowledge (Cajete, 1999; SIKAT, 1999). The study of indigenous knowledge is a part of the continuing effort and struggle of different social groups and individuals

to redeem their cultural and historical identity (SIKAT 1999). Indigenous knowledge and learning systems have long been recognized as indispensable components of indigenous peoples' education, but formal educational systems usually neglect this indigenous knowledge (Abayao, 2003).

Mendoza (2000) discusses indigenous knowledge as something that has to do with origin, having originated in and being produced, growing, living, or occurring naturally in a particular region or environment. On the other hand, Warren (1991) described indigenous knowledge as a broad system of knowledge that is unique to a particular culture and is passed down from generations to generations of members of the society. Indigenous knowledge served as the basis for localdecision- making in agriculture, health care, food preparation, education, natural resources management, and a host to different activities in rural communities (Rood and Casambre, 2001). It is a heritage from the past, including specific bodies of knowledge in different areas like botany, medicine, and social governance (Easton, 2004). This indigenous knowledge system was tested by time and validated by the experiences of people living in a particular society (Cajete, 1999; Jones and Hunter, 2003; Mendoza, 2000). This is more than enough to say that there is a strong foundation or basis for people to patronize this indigenous knowledge in their daily life.

This indigenous knowledge is very influential to the development of young children. It is embedded in their daily life since the time they were born. They grow into a social and cultural setting – family, community, social class, language and religion – where indigenous knowledge is also prominent. The process of transmitting the indigenous knowledge systems is done through stories and encounter with other folks, and it is constructed in the learners' minds through daily life experience. The context of the children's social setting affects how they think and behave. Originally, proponents of the essentialist philosophy of education are impressed by the large body of knowledge collected over many thousands of years, the so called *cultural heritage*, and emphasize it as the primary source for deriving curricular objectives (Tyler, 1949).

What is indigenous science?

Part of the indigenous knowledge of the people is *indigenous science.* It is one of the components of indigenous knowledge system developed by people through their daily-life experiences that includes complex arrays of knowledge, expertise, practices and representations that guide human societies in their enumerable interactions with the natural milieu: agriculture, medicine, naming and explaining natural phenomena, and strategies for coping with changing environments (Cajete, 2004; Nakashima and Roue, 2002). Indigenous science is broad categories that include everything from metaphysics to philosophy and to various practical technologies practiced by indigenous peoples both past and present (Cajete, 2004).

Ogawa (1995) claims that indigenous science is super ordinate to individuals' minds and it cannot simply be expressed by individual as a kind of specific theoretical system, rather, it is collectively lived-in and experienced by the people of a given culture. Laccarino (2003) elaborated this idea by explaining that science is a part of culture, and how science is done largely depends on the culture in which it is practiced. In another point of view, Nowotny, Scott and Gibbons (2001) stress that historical and cultural influences have always shaped science through the years.

It is through this interplay between the society and the environment that indigenous science knowledge developed diverse structures and contents (Kroma, 1995). Kuhn (1962) pointed out, that early developmental stages of most sciences are characterized by continual competition between a number of distinct views of nature, each partially derived from, and all roughly compatible with the dictates of scientific observation and method that enabled people to observe, describe, and understand the world around. In practical and concrete way of explaining this view, it is good to think how the farmers and other village peoples developed their knowledge of the rain patterns, soil types, crop varieties, terracing, and building irrigation systems. Fishermen also develop their knowledge in using a lunar calendar in order to catch good number of fishes. The use of medicinal plants is also one of the living legacies of the indigenous science of the people from the past that helped people survive numerous diseases and other forms of illness.

Sibisi (2004) points out that indigenous knowledge has contributed a lot of things in the development of science and technology. Accordingly, the basics of astronomy, pharmacology, food technology, or metallurgy derive from traditional knowledge and practices. In the Philippines, a study conducted by UP-NISMED (1998) shows a concrete example of how science explains a number of indigenous practices and beliefs of the Filipino people. This is a successful attempt in linking science with indigenous knowledge. Thus it can be said that one of the foundations of science is rooted in understanding the practice of indigenous knowledge. The UNESCO's Declaration on Science and the Use of Scientific Knowledge (1999) also acknowledges the historical and valuable contribution of traditional and local knowledge to science and technology.

Looking at the history of renaissance when modern science was born, leads to the idea that science was already practiced by early civilizations (Gribbin, 2001; Mkapa, 2004; Sibisi, 2004). For example: the history of the pyramids and the early science in Egypt, the early astronomy in Greece, the great civilization of Mesopotamia, the use of traditional medicine in China, and the building of the rice terraces and other indigenous farming methods in the Philippines, and many others prove that science is as old as life itself. It is integrated in all activities of human beings starting in the early times when humans started to learn about the environment and how to live.

RESEARCH METHODOLOGY

This study explored the possibility of integrating indigenous knowledge in the elementary science curriculum. It identified several indigenous that could be integrated in the elementary science curriculum and proposed a model of integration. Bredekamp (1997) opined that the best strategy of integrating the curriculum is to begin with the discipline frameworks and identify the connections, the ways that curriculum can be integrated and be made more meaningful for the learners. Hence, the study sought to answer the following questions:

1. What are the examples of indigenous knowledge that can be integrated in the elementary science curriculum?
2. What models of curriculum integration can be used to integrate indigenous knowledge in the elementary science curriculum?

This study was conducted in a local community in Ilocos Sur. The community is a member of the Bago cultural minority group identified by the government. An interview with community people is done to identify the indigenous knowledge of the people that are still practiced in the local communities. Senior citizens who are more than 60 years of age are the main respondents of the interview. The responses were recorded and analyzed to get the information needed for the study. An analysis of the elementary science curriculum was also done to identify certain topics where indigenous knowledge can be integrated.

To come up with a design to integrate indigenous knowledge with the elementary science curriculum, an analysis of different modes and approaches used by different authors in integration was conducted. These models and approaches were analyzed and compared in order to identify which is the best model or approach, or if none, then a new model for integration that is applicable for the Philippine setting can be developed.

RESULTS OF THE STUDY

1. What are the examples of indigenous knowledge that can be integrated in the elementary science curriculum?

The community is a host to all forms of indigenous knowledge. The local folks serve as guardians of this indigenous knowledge. The study found out some examples of indigenous knowledge that are taught and practiced by the Ilocano people. Examples of this indigenous knowledge are:

1. Knowledge in observing animals' behavior and celestial bodies to predict weather conditions and seasons
2. Traditional health habits or practices

3. Child rearing practices
4. The use of herbal medicine
5. Knowledge on preserving foods
6. Classifying and naming plants and animals into families and groups based on cultural properties
7. Preservation and selection of good seeds for planting
8. The use of indigenous technology in daily life – in farming, preparing foods, and other daily life activities
9. Building local irrigation system
10. Classifying different types of soil for planting based on cultural properties
11. Making wines and juices from tropical fruits
12. Local methods of growing plants and vegetables in the yard
13. Indigenous methods of counting, calculating or estimating, classifying, measuring, and organizing things
14. Knowledge on mineral resources found in the community

There are categories where these traditional or indigenous knowledge are parallel to some areas of science in the curriculum like: (1) Classification – understanding of specific elements of factors in the environment, such as plants, animals, soil, water, air, weather, and other environmental phenomena; (2) Technology and Management of Resources – the development and use of traditional technology in daily lives, and management of resources for the present and future generations; (3) Ecology, Evolution, and Systems – the understanding and awareness of the life processes - this includes origins, interrelatedness of living and non-living things in the environment. This makes it easy to integrate some indigenous knowledge of the people to the science curriculum.

As part of the indigenous knowledge, the communities also maintain some cultural beliefs that are useful and sacred to them. Some of the cultural beliefs are as follows:

1. The land is a source of life. It is a precious gift from the creator.
2. The earth is revered as “Mother Earth”. It is the origin of their identity as people.
3. All living and non-living things are interconnected and interdependent with each other.
4. Human beings are stewards or trustee of the land and other natural resources. They have a responsibility to preserve it.
5. Nature is a friend to human beings – it needs respect and proper care.

These community beliefs can produce or develop desirable values among the people that are relevant or consistent to the scientific attitudes, attitudes in

science, and attitudes to science identified by Johnston (2000, p. 13). Johnston grouped these set of attitudes into four types namely: (1) motivating attitudes; (2) cooperating attitudes; (3) practical attitudes; and (4) reflective attitudes. These cultural beliefs, therefore, can be good foundation for developing positive values towards learning and doing science and in bringing science in a personal level.

These cultural practices, traditions, and beliefs are concrete and creative expressions of how human beings view nature and their relationship with nature, in relation to their observations and experiences. Likewise, the songs and chants, for example, contain language metaphors of how people view certain objects and events in the environment in relation to their daily life.

2. How can indigenous knowledge integrated in the elementary science curriculum?

The study identified several approaches that can be used to integrate indigenous knowledge in the elementary science curriculum.

1. **Real-Life Story Model of Integration** – Indigenous knowledge is embedded in the daily life experience of the young children as they grow up. They live and grow in a society where indigenous knowledge is prominent. Parents or old folks served as teachers. They were not professional teachers, yet their methods of teaching are very effective in transferring cultural knowledge to young children. The lessons are intimately interwoven with their culture and the environment. The lessons comprised of good values and life stories of the people on their daily life struggles. Their views about nature and their reflections on their experiences in daily life are interwoven in their stories, poems, and songs. Drake (1993) originally proposed the idea to use stories to connect knowledge. This model is called "story model" which develops a personal, cultural, and global story as the context for any topic being studied. Beane's (1997) collaborative planning model is more radical than the negotiation of the curriculum. The lessons begin from the student's questions, not some predetermined topic.

2. **Problem-based Approach to Integration** – Learners are exposed to different lessons in problem solving involving real-life problems and apply different process skills in science to explore life problems and to examine the validity of some simple indigenous knowledge. There are science skills as well as attitudes and values needed in solving everyday problems linked with real life situations. By doing problem-solving activities, the learners are exposed to some practical situations or issues that are important to them and to their community.

3. **Thematic Approach –** thematic approach is the most popular approach to

integrate the curriculum. This approach requires the use of themes to integrate lessons and contents of the curriculum. The following are the procedures that should be followed in designing a lesson based on the integrated approach:

a. **Selection of themes or problems** – The theme or the problem prioritizes the information and enables teachers and learners to agree on the issues that are most important and interesting to them

b. **Selection of concepts and skills to be integrated –** The teacher should brainstorm a list of concepts and skills that can be integrated in the two subjects.

c. **Selection of objectives –** The expected learning outcomes should be selected based on the lesson.

d. **Planning appropriate instructional activities –** Instructional activities must be sequenced, and activities must be planned. The activities should be based on the interest of the learners and their level of understanding.

e. **Assessment and Evaluation –** the assessment should be designed in such a way that it should show the level of achievement of the learners.

The learners can be involved in the selection of themes and learning experiences. They can help the teachers plan and design the lesson to make sure that their interests are represented. Involving the learners in designing the lesson is a way of empowering them and to make them feel that their ideas are valued in the curriculum.

CONCLUSION

Integrating indigenous knowledge to the elementary science curriculum has become a challenge to educators in the Philippines. This sample found out that some indigenous knowledge is found to be parallel to science ideas. This makes it possible to integrate indigenous knowledge in the science curriculum. It is vital that young children from local cultural communities realize that cultural understandings of natural phenomena and of the natural environment are complementary to universal science ideas.

The cultural values of the people are also relevant to science attitudes and values. Integrating indigenous knowledge in the elementary science curriculum could open wide range of opportunities for connecting scientific knowledge with the indigenous knowledge of the people. It can bring the teaching and learning of science in a more personalized manner for young children and it is an outstanding paradigm for bringing science near to peoples' culture.

The study recommends using real-life story model, problem-based approach, and thematic approach as possible models that can be used in integrating indigenous knowledge into the science curriculum. These models of integration can be taught to teachers in local and indigenous communities who wish to make the school science curriculum to be more meaningful and culturally relevant. Finding effective ways to make science more meaningful and responsive to peoples' lives and culture is a noble goal. Hence, integrating indigenous knowledge in the elementary science curriculum is an important and innovative educational adventure that can be explored.

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