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INTEGRATING INDIGENOUS KNOWLEDGE INTO SCIENCE TEACHING IN SECONDARY SCHOOLS

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ABSTRACT

Science is the basic discipline that enable the development of individual and social life and the process and products of science must be used for the betterment of human life. From the very beginning man has explored the world with a scientific approach and the development of human life purely depends on the fruits of scientific knowledge. In the context of electronic and technological revolution the use and application of scientific knowledge is to be analysed from a critical point of view and the movement should be to mobilise the constructive application of science in the most positive way. Indigenous knowledge can contribute to the development of human values particularly if it is combined with the cause effect relationship of science. Indigenous knowledge is nothing but the traditional and cultural knowledge of a society, culture and civilisation. It helps to develop a positive attitude towards ecological sustainability, preservation of the diversity of earth and also effective management of resources. Where there is a possibility of integrating indigenous knowledge with science teaching, it can bring desirable impacts among students with respect to values and attitudinal changes. Science without values will be disastrous and it is within the sphere of morals, ethics and values, science is to be learned and practiced. The present paper highlights the exploration of indigenous knowledge that can be integrated into science teaching in the context of Kerala and how it can bring social, cultural and attitudinal change among the society especially the students. The attempt is to find out the aboriginal concepts of human life and how it can be connected with science teaching at the secondary level or even from the primary level onwards.

KEYWORDS: Indigenous Knowledge, Ecological Sustainability, Science Teaching, Attitudinal Change.

Indigenous Knowledge has become the accepted term to include the beliefs and understandings of people acquired through long-term association with a place. It is knowledge based on the social, physical and spiritual understandings which have informed the people's survival and contributed to their sense of being in the world. Indigenous Knowledge goes by many different names, such as Traditional Ecological Knowledge (TEK), Indigenous People's Knowledge (IPK), and even 'folk knowledge'. While Indigenous knowledge sometimes contrasts with scientific knowledge, it can also be complementary and provide supplementary information about the world.

Science is the system of knowledge which relies on certain laws that have been established through the application of the scientific method to phenomena in the world around us. The process of the scientific method begins with an observation followed by a prediction or hypothesis which is then tested. Depending on the test results, the hypothesis can become a scientific theory or 'truth' about the world.

Indigenous Science

Indigenous science is the science that Indigenous people developed independent of science. If we understand 'indigenous' to relate to people who have a long-standing and complex relationship with a local area and 'science' to mean a systematic approach to acquiring knowledge of the natural world, then Indigenous science is the process by which Indigenous people build their empirical knowledge of their natural environment. As is the case with science, Indigenous science is the practical application of theories of knowledge about the nature of the world and increasingly indigenous people are incorporating scientific knowledge into their practices.

Relationship between Indigenous Knowledge and science

Scientists generally distinguish between scientific knowledge and Indigenous Knowledge by claiming science is universal whereas Indigenous Knowledge relates only to particular people and their understanding of the world.

There are occasions when science takes on board some aspect of indigenous knowledge but only when it meets the criteria of science. Generally, however, Indigenous Knowledge does not fit the criteria for science and therefore is classed as a different kind of knowledge.

Another approach is that science and Indigenous Knowledge represent two different views of the world around us: science focuses on the component parts whereas Indigenous Knowledge presents information about the world in a holistic way. With this analysis it is possible to see how one system can complement the other. Finally it is important to remember that in today's world there is no isolated system of knowledge and that the

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knowledge systems of all people are constantly changing in response to new knowledge.

Significance of Indigenous Knowledge in science

There are two main reasons to include Indigenous Knowledge in the science curriculum: firstly, by introducing students to the concept of Indigenous Knowledge in their science education they will have an increased awareness of Aboriginal culture and identity, and secondly, modern day environmental problems have social and cultural dimensions which benefit from perspectives other than science. While scientific knowledge is needed to solve these problems, science alone is often not sufficient and Indigenous Knowledge may make a useful contribution.

How has it been taught in the past?

Although education policies in many countries require teaching of Indigenous perspectives within a broad range of curricula including science, it seems that curriculum content, teaching methods and resources have been focussed on a Western, scientific view of Aboriginal cultural knowledge.

In science education, educators have treated the concept of Indigenous Knowledge as another body of ecological knowledge divisible into categories that correspond neatly to scientific categories. Taking the example of fire knowledge, science educators have concentrated on people's knowledge of how to create fire as well as their knowledge of the seasons and fire behaviour. However, this approach not only denies the cultural significance of fire knowledge but also denies opportunities for significant learning.

An alternative strategy is to explore other aspects of fire in the cultural life of the local Indigenous community. Certainly Aboriginal people burn the landscape to create better hunting areas and to increase production of valued resources but they also believe that they have a responsibility to their ancestors. Indigenous knowledge of fire has been passed on through language, songs, rituals and social organisation in which words, designs and relationships are the keys to knowing how to interact with the environment. Individual people have rights to burn in a particular location not only on the basis of their ecological knowledge but also because of their relationships to the traditional owners of that country. To understand Aboriginal use of fire ecology, science students need this broader understanding of cultural knowledge which is essential to understand the ways in which Indigenous people have successfully managed the environment over the long term.

Indian context

India has about 53 million tribes, it is perhaps the largest country possessing a good treasure of accumulated indigenous tribal knowledge. There are three major sources of ethno-botanical knowledge in our country. They are Archaeological sources that include mural paintings, drawings, remains of ancient constructions etc. Traditional sourcesinclude ethno-botany of indigenous religions and medical practices and are based on old works in Sanskrit. Tribal sources – Tribals are the aborigines who first inhabited the land and they have their own indigenous knowledge and is associated with their environment. Written records of the use of plants for human and animal diseases can be traced back to the Rigveda (5000-1600 BC), the earliest scripture of the Hindus (Jain, 1994). The Vedic Aryans were familiar with a lot of medicinal plants. The Indian indigenous system of medicine named Ayurveda, dating back to the Vedic ages (1500 – 800 BC) became most popular within the country and abroad. Ethno-botany is the direct use of plants by man. The ethno-botanical knowledge is therefore associated with the elder generation and tribals who lived in a time where the modern medical facilities were less developed.

In communities where members lead a traditional lifestyle, everyday experiences may include elements of localised knowledge, which in some cases may be described as 'indigenous'.

As far as Kerala is concerned, Traditional Knowledge is not sufficiently codified. There is no formal mode of transmission of TK; and TK is not coming in the ambit of any legally defined Intellectual Property Rights. In Kerala earlier there existed several traditional physicians called Vaidyan' who were authoritative in the use of local plants for healing many diseases including snake bite.

Method used for the study

The present study analysed the possibility of integrating indigenous knowledge in teaching science in schools by exploring the secondary sources. An interview was also conducted with twenty secondary school science teachers in Thiruvananthapuram District. The results are elaborated below.

Identifying Indigenous Knowledge

Identifying knowledge that can be characterised as 'indigenous' is an important first step when thinking about IK and science integration. However, the identification process depends on how both the concepts 'indigenous' and 'knowledge' are defined. Both these concepts are the subject of debate in philosophy and in science education.

Indigenousknowledge constitutes factual knowledge and practical knowledge (including value systems) that a community continually constructs from their interactions within given natural and socio-cultural environments. While factual and practical knowledge are different, they are also closely related and continually influence each other, and at the same time shape the peoples' survival strategies.

The acknowledgement of the existence of multicultural societies and multicultural classrooms, and how cognitive frameworks are different from that of science, accounts for the general consensus among science education researchers of the need to consider ways of knowing in addition to Western-oriented science in the classroom (Cobern, 1993; Lawrenz& Grey, 1995; Richards, Conlin, Gupta &Elby, 2012). School science is closely aligned to Western culture, and is different in many ways to indigenous ways of knowing. Including Indigenous knowledge in the classroom is a step towards recognising diversity in ways of knowing, as well as recognising the value of Indigenous knowledge. Research suggests that indigenous knowledge throughout the world make significant contributions to knowledge diversity (Turnbull, 1997). Besides, IK constitutes students' prior knowledge and could be a useful resource for learning (Chinn, 2007; Malcolm, 2008).

IK is more than theoretical knowledge. It includes views of reality which influence both thought and action. As a result, some literature emphasises method in addition to content in integrating IK and school science. This perspective of IK-science integration that goes beyond content has been used to develop culturally relevant curricula among Indigenous peoples in Kerala.

An indigenous paradigm views relationships as central to the research process, thus knowledge and people are not seen as 'objects' (Louis, 2007; Wilson, 2001). Louis (2007) synthesises four important principles of indigenous methodologies. Firstly, relational accountability describes the network of relationships indigenous peoples have with both their social and physical worlds. In the field, the researcher is not only responsible for developing relationships, but is accountable to all these relations. Where relationships with participating communities have been appropriately established, they can last beyond the duration of the study (McIvor, 2010).

The knowledge of place that the students have accumulated could be a resource for science teaching and learning. The integration of IK and school science has been seen to succeed where there is careful planning and participative collaboration with knowledge holders in communities around schools. Continuity of cultural practices from past into the present and possibly into the future, is suggested. As is the case with knowledge of place, an important dimension to knowledge as cultural practices is the spiritual connection. Data about religion came through follow ups and deliberation on traditional huts.Another form of knowledge that comes through in interaction with the community is practical knowledge (skills).

Topics for Integrating Cultural Knowledge and Science

Some of the topics where IK can be integrated are: Medicinal and Edible Plants, Weather, River Dynamics, , Seasons, Food Gathering and Preservation, Navigation, Animal Behaviour/Habitat, Tides, Erosion and Relocation, Tools and Technology, Snow and Ice, Land Forms, Shelter and Survival, Anatomy, Use of Local Materials etc.

Application of local knowledge in science teaching and learning	Possibility of application
Values	□ practical environmental conservation activities based on the value of respect □ Encouraging respectful learner-teacher and learner-learner dialogue in the classroom. □ Encouraging deliberative argumentation on issues □ Using project work where students consult with Elders and/or study phenomena in the local environment. □ Invite Elders as resource persons to facilitate discussions on issues where they have expert knowledge.
Language	□ Promoting classroom dialogue through the use of students' home language. □ Encouraging students to explain or summarise concepts learnt in home language.
Traditional foods	□ Using locally found and valued examples as basis for teaching and learning in Chemical Systems and Chemical Change
Spiritual connections	□ Using role-plays that include roles for ancestral spirits in for example, environmental protection.
Knowledge of the environment	□ Incorporating fieldwork in Environmental Studies; Life processes in Plants and Animals; Diversity, Change and Continuity. □ Using locally available plants and animals to explain concepts in the knowledge strands listed above. □ Teaching science through the issues-based approach
Song and Dance and Poetry	□ Having students express their understanding of topics / concepts in the form of poems. The poems could reflect the extent to which students can link concepts in the same ways as would do concept maps and/or mind maps, and also as an avenue to understanding students' feelings and attitude towards their topic learnt. □ Using song and dance in teaching Waves, Sound & Light.
Hut construction	□ Investigating issues about thermal conduction in Matter and Materials.
Aesthetics	□ Increasing the number of outdoor activities. □ Including questions on aesthetics in regular assessment.

CONCLUSION

Knowledge gained by students in their context as comprising (among other things) raising crops and livestock, sharing knowledge on health, traditional medicine, art and craft, religious leadership, community representation, history of the local area; knowledge of the local environment and knowledge of language. While some of the knowledge can be related to the content of school science (for example knowledge related to farming), other forms of the knowledge (for instance religious beliefs and community leadership) are more difficult to fit in with school science. Nonetheless, the community values them, and students bring them to the science class. While the traditional science class would dismiss such knowledge as belief and superstition (see Horsthemke, 2004), the importance of giving recognition to socio-cultural factors in science learning is now widely accepted (Aikenhead, 1996; Bang &Medin, 2010).

Actions currently being taken by Indigenous people in communities throughout the world clearly demonstrate that a significant –paradigm shift is under way in which Indigenous knowledge and ways of knowing are recognized as constituting complex knowledge systems with an adaptive integrity of their own (Barnhardt and Kawagley 2004).

IK consists of an intimate knowledge of plant and animal cycles and contains details of the intricate connections in the natural world. This knowledge represents a precious and irreplaceable heritage, the value of which is being increasingly recognised, considered and appreciated by all.

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