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A Study of Significance and Relationship among Indigenous Knowledge in Science Teaching

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Abstract – People's lives can only be improved by science, which is a fundamental discipline that helps people grow as individuals and as a society. A scientific approach has always been used to study the world, and human progress has always relied only on scientific discoveries. Scientific knowledge must be examined critically in light of the current electronic and technological revolution in order to mobilise its constructive application in the most favourable way. Scientific research and indigenous knowledge can both play a role in the formation of human values, especially when they are integrated. Only the traditional and cultural knowledge of an entire society, culture, and civilization constitute indigenous knowledge. It fosters a more optimistic outlook on environmental sustainability, biodiversity preservation, and resource management. There are positive effects on students' values and attitudes if indigenous knowledge and science are integrated. To learn and practise science, one must first have a strong sense of morality, ethics, and values. In this work, indigenous knowledge is explored in terms of how it might be incorporated into science instruction to affect social, cultural, and attitudinal change, particularly among students. The goal is to learn about indigenous conceptions of human existence and how they might be included into secondary school scientific curricula, if not earlier.

Key Words – Indigenous Knowledge, Ecological Sustainability, Science Teaching, Attitudinal Change.

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INTRODUCTION

The phrase "Indigenous Knowledge" refers to the ideas and understandings of people who have lived in a particular place for a long period of time. People's survival and feeling of place in the world have been informed by knowledge based on social, physical, and spiritual understandings. Traditional ecological knowledge (TEK), indigenous people's knowledge (IPK), and even "folk wisdom" are all terms used to describe Indigenous Knowledge. There are occasions when indigenous knowledge is in direct conflict with scientific knowledge, yet it can also bring further insights into the world. We know that science is a body of knowledge that is based on the application of the scientific method to phenomena in our immediate environment in order to discover new laws. In the scientific method, the first step is observation, which is followed by a prediction or hypothesis, which is then tested. The hypothesis may or may not become a scientific theory or 'truth' about the world, depending on the results of the tests.

INDIAN CONTEXT

There are over 53 million indigenous tribes in India, making it the largest country in the world with indigenous tribal knowledge. Our country's ethnobotanical knowledge is mostly derived from three distinct sources. Murals, sketches, and the ruins of historical structures are all examples of archaeological evidence. Ethnobotany of indigenous religions and healing practises are traditional sources that draw on ancient Sanskrit texts. anthropological sources They are the original inhabitants of the area, and their indigenous knowledge is closely linked to their surroundings. Tribals The Rigveda (5000-1600 BC), the earliest Hindu text, contains written records of the usage of herbs to treat human and animal ailments (Jain, 1994). Vedic Aryans were well-versed in the therapeutic properties of a wide range of plants. Ayurveda, an Indian indigenous system of medicine that dates back to the Vedic era (1500–800 BC), became the most popular in India and around the world. Ethnobotany is the study of how people throughout the world use plants. The knowledge of ethnobotany is consequently linked to the elders and the tribals who lived at a time when modern medical facilities were less established. Everyday life may include elements of localised knowledge that might be classified as "indigenous" in communities whose individuals follow a traditional way of life.

INDIGENOUS SCIENCE

Indigenous science is the science established by Indigenous peoples on their own, without the help of science.. For indigenous people, the process of building their empirical knowledge of their natural environment is known as Indigenous science. If we define 'science' as the systematic acquisition of knowledge of the natural world, then Indigenous science is the process by which indigenous people build their empirical knowledge of their natural environment. Scientific theories are used in practise in Indigenous science, just as they are in scientific theory. Increasingly indigenous people are using scientific knowledge in their activities.

RELATIONSHIP BETWEEN INDIGENOUS KNOWLEDGE AND SCIENCE

Most scientists make the distinction between scientific and Indigenous Knowledge, saying that scientific knowledge is universal while Indigenous Knowledge is specific to a group of people and their interpretations of the universe. In other cases, indigenous knowledge is incorporated into science, but only if it fits certain standards set by the discipline. Indigenous Knowledge, on the other hand, does not meet the scientific requirements and is therefore considered a different form of knowledge. It's also possible to see science and Indigenous Knowledge as two distinct perspectives on the world around us, one focused on the components and one focused on a more holistic picture. With this study, it is easy to show how one system can work in conjunction with the other. "" We must also keep in mind that there is no single system of knowledge and that everyone's systems of knowledge are continually evolving in reaction to new information in today's environment.

SIGNIFICANCE OF INDIGENOUS KNOWLEDGE IN SCIENCE

First, students will gain a better understanding of Aboriginal culture and identity if they are exposed to Indigenous Knowledge in their science education; and secondly, present environmental issues have social and cultural components that can benefit from perspectives other than scientific ones. Despite the importance of scientific understanding in solving these issues, it is frequently not enough to rely just on scientific information.

A Western, scientific understanding of Aboriginal cultural knowledge appears to be the focus of curriculum, teaching techniques and resources in many countries requiring Indigenous perspectives to be taught in a variety of subjects. An important aspect of indigenous knowledge is that it can be divided into categories that are similar to those used in scientific research. Fire knowledge has been used as an example of how science educators have focused on people's knowledge of both how to start fire and how it behaves over time. This approach, on the other hand, denies not only the cultural significance of fire knowledge, but also significant learning opportunities.

An alternative approach is to look into other aspects of fire in the local Indigenous community's cultural life. Aside from creating better hunting sites and increasing the production of valuable resources, Aboriginal people believe that they have a duty toward their ancestors. Through language, songs, rituals, and societal structures that emphasise the importance of words, designs and connections, indigenous knowledge of fire has been passed down for millennia. Burning in a particular region is not just a matter of ecological expertise, but also a matter of ties to the country's indigenous peoples. This broader understanding of cultural knowledge is essential for students of science in order to understand how Indigenous people have successfully managed the environment over the long-term.

IDENTIFYING INDIGENOUS KNOWLEDGE

An important initial step in thinking about IK and science integration is identifying information that can be classified as 'indigenous.' However, the process of identification is dependent on the definitions of the terms "indigenous" and "knowledge." There is a lot of dispute in philosophy and scientific education about these two notions. Indigenous knowledge consists of both factual and practical knowledge (including value systems) that a community creates through its interactions with its natural and cultural surroundings. Despite their differences, factual and practical knowledge are intertwined and have a lasting impact on human survival tactics.

Researchers in science education have come to the general view among themselves that there is a need to include non-Western-oriented ways of knowing in the classroom in addition to science (Cobern, 1993; Lawrenz& Grey, 1995; Richards, Conlin, Gupta &Elby, 2012). Unlike indigenous ways of learning, school science is strongly influenced by Western society. One way to acknowledge the worth of indigenous knowledge and the diversity of methods of knowing is to incorporate it into the educational curriculum. There is strong evidence that indigenous knowledge contributes significantly to the diversity of knowledge (Turnbull, 1997). IK is also a source of prior information for pupils, and hence could be a beneficial tool for learning (Chinn, 2007; Malcolm, 2008). IK is more than just a body of information. Thought and conduct are influenced by these perspectives of reality. As a result, literature on the integration of indigenous knowledge and school science has an emphasis on both technique and content. As a result of this, information and people are no longer considered as 'things,' in an indigenous worldview (Louis, 2007; Wilson, 2001). Indigenous techniques can be summarised by Louis (2007), who outlines four key elements of indigenous methodologies. As a first step, relational responsibility refers to the network of relationships that indigenous people have with both their social and physical contexts. In the field, the researcher must not only build relationships but also answer to the people with whom they interact. It is possible to maintain relationships with study participants long after the study has ended (McIvor, 2010). Students' collected geographic expertise could be used to enhance science instruction and learning. The successful integration of indigenous knowledge (IK) and school science can be attributed to well-thought-out plans and the active participation of local knowledge bearers. It is believed that cultural traditions will continue to be practised in the present and potentially in the future. Knowledge as a cultural practise has a spiritual component, much like knowledge of location. Follow-ups and deliberation on traditional huts provided data on religion. Practical knowledge is another type of information that can be gained through contact with the local community (skills).

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	G practical environmental conservation activities based on the value of respect G Encouraging respectful learner-teacher and learner-learner dialogue in the classroom G Encouraging deliberative argumentation on issues G Using project work where students consult with Elders and/or study phenomena in the local environment G Invite Elders as resource persons to facilitate discussions on issues where they have expert knowledge
Language	G Promoting classroom dialogue through the use of students' home language G Encouraging students to explain or summarise concepts learnt in home language
Traditional foods	G Using locally found and valued examples as basis for teaching and learning in Chemical Systems and Chemical Change
Spiritual connections	G Using role-plays that include roles for ancestral spirits in for example, environmental protection.
Knowledge of the environment	G Incorporating fieldwork in Environmental Studies; Life processes in Plants and Animals; Diversity, Change and Continuity. G Using locally available plants and animals to explain concepts in the knowledge strands listed above. G Teaching science through the issues-based approach
Song and Dance and Poetry	G 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. G Using song and dance in teaching Waves, Sound & Light.
Hut construction	G Investigating issues about thermal conduction in Matter and Materials
Aesthetics	G Increasing the number of outdoor activities. G Including questions on aesthetics in regular assessment

CREATING SCIENCE CLASSROOMS THAT SUPPORT THE EMERGENCE OF ADOLESCENTS' COGNITIVE ABILITIES

Numerous studies in the last few years have shown that enhancing the cognitive capacities of adolescents in science courses is possible. Teachers can have a significant impact on how adolescents think and feel as they deal with the day-to-day concerns of school life. On a day-to-day basis, instructors' decisions have a significant impact on student learning results. Teachers' instructional methods have a significant impact on how pupils learn. Teachers make choices everyday regarding

(a) The types of tasks that they will use in class and for homework assignments;

(b) The types of rewards that students can earn;

(c) Assessment procedures;

(d) Grouping arrangements (e.g., heterogeneous vs. homogeneous);

(e) How much autonomy will be afforded to students; and

(f) Whether or not they will hold high expectations for all students.

How well students learn science and their motivation to study science (including their willingness to do so in the future) are directly influenced by the decisions teachers make about each of these instructional approaches.

Three areas of science instruction will be discussed in detail in the following sections, and research shows that teachers can use these three areas to their advantage in terms of engaging students, fostering conceptual growth, and helping them learn more. In order to encourage young people to explore a career in science, and to eliminate gender disparities in scientific achievement and involvement, it is imperative that we provide more effective teaching settings for teenage science students.

Creating Adaptive Motivational Contexts in Science Classrooms

The significance of motivational structures in science education has been examined extensively in recent years. Researchers have found that students' motivating goals, belief systems, and attitudes have a direct impact on their cognitive processing of information. Teachers' motivational climates and students' cognitive functioning are linked in a complicated way by research from a goal orientation theory approach. discovered an association between a focus on mastery and students' opinions about the use of deep cognitive processing processes in high school science classes (e.g. comprehension monitoring and the connection between newly learned information and prior knowledge) (i.e., feeling successful when learning new information). HLM was utilised by Anderman and Young (1994) to explore the relationship between science teachers' instructional strategies and student outcomes in teenage science courses. It has been found that teachers' employment of ability-focused instructional strategies (such as calling out students who do particularly well in science or granting special advantages to children who do well in science) is associated with lower levels of mastery goal orientation in their pupils. Researchers found a link between the use of deep-level cognitive processing methods (such as focusing on grades or performing easy work) and having science mastery objectives, whereas they found a link between the use of surface-level cognitive strategies (such as focusing on grades or doing easy work).

Classroom Social Environment

Teachers' choices of instructional approaches have a significant impact on the motivational climate in scientific classes, as previously indicated. The study of classroom social situations, on the other hand, is starting to gain much needed attention. Students' cognitive engagement with and learning from their academic work is influenced by both their interactions with their classmates and their interactions with their teachers. Teachers can decide whether or not they want to develop personal connections with their students, according to the findings of recent studies. Specific to teachers who are committed to building meaningful relationships with kids, academic achievement increases. There are a number of theoretical arguments as to why teacher-student relationships are beneficial to education. This topic can be approached from a self-determination standpoint. People have three essential wants, according to Deci and Ryan (1985): competence, autonomy, and a sense of belonging. Relationships with other people are a key aspect of fulfilling the "relatedness" demand. Peers play a significant role in the lives of adolescents, making the necessity for close relationships (with both them and their professors) all the more critical for them. Individuals who have all three of these needs met are more likely to internalise actions and attitudes that were previously considered to be external to them. Relationships between students and teachers are critical in science education because students' relatedness requirements will be addressed, and as a result, students are more likely to absorb some of the norms and behaviours that are being taught in the classroom. In addition, there has been a lot of interest in school belonging studies in the last few years. In spite of the fact that school belonging has been shown to reduce teenage hazardous behaviour, more recent research shows that school belonging is linked to positive learning outcomes for adolescents. . (e.g., greater achievement and cognitive engagement). A number of studies have shown that school teachers can foster a sense of belonging in both classrooms and schools.

RECOMMENDATIONS FOR SCIENCE EDUCATORS

From our perspective, there are number of constructive, affordable, and practical recommendations that emerge from an educational psychology perspective on adolescent learning in the sciences. Specifically, we make the following seven recommendations which we list, then describe below:

1. Foster productive learning environments.
2. Promote active engagement based on connections to students' personal interests and career goals.
3. Develop requisite knowledge, skills, and dispositions necessary for science literacy and to support nascent science career choices.
4. Capitalize on learning progressions by revisiting earlier content in more depth.
5. Promote an inquiry and problem-based learning approach to science instruction.
6. Use assessments that focus on higher-order learning.
7. Provide professional development for secondary science in-service and pre-service teachers that include adolescent development and motivation.

CONCLUSION

In addition to cultivating crops and livestock, students learn about health and traditional medicine; art and craft; religious leadership; community representation; history of the local area; knowledge of the local environment; and knowledge of the local language. Knowledge gained by students in their context includes School science can incorporate some of the information (for example, farming knowledge) but not all of it (for example, religious beliefs and community leadership). As a result of this, pupils bring their own specimens to class. However, a long-held idea and superstition about the relevance of socio-cultural variables in science education is now universally accepted. One of the most fundamental paradigm shifts taking place right now in Indigenous communities is the recognition that Indigenous knowledge and ways of knowing constitute a complex, adaptable knowledge system in its own right. Plant and animal life cycles, as well as their complicated interrelationships, are central to IK. As the significance of this knowledge is progressively recognised, considered, and enjoyed by everybody, it stands as a priceless and irreplaceable legacy.

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