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SENSITIVITY DOMAIN OF LEARNING FOR SUSTAINABLE FUTURE

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Abstract

The complex and intimate relationships among the technological products we consume calls for a sensitive attitude towards the values that underpin them. A blind eye towards the inevitable balance of the biosphere that sustains us can prove disastrous for us in the future. Majority of the social, moral, environmental and health issues of human life arise out of our lack of a responsive, caring and compassionate disposition towards various interacting elements associated to these realms.

Scientific sensitivity characterised by a sense of responsibility, sense of caring, compassion, empathy, respect, sense of belongingness, sense of critical awareness and sense of problem solving must be inculcated in pupils for solving various scientific issues. This can be done by raising them from mere 'awareness level' to the 'sensitisational level' whereby they become 'responsible citizens' of the world through an 'attitudinal shift' from egocentric ethic to planetary ethic.

In the paper, the authors suggest the possibility of a new domain of learning – the ***Sensitivity Domain*** which aims at a shift from mere 'level of awareness' to a 'level of sensitivity' through 'personal experience' and which enables the exploration and realisation of the *interrelationship, interdependence and the interconnectedness* of the various systems of the universe. The paper recommends important pedagogic strategies, both formal and informal, for developing scientific sensitivity in students. It also illustrates various models of science learning designed to sensitise students to conserve the resources and to discard the harmful.

Keywords: Sensitivity Domain, Scientific Sensitivity, Sustainable Future

1. Introduction

We live today in a globally interconnected world in which physical, biological, psychological, social and environmental phenomena are all interdependent. An indiscriminate use of natural resources can disrupt the "complex webs of relationships and multiple interdependencies" among various systems of the universe. Human encroachment and exploitation of natural resources has disrupted the biodiversity which has led to the environmental crisis of climate change and global warming. This has posed a serious threat to the healthy existence of human and non-human species on earth.

However, it is inappropriate to regard environmental problems as matters of mere careless industrialization and inexpert management of natural resources which can be solved by experts and officials. Environmental problems are not "problems 'out there' in our surroundings, but problems 'in here', in the way we choose to make sense of the world. They are pre-eminently social problems - problems of people, their life styles and their relations with the natural world". "Environmental problems will not 'go away' nor will they be solved by a quick 'technical fix' while we blithely maintain our profligate life style". I must change the way I live. Changing my way of life entails changing my values in favor of an orientation towards "the organic, the gentle, the nonviolent, the elegant and beautiful" (Shumacher, 1973).

Anthropocentric thinking and the consequent objectification of nature has been argued as the root cause of the global environmental crisis (Corcoran & Sievers, 1994; Russel & Bell, 1996). By objectifying nature, people absolve themselves of any moral responsibility for the care and preservation of the natural environment and justify their continued exploitation of the natural resources and other life forms. Hodson (2003) advocates the replacing of anthropocentrism with a *biocentric* ethic comprising the following elements: all things in the biosphere have intrinsic value and an equal right to exist alongside humans; the natural world is not just a resource for human use; all life forms are inextricably interconnected (Russel, 1997). Adopting such an ethic means having respect for the intrinsic value of all living things, cultivating a sense of compassion and caring towards both human and non-human species, having a concern for maintaining the existence of biological and cultural diversity and challenging and rejecting all forms of discrimination. Appreciating interconnectedness means acquiring an understanding of the relationship that exist between all the natural and human made systems, recognizing that all human actions have consequences that will affect a complex global system that includes human and nonhuman species, having an awareness of and acting on choices to maintain an ecologically sound and humane life style. Laszlo (2001) describes the inculcation of this clutch of values as developing a '*planetary ethic*'- an ethic which respects the conditions under which all people in the world community can live in dignity and freedom, without destroying each other's chances of livelihood, culture, society and environment.

The authors of Science For All Americans (AAAS, 1989) direct attention towards scientific literacy for a more socially compassionate and environmentally responsible democracy when they state that science can provide knowledge 'to develop effective solutions to its global and local problems' and can foster 'the kind of intelligent respect for nature that should inform decisions on the uses of technology and without which , they say, 'we are in danger of recklessly destroying our life support system'. Regrettably, they do not go on to suggest that scientific literacy also includes the capacity and willingness to act in environmentally responsible and socially just ways. The Scottish Consultative Council on the Curriculum (SCCC, 1996) adopted the term *scientific capability* instead of scientific literacy. Scientific capability is described in terms of five distinct, but clearly interrelated aspects; scientific *curiosity*-an enquiring habit of mind; scientific *competence*-ability to investigate scientifically; scientific *understanding*-understanding of scientific ideas and the way science works; scientific *creativity* –ability to think and act creatively; and scientific *sensitivity*-critical awareness of the role of science in society, combined with a caring and responsible disposition. Hence, becoming "scientifically capable" involves the development of personal qualities and attitudes, the formulation of one's own views on a wide range of issues that have a scientific and technological dimension and the establishment of an underlying value position. A person who is scientifically capable is not only knowledgeable and skilled, but is also able to draw together and apply her/his resources of knowledge and skill, creatively and with sensitivity, in response to an issue, problem or phenomenon.

2. Re-orienting Pedagogic Approaches

The present day education has adopted *fragmented approaches to reasoning,* negating the possibility of a deep connection between humans and nature and the very notion of stewardship, which provides one with 'a sense of responsibility towards the dynamic web of relationship in this universe' is erased. Since we have either refused or been unable to see the ***interdependence*** of things, social alienation and environmental decay have occurred (Miller, 1999). One of the purposes of fragmented education which 'took away the parts from the whole' was to make *understanding better*, but in doing so the connections were destroyed which changed our perspectives of the whole. Modern schools concentrate mainly on *thinking* and 'processing information' without any regard for the experience of 'being'. This, in turn, has led to our failure in understanding ourselves holistically in all profundity.

This has also resulted in the lack of resilience in children and adolescents in the face of stress.

Educators have a crucial role to play in enabling pupils to recognize the 'wholeness of their being', which would make them 'sensitive' to their part in the *complex web of relationships* among human and non-human species and various other systems of the universe. A creative curriculum, where children can **experience and sense the world in its natural state** can awaken pupils to 'responsible stewardship' (taking care of the earth), characterized by a strong sense of responsibility towards the dynamic web of relationships in this universe. Learning activities that provide a **'personal' experience of the beauty and benevolence of nature** can instill in the pupils a feeling of 'oneness' with it which can lead to an 'inner urge' for the *conservation* of forests, ponds, the sacred groves, various plant and animal species and other natural resources that influence our lives in various ways. In forging a lasting relationship with planet earth, we need to teach a new set of ***three R's*** regarding this relationship (Abijan, 2008):

a) ***'Respect'*** which means 'honouring' the defined ways of acting towards the relationship.
b) ***'Responsibility'*** which demands a responsive attitude and 'loyal fulfillment' of the responsibilities to each other and to the relationship itself.
c) ***'Reverence'*** which means considering the relationship 'sacred'.

Education *in* and *through* the environment can play a substantial role in **personal exploration of the interconnectedness** of the various systems of the universe. Hodson (1999) advocates the idea of ***'getting a feel for the environment'-*** building a sense of ecological relationships through powerful emotional experience 'in the field'.

In all our attempts to create awareness of 'modern science' of the earth through scientific explanations about it, we ought to keep a place for the unexplained - the silence and majesty of the forest, mountains and seashore; the spirituality of the caves, volcanoes and trees which would lead to a sense of awe and wonder in children rather than seeing them merely as products of erosion. This is what many indigenous people around the world have never lost: **a sense of unity between humanity and the environment** which is indispensable in our progression from **'the level of awareness' of nature to 'the level of sensitivity' to nature.**

Keeping this in view, the researchers developed a **Curricular Transaction Design** for the *Next Generation Science Teachers (Science Teacher^{NG}) which was* adopted in the Department of Physical Science, P.K.M. College of Education, Kannur University, India from 2010-11 B.Ed. (Bachelor of Education) batch to 2015-17 batch.

3. Curricular Transaction Design: Science Teacher ^{NG}

The "Curricular Transaction Design: Science Teacher^{NG}" (Figure:1) developed by the researchers point to the four major issues in Science Learning in secondary school classrooms; the Curricular Transaction processes adopted to solve the issues and the Curricular Products or Pedagogical solutions to the issues.

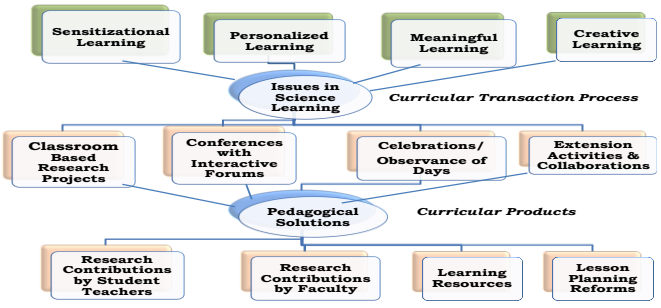

Figure: 1. Curricular Transaction Design: *Science Teacher^{NG}*

3.1 Issue: Sensitisational Learning of Science

The present paper concentrates on the Curricular transaction processes (Figure: 2) which was adopted to solve the issue of lack of "Sensitisational Learning of Science" and the curricular products or pedagogical solutions (Figure:3) to the issue.

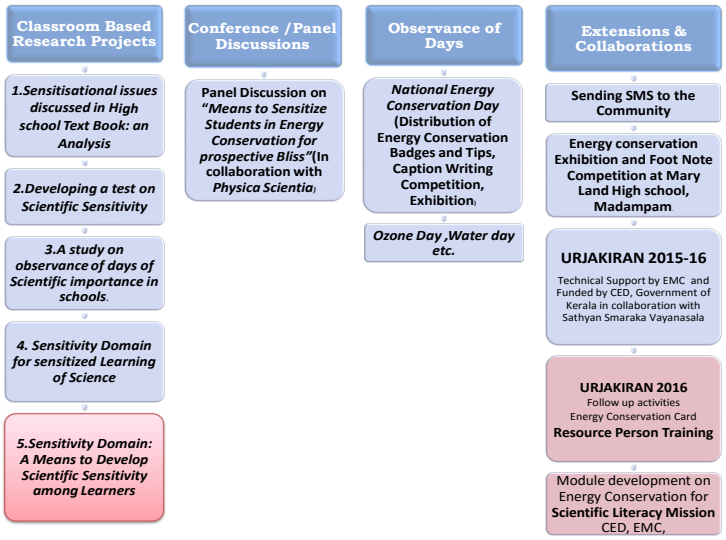

Figure 2: Portfolio of Curricular Transaction Process

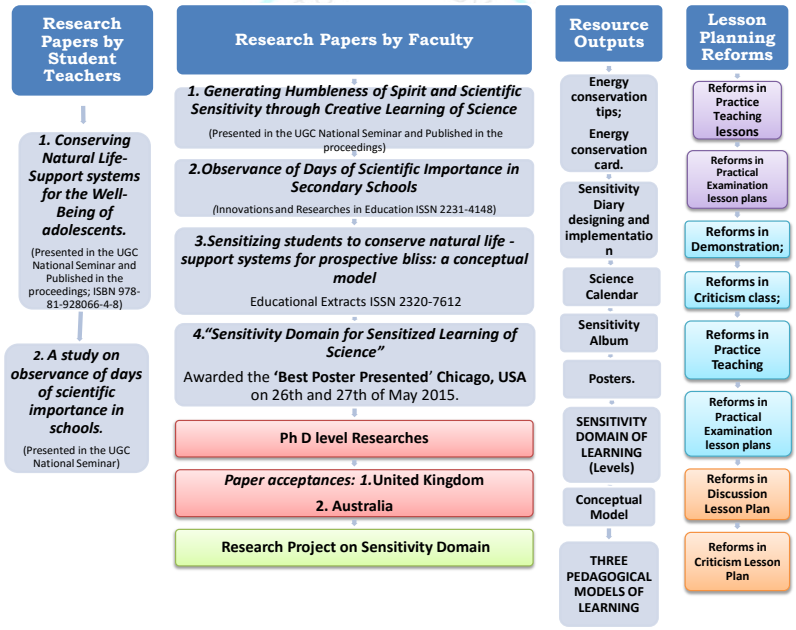

Figure no.3: Portfolio of Curricular Products

4. Sensitivity Domain of Learning

Based on the Curricular Transaction Processes on the Issue of Sensitisational Learning of Science, a new domain of learning **"Sensitivity Domain"** has been designed by the researchers for sensitized learning of science. Sensitivity domain intends to empower learners from the "level of awareness" to the "level of Sensitivity" to Social, Moral, Environmental and Health issues.

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4.1 Sensitivity Domain: Levels

The progressive levels of learning that come under the sensitivity domain are illustrated in Figure 4 and Table 1.

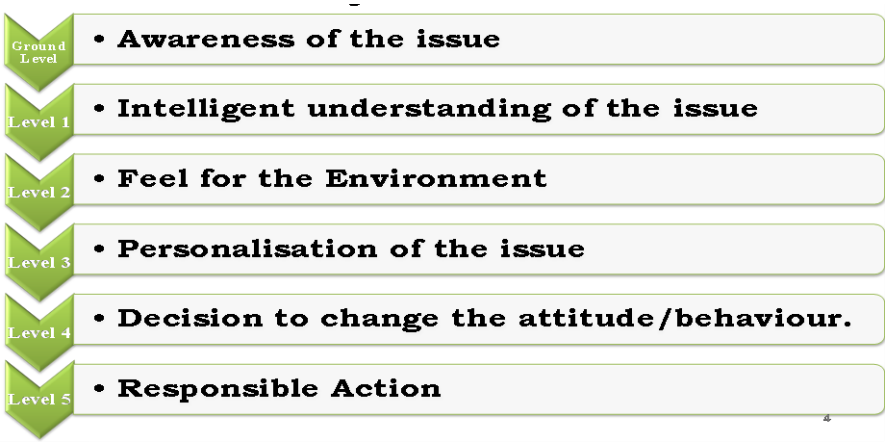
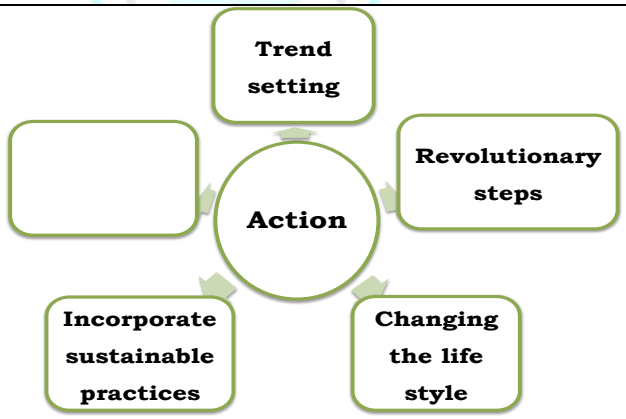


Figure 4: Sensitivity Domain: Levels

Table 1: Sensitivity Domain: Levels

<table>
<tr><th colspan="3">Sensitivity Domain: Levels</th></tr>
<tr><td>Level 0:</td><td colspan="2">Awareness of the issue</td></tr>
<tr><td>Level 1:</td><td colspan="2">Intelligent Understanding of the Issue</td></tr>
<tr><td>A.</td><td colspan="2">Understanding the nature of the issue</td></tr>
<tr><td></td><td>Something to be Conserved</td><td>Something to be Avoided</td></tr>
<tr><td></td><td>Natural Life Support Systems (Air, Water, Soil, Trees, Forests, Biodiversity, Wet lands, Ozone, Food, Agriculture, etc.)
Natural Energy Resources (Renewable energy sources, Electricity, Fuels etc.)</td><td>Artificial sources (Plastics, E-wastes, Air conditioners, Vehicles, Chemical Fertilizers, Pesticides Soft drinks, Fast foods etc.)</td></tr>
<tr><td>B.</td><td colspan="2">Understanding the cause and consequence of the issue</td></tr>
<tr><td></td><td colspan="2"> 
</td></tr>
<tr><td>Level 2 :</td><td colspan="2">Feel for the Environment</td></tr>
<tr><td></td><td>Building a sense of ecological relationships through powerful emotional experiences
Experience the 4 B’s
Explore the 3 I’s
Develop the 3 R’s</td><td>Recovering a sense of unity between humanity and environment
Shift from
Feel about environment
to
Feel for the environment</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">SENSITISE TO CONSERVE : A CONCEPTUAL MODEL
<table>
<tr><td>LEVEL OF AWARENESS</td><td colspan="3">PHASES OF SENSITISATION</td><td>OUTCOMES</td></tr>
<tr><td>End
4 E's</td><td>Experience
4 B's</td><td>Explore
3 I's</td><td>Develop
3 R's</td><td>Experience
4 W's</td></tr>
<tr><td>• Encroachment
• Exploitation
• Extinction
• Endangerment
• of Nature</td><td>• Beauty
• Blessings
• Benevolence
• Biodiversity
• of Nature</td><td>• Interrelationship
• Interdependence
• Interconnectedness
•of Nature</td><td>• Respect
• Responsibility
• Reverance
• in relationship with Nature</td><td>• Physical Well being
• Emotional Well being
• Psychological Well Being
• Spiritual Well being
• of human beings</td></tr>
</table></td></tr>
<tr><td>Level 3:</td><td colspan="3">Personalization of the issue</td></tr>
<tr><td></td><td>How it affects Human Life?
to
How it affects my life?</td><td colspan="2">Shift from
Social Responsibility
to
Personal Responsibility</td></tr>
<tr><td>Level 4 :</td><td colspan="3">Decision to change the attitude or behavior</td></tr>
<tr><td></td><td>Radical shift in student values
Care about
to
Care for</td><td>Sympathy
to
Empathy</td><td>Anthropocentrism
to
Biocentrism
to
Planetary ethics</td></tr>
<tr><td>Level 5:</td><td colspan="3">Responsible action</td></tr>
<tr><td></td><td colspan="3"> 
</td></tr>
</table>

4.2 Sensitivity Domain: Pedagogical Models

The researchers designed three pedagogical models of Sensitivity Domain of learning for sensitized learning of science (Table 2). Model 1 has been designed based on critical analysis of the causes of environmental issues; Model 2 and 3 on the basis of creative analysis of the consequences of environmental issues.

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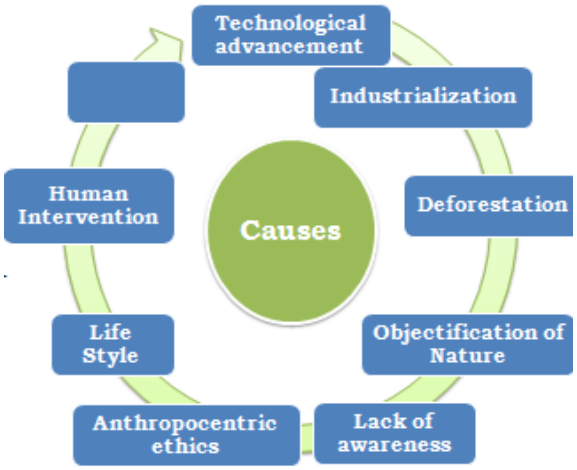
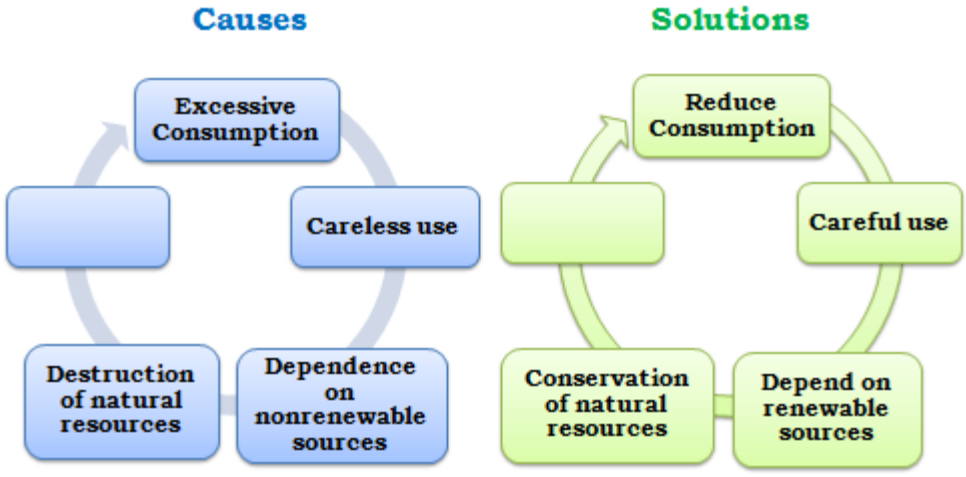
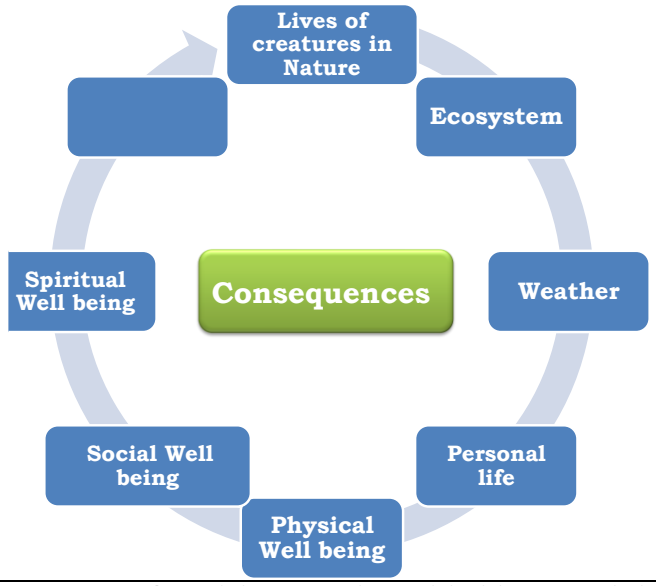
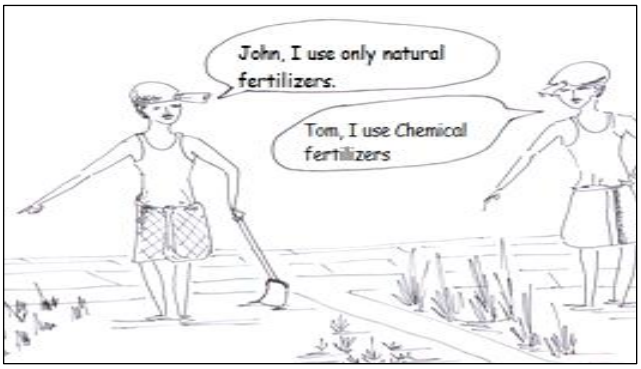
Table 2: Pedagogical Models

<table>
<tr><th colspan="3">Sensitivity Domain: Pedagogical Models</th></tr>
<tr><td>A.</td><td colspan="2">By critically analyzing the causes of environmental issues</td></tr>
<tr><td></td><td colspan="2"> 
</td></tr>
<tr><td>Model 1.</td><td colspan="2">Sensitise to Conserve/Avoid -Critical thinking model</td></tr>
<tr><td rowspan="6"></td><td>Awareness of the issue</td><td></td></tr>
<tr><td rowspan="2">Intelligent Understanding of the issue</td><td>Phase 1.
Critically analyzing the causes of the issue</td></tr>
<tr><td>Phase 2.
Designing solutions on the basis of the causes</td></tr>
<tr><td>Feel for the Environment</td><td></td></tr>
<tr><td>Personalization of the issue</td><td></td></tr>
<tr><td>Decision to change</td><td></td></tr>
<tr><td>Responsible Action</td><td></td></tr>
<tr><td>Example:</td><td colspan="2">Energy Crisis
 

Learners critically analyse the causes for Energy crisis
They arrive at the solutions based on the causes of the Energy crisis.</td></tr>
<tr><td>B.</td><td colspan="2">By creativelyanalyzing the consequences/effects of the environmental issues</td></tr>
</table>

<table>
<tr><td></td><td colspan="2"> 
</td></tr>
<tr><td>Model 2.</td><td colspan="2">Sensitise to Conserve /Avoid - Creative Thinking model</td></tr>
<tr><td rowspan="6"></td><td>Awareness of the issue</td><td>Phase 1.
Understanding the existing reality</td></tr>
<tr><td rowspan="2">Intelligent Understanding of the issue</td><td>Phase 2.
Thinking creatively on a condition contrary to the existing reality</td></tr>
<tr><td>Phase 2.
Comparing the existing reality with the creative expression</td></tr>
<tr><td>Feel for the Environment</td><td></td></tr>
<tr><td>Personalization of the issue</td><td></td></tr>
<tr><td>Decision to change</td><td></td></tr>
<tr><td>Responsible Action</td><td></td></tr>
<tr><td>Example:</td><td colspan="2">While learning the environmental issues
Deforestation
Water pollution
Air pollution
Learners think creatively on conditions like;
What would happen if:
there were no plants?
there was no water to drink?
there were frequent acid rains?
They compare the existing reality with the creative expression</td></tr>
<tr><td>Model 3.</td><td colspan="2">Sensitise to Conserve/Avoid–Compare and Contrast model</td></tr>
<tr><td rowspan="4"></td><td>Awareness of the issue</td><td></td></tr>
<tr><td rowspan="2">Intelligent Understanding of the issue</td><td>Phase 1.
Argumentative discussions on preferences for Natural and Artificial resources</td></tr>
<tr><td>Phase 2.
Arriving at sagacious judgments based on consequences</td></tr>
<tr><td>Feel for the Environment</td><td></td></tr>
</table>

	Personalization of the issue	
	Decision to change	
	Responsible Action	
Example:	Learners compare and contrast the effects of the use of Natural and Chemical Fertilizers  They arrive at sagacious judgments based on the aftermaths	

Conclusion

The crucial challenges faced by the world today relating to social, moral, environmental and health issues pertain to the lack of a sensitive attitude to these issues. The same is true in the case of education also. Science Learning devoid of sensitivity can lead to major catastrophes. The sensitivity domain of learning designed by the researchers; the curricular transaction processes adopted; the curricular products of the transaction process; the levels of learning of the sensitivity domain and the pedagogical models of the sensitivity domain are initiative steps for sensitized learning of science. It highlights the scope of further researches for development of lesson transcripts, curriculum designing and teacher training for sensitized learning of science.

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