IMPORTANCE OF ENVIRONMENTAL EDUCATION FOR SUSTAINABLE DEVELOPMENT

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Theme : Need for Environmental Education in Schools and Colleges

Abstract:
In the present scenario due to anthropogenic activities the environmental degradation is in an alarming rate and it results in various environmental issues such as Global warming, Ozone layer depletion, green house effects, raise in sea water level, improper monsoon and acid rain. Science and Technology have brought immense benefits but we are paying high ‘price’ for it. There is a wrong myth that economic development is based on only in industrialization. But in the international organizations such as World Bank and International Monetary Fund, the environmental degradation is considered as the norm. The Science and advanced Technology can however only help the process of global sustainable environment in a limited way but cannot deliver it. The success of the technology lies in its implementation part. In spite of conducting more conferences, seminars and world summits towards the protection of environment for the past two decades, the present world is environmentally less sustainable than in the previous days. The progress whatever the rich developed countries have made so far has largely been achieved through the relocation of their dirty manufacturing facilities to poor developing countries. However the relocation of the manufacturing facilities in this way cannot address the growing problem of anthropogenic pollution – it merely changes the jurisdiction of the pollution created from the ‘rich’ to the ‘poor’ world. Therefore in order to achieve the acceptable level of global environmental sustainability, the citizens must be empowered with essential knowledge and information especially in developing countries like India. Since educational institutions are the places where the contact of the society is more it is possible to bring remarkable change in the mindset of the public. To protect children living in polluted regions, environmental education represents a relevant means of prevention because this type of education encourages learners awareness of their environment’s ambient conditions, as well as their active participation in solving local problems. It is need for the hour to propose the environmental education with the essential elements of moral philosophy. Conventional educational methods are no longer adequate for the real needs of tomorrow. Future engineers and also other specialised area students must acquire knowledge and skills in their own field and keep pace with rapid advances in practically in all branches of engineering as well as other area of specialization. The communication perspective opens the door to another kind of tools that environmental educators can use in order to improve the educational practice.

To this end a generic outline syllabus, including essential elements of moral philosophy has to be proposed for the environment education in schools and also undergraduate students in college level.

Key Words: Environmental Education, students, schools and colleges, sustainable development, pedagogical strategies, responsible environmental behaviour, ethics, morality.

1. Introduction
For the past one decade much effort was expended in global level to achieve the sustainable development. In spite of conducting more conferences, seminars and world summits towards the protection of environment, the present world is environmentally less sustainable than in the previous days. The reason is very predictable that the poor developing countries had been seriously thwarted by lack of financial and skilled manpower resources where as the rich developed countries appeared to be reasonably content with the progress they had made. The progress whatever the developed countries have made so far has largely been achieved through the relocation of their dirty manufacturing facilities to poor developing countries. However the
relocation of the manufacturing facilities in this way cannot address the growing problem of anthropogenic pollution – it merely changes the jurisdiction of the pollution created from the ‘rich’ to the ‘poor’ world. Therefore in order to achieve the acceptable level of global environmental sustainability, the citizens must be empowered with essential knowledge and information. Then only they can exert pressure on their elected representatives to develop and implement policies for securing environmental sustainability. The awareness among the public and industrial generators have to be created and motivated by the updated techniques and incorporating the innovative and implementable solutions to reform our economy which can be achieved through environmental education.

Thus, the environmental education has two essential components:

1. Alerting the public to the need to achieve global sustainable development and the likely consequences of failing to do so.
2. Focusing the educational curricula for global sustainable development by incorporating the know-how and skills and also the moral imperatives.

To have a clear idea about the environmental education, more awareness about the following issues are needed.

1. Difference between sustainable development and environmental sustainability.
2. Unique definition for sustainable development
3. Depending on Science and Technology alone will deliver environmental sustainability?

2. Sustainable development and environmental sustainability:

Unfortunately, experience shows that in the environmental community, there are many who do not understand the true meaning of sustainable development. In addition, the environmental community must discharge its collective professional responsibility in ways that are consistent with the core requirements of sustainable development and global environmental sustainability.

The common definition for sustainable development is as follows:

“Development that meets the needs of the present without compromising the ability of future generation to meet their own needs”

The resource base is not inexhaustible, it follows that there must exist some limit beyond which the rate of exploitation of natural resources to supply the open ended and increasing demand for goods and services will compromise the ability of future generations to meet their own needs. Therefore it is clear that the sustainable development is economic development that exclusively relies upon and is firmly rooted in the integrity and sustainability of the natural environment. National resources management has emerged in line with the evolving concept of sustainable development over the past 3 decades. If nature’s resource base is irredeemably depleted or irreversibly degraded, the means of wealth creation for social welfare will be seriously jeopardized. Without environmental sustainability it is impossible to achieve sustainable development.

3. Unique definition for sustainable development:

At present there is no unique operational definition for sustainable development. The reason is that there is no single indicator for comparing the relative progress made by different countries or regions towards sustainable development at a given time or for measuring progress made by a given country or region over time. This lack has been impeding progress towards global sustainable development.

The operational definition of sustainable global development:

“Sustainable global development requires that those who are more affluent adopt life styles within the planet’s ecological means – in their use of energy, for example.”

Therefore if the international community is at all serious about achieving even a modest degree of global sustainable development, its operational definition must be based on the reduction in consumption of goods and services by the affluent within and between nations. Such a definition will pave the way both to developing a simple and unique indicator to measure sustainable development and to a more equitable distribution of wealth and resources among nations. The production and consumption must be curbed to achieve even a modest degree of sustainable development and determined efforts must be made to reduce consumption through formal education. The eminent French anthropologist Levi – Strauss view is that “Man is not a privileged inhabitant of the universe, but merely a passing species that will leave only a few faint traces of its passage when it becomes extinct”.
4. Science, technology and environmental sustainability:

4.1 Role of science and technology in delivering environmental sustainability:

There is a strong belief in the international scientific community that the environmental problems can be solved and sustainable development and global environmental sustainability achieved only with the application of science and technology alone. But the progress towards sustainable development is dependent upon a fundamental change in societies’ attitude to nature and the environment. It is only with such enlightenment that the affluent would be willing to adopt less consumptive lifestyles commensurate with earth’s ecological capacity. Science and Technology, however advanced cannot help in this matter. Hence what is needed to bring about this change of attitude is education in moral and ethical philosophy. In the young minds it is essential to reinforce the environment-respecting moral values.

4.2 Sustainable development through science and technology:

It is very hard to find any aspect of modern life untouched by Science and Technology. Directly or indirectly they have brought immense benefits to human societies, and given us the means to understand how the physical world around us works. The impacts of science and technology are determined by how they are applied, why they are applied, and whether or not we choose to apply them in the first place. As for as the natural environment is concerned, whether they turnout to be good or bad is determined by their environmental impacts.

Following the industrial Revolution, economic development through industrialization based on science and technology became the norm. But in the international organizations such as World Bank and International Monetary Fund the environmental degrading is considered as the norm.

The science and technology have brought immense benefits. However we are paying a high ‘price’ for it in terms of environmental degradation. and the ‘price’ is escalating to thwart the achievement of even a modest degree of global sustainable development. And this has serious implications for future generations.

An analysis would show that the main contribution of science and technology to environmental protection has been in two distinct areas. First, alerting us to potential or manifest environmental problems. For example, it is through science that the global impacts of some of our polluting activities have been discovered mainly in terms of qualitative cause-effect relationships. Typically, it was through science that CFC emissions were found to be the cause of stratospheric ozone depletion. Once a scientifically sound cause-effect relationship is established, appropriate measures (such as the Montreal Protocol in the case of ozone depletion) may be taken by the international community to modify our lifestyle in a way that reduces or stops further environmental degradation. However, neither science nor technology can be applied to repair the damage already caused. For example, neither can offer an economically viable method of restoring the stratospheric ozone layer to its pristine state.

The only hope is that if we reduce or stop further CFC emissions, in due course the problem would probably (or possibly) be solved by nature’s own capacity for regeneration. And second, while science and technology can offer economically viable solutions to small-scale environmental problems, such as those for treating municipal wastewater or restoring relatively small areas of contaminated land, they cannot be applied to solve large-scale or global man-made problems, or to alleviate their impacts, that must be addressed to achieve global environmental sustainability.

So we are compelled to conclude that although science and technology can help the process of sustainable development and global environmental sustainability in a limited way, they cannot deliver them. Science and Technology are exclusively concerned with treating the effluent and not the cause. Hence this conventional approach, which focuses only on symptoms, cannot bring meaningful progress towards global sustainable development.

If Science and Technology can deliver sustainable development, then the rich developed countries should be the most sustainable. On the contrary, they are the biggest consumers and polluters. For example USA with 4.5% of the world’s population, it consumes an estimated 25% of the world’s resources and produces an estimated 26% of global pollution. Such a nation cannot be said to be sustainable.
5. Environmental awareness through education:

5.1 Teaching methodology in schools:

Over the course of the last century, the principal types of infantile diseases have evolved a great deal. For children in industrialised countries, environmentally related diseases like asthma, lead poisoning, cancer and certain neurological or behavioural problems have progressively replaced infectious diseases [15]. Even if, in the environmental health field, it is still difficult to attribute the cause of these new diseases to pollutants or specific environmental conditions, we recognise that toxic materials are more harmful to children than adults. Children ingest greater quantities of toxins because they breathe twice as much air, consume three to four times as much food, and drink two to seven times as much water, relative to their body weight, than adults [15]. Children are thus particularly vulnerable to pollutants present in the air they breathe, water they drink, food they eat and environments in which they grow, learn and play.

To protect children living in polluted regions, environmental education represents a relevant means of prevention because this type of education encourages learners’ awareness of their environment’s ambient conditions, as well as their active participation in solving local problems. However, ways to utilise Environmental Education in the environmental health field have yet to be developed. The students have to be invited to participate in an educational process, which includes various activities allowing them to construct broader (more developed) ideas on pollution and the pollution-health relationship.

5.1.1 Young children’s ideas about pollution:

The young minds may be moulded very easily and they will be having their own ideas and concepts about pollution. The ten years old children have the idea about pollution as follows:

“Pollution is what people don’t want and throw on the ground … It harms animals and humans. We can see, touch, taste and smell pollution … People don’t want to live with pollution.”

Nine and ten year old students thus conceive pollution as the presence of harmful garbage. They are incapable of identifying the precise consequences of pollution on the state of their health.

In the similar way the 14 year old children have got different opinion about pollution.

“Pollution comes from garbage we throw out that isn’t biodegradable. It kills fish and harms the environment, plants and other living organisms. It is mostly chemical in nature … Even if we don’t always see it, pollution affects our planet.”

Thus concept about pollution varies under the different age groups and the 14 year old have got little bit clear concept about pollution that it harms all living organisms.

5.1.2 The evolution of children’s conceptions:

Children’s conceptions are personal interpretations of natural phenomena they believe in and use to solve problems, draw conclusions and make generalization about the facts of daily life. Children’s conceptions can be considered as different from those of the scientific community, but they stem from modes of reasoning that are organised and relevant to them. More and more, researchers consider a child’s reasoning plausible and firmly based on his or her prior knowledge [13].

One of the goals of science education or environmental education (EE) at the elementary level is the evolution of children’s initial conceptions into conceptions that are more thought-out and/or closer to those of the scientific community. This evolution is called conceptual change [7]. During this “gradual process, the initial conceptual structures based on infantile interpretations of daily experiences are continuously enriched and restructured” [23]. The cyclical process is characterized by multiple phases of inductive and deductive work [11]. This is how conceptual change supposes an important modification of students’ initial ideas about a phenomenon, toward notions closer to those of accepted science.

This modification of initial ideas may be:

- complete: the old concept is totally replaced by a new one [9]
- peripheral: the initial idea persists and is included in the new concept.
More specifically, students’ initial conceptions may suffer several transformations in response to a conceptual change: concepts may be added or subtracted, links between concepts can also be added or excised, or the initial ideas’ structure may be radically modified. In science or in environmental education, noting a conceptual change in students constitutes tangible proof that learning has occurred. The goal of conceptual change is not easy to attain however. Students begin a lesson or scientific theme with firm beliefs about a scientific phenomenon and its relationship to other phenomena [18]. Several situations may present themselves and limit conceptual change:

- Understanding the phenomenon may turn out to be too difficult [8]
- Students might understand a new theory about a phenomenon, but not believe it
- They may firmly believe their initial idea to be valid and ignore some data to preserve that first opinion
- They may demonstrate little interest in the studied phenomenon
- Finally, members of the community where the students live can share different opinions and conceptions than those to be developed by students, holding back the learning process [13].

5.1.3. Teaching Strategies favouring conceptual change:

Several pedagogical strategies that favour conceptual change have been identified ([23,11,18,16,] etc). Posner et al.’s conceptual change model [20] was one of the most experimented with and criticised. According to Posner et al. [20], several conditions must be met for a learner to decide to modify one of his or her conceptions. An individual must first experience dissatisfaction with the initial conception. That individual must then understand the new conception that is proposed and find it plausible. Finally, he or she must find that the new conception enriches his or her knowledge.

Hewson and Thorley [12], inspired by Posner et al. [20], however clarify that in the course of the conceptual change process, the initial conception considered relevant at the beginning progressively loses its status to be replaced by a conception closer to that of accepted science. The idea is to first invite students to express their ideas regarding a given phenomenon and then present them with a demonstration that counters those ideas. The resulting cognitive conflict then provokes dissatisfaction, and the remainder of the conceptual change process occurs naturally [20]. Goals, values and feelings of efficiency and control are also influential factors in the conceptual change process. Students’ goals and perceptions are components that influence their commitment on the path toward the modification of conceptual structures.

Finally, the classroom context influences the interaction between motivational and cognitive factors in learners. A teacher must, during the educational process, encourage the expression of a variety of ideas from different people in the class and must invite them to fully explain their ideas. The teacher must also make use of metacognition and ask students to think about the value of their ideas. It is thus important to supply students with a learning environment that encourages the expression of their ideas and beliefs, and then to make them have significant experiences that allow them to understand the limits of those ideas and beliefs, and consequently to motivate students to revise them.

Researchers also propose other strategies designed to favour conceptual change. Experiential learning, or real contact with people and objects in the environment, is one of these. Pruneau and Lapointe define experiential learning as a process through which the participants fashion their ideas and beliefs through affective and cognitive transactions with their biophysical and social environments. Bell [2] contends that experiential learning consists of a relationship between people and their environment during which a meaning is discovered.

In the field of Environmental Education, Sauvé explains the stages of experiential learning in the following manner.

- *concrete experimentation* is a mode of learning centred on feeling. During this stage, the learner is in a learning or problem-solving situation; one gains new experiences by interacting with one’s environment.
- *reflective observation* is centred on the act of observing. The learner must observe, reflect and try to understand reality from his or her experiences.
- *conceptualisation*, the learner thinks about, fashions and constructs his or her conceptions.
- *active experimentation* is centred on the act of doing. At this stage, the learner relies on his or her new found knowledge to make decisions and solve problems. The learner also makes a transfer by experimenting that knowledge in new situations.
During reflective observation, the student can reflect alone or with a teacher on what was experienced. Furthermore, during synthesis (active experimentation), the learner can share the value of his or her experience with peers, or apply it to another context. Experiential learning thus allows students to feel different emotions such as challenge, pleasure, desire to share their impressions, amazement, compassion, etc.

Another strategy that encourages conceptual development is [6] verbal interaction between peers allows students to verbally communicate their ideas and opinions, and thus their conceptions. Social interactions create cognitive dissonance and debate among the children, making them aware of the existence of ideas different from theirs. This contradiction can lead them to modify their initial ideas.

Finally, scientific writing is another strategy that helps conceptual change. Having to write down their ideas allows students to elaborate on them, evaluate and revise them.

In that respect, two pedagogical methods have proven themselves:

- **concept mapping**: students schematically represent their ideas at each stage of the learning process
- **dialogue journal** [21]. The dialogue journal’s goal is to guide the student to a higher level of understanding and thought. The teacher, acting as collaborator rather than evaluator, formulates a problem for the student.

There follows a back-and-forth of questions and answers between teacher and student, a process that creates a deeper reflection. Deeper reflection is another strategy that influences conceptual change [24].

According to Duit [7], it is possible to create three types of cognitive conflict: the conflict resulting from interaction with the environment, the conflict created during discussions between the teacher and the students, and finally, the one born from interactions between peers. According to Novak [19], conceptual change is a difficult process. The students, in order to change their conceptions, must be able to insert the new information in their previous cognitive structures, i.e. these previous structures must allow the desired construction. Thus, what we perceive of events or objects depends on what we already know, but also on our observation strategies and emotional, physical and social situation [19].

5.2. Teaching methodology in Colleges:

5.2.1 Curriculum development:

The younger generations, students are the effective media to bring the enormous change in the society and hence educating about the environment in these young minds is the right step and also this is the right time for the same. The resource base is not inexhaustible and there must exist some limit beyond which the rate of exploitation of natural resources will comprise the ability of future generations to meet their own needs. Hence the focus must be on reducing consumption with a view to achieving sustainability. Wherever possible, strategies for reducing consumption of energy and materials, and greater use of renewable resources, should be incorporated in design and construction.

Science and Technology, even though advanced, cannot help in bringing about the change of attitude. Hence education in moral and ethical philosophy is needed and Environmental study should be made as a mandatory part.

Reasons for including moral education in Curriculum Development:

- As future planners, designers, builders and decision makers, engineers shoulder special responsibility in protecting the integrity of nature and the natural environment.
- Human beings are rational creatures who have an innate need to rationalize all their actions and thoughts. Moral philosophy provides this rationale, and by doing so gives us our humanity.
- Albert Einstein’s statement “Science without philosophy is just mechanics”.

This moral education reinforces environment – respecting moral values, especially in the young through formal education.
5.2.2 Criteria for curriculum development:

- The focus must be on reducing consumption with a view to achieving sustainability. Wherever possible, strategies for reducing consumption of energy and materials, and greater use of renewable resources, should be incorporated in design and construction.
- The content should be holistic, covering all essential aspects.
- The content should comprise two strategic elements:
  1. The ‘end-of-the-pipe’ element based on science and technology to deal with pollution already produced.
  2. The ‘before-the-pipe’ element concerned with pollution prevention and reduction.
- Low cost technologies which are more practicable for implementation is essential.

Local, national or regional environmental issues and problems should be emphasized as appropriate and likely contributions to the environmental problems explained in accordance with the Rio slogan of “Act locally and think globally.”

5.2.3 Enhancing Research activities:

In research priority may be given for sustainable development, global change and ecosystems. The scientific and technological capacities needed for our country can be strengthened. This will be able to implement a sustainable model in the short and in the long term, integrating its social, economic and environmental dimensions contributing to international efforts mitigating adverse trends in global change.

Affluent would be willing to adopt less consumptive lifestyles commensurate with earth’s ecological capacity. The research may be centered on pollution, health and environmental action. More fund can be allotted for environmental related projects and students may be motivated by giving awards and prizes for best social impact environmental project. The interest among the students may also be enhanced by conducting essay writing competition.

6. Understanding environmental behavioural change through communication:

6.1. Defining responsible environmental behaviour

In many of the conferences it was presumed that in order to solve environmental problems it was necessary, besides the technical and scientific solutions that everybody adopted a different behaviour towards the environment. Developing a ‘responsible environmental behaviour’ became one of the tasks of environmental education. Unfortunately changing behaviour through environmental education confirmed itself as a difficult task. A communication approach can give us a new perspective of responsible environmental behaviour. It allows us to consider it not only from the individual perspective but also from a social perspective[1].

The first approaches linking knowledge to attitudes and attitudes to behaviour proved wrong in practice and environmental education was forced to change and evolve its practices. Many environmental education researchers and practitioners consecrate themselves to understand the responsible environmental behaviour in order to improve environmental education. The ‘responsible environmental behaviour’ is defined as “the whole of actions of an individual within the society, that takes into account, in a conscious way, the perennial and harmonious relationship between these actions and environment”. Communication is a way of approaching and explaining processes in society and it can be defined as “the exchange processes among the individual and group members of a given society”.

In the field of environmental education the research on responsible environmental behaviour has been directed in two main directions:
- The predictors of a responsible environmental behaviour within the individual
- The link between environmental behavioural change and its outcomes in practice.

The responsible environmental behaviour is the product of personality factors, action skills and knowledge that influenced the intention to act.
The communication approach explains the difficulties to change behaviour from the lack of stability of the innovation. In this case the fact that the individuals susceptible to learn and change their behaviour towards the environment are influenced by the interactions they have with other individuals.

6.2. Communication approach in responsible environmental behaviour:

In everyday speaking communication is often reduced to providing information, marketing or technical means (television, telephone) that are part of the so-called information and communication technologies. This is not what communication is about from a scientific perspective. Communication as we use it is a way of approaching and explaining processes in society. Like mathematics or economics it fosters a particular way of describing the world. It is another hole in the box through which we can look at reality, although reality can only be explained partially from our perspective.

We can define communication as “the exchange processes among the individual and group members of a given society” [14] These processes, that involve interlocutors, codes, rules, networks, techniques and content [14], can represent a different point of view to observe social phenomena considering the individual level and also the individual in relation to other individuals, groups and institutions.

7. Conclusion:

The international community is serious about achieving even a modest degree of global environmental sustainability and sustainable development, effective policy must be implemented to curb consumption by the affluent. We need moral education to instill genuinely environment respecting moral values in the young budding engineers and other specialized area students who, in their professional careers as planners, designers, builders and decision makers, will bear considerable responsibility for mankind’s impact on nature and the natural environment. Conventional engineering education is no longer adequate for the real needs of tomorrow. Future engineers must acquire knowledge and skills in engineering and keep pace with rapid advances in practically in all branches of engineering and other areas too.

Following interventions based on observations, discussion, research, writing, reflection and idea comparison, young children seem to be able to construct the conception that pollution can be hazardous to their health, starting from the idea that pollution only constitutes visible waste. We believe experiential learning and the socioconstructivist approach, as experienced, contribute to significant learning and encourage learning. Indeed, Novak [18] explains that at the point where significant learning occurs, new concepts are integrated into the previous cognitive structure as long as sufficient effort is made to favour that integration. This significant learning is opposed to learning ‘by heart’ (memorisation), an approach often used in schools.
Perhaps the effort required of these last interventions that sustain the cognitive conflict between peers’ and adults’ ideas favours learning better than traditional methods of information-explanation and learning by heart. As Hassard [10] would say, hands-on experience is not enough; we also need minds-on experiences. The communication perspective opens the door to another kind of tools that environmental educators can use in order to improve the educational practice.

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