

Integrating Ethics in Technical Education for Sustainable Development

Zeeshan Ali

Assistant Professor, Department of Humanities and Social Sciences, National Institute of Technology, Patna, India

Ashish Ranjan Sinha

Head & Assistant Professor, Department of Humanities and Social Sciences, National Institute of Technology, Patna, India

Abstract

The contemporary epoch of a knowledge society requires a new approach to understanding of knowledge which is different from what was basic during the modern era up to now. The goal of knowledge societies is to foster peace and sustainability. It is imperative that strategies for action ensure that decisions at all levels promote the integration of knowledge within people's lives in ways that maximize the benefits and minimize harms, taking into account the goals of environmental protection, inclusive social equity and justice. Engineering and management are important and learned professions, which have a direct and vital impact on life of all people. They have to be conscious of the fact that by using available technologies it is possible to provide abundance for all human beings, but if not rationally applied may tend to completely destroy life on Earth. They must perform under a standard of professional behaviour that requires adherence to the highest principles of ethical conduct. They should also contribute to environmental protection and to sustaining the balance in nature. To be an engineer or a manager of a high quality one has to study, not only engineering and management, but also values and ethics. This paper aims to reflect upon the need to integrate ethical studies to reorient curriculum, programs and practices to address sustainability at institutions of technical education. It is also proposed that embracing sustainability in the curriculum will teach students make intelligent choices that will enhance their understanding and a wider appreciation of their role as a professional for sustainability of society.

Introduction

The last few decades have witnessed astonishing advances in the field of science and technology and consequently rapid industrialisation have taken place in the world. Tremendous increase in some of the economic parameters like gross domestic product and gross national product have been achieved alongwith the ruthless materialistic developments. According to Sinha et al. (2005), these have been found to be responsible for creation of ocean deep socio-economic disparities between developing and developed nation which has been attributed to be one of the most significant factors in aggravating and accentuating the world under social unrest. At present, a complete state of conflict and confusion, hatred and violence, war and rebellion has galloped the world scenario mainly due to serious negligence of ethical values and spirituality and therefore integration of ethics and spirituality in technical education is necessary

for achievement of sustainable development and welfare of the society. In this paper, an attempt has been made to present insights into the problems of sustainable development and prospects of linking ethics with technical education for an effective and appropriate response to sustainable issues.

1. Destabilisation of Ecosystem: Greatest Danger to Sustainable Development

Human beings cannot secure the blessings of nature unless they give up the idea of ruling and disturbing the various biotic and non-biotic elements comprising nature. The frequent occurrence of natural disasters like earthquakes, floods, unprecedented draught, famine, and epidemics is gripping the earth. It is obviously the outcome of mishandling the natural phenomenon that has resulted in provoked reaction. The tranquillity and lucidity of nature has been changed into imbalance, irritation and finally onslaught on

vast population. The organisms of different community, besides interacting among themselves, always bear functional relationship with the external world or the environment. This structural and functional system of communities and their environment is called an ecosystem. In fact ecosystem essentially comprises of the biotic community and its interaction with the abiotic component (environment) which comprises of material and energy. An ecosystem may be considered to be of any dimension where the living and non-living systems are involved in continuous flow of energy and cycling of materials through the non-living component. It is dynamic yet a functionally stable system, which in balanced condition is self-sufficient, self-regulatory and self-adjusting.

In fact, there is a great need of conservation of different ecosystem for the welfare and existence of human life on the earth. This is essential for the survival of any creature. Due to excess cutting of trees, converting forest into industrial and agricultural units, blasting of mountains for getting materials for construction and other purposes, excavating mines for fossil fuels, the different ecosystem have been disturbed. One can't venture tearing and dismantling the ecosystem completely and still expect it to function stable. We must remember the warning of ecologist that man is a part of nature and not apart from it. Since several ecosystems are interrelated and often smaller systems together make a larger ecosystem, disturbance to smaller ecosystem may also produce disastrous result. The components of ecosystem go on rotating in a cycle known as biogeochemical cycle which maintains equilibrium and as such a basic and fundamental education on national natural resources, the function of ecosystem, the ecological interdependences, the ecological checks and balances, the short and long range chain effects of an action on organism, etc. is urgently needed if we really want to prevent further damage of nature and to improve our present and future by using resources wisely.

In India, we have a very rich cultural and scientific heritage. If we look back towards the ancient sages who used to be not only spiritually advanced but scientifically also like Maharishi Kanad, Charak, Dhanbantari, Aryabhata, and others. One common thing may be observed that all of them lived in a place surrounded by trees, plants, creepers and animals, quite away from hue and cry of cities and did most of teaching in their open courtyard of 'parnakutti' (cottage). They were real environmentalist and had already visualized the importance of conservation of nature and would therefore not allow cutting of trees or killing of animals strictly considering same soul in them also.

2. Role of Technology in Sustainable Development and Ecology

It is not easy to make a compromise between progress and ecology, reliability and sustainability, between technically practical, viable, safe and economic requirements, between moral responsibility to people and the whole environment and obligations to future generations. Professionals from technical field need to keep in mind their moral responsibility and obligation towards society as a whole. Their professional ethical standards have to transcend commonly accepted morality. Professionals like engineers have obligations to future generations that could be harmed by irresponsible engineering activities, because it may take decades and generations for products and facilities to have adverse effects. They should not act using immoral and unethical rules and laws.

The main problem is that we have allowed our technology to get away from our ethics. The nuclear and space age that we live in, encourage the vigorous progress of science. Human technology is developing very fast but unfortunately human ethics has gone very weak. In the case of the Chernobyl nuclear disaster, it seemed that the two engineers in charge of the control room, decided to experiment to play with the nuclear reactor. Thereby they caused one of the biggest nuclear

disasters so far. The human made technology has changed ethics because technology has changed the scope of human action.

Engineering profession has a significant role to play in sustainability. Engineers work to enhance the welfare, health and safety of all, with the minimal use of natural resources and paying due regard to the environment and the sustainability of resources. Their work is influenced by the opportunities and challenges that sustainability brings. Engineers are the providers of options and solutions to maximize social value and minimize environmental impact. According to Engineering Council (2010), the following principles have been agreed in the UK to achieve sustainable development. It can be summarized in six principles to guide and motivate engineers when making decisions for clients, employers and society which affect sustainability:

- Contribute to building a sustainable society, present and future;
- Apply professional and responsible judgment and take a leadership role;
- Do more than just comply with legislation and codes;
- Use resources efficiently and effectively;
- Seek multiple views to solve sustainability challenges;
- Manage risk to minimize adverse impact to people or the environment.

The goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising quality of life for future generations. Professionals from technical area need to understand and live within environmental goals to ensure a healthy and just society. To achieve sustainable economy, they should not only use science responsibly but should also promote good governance.

To accomplish these goals, they have to recognize the importance of sociological and cultural context

of the engineering or management profession. Technical students also have to develop spiritual intelligence which is the backbone of human consciousness, responsible for character building and meaning making. Growing in spiritual intelligence, professionals grow in their action logic from the perception of "What I can get ..." to "What I can contribute ... ". The practice of self-reflection and contemplation enhances development of spiritual intelligence, and a depth of compassion and benevolence to all life on Earth develops as well.

Thus, contemporary professionals will develop the ability to act with wisdom and compassion, while maintaining inner and outer peace, regardless of the circumstances. All these qualities are necessary for them to become a humanist who, while working in his profession, respects, protects and welcomes all life on Earth. When a person does not have any virtue left, he is no longer considered worthy of being a human and therefore should have no place in the human society. Therefore, virtue, ethics and moral should be deeply rooted in the history, society and culture of human beings.

3. Sustainable Development (SD)

In order to understand Education for Sustainable Development (ESD), one needs to understand the concept of sustainable development. After all, the UN Decade of Education for Sustainable Development is about engaging the world's educational systems to work for a more sustainable future. The concept of sustainable development was described by the 1987 Brundtland Commission Report (WCED, 1988) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The four dimensions to sustainable development – society, environment, culture and economy present a model for thinking about the future in which environmental, societal and economic considerations are balanced in the pursuit of an improved quality of life.

For several decades the United Nations has

encouraged all education sectors to address Education for Sustainable Development to integrate the concept of sustainable development into all learning areas, reorient education so as to develop initiatives. Sustainable development (SD) encompasses technological and environmental factors as well as economic and social factors. Therefore, to achieve a more sustainable society, it is imperative that professionals especially from the technical field must be involved in SD. so that by using an integrated approach, they can offer diverse solutions for the sustainability problems posed by our society. Education for sustainable development (ESD) must be considered a basic educational principal that involves a range of professionals who are capable of connecting several fields of knowledge.

To bring ESD to this level, the academic structure of study must be changed to introduce SD as a transversal skill in all majors, defining the skill as the student's capacity to internalize and apply sustainable solutions to all aspects of their professional lives: technological, environmental, and social aspects. This capacity affects the rest of the competencies that the student must acquire, which justifies its transversal nature.

3.1 Principles of Sustainable Development

There is more to the understanding of the concept of what sustainable development means beyond a simple one-sentence definition. The Rio Declaration on Environment and Development (UNEP 1972) flashes out the definition by listing 18 principles of sustainability which may be summarised as below.

The declaration emphasises that people are entitled to a healthy and productive life while maintaining the health and integrity of the Earth's ecosystem. The current developments in anyways must not undermine the development and environment needs of present and future generations.

Nations should use precautionary approach to protect the environment by using their own resources, but without causing environmental damage beyond their borders. They should develop international laws to provide compensation in case of trans-border damage and impacts. Also, nations should frame effective environmental laws, including laws for the victims of pollution and other environmental damage. As the declaration adds that the polluter should, in principle, bear the cost of pollution.

In order to achieve sustainable development the declaration says that eradicating poverty, reducing disparities in living standards in different parts of the world, eliminating unsustainable patterns of production and consumption and open international economic system are essential to achieve a sustainable economic growth.

Environmental issues will be best handled with full participation of the citizens including women and therefore nations should increase and encourage public awareness by making environmental information widely available to all. They should share and expand the knowledge of innovative technologies to achieve the goal of sustainability.

Most importantly, it emphasizes that peace, development and environmental protection are interdependent and related to each other. The Nations must respect international laws protecting the environment in times of war and should cooperate in positive establishment.

It seems that our current knowledge base does not contain the solutions to contemporary global environmental, societal and economic problems. Today's education is crucial to the ability of present and future leaders and citizens to create solutions and find new paths to a better future. The "Rio Principles" give us parameters for envisioning an education system which may teach to utilise relevant and appropriate sustainable resources. These principles will educate the citizens of the

world, the need to learn their way to sustainability.

4. Education for Sustainable Development

Education is essential to sustainable development. UNESCO explains Education for Sustainable development (ESD) as an umbrella for many forms of education that already exist, and new ones that remain to be created. It promotes efforts to rethink on the content and pedagogy of educational programmes and systems that currently support unsustainable societies. Many individuals and organizations have now implemented programmes using an ESD approach to learning which is life-long and is also critical for achieving sustainability. UNESCO suggests a combination of formal, non-formal and informal education to enhance and improve society. The characteristics of Education for Sustainable Development (ESD)

- is based on the principles and values that underlie sustainable development;
- deals with the well-being of all four dimensions of sustainability – environment, society, culture and economy;
- uses a variety of pedagogical techniques that promote participatory learning and higher-order thinking skills;
- promotes lifelong learning;
- is locally relevant and culturally appropriate;
- is based on local needs, perceptions and conditions, but acknowledges that fulfilling local needs often has international effects and consequences;
- engages formal, non-formal and informal education;
- accommodates the evolving nature of the concept of sustainability;
- addresses content, taking into account context, global issues and local priorities;
- builds civil capacity for community-based decision-making, social tolerance, environmental stewardship, an adaptable workforce, and a good quality of life;

- is interdisciplinary. No single discipline can claim ESD for itself; all disciplines can contribute to ESD.

5. Technical Education System and ESD

While an increase of interest in incorporating SD into college curriculum has been seen recently, progress in the field has been slow and the evidence of effective teaching and learning using this global perspective in Technical Education has been scarce. In spite of the deteriorating status of the environment, study of environment and sustainable development has so far not received adequate attention in our technical programmes. Sustainable education aspires to develop a social environment which can not only solve scientific and technical problems but can also resolve socio-economic and environmental issues.

The objectives of embedding SD in Technical Education system is to:

- get acquainted with the basic understanding of SD and its related issues.
- to have optimistic outlook for the environment and ecology.
- to be appreciative of the critical relation between society, economy and environment with technology.
- to be able to solve issues arising from this critical relationship ethically.

Earlier sustainable education as a subject was not integrated in the curriculum of technical education; but very recently the need of incorporating sustainable issues/ content has been appreciated by many government organisations such as Ministry of Human Resource Development (MHRD), Ministry of Environment, Ministry of Rural Development, Ministry of Agriculture and many more.

6. Relevance of Values and Ethics for Technical Students.

Understanding values, the values of the society, and the values of others is a central part of education for sustainable development. It is imperative for technical students to learn the skills of recognizing their own values and assessing these values in the context of sustainability.

Subramanian (2013) defines human values as the fundamental constructs, principles, or standards developed over a period of time that we use as a reference to base our decisions and actions. Value systems are used by individuals, societies, and corporate bodies to guide their actions. They are important in determining the ethical actions of everyone in a group. A value system can be defined as a coherent set of values adopted/evolved by individuals, organisations, or society as a yardstick to guide and control behaviour in all situations. The benefits of having a good value system are:

- Values will guide the students to live ethically, take the right decisions and act appropriately.
- Values will help them to evaluate and judge other's actions similarly.
- Values and beliefs will have a bearing on their attitudes. Attitudes are very important for success and harmony in life.
- Good values will help them in feeling at peace from within, and live in harmony with themselves and the society.
- Values will give a direction to their life.

Values and ethics seem to have many common features but they are obviously not the same. Values can be defined as the fundamental constructs, principles, or standards developed over a period of time that we use as a reference to base our decisions and actions. All these have a bearing on the ethical behaviour of a person. Ethics is concerned with right or wrong, good and bad behaviour and making decisions.

Real ethics or the values behind them cannot and should not change with time, although their expression or focus may change. But nowadays we can see that human morality has declined drastically and that the ethical standards in society

are very low. We have to be aware of the fact that by using available engineering technologies it is possible to provide abundance for all human beings, but also to destroy all life on Earth. Therefore modern engineers have to study and apply ethical codes, doctrines and principles in their professional engineering practice. In the modern era, engineering profession is no longer a pure technical discipline.

Therefore, it is no longer possible to practice technical professions without regard for the ethical context. Professionals like engineers and management graduates will face unethical situations beyond their control during their careers. A good value system and awareness of ethics will help engineers make ethically healthy choices.

6.1 Value Education in Curriculum for Sustainable Development

To create a viable curriculum for technical education, the authorities need to identify issues, skills and values which conform to the needs of SD in each of the three components - environment, economy, and society. A single discipline may not be able to integrate all the common objectives of Education for SD. Therefore, the curriculum comprising of values for technical education should be tailored with contributions from many disciplines. For example,

Basic Sciences like green chemistry will teach students to understand how chemical production could be achieved without posing hazard to human health and environment at the same time being efficient and profitable.

The study of subject like Science, Society and Ethical Values will inculcate the right values during the period that a youngster is preparing to step into the professional world and still in the process of understanding the society and relevance of science in the right perspective.

Industrial Economics and Financial Management needs to be well understood by the technical

students since it will have a deep impact on their ethical decision making ability and also in selecting the best possible alternative out of the ones available to them.

Subjects like Sociology, Psychology and Anthropology will help students to understand human beings, society and their behaviour while incorporating and appreciating sustainable learning simultaneously to lead a sustainable lifestyle.

The combined pedagogical techniques and strategies of each discipline will contribute to the vision of how to teach creativity, critical thinking, and a desire for life-long learning - all mental habits that support sustainable societies.

Therefore, values play important role in the development of curriculum for technical education as students inhabit desired behaviour when directly exposed to instructions or models of accepted values. By the study of the relationship between science, society and ethical values, the learners will adopt values derived from their teaching and learning experience. The learners develop a value system which will encourage them to participate in ethical practices for decision making. All of these approaches contribute to the overall goal of sustainability.

7. Engineering Education and Ethics

A sustainable education including the teachings of values and ethics are necessary in engineering education because engineering affects our lives intimately. It takes care of all requirements of our lives by providing products and services that are invaluable. Development due to engineering is like a double-edged sword. While it benefits the society in many ways, it is also often directly responsible for a world full of potential dangers. For example, nuclear energy can satisfy the power needs of an exploding population and technological advancement; the same technology becomes very dangerous as weapon of war. The engineering

discipline has a dominant role to play in sustainable development and therefore engineering education holds a position of considerable responsibility.

Govindarajan et al. (2004) defines Engineering Ethics, as a subject of study, owes its origin not only to the lack of ethics that led to the engineering disasters that have been recorded over a period of time but also to the day to day ethical behaviour that ought to be followed by engineering professionals. In the case of disasters, several factors were responsible-overconfidence (Titanic disaster), impatience (space shuttle challenger explosion), negligence and poor maintenance (Bhopal Gas tragedy) - these were the four main factors that caused these disasters. Most of the disasters could have been prevented if the necessary code of ethics were established. The main purpose of ethical codes is to ensure public safety. Govindarajan et al. (2004) summarises the actions of the engineer on matters of sustainability and environmental impact as follows:

- Engineers must assume a responsibility for the effects of their work and endeavour to make a substantial contribution to the protection of the environment.
- They must not participate in projects that are unnecessarily destructive to the environment.
- Engineers should express their professional opinions on environmental matters based on sound knowledge and analysis.
- Where no national guidelines exist, the engineer has the responsibility to set appropriate standards to communicate these to others and to work in accordance with these self-generated regulations.
- Engineer has the right to withdraw from a project that is harmful to the environment with the right to make his concerns known to the relevant authorities.

Therefore, it is expected of professional engineers to undertake engineering activities in a way that contributes to sustainable development.

8. Ethics in Management Education for Sustainable Development

Management education is an integral component of technical education. Nearly 130 years ago, the first business school was started at the University of Pennsylvania, U.S.A. In India, the management education in its pure academic form was started in Ranchi University as a subject of labour studies during 1950s. The importance of management education has been increasing and gaining momentum for a long time since its inception mainly to manage corporate world effectively. After industrial revolution, the size and shape of business changed from simple organisation to a complex one. Stakeholders of business have increased in leaps and bounds. In this scenario, process of management of corporate world which aims profit maximisation, required and necessitate proper management of organisation through planning, organising, controlling and directing.

Carroll (2009) has suggested four categories of responsibilities that a business has to bear are economic, legal, ethical and discretionary or philanthropic. The economic responsibility refers to business to be profit making so that it motivates people who bears risk; legal responsibility includes responsibility to abide by law under which the business is expected to run; Businesses are expected to fulfil ethical responsibility; Philanthropic responsibility includes public's expectation that business will engage for social responsibility. Practice of ethics in management education play a crucial role for SD. Management education constitute amalgamation of several courses to give niche/facilitate business people to learn marketing, HR, production, finance, quantity management, supply chain etc.

Sustainable economic development can be achieved only if we practice ethics in business process, whether it is marketing, HR or production, ethics plays an important role. Marketing is related with product, price, place and promotion. Every aspects of marketing require incorporation of ethical aspects. True information about its product

develops confidence in customers. As in case of Maggi recently., customers have lost their confidence and felt cheated. Sales Promotion is the method to promote product and services among customers. A lot of information is provided to customers about the product and services. If ethics and value are not taken care of many disastrous result may occur which will reduce both goodwill of company as well as on confidence of customers in long run.

There are few basic principles or codes that managers of different functional areas should follow. They should

- act consistently and continuously for the benefit of public interest.
- act in a manner that, it is in the best interest of their clients and employer consistent with the public interest.
- ensure that their products and services meet the highest professional standards.
- maintain integrity and independence in their professional judgement.
- subscribe to and promote an ethical approach to the management of organisation.
- advance the integrity and reputation of the profession of management consistent with the public interest.
- be fair to and supportive of their colleagues without any discrimination.
- strive for equal economic opportunity regardless of caste, creed, community and gender.
- participate in lifelong learning regarding the practice of management profession and shall promote an ethical approach to the practice of management profession.

Presently, the curriculum of management program generally consists of courses in economics, organisational behaviour, human resources, marketing, supply chain and many more but very few courses are offered in ethics, moral values and spirituality. These courses should be taught to management students so that they can understand what is right and what is wrong in perspective of

organisation and its impact on SD of a country, environment and society. The following can be the advantages of incorporating ethical and spiritual education in management education for benefit of stakeholders of business and society.

- Business ethics substantially improves society.
- It cultivates strong team work and simultaneously productivity of the organisation.
- It supports employee development, organisational development and organisational culture.
- Ethics program may help values associated with quality management, strategic planning, supply chain management etc.
- It promotes green product, green economics, green marketing and environmental and ecological protection etc.

9. Institutional Role for Ethics and SD in India

It is legendary that India manages to feed the second largest population in the world while maintaining continuous, rapid national economic growth. These developments, however, have been achieved at a tremendous ecological cost. Against the background of such severe environmental damage, how should India's educational system take measures to respond to the environmental crisis? All educators need to be engaged. How can university/college teachers prepare students to handle these environmental issues? This can be done by including the teaching of sustainable development (SD) and ethics in the technical education curriculum.

A core group of Value Orientation of education was thus set up by the planning commission of India in January 1992 to emphasize the need for focusing on value orientation of education and should be incorporated in various sectors of education whether it is technical or management education. It is worthwhile to quote a passage from the report of

the Education Commission (1964-66) which is still relevant, 'modernisation did not mean least of all in our national situation-a refusal to recognise the importance of or to inculcate necessary moral and spiritual value and self-discipline while a combination of ignorance with goodness may be futile that of knowledge with a lack of essential values may be dangerous.' (Swaminathan,1996) "The growing concern over the erosion of essential values and an increasing cynicism in society has brought to focus the need for readjustments in the curriculum in order to make education a forceful tool for the cultivation of social and moral values" (Education Policy Modified, 1992). The Education Policy thus states that, "De-culturation, de-humanisation and alienation must be avoided at all costs" (Education Policy, 1986). For ordinary citizens, the S&T Policy emphasizes the need for public awareness thus: "People must be able to consider the implications of emerging science and technology options in areas which impinge directly upon their lives, including the ethical and moral, legal, social and economic aspects' (S&T Policy, 2003).

Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment with a module on SD at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the universities and colleges of India. The Core Module Syllabus for Environmental Studies includes class room teaching and field work. The syllabus is divided into eight units covering 50 lectures. The first seven units will cover 45 lectures which are class room based to enhance knowledge skills and attitude to environment. Unit eight is based on field activities which will be covered in five lecture hours and would provide students first-hand knowledge on various local environmental aspects.

Taking the global environmental crisis into consideration, the objective of the Indian education

system should be to produce value-based knowledge for the society and prepare them to take sustainable steps in tackling issues which may arise in future.

10. Technical Teachers Training for SD

The rationale behind technical teachers training about SD is to introduce several aspects of environmental and ecological studies, socio-economic issues, pollution studies including ethics and spirituality to enable teacher trainees of various disciplines to understand and address SD related problems. The trainees should also be well-equipped with the knowledge related to the issues of SD including crisis arising not only from the conservation and preservation of environment and ecosystem but also from unethical practises so as to add correct solutions in the development of the curriculum.

A few examples of topics and issues related to the components of SD that can be incorporated in the curriculum of technical teachers training may be ecology, ecological issues, consequences of the ecological issues, concept and approaches of sustainable development, principles and guidelines of agenda 21 of UN, Earth Charter, education for sustainable development, ecosystem based technology and management, environmental laws, sustainable economy and society, gender, human rights, globalization and development, science, society and ethical values, engineering and business ethics, green engineering, global issues, ESD resources across the curriculum, SD related co-curricular approach activities.

In fulfilling these goals, the institutions imparting teachers' training can develop a module called the "Education for Sustainable Development Module" for teachers. The objectives of the module may be summarised as follows:

- to develop trainee in understanding the concept of SD, its related issues with ethical solutions.
- to impart training to the trainee on how to integrate SD and value related concepts in the curriculum,
- to organise a course to train directors/principles/administrative personnel of technical institutions on various concepts/issues of ethics and SD.
- to facilitate guest lectures/talks/panel discussions in the training institutions.
- to organise workshops/seminars/short term programs/conferences for teacher trainees especially on the occasion of World Environment Day.

Also, the institutions should encourage and support the implementation and integration of SD in it straining curriculum to disseminate best pedagogical approach related to SD during the teaching and learning process.

11. Integrating SD Related Activities at Technical Institutions

For the implementation of the concepts of SD into practice, the government organisations should collaborate with different stakeholders involved in SD to promote the use of appropriate technology recycle technology and welfare technology. The program will aim to embed conservation and preservation of resources into the course modules of technical institutions. In this program, the students will be able to explore the different sources of renewable and non-renewable resources, energy conservation, alternative energy etc.

The integration of these concepts during campus activities like Science and Technology Fest, Vigilance Week, Good Governance Day and World Environment Day can raise awareness as well as can positively influence the attitudes and behaviour of the students. These activities will not only develop the knowledge base of the students but will also give them hands on experience in implementing these important concepts in practical life.

The different ways to impart SD into the technical education system are as follows:

- SD and ethics may be introduced as a core subject in every discipline.
- Study of documents, reports and projects of United Nations on SD and ethics.
- Opportunity to attend/participate in national and international workshops and seminars to strengthen their knowledge of SD and ethics.
- Eco-collaboration between technical institutions, ministry, government organisation, foreign agencies, research organisation, NGOs and related agencies.
- Enhancing student learning processes by field visits, lectures from speakers from relevant areas.

11.1 The Concept of Sustainable Cell at Technical Institution

A Sustainable Cell will be a unit of the technical institute which will encourage and create awareness in stakeholders like students, faculty, staffs, administrative personnel, parents, and people from local community etc. to lead a holistic life that is sustainable in nature through the medium of curriculum and co-curriculum activities.

The Sustainable Cell will include students, faculty, staffs, their families, local community, NGOs, government and non-governmental organizations. The cell will try to facilitate a value-based environment within its stakeholders about the significance of ethical values, issues related with SD like greenhouse effect, pollution control, renewable and non-renewable resource conservation etc.

The Sustainable Cell will involve planned environmental, social and economic activities. The institute with the help of this cell will promote and establish green campus and green buildings within its periphery and vicinity. It will take special initiative to spread awareness amongst its

stakeholders by organising awareness programs like green workshops, seminars, eco-talks, cultural programs to assist in creating a campus that is favourable for practicing SD. For example, the stakeholders of the institute may make a visit to a recycle technology centre to understand how indigenous technology or recycle technology may be useful in creating an environmental friendly technology from waste/by products.

Through this program, teachers and parents will be encouraged and trained to build environment and ethics related knowledge and skills. They will be trained to develop appealing and motivating strategies and activities to live a natural and holistic lifestyle.

12. Recommendations

The study of ethics and SD should promote interdisciplinary learning. In order to implement the concepts of SD and ethics across the technical education sector in India, the following recommendations are important:

- The strategic support from the Government, non-government institutions, NGOs etc. should ensure proper implementation of SD and ethical values in technical education.
- Steps may be taken by different government and non-government organisations organize sustainable and ethical educational programs in order to promote lifelong learning and sustainable lifestyles.
- Proper policies may be framed to ensure teachers' training in the concept of SD and value education.
- Training schemes on sustainable work practices and processes should be organised for educators and facilitators.
- Development/reorientation of a curriculum should be facilitated that promotes sustainable and ethical education program through consultation with the stakeholders of SD.

- Feedback to institutions should be received from different stakeholders regarding the use and application of the SD for further improvement.
- The ultimate aim of embedding SD within institutional procedures should be prioritised.
- An appropriate curriculum with an interdisciplinary approach should be developed that promotes sustainable development.
- A holistic education combining technical knowledge with science, society, spirituality and ethical values should be promoted for overall development of learners.
- Students should be encouraged to take active role in activities which promote green campus.
- Infrastructural facility of technical institutions should be strengthened to promote SD and holistic learning.
- Traditional knowledge, indigenous technologies and traditions should be promoted that are conducive to sustainable development.

13. Conclusion

In this era liberalisation and globalisation, the advancement of science and technology is prerequisite for the social and economic development of a country but simultaneously it also creates socio-economic disparity in the society which is characterised by mass poverty, illiteracy, violence, unemployment and etc. In this direction, integration of moral and ethical studies in technical education will be a rational approach to solve the critical issues like climate change, ecological imbalances, depletion of resources, immoral socio-economic activities etc. that are posing a threat to world environment and economy. To sum up, mainstreaming of education for Sustainable Development in technical education is vital if graduates are to possess the abilities, skills, and knowledge needed to tackle the sustainability

issues of the future. But unfortunately, even today the teaching of ethics and SD is not properly incorporated in the curriculum of the technical education system. For this proper policies should be formulated and recommended by the higher government agencies so that proper action may be taken by the technical institutions in this direction.

References

- Carroll, A., and Buchholtz, A. (2009). *Business and Society: Ethics and Stakeholder Management*. South Western: Cengage Learning.
- Education Policy (1986). *National Policy on Education, 1986*. Department of Education, Government of India.
- Education Policy Modified (1992). *National Policy on Education 1986 as modified in 1992*. Department of Education, Ministry of Human Resource Development, Government of India.
- Govindrajan, M., Natarajan, S., and Senthilkumar, V.S. (2004). *Engineering Ethics*. New Delhi: Prentice Hall of India.
- Science Policy (1958). *Scientific Policy Resolution, 1958*. Department of Science and Technology, Ministry of Science and Technology, Government of India.
- Technology Policy (1983). *Technology Policy Statement, 1983*. Department of Science and Technology, Ministry of Science and Technology, Government of India.
- Sinha, K.K., Singh, N.N., and Sinha A.R. (2005). *Welfare Technology (Technology for Human Welfare)*. New Delhi: Samiksha Prakashan.
- S&T Policy (1958). *Science and Technology Policy, 2003*. Department of Science and Technology, Ministry of Science and Technology, Government of India.
- Swaminathan, D. (1996). *Mobilization of Additional Resources for Technical, Planning & Management of Technical Education in India*. New Delhi: AICTE.
- Subramanian, R. (2013). *Professional Ethics*. New Delhi: Oxford University Press.
- Links
- <http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/education-for-sustainable-development/>

<http://www.unep.org/documents.multilingual/default.asp?documentid=78&articleid=1163>

<http://unesdoc.unesco.org/resources/img/0015/001540/154093e.pdf>.

http://www.um.edu.mt/data/assets/pdf_file/0006/63861/education_esd_lbriguglio_ppace.pdf.

<http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/education-for-sustainable-development/>.

<http://www.engc.org.uk/standards-guidance/guidance/guidance-on-sustainability/>