

Sustainable education development in Engineering Institutions

Dr.D.Sumathi, Professor,
Department of CSE
Malla Reddy Engineering
College(A),Hyderabad ,India
Sumathi.cloud73@gmail.com

Dr.S.Sudhakara Reddy,
Principal,Malla Reddy Engineering College(A),
Hyderabad,India
principal@mrec.ac.in

Abstract— Sustainable development refers to the ultimate goal of man-environment relationship. The education system has various goals such as democracy, human rights and social justice etc. Conventionally education system was based on attainment of facts and nowadays, this process becomes obsolete. Thus, this results in the decision of the policymakers to transform the education system which has more insights into the most special features of the human world from business to technology to social environment. It is also assured that there must be a separate education for each and every era. A strong curriculum forms the sturdy foundation of strong education systems. Hence, the curriculum needs a revision which must be in a way that portrays the essential competencies a student has to possess and sustain. In addition, a comparison about how the curriculum of the present century differs has been brought in this work. Moreover, this also gives a detailed overview of the sustainable education system that has been implemented in our campus which would meet out the challenges of the present social, societal and environmental challenges. To this end, the work also shows the outcome of the sustainable education system that has been followed in our campus.

Keywords—Sustainable; education system;
Introduction (Heading 1)

I. INTRODUCTION

Nowadays, it is very easy to acquire information due to the advent of latest technologies that prevails in the world. Facts that were collected until now as a result of study are available on the Internet for young generations. It is understood that the education that has to be provided must know what to do with the information gained and how to analyze it. The need for analysis makes sense of the available data which is abundant in nature, its complexity, synthesizing information by cooperating with others and then the results are communicated. Accordingly, it is observed that the quality education does not depend on fact collection. Hence, policymakers justify that there is a need for the transformation in

the education system. Hence, these transformations need a high vision of possible transformations and evidences to justify those transformations. Therefore, Evidence-based decision making gains the importance in the education community. Hence, it could be recommended that sustainability could initiate from the education department. Consequently, it could be understood that the education could advance the goals of sustainable development. The goals could be described as given below:

1. Education encourages the sustainability in agriculture and moreover the knowledge gained by parents helps in applying proper health and hygiene practices.
2. Assures life-long learning abilities for all and ensures equitable quality education to all.
3. Healthy lives are assured and encourages well-being for all age-group.
4. Gender discrimination could be overcome.
5. Assures reliable, sustainable and modern energy to all.
6. Puts an end to poverty in all its form everywhere.
7. Helps to protect our environment.

II. EDUCATION SYSTEM IN INDIA

India had the Gurukula system of education in which pupils went to the teacher's home and they were taught. The students used to help the guru at his place and in all activities at his home. Hence, there exists a strong relationship between the teacher and the student.

In the year 1830, Lord Thomas Babington Macaulay introduced the modern school system in India and this system included the English language. Subjects like science and mathematics was given as the main subjects whereas on the other hand, subjects like philosophy and metaphysics were not included. Education was given in classrooms and in addition the relationship between the students and teacher has

been reduced and the present education system is shown in the below Fig 1.

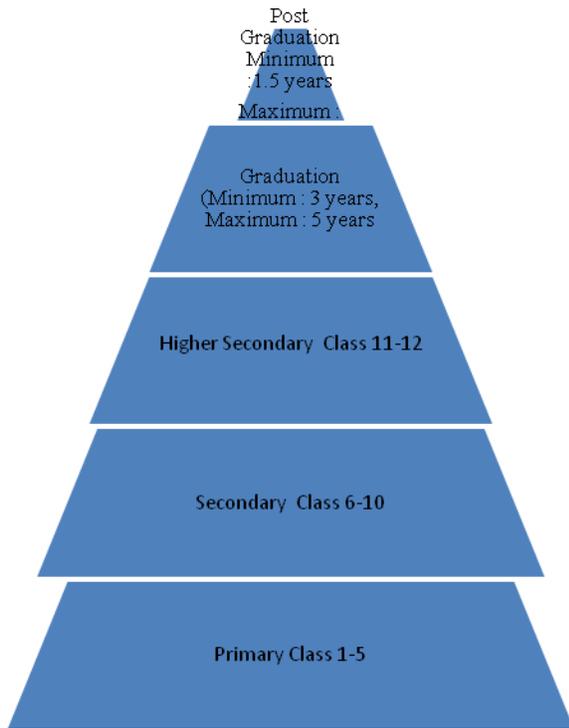


Fig 1. Education System in India

Education system at present has undergone various transformations what it was a decagon or a couple of decagons in the past. The word “sustainable education” refers to find out permanent solutions with the help of education that corresponds to the three important factors of sustainability namely economic, environmental and social issues as shown in fig 2.

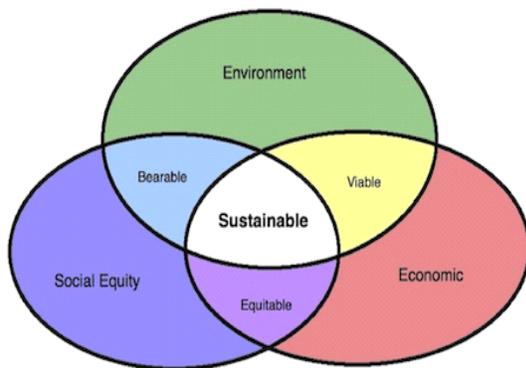


Fig 2. Three factors and descriptors of sustainable education

To identify significant constructs and to check the applications on educational organizations, sustainability and education is used. Sustainability process is carried out by exposition of indicators that are used to determine social, economic and ecological sustainability forces in institutions. In addition to the conventional knowledge base, new and emerging skills are needed for promoting sustainability by modifying and enhancing the curriculum. Sustainability incorporates an intrinsic goal of being able to endure, maintain, and tolerate as recommended by (Stephens, Hernandez, Roman, Graham, and Scholz, 2008). “Sustainability is often seen as being about fortification of facilities (including cultural diversity)” (Kemp, Parto, and Gibson, 2005). Munier (2005) described that the development that satisfy the current needs without the pacification of the capability of future generations to satisfy their needs. In addition, some steps are followed to reach the goal that is been established. From various studies, it is observed that there are three sustainability indicators namely ecological, economic and social indicators.

Bell and Morse (2003) identified that the sustainable development is a process of learning. As per the study of theory and knowledge, the sustainable development refers to the knowledge and creation of knowledge. Therefore the learning cycle serves as an opportunity for the systematic learning. The general view of sustainable development identifies that the education and training especially personality development training has to be implemented. In an educational system, entities could be named as equipment, teaching resources and physical infrastructure. Institutional development plans, the curriculum classroom programs are treated as artifacts for a process or an activity. Identifying and achieving the goal for an educational organization is a mandatory task. To accomplish this, there are ‘big-picture’ designs and in addition many improvement plans based on small incremental steps have to be established.

An organizational dimension:

- Data location has to be pertinent to sustainability indicators
- The gaps between the data has to be identified
- Evaluation of sustainability analysis must be done through the prepared documentation and data which is used
- Procedures and policies that must identify the decisions about the sustainability.
- The importance of sustainability principles within the organization is determined.

A methodological dimension:

- Stakeholders are identified and recruited
- Training is given to the stakeholders to educate them in sustainability
- The units of investigation have to be identified

Sustainable education is defined as an enriching change in the way that education and learning is seen. Hence it created an impact in the curriculum. The systematic change in thinking and practice is referred as ecological thinking and values and this is identified as a new pattern that emerges around sustainability, complexity and systemic thinking. Therefore the transformation happens in the current education system in such a way that the reflections are seen around cohesion, sustainability, rational thinking and intricacy. As a result of this transformation, education is made appropriate and suitable to the dynamic conditions that prevail now. Due to this, the active learners gain certain important attributes like creativity, adaptability, self-reliance, hope and resilience. Descriptors that are involved in the sustainable education are

- Healthy – This is considered as a viable system, that nurtures and embodies healthy relationships and materialize at various system levels
- Robust- It works properly
- Defensible- it is ethically secure, working with veracity, fairness, respect and extensiveness
- Sustaining- Helps to maintain ecosystems, communities and people

Sustainable education has been bundled by many researchers as ‘sustainability education’, ‘Education for Sustainability’ and ‘ESD’. All these terms identify the developments but it does not imply the requirement for deep changes in educational values. Therefore the education system should be in such a way that the transformations implemented in education must be known to the public.

Therefore there are two questions that arise over here:

1. First order change – The system is not affected as a whole.
2. Second order change- The whole system itself needs changing.

Rather than the first order change, the second order changes need a lot of work that has to be done. In this, the assumptions have to be reconsidered.

The learning response generally happens in the community field, personal field and organizational field. Among this, the most challenging task is the change in the educational institutions but this created awareness among the individuals and clear shift in social values and behaviors at the community level and public debate. Therefore the policymakers forecast this change and took steps in the working context in order to improve the learning process that created an impact on the sustainable future for all.

As per the perspective of the education field in the 21st century, it is observed that , to learn for “how to live sustainably” needs a proper educational systems, institutions and faculty members whom could be called as (Gurus) as in previous olden days in order to educate the young generations to develop response-ability. The term response-ability – the competency and determination to resolve the challenges and opportunities that sustainability presents. Consequently, as per the All India council for Technical Education, the curriculum has been designed in our campus so that it resolves and makes the budding engineers to develop the sustainability by incorporating it with the curriculum by introducing various modules in the current regulation.

A. India K12 Education system:

K12 schooling is the most important phase of student’s life. This life aids to determine goal and principle that a student has to obtain. To survive in this competitive world, education and food are important. To improve a country, society, education is the predominant factor that plays the vital role. Quality schooling system is required in the Indian education sector. In spite of achieving a level in education in India, still students lag in ability of reacting in real life scenarios. Hence, educationalist must resolve all these issues by providing a quality education and prepare the students in order to compete with any of the challenges that they face. Thus, schools are there to direct students and prepare them to contribute and work in the society. With this education system increasing its rapidity in the current education system, a platform is adopted in the school in order to contribute their best to growth and improvement of the education system in the country. Moreover the education system has been reformed by introducing technology to the classrooms. In addition, the mode of teaching, syllabus and resources are also changed. In this system, textbooks are not considered as the primary source, instead, technology has been infused and also several student aids and learning tools have been introduced that

facilitates students to communicate and develop knowledge.

III. SUSTAINABILITY EDUCATION

The Dutch Criteria for Academic Bachelor’s and Master’s Curricula (Meijers et al. 2005) mention that at the master’s degree level a student is capable of

- Investigating the outcome of scientific thinking and impact on the environment and sustainable development
- Determine the moral and the customary aspects of the implications and assumptions of scientific thinking and acting
- Integration of the above said recommendations in the scientific work that is to be carried out
- Focus on several roles of professionals in society and a place is selected as a professional in society

The European “Dublin” Descriptors (Joint Quality Initiative 2004) are

- The European framework of qualifications awarded to students
- Unique learning outcomes
- Categories like
 - Applying knowledge and understanding
 - Knowledge and understanding
 - Taking decisions
 - Learning skills and
 - Communication skills

US –Based Accreditation Board for Engineering and Technology focused on sustainable development and the attributes were achieved gradually as mentioned from the ABET website[9]. The Program outcomes that were framed are as given below

- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multidisciplinary teams
- an understanding of professional and ethical responsibility
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

- a recognition of the need for, and an ability to engage in life-long learning and
- a knowledge of contemporary issues

B. SUSTAINABLE EDUCATION

Sustainability in education is about to be implemented by the following implications:

- In our campus, at the graduate level, degree programs include both inter and intra departmental programs.
- Professional and social capabilities have been improved at par with future scenarios for people and planet.
- Hence, every academic and professional subject area is considered as the significant and explicit contribution towards the sustainability
- Curriculum has been revised by reducing the number of credits
- Facilitates the students to opt the electives that might be from the same and as well as cross disciplines
- Internship at the end of every year so that the budding and grooming Engineers might understand the requirements of industry
- Hands on training acquired through this aids them to develop projects that is relevant to the industry
- Courses on “Indian Constitution”, “Environmental Science” have been included in the curriculum
- Virtual labs have been introduced
- Introducing scientific break-throughs and new technological abilities to manipulate “bits,atoms, neurons, and genes” in emerging technoscientific fields such as nanobiotechnology, synthetic biology, Life science for engineers

The proposed model curriculum that has been proposed by our institution is given as below:

S.No	Category	AICTE Suggested Breakup of Credits (Total 160)	MREC Breakup of Credits (Total 160)
1	Humanities and Social Sciences including Management courses	12*	14.5
2	Basic Science courses	25*	20
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24*	18.5
4	Professional core courses	48*	61
5	Professional Elective courses relevant to chosen	18*	18

	specialization/branch		
6	Open subjects – Electives from other technical and /or emerging subjects	18*	13
7	Project work, seminar and internship in industry or elsewhere	15*	15
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	0
	Total	160*	160

In addition to this, 2 internships have been proposed for the students. One internship must be undergone by the students at the end of 3rd semester and the other internship at the end of 5th semester. Undergoing internships aids the students to develop projects in state of art technologies.

The expected outcome of the proposed curriculum could be interpreted as when the program outcomes gets mapped with the course outcomes, so that potential drawbacks could be identified in which alternate solutions could be proposed in such a way that an improvisation could be done in the course. For example, among the available program outcomes, few like "Exhibits ethical and social responsibilities in professional and social context", "Gains the ability to solve problems relevant to industries and research organizations", and "Familiarizes with modern engineering software tools and equipment to formulate and analyze computer science and engineering problems" could be mapped with the course outcomes of "Internship" so that the Budding Engineer will gain the sustainability in facing the challenges around him in the near future. Rubrics to evaluate the internship have been set and it could be described as follows:

- Opportunity to develop new skills and abilities
- Workload and productivity
- Orientation to the position

Hence it is observed that the students' internship might contribute towards sustainable education in striving the social, societal sustainability.

V Conclusion

The new method of sustainability provides the entire perception on the three factors namely economic, social and ecological constraints that drive the sustainability. Hence, the organization gets a complete view horizontally and vertically in all aspects. Sustainability refers to the change and the need for it will certainly require shifts in the operation of organization. Therefore, this results in

the cultural change. The framework that have been followed could prove its success and cope up with sustainability education around the world. Educational program improvements and increased knowledge are used to augment its popularity worldwide. Thus, it is observed that many educational institutions need to expand their curriculum and react to the dynamic changes, continual development in the education requires economic, social and ecological sustainability.

V References

- [1] ABET, Inc. 2009. Criteria for accrediting engineering programs effective for evaluations during the 2010–2011 accreditation cycle. Baltimore, MD: ABET, Inc
- [2] Bell, S., and Morse, S. (2003). Measuring sustainability: Learning by doing. London: Earthscan Publications Limited.
- [3] Munier, N. (2005). Introduction to sustainability: Road to a better future. (2005). AA Dordrecht: Springer.
- [4] Stephens, J.C., Hernandez, M.E., Roman, M., Graham, A.C., and Scholz, R.W. (2008). Higher education as a change agent for sustainability in different cultures and context. International Journal of Sustainability in Higher Education, 9(3), 317-338.
- [5] Kemp, R., Parto, S., and Gibson, R.B. (2005). Governance for sustainable development: Moving from theory to practice. International Journal of Sustainable Development 8(1/2), 12-30
- [6] EESD (Engineering Education in Sustainable Development). 2004. Declaration of Barcelona. http://eesd08.tugraz.at/pics/declaration_of_barcelona_english.pdf (accessed August 3, 2008)
- [7] Joint Quality Initiative. 2004. Shared "Dublin" descriptors for short cycle, first cycle, second cycle and third cycle awards. A report from a Joint Quality Initiative informal group. [www.jointquality.nl/content/descriptors/CompletesetDublin](http://www.jointquality.nl/content/descriptors/CompletesetDublin%20Descriptors.doc) Descriptors.doc (accessed January 31, 2010).
- [8] Meijers, A. W. M., C. W. A. M. van Overveld, J.C. Perrenet. 2005. Criteria for academic Bachelor's and Master's curricula. Eindhoven, NL: Eindhoven University of Technology.
- [9] <http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2016-2017/>.