

The Need for Integration of Disaster Management into Engineering Curriculum

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ABSTRACT: *Disasters are happening in this world as a natural phenomenon or as anthropogenic activities. Organizations and agencies involved in Disaster Management find it necessary to recruit professionals having specific skills and knowledge, who can contribute to a more holistic understanding of the development, vulnerability and mitigation of disasters. These professionals should be involved in conceptual work, evaluation studies and in the prediction of disasters scientifically. Engineering Education is supposed to educate the budding Engineers, to solve the real and complex problems faced by the world, to have a successful career at their place of work and also in their life. A modified curriculum has to be formulated including Disaster Management as a core paper for engineering students rather than an Elective paper as in some Indian Universities. All Engineering fields are prone to some sort of hazard. Depending on the nature of this hazard, Disaster management component may be included in each and every subject so that the student will be able to understand the practical aspect of the subject better.*

Keywords: Curriculum, Disaster Management, Engineering Education, Interdisciplinary learning.

I. INTRODUCTION

A disaster, according to WMO, can be defined as a catastrophic consequence of natural phenomena or a combination of phenomena resulting in injury, loss of life or input in a relatively large scale and some disruption to human activities. Disaster response cannot be handled by Legislation alone. The entire community needs to be aware and be a part of the process. Adequate Research and planning is needed to focus on ways to mitigate the impact of disasters.

Engineers are required for safe and effective response of the disaster. For this, they shall be trained on the various disasters that can happen in their respective field of Engineering. Government and Technical Institutions should aim at focusing Disaster Awareness and Management at all levels of Educational Institutions and produce quality professionals. For this, the curriculum should include Security Preparedness, Security Education, Hazard Awareness and Disaster Management.

India, being a country of diverse hypsographic and climatologic conditions has to face 70% of the cultivable land prone to drought, 60% of the land area prone to earthquake, 12% to floods, 8% to cyclones, 85% of the land area is vulnerable to a number of natural hazards and 22 states are categorized as multi hazards states [1].

II. DISASTER MANAGEMENT IN ENGINEERING EDUCATION

Engineering Education is supposed to educate the Engineers, to solve the real world problems. An Engineer has to have adequate theoretical knowledge and be able to adopt it for use in his/her practical work. In Engineering Education, Disaster Management is provided as a core paper, an elective or not at all in the curriculum. Engineers actually have to control, manage, improve and develop technological processes using their theoretical knowledge and skills according to the knowledge they acquire during their four or five year Engineering Degree Program.

2.1. Disaster Management Education.

Disasters vary from place to place. Cyclones, Tsunamis in coastal areas, Droughts in and around deserts, landslides in mountainous areas, avalanches at high altitudes etc... People living in coastal areas suffer a disaster, which is entirely different from that of the people living near mountainous areas. Education, in the context of Disaster Management, is the process of enlightening the mankind about the nature, extent and methods to deal with the disasters, which facilitates them in facing Disaster rather than got caught without understanding how to react. Public awareness and education were identified as regional gaps that should be addressed at the national and local levels, for an effective Disaster Management System. [2].

Students are expected to develop skills and behaviors during the course of their study at an Engineering College. The properly designed curriculum serves as a link between different courses in the curriculum as well as provides connections to real – world applications, which can serve as a motivator for students to master and retain the course content. In actual practice, Engineers are engaged in problem – solving and design using their technical knowledge attained during their period of study as students.

They should be able to communicate properly, at the right time. They shall be trained to work as in teams without hesitation, and shall be informed and explained about the need and importance of teamwork in Disaster Management aspect. There shall be proper communication between technical and nontechnical persons. Therefore, teamwork shall be a process of information exchange between two or more groups or individuals, regarding disaster risks and mitigation measures to be taken, according to the severity of the situation.

Engineering Education educates Engineers as designers who can adjust and act according to the situation. Curriculum Development shall be based on the model of Engineering Practice that includes Conceiving, designing, implementing, and operating on the curriculum. [3], which is a model based on technical problem – solving and design.

2.2. Who is a Disaster Management Engineer?

An Engineer has to have adequate theoretical knowledge and be able to adopt it for use in his/her practical work as and when required. Engineers have to control, manage, improve and develop technological processes and aggregates using their theoretical knowledge and skills. Practical work experience in the form of Field visits, Industrial visits, should become a key component in Engineering Curricula.

2.3 Emergency Preparedness

Emergency Preparedness synonymously used for civil protection. It refers to the process of managing, coordinating, operating, in the various stages of the disaster cycle: hazard and risk mitigation, disaster preparedness, emergency response, recovery and reconstruction. [4], shows that Training and Education have long been acknowledged to be a vital part of emergency preparedness as they are the vital elements in the drive to turn emergency management into a full – fledged profession. Personal Training is one of the most important elements for capacity building and developing a disaster preparedness plan. Training is the process of changing a given behavior pattern to a desired behavior pattern.

III. INTERDISCIPLINARY MODE OF LEARNING IN HIGHER EDUCATION

Interdisciplinary Learning is a methodology that includes learners from different disciplines that work closely together contributing their knowledge, skills and experience to support, enhance the contributions and attributes of each discipline.

The Interdisciplinary Learning initiatives are proliferating throughout higher education at an unprecedented rate. They can be found in general education replacing and augmenting distribution requirements; in emerging disciplines, such as cultural and gender studies, environmental studies, neuroscience, in new pedagogies such as collaborative learning and web – based instruction and in new curriculum designs such as learning communities, capstone courses and service learning.

In interdisciplinary service learning, students from different fields, disciplines or professions, share service and learning objectives. Service Learning is a teaching and learning approach in which the students are engaged in activities that address human and community needs together with structured opportunities, intentionally designed to promote student learning and development.

3.1 Problem Based Learning

Civil Engineering is a key profession to the incorporation of sustainability into our society [5]. As the environment is constantly degraded by the human actions, there is a need to equip Civil Engineering Students with a wider horizon on concepts, in terms of the Sustainability into the society. Problem Based Learning (PBL) gives the students to experience Real Life Problem Solving, Project Management, Interpersonal Skills of Written and Verbal Communication, Working Productively in a Team, Work Integrated Education and Leadership Skills. Team work, by its nature, promotes the multidisciplinary aspect of solution techniques. PBL emphasizes students' pre – existing

knowledge and start with “what the students know” to the “unknown”. Problem or Project Based Learning (PBL) helps students to develop deeper understanding of the subject area by focusing on a realistic problem. It helps the Engineering students (learner) adopt a change in mindset from teacher-dependence to self reliance. It develops life – long learning skills.

Problem-based learning begins with the presentation of an authentic problem stated as it might be encountered by the practitioners. It supports the application of problem-solving skills required in “practice.” Students assume responsibility for their own learning and faculty act as facilitators. It develops Research Skills. Students need to learn how to get information when it is needed and will be current, as this is an essential skill for professional performance. The role of the instructor is to facilitate the application and development of effective problem-solving processes. Instructors must avoid making students dependent on them for what they should learn and know professionally.

Therefore, the students shall be given an opportunity to learn problem based than theoretical. They shall be given option to study the present scenario available in the country, in the context of disasters and then apply their engineering skills to solve the situation. In the context of this research, the identified problem is to manage disasters effectively so that the country will not face much impact on the environmental policies, financial policies and the people.

In the problem, the factors to be considered are the landscape of the country, the Coastal areas, the educational and economic background of the people, Environmental Impact Assessment of the disasters and the feasible engineering solutions in the case of the outcome of a disaster, with respect to the area affected. By this way, the casualties are minimized, waste and destruction of structures minimized. The most important among all the factors is the Disaster Management Education among the Engineers and the Community.

The Students /Engineers shall be able to apply knowledge of Basic Mathematics, Science & Engineering, Techniques, Skills and Modern Engineering Tools for Engineering Practice, Design a System, Components, or Processes to meet the desired needs within realistic constraints such as Economic, Environmental, Social, Political, Ethical, Health & Safety, Manufacturability and Sustainability. They should be able to function in multidisciplinary teams and work professionally. But the key factor is proper efficient communication. The solutions to these Engineering problems shall be obtained from the global, economic, environmental and societal context. Their Project work should be to tie different concepts together and see how they are used to solve realistic concepts.

IV. CURRICULUM INTEGRATION

Curriculum is a living, organic instrument to help teachers and institutions to find optimal ways to educate the youth. Curriculum reform is seen as a core of the ongoing efforts of Education Development and Quality Improvement. It provides students a richer academic experience by broadening the context and applicability of information and skills that are learned. It should challenge

students to solve real world problems. Educational researchers found out that an integrated curriculum can result in greater intellectual curiosity, enhanced problem-solving skills, and higher achievement in their career.

Curriculum Integration model can be referred to as the Problem Based Model. Integrated approach to curriculum, enable teachers and students to go beyond the strict disciplinary boundaries and respond to issues that may be more immediately relevant and motivating young people. Curriculum Integration aims at the interdependence and independence of the students. They will be able to perceive the curriculum as relevant to their learning needs and teaching learning process is enhanced more effectively than through a separate subject approach. (Figure 1.)

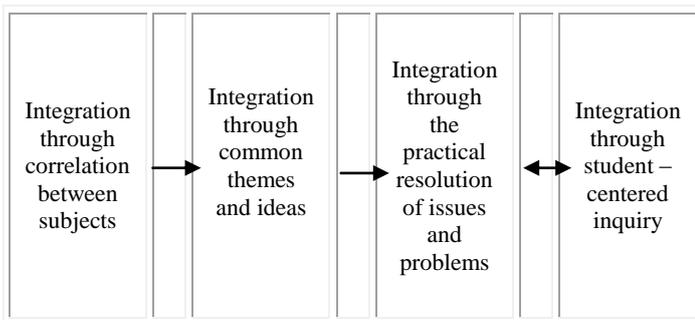


Figure 1. Relationship between the integrative curriculum and teaching learning continuum.

Curriculum integration can improve the effectiveness of education. [6]

Therefore, the contents that the students should compulsorily be aware of in the Management of Disaster perspective are identified, and shall be divided proportionately among various core papers to facilitate the students. There comes the need of Integrating Disaster Management components into the Engineering Curriculum.

V. CONCLUSION

As India is a country of various anthropogenic disasters and natural disasters, it becomes necessary for the future generation of Engineers to be familiar with preventive measures and the Disaster Management practices. As this is a period of globalization, the promising Engineers should be competent enough, who are very much informed and acquainted with the practices of safe, secure and sustainable humanity. For this, their curriculum should be sufficiently rich. In the Disaster Management context, when the Engineers are in their students' years itself, they shall be given information, advertently or inadvertently into their minds, which will be useful for their personal life and also in their duty towards humanity.

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