GC 2012-5630: ENGINEERING EDUCATION IN INDIA NEED FOR INTERNATIONAL COLLABORATION FOR STUDENT DEVELOPMENT

Prof. D. N. Reddy, Indian Society for Technical Education,

Presently Prof. Reddy is the Member of University Grants Commission, Govt. of India, New Delhi and also he is Regional Chairman, AICTE, South Central Region, Hyderabad and Chairman, Indian Society for Technical Education, A.P. State Section and also as chairman, appellate committee, National Board of Accreditation, MHRD, Govt. of India, New Delhi.

Prof. Reddy served as Vice-Chancellor, JNT University Hyderabad during 2008-2011 and also In charge Vice Chancellor for Osmania University from Feb. - July 2011.

Professor D. Narasimha Reddy is well known and renowned professor in Academic circles in the country and abroad. His academic record wise he has obtained B.E. (Mechanical Engineering) degree from Osmania University, Hyderabad, M.Tech from IIT Madras, and Ph.D from IIT, Delhi.

Commencing his academic career in Research and Development as the Senior Scientific Officer in ARDE (DRDO), Pune from 1976-78, then moving onto the Post of Development Engineer of M/s Hyderabad Industries, Hyderabad from 1978-1980. His first stint in academic career began from 1980-86 when he took up the Faculty assignment in the year 1980 in Mechanical Engineering Department, Osmania University. Scaling up the academic ladder, Dr. Reddy got promoted as Professor in 1991. From 1991 onwards Teaching, Administration and Research have been his forte. His administrative experience speaks volumes. He has held various positions as Head, Department of Mechanical Engineering from 1996-99, He became the Head of the Department of Bio-Medical Engineering, Osmania University between 2001-2003 and 2005-2007 and Founder/ Director, Centre for Energy Technology in Osmania University, Hyderabad. Principal, University College of Engineering, Osmania University for nearly 8 years, Dean Faculty of Engineering for 2 years and also the member of the Executive council at Osmania University. Awards and honours have been exemplary to his intellectual. Capability Notable among them are: 1. Eminent Engineer National Award by Institution of Engineers in 2007. 2. Bharatiya Vidya Bhavan (ISTE) National Award for best Engineering College Principal in 2003. 3. 2000 Millennium Medal of Honour awarded by American Biographical Society, USA. 4. Eminent Engineer Award by M/s Institution of Engineers (India) in 2000. 5. Vijaya Ratna award and Certificate of Excellence, 1999, New Delhi. 6. Best research paper award at International Conference on Fluid Mechanics and Fluid Power held in IIT Roorkee, 2002. 7. Best research Paper award at National conference on Fluid Engineering held in Hyderabad 2006. 8. Best Mechanical Engineer Award by the Institution of Engineers, Hyderabad. 2009 9. Sarvepally Radhakrishnan Award for Academic Excellence in the year 2011. His contribution to society are numerous. Some of them are responsible for the award of Bharatiya Vidya Bhavan National Award for the best Engineering College, O.U, and also for the ISO 9001 : 2000 certification. Along with this he was responsible for serving as member in the National Executive Council (ISTE), setting up Renewable energy technology park in Osmania University, organized Swarna Bharathi Science and Technology exhibition, during Indian Science Congress held in Hyderabad served at the Convenor of the state wide ICET exam PGECET and Chairman, EAMCET 2008-2011 state wide entrance test for professional courses. Served as Resource person at international Institute of Information Technology, Hyderabad.

Dr. Reddy's Leadership is almost innumerable. He has attended a total of 42 National Conferences and 29 International conferences, has composed 12 monographs and published in 12 national /International journals, and supervised 15 sponsored research projects from various funding agencies. He has provided guidance to 12 Ph.D students.

He holds life membership in many professional societies like Indian society for Technical Education, society for Mechanical Engineers, National Society of Fluid Mechanics and Fluid power, Solar energy Society of India, Indian Science Congress Association. He is also a Fellow and life member in the Institution of Engineers and Indian Institute of Plant Engineers. He is also Fellow of A.P. Academy of Sciences and Member of Executive Committee of the Academy. World wide exposure is his experience which consists of visiting countries like USA, UK, China, Thailand, Ireland, Malaysia, Ethiopia, Kuwait, Italy, Spain, Australia, South Africa and Sweden. During his tenure as Vice Chancellor of JNT University, Hyderabad has introduced many reforms in curriculum evaluation new Education Models and Foreign collaborations for improving the Quality of Engineering Education. He is well known in the academic circles as straight forward and known for objective assessment of issues.

He is a role Model in Higher and Technical Education for Faculty and Students and he keen interest in promoting Teaching Learning processes using ICT. He served as expert committee Member/Advisor for various organisations like DRDO, UPSC, UGC, AICTE, ESCI and several Universities/Institutions in the country.

Engineering Education in India – Need for International Collaboration for Student Development

Prof. D.N. Reddy *

Abstract

Education today is the key driver for Economic development of any country. India bestowed with large Human resource base in the world next to China. There are 55 million youth between age group of 18 and 23 in India and only 15% of them have opportunity to pursue Engineering Education. Though the Focus is to provide access, to many but equally important is to ensure quality of education. Engineering graduates today require not only adequate technological ability and problem solving skills, but also must be equipped with soft skills, business skills, inter personnel and intercultural adaptability.

Now, the emphasis should be on self learning and the role of teacher is redefined as facilitator to enable the students to be more involved in active learning through laboratory. Project work , assignments and case studies Lifelong learning and continuous learning is key aspect of teacher and student.

International collaborations are essential for better student development. Inview of the globalisation and in this endeavour the role of ICT is the key enabler for enhanced student learning . Apart from F2F learning, Blended learning through online, web based methodologies will provide better opportunities through International collaborations for student development.

Innovative models of undergraduate and graduate students is desirable through International collaboration to enrich the students of better understanding and level of competency can be developed.

---

* Regional Chairman, AICTE (SCRO), Hyderabad

Chairman, Indian Society for Technical Education (ISTE), A.P. Section Hyderabad.

Former Vice Chancellor, JNTU Hyderabad – 500 085., India

Email.reddydn@gmail.com

1.1 Introduction

India's large human resource base combined with positive government policies, private participation and Accreditation initiatives has given it a competitive advantage in producing quantity and quality Engineering manpower when compared to other nations. The role of an Engineer in his career is changing from one-time being concerned with largely technical feasibility to now on concerning market, technical and societal feasibility. The distinctive characteristics of the 21st Century students , rapid advancements in the ICT, Globalization and Dynamic workforce requirements provide opportunities and challenges for Millennium Student Development. The success and limitations of instances of International Collaborations in the Universities need to be discussed. The importance of International Exposure, Mobility, teamwork and Intercultural Adaptability and Skills are recommended for preparing students to face the Challenges. International Collaborations beyond the study abroad programs are stressed for Student Development to match the pace of Challenges and Diversity of demands of Engineering Student.

1.2 Engineering Education Programs in INDIA

India is bestowed with large Human resource base in the world next to China. There are 55 million youth between age group of 18 and 23 in India. About 15% of them pursue Engineering Education. There is ever increasing interest among students and parents in taking up Engineering Education. The Secondary and Post-Secondary Education of the tertiary Education System in India provides strong foundations in Mathematics and Science which prepares the students for sound performance in Engineering Education. The Enrolments in the Engineering Education in the past decade has been phenomenal. With the encouraging demand, private participation has been on the rise. India has 600+ Universities including 130 Deemed Universities offering Engg/Technical Education. Apart from 43 IITs, NITs and Institutions of National importance, there are 3000 Private Institutes in the Country

offering Engineering Education on self financing mode of the Engineering Institutes in the Country. The institutions are affiliated to state Universities and are monitored and accredited for quality by NBA independent Agency. About 2-3% of the Engineers graduating every year takeup higher studies. The remaining engineers have been part of the Global Workforce. Much of them, independent of their specialization in the past few years preferred jobs in the IT sector. The Skill-Set required for these jobs were provided by Finishing School concept in several Institutions. India has on the otherhand with insufficient investments in R&D and Industry has witnessed Brain Drain of graduates coming out of good institutions.

1.3 21st Century Career Outlook for Students

The fast paced world is changing the way Engineers think and work. Engineering graduates in the past preferred to work with one large employer, almost for life, concerned largely with the technical feasibility. They worked and were judged as individuals. However the demands on Engineers in the 21st Century are diverse. They need to work as Engineers and Non-Engineers being concerned with market, technical and societal feasibility. Rapid advancements in ICT and Globalization and reduction in transaction costs have created opportunities for the formation of more agile organizations and Dynamic Workforce beyond geographies. The challenges for Engineering graduates are also on the high and in addition to the technical skills, they have to be equipped with the requisite Soft-Skills to succeed in their career. The graduates will have to work and are evaluated on interdisciplinary teams may be cross-border. They will have to work for a number of firms of different size and maturity. The Millennium Engineer should therefore be additionally equipped with soft skills, business skills, problem-solving, communication, teamwork, self-assessment, change management, lifelong learning, inter personnel and intercultural adaptability Skills in global setting. Several International accords have taken shape and graduate attributes for the 21st Century Engineer have been identified [Washington Accord]. India for the past decade has not only been the

major contributor of global workforce but has demonstrated partnerships in Research and Innovations solving many of problems faced by world over .

1.4 Engineering Education in a Knowledge Society

Rapid advances in Information and Communication technologies have helped nations all over the world in accessing information and knowledge created anywhere in the world and using them for the prosperity and well being of its people. They have also give a major fillip to the creation and dissemination of knowledge inside the country and using it extensively for economic, social cultural and other human activities. Knowledge Society normally refers to any society where knowledge is the primary production resource instead of capital and labour and where due importance is given to the use of knowledge and information in all economic activities. Creation and utilization of knowledge have been a feature of all modern societies and have always received due importance and respect, but have remained mostly localized in the community. Current technologies have eliminated the constraints of localization and geographical proximity and have provided increased opportunities for sharing, storing and retrieving knowledge and for marketing domain specific knowledge and skills required for the country and also across the globe.

While all knowledge is important and useful, engineering education plays a very dominant role in developing knowledge and skills which are vital to the growth and maintenance of knowledge, knowledge-based and knowledge processing industries. Apart from providing specific domain knowledge in different engineering disciplines and producing experts in computer science and engineering, and information communication technologies, all engineering graduates irrespective of their fields of study are given education and training to acquire a reasonable level of competence in problem solving skills, software development, computer applications, modeling and simulation, and environmental impact analysis areas, which are important in creating new

applications for knowledge and in marketing them both for domestic applications and for export. In recent years with the advent of the knowledge age, there has been a significant increase in enrolment in engineering programs all over the world including India in computer and information sciences, software engineering and information and communication technologies. India has taken a major lead in this area and is exporting both manpower and skills in IT to most countries in the World. To maintain its leading position in this area the engineering education system in the country has to continuously improve quality, upgrade facilities, and produce graduates with globally marketable skills.

1.5 Innovation and Entrepreneurship

Engineering Education offers enormous opportunities for promoting creativity and innovation since the process of innovation are identical to those of problems solving and design which on the basic focus of all engineering education. Fostering a culture of innovation among students would require training in critical thinking, encouraging, thinking out of box, looking of problems from multiple points of view, generating ideas and solutions including those which appear at first sight to be highly improbable, providing access to experimentation.

Engineering graduates to-day require not only adequate technological ability and problem solving skills, but also be endowed with softskills like co-operative working, communication and presentation skills, business ethics and Inter – personnel relationships and posses a deep commitment to safety, reliability, quality and sustainability of all engineering activities.

1.6 New Learning Paradigm and Alternative Delivery Systems

The Indian education system has been accustomed to teacher-centric learning where the teacher is assumed to be all knowledgeable to transmit information and

knowledge via his lectures to the students in general. Some interactivity is added through question answer interventions but it is strictly limited both in time and in the coverage of the number of learners. Tutorials and Laboratory work do bring some more interactivity between the teacher and the learner but learning continues to be teacher- centric. This model of learning is currently under serious questioning. The alternative of student-centric learning is being actively pursued in many institutions across the globe where the teacher acts primarily as a facilitator in the learning process and students become active participants in the classroom. This new model encourages self-learning and trains students to seek and validate information independently and then work co-operatively with other fellow students to absorb new knowledge and skills under the guidance, and assistance of the Faculty. Problem – based learning, project-based learning, case study method, using laboratory as a place for solving unknown engineering problems by experimentation, and design simulations are other tools being progressively used for imbibing students with attributes and developing in them both problem solving skills and attitude for life-long learning.

1.7 Engineers of the Future

Globalization is radically changing the way national economies around the world design, produce, distribute, and consume goods and services. Engineers are in the midst of this dynamic development. They need to work in teams and on projects with members from different nations and continents. They need to be internationally mobile, whether physically or virtually to respond to the growing international concern about the preparation of engineering workforce in the future. In a major study carried out by the U.S. National Academy of Engineering (NAE) on "The Engineers of 2020: Visions of Engineering in the New Century"(Published by the National Academic Press), a detailed analysis was done to identify the types of activities which will be in the domain of the engineers in the future. According to this study "The engineer of 2020 will be faced with myriad challenges, creating aggressive and defensive solutions at

the macro-and micro scales in preparation for possible dramatic changes in the world. Engineers will be expected to anticipate and prepare for potential catastrophes such as biological terrorism; water and food contamination; infrastructure damage to roads, bridges, buildings and the electricity grid; and communication; breakdown in the internet, telephony, radio and television. Engineers will be asked to create solutions that minimize the risk of complete failure and at the same time prepare backup solutions that enable rapid recovery, reconstruction, and deployment. In short, they will face problems qualitatively similar to those they already face today".

2.1 Existing Collaborations - Their progress and limitations

International Collaborative programmes like Dual and Joint Degree Programs, Twinning Programs have been started by Academic Institutes across the country. The draft bill by the Govt. for encouraging establishment of foreign universities has initiated several opportunities for student International experiences especially understanding cultural differences and working in teams. Most of the programs include a semester long study abroad/ Student exchange components. However such programs have not yet reached the pace and breadth of global changes and requirements of the Engineering Professional. One of the obvious concern in imparting the additional components in the Education are on how to devote semester credits to these components into an overcrowded engineering curriculum and who has to teach these courses. While the Staff development and pedagogical changes have certain extent addressed this concern, the debate of including them as additional courses continues to dominate. These collaborations mostly are between two nations and typically the student needs to work on teams from more than one nation. Also sometimes the enrolments are limited for security and funding options available in those countries. The collaborations in an Institute are often limited by the non uniform Credit Transfer System among the different countries. The Programs also often have a highly structured curriculum which is rigid to accommodate rapid global changes.

2.2 Potential Partnerships- Developing Communities

Central to overcoming these constraints and responding to the imperatives, Non-formal education through Networks of International Collaboration is proposed. Professional Societies such as ISTE interface with the Government, Industry and Academic Institutes in promoting rapid Student Development. The society through Collaborations can expand the goals of Internationalization creating Global learning Models which are more than study abroad programs. This can positively impact local and global communities and adding new Funding Streams serving Students. ISTE 35 year old, professional society nation wide collaboration of Engineers is strategically positioned to expand Dissemination and utilization of findings and in Creating International frame of mind. Much of the learning in a study broad experience arises from random personal contacts with individuals in informal cultural settings rather than solely in structured exercises supervised by a highly qualified instructor. Teamwork, Communication, Creativity and Design, Entrepreneurial thinking are usually self-directed and agile when learnt through Informal Education. Professional Society have the potential to interface with the Universities, Industries and the Government and can expedite the collaboration processes. Project competitions and Conferences and Seminars can facilitate this overcoming of limitations of Formal Education.

3.0 Conclusion: Transformation of an Engineering Student to a Global Engineer is much needed to reflect the challenges and opportunities of the unprecedented changes World-Wide. The constraints and barriers that Engineering Education operates in should not be allowed to reduce the pace of this transformation. Professional Societies, through International Collaborations can become key enablers in embedding this dimension at all levels of Engineering education.

References :

1. Profile of Engineering Education in India Status, Concerns and Recommendations, Narosa Publishing House, New Delhi.
2. 21st Century Priorities in Engineering Education , R. Natarajan and M. Ananda Krishnan, ISTE, New Delhi.