New Pedagogy in STEM Education for Developing Nations

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Abstract:

The most recent survey indicates that Science, Technology, Engineering and Maths (STEM) graduates have tremendous difficulty finding jobs in the current open market economy. The lack of generic attributes and hands-on skills in co- and extra-curricular activities make graduates unemployable. Therefore, STEM graduates need to develop generic skills to be employment ready.

The new millennium of digital communications has witnessed so many technological developments. These have been reflected in our digitally oriented pedagogy. However, the survey reflects some loophole in the education system that needs to be fixed. The 21st century learners are less equipped in STEM, but more exposed to social media and multi-media contents. For educators, innovation in pedagogy is the key to teach the very abstract principles of engineering disciplines.

The keynote speech presents the existing gaps in university education, specifically in developing nations, and the significance of Bloom's Taxonomy of high level experiential learning. To augment these, a new method of pedagogy drawn from experiential and anecdotal inferences will be presented with a case study of the most abstract STEM unit '*the advanced electromagnetics (AEM)*'. Inferences and analogies, which are drawn from nature, fauna, flora, and human interaction in society, help digest complex physical principles and laws of STEM.

However, the main bottleneck of experiential learning is the expensive laboratory set up that the universities of the developing nations cannot effort. To address to this predicament in universities, a very low cost and state-of-the art laboratory for AEM, wireless communications, microwave engineering and antenna technology is developed. The laboratory is equipped with a graphical user interface (GUI) based computer aided design tool. An entrepreneurial exercise on innovation marketing to find niche markets of the developed prototypes in the design project is added as a professional practice. Hands on and entrepreneurial skills developed in the laboratory are essential in current professional practices in both industry and education sectors.

In conclusion, the innovative pedagogical practices and laboratories enhance the learning experience of university students, and maximise their retentions of complex and abstract concepts in the electrical and electronics engineering disciplines. Graduate skills developed in the state-of-the-art laboratory, design projects and entrepreneurial exercises make engineering graduates employment ready before they leave university.

About the Speaker:

A/P Nemai Karmakar graduated with BSc (EEE) and MSc (EEE) degrees from Bangladesh University of Engineering and Technology, MSc in EE from the University of Saskatchewan, Canada, PhD in ITEE from the University of Queensland, PGDipTHE from Nanyang Technological University, Singapore and MHEd from Griffith University. He worked as a microwave design engineer at Mitec Ltd., Brisbane from 1992-1995 and contributed significantly to the development of Optus Mobilesat smart antennas in Australia. He taught senior-level courses in electronics, radar, microwave active and passive design and antennas at Queensland University of Technology, Nanyang Technological University, Singapore, and Monash University. He has been working on collaborative research projects on smart antennas for soil moisture measuring radiometer in L/Ku/K-band downscaling, fully printable chipless RFID sensors for ubiquitous tagging and sensing, wireless power transmission, microwave biomedical imaging and devices, smart antennas for mobile satellite communications, and RF diagnostics of faulty power equipment. He has many patent applications in chipless RFID and sensors, eight books and more than three hundred refereed journal, conference and workshop publications. A/P Karmakar is a graduate member of IEAust and a senior member of IEEE.