
“Enhancing Teaching-Learning in Engineering using ICT Tools” : An Implementation Approach

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ABSTRACT

As per the statistics on “Employability of Engineering students”, a considerable decline has been observed for the past few decades. This is reflected as a symptom of “skill deprivation and lack of essential practical knowledge”, which is an unwanted outcome of the present engineering pedagogy. Out of 97% of the graduating engineers, only 3% have the suitable skills to be employed in a software product market and only 7% can handle the core engineering jobs. (13th July 2016, indiatoday.in)[1]

The changes in learners’ cognition supplemented with internet technologies have made a great impact on traditional teaching -learning environment. Pioneering ICT can synergize the teaching-learning methodology by means of Flipped Learning, Blended Learning, Augmented Learning, Games and Simulations etc. There are basically four broad domains of learning styles: Visual, Auditory, Read-Write and Kinesthetic. Our traditional passive learning system cannot direct the classroom learning instructions in a more holistic manner, covering all learning styles. It is therefore need of the hour that a more sophisticated and easy to access learning methodology should be developed and introduced for a better learning outcome.

INTRODUCTION

The term “Engineering” is derived from the Latin “Ingenium”, which means “cleverness” and “Ingeniare”, meaning “to contrive; i.e. creation of an object by deliberate use of skill and artifice”. The derivation itself signifies the importance of practical application of knowledge in the entire domain of engineering. Engineers are therefore required to apply mathematics and science knowledge to solve the existing problems and render continuous improvements in them. The rote techniques in today’s education rather take a different turn than what engineering stands for. **Malcolm Gills**, the President of Rice University of right when he said “Today, more than ever before in human history, the wealth—or poverty—of nations depends on the quality of higher education. Those with a larger repertoire of skills and a greater capacity for learning can look forward to lifetimes of unprecedented economic fulfillment”. In 2014, *Biologist* **Scott Freeman** [2] concluded – “teaching approaches that turned students into active participants rather than passive listeners reduced failure rates and boosted scores on exams by almost one-half a standard deviation”.

Engineering should be presented as a more exciting and forever learning opportunity which drives the quest for innovation and inventing the non-existential. The longest lived British Monarch, **Queen Victoria II**, was undoubtedly correct, when she said “*At its heart, engineering is about using science to find creative practical solutions. It is a noble profession*” [3]

DISCUSSION

The authors have identified the following key concerns by scanning the available Indian context of higher education literature:

-) India is a continent of young population with a thirst for quality higher education.
-) Lack of quality teachers and quality education system has generated unemployment among youths. Further, the inappropriate student –teacher ratio also contributes towards this problem.
-) Due to insufficient skills, Young Engineers mismatch the present day global skill requirements.
-) Our India, with multiple economic and political conditions with a rich cultural heritage has forgotten the traditional way of learning (Gurukulam Methodology) and has adopted the western system of education without customizing it as per their requirements.

The authors have a strong faith that ICT facilitates the acquisition and absorption of knowledge, thereby providing remarkable teaching-learning pedagogies. Few key benefits are:

1. Encourage active learning pedagogies: Active Learning pedagogies engage learners for better reception and processing of information. **Ratey** found that brain cells grow only when people are engaged actively and the connections in our brain disappear if the activities are not repeated and reinforced. ICT infused learning pedagogies can be used to generate interactive environments of study with less distraction. When such ICT pedagogies are merged with regular brick and mortar learning pedagogies (Flipped Learning), an active learning environment is developed with a due focus on increasing interactions and attainment of learning outcomes.

2. Solution for expert faculty shortage: Expert faculty shortage is one of the major concerns of deteriorating educational quality parameters around the globe. The best possible learning materials in electronic forms can be developed with domain experts around the globe. The experiences and knowledge of these field professionals can be instructionally developed and globally delivered. These electronic learning materials can also be translated, animated, gamified and simulated as per needs to maximize their usage around the globe.

3. Content Re-Usage: What an experience it would have been to realize the fundamentals of “Gravitation” from **Sir Isaac Newton** himself! The electronic learning materials are in the form of interactive videos, whose conceptual quality will never degrade. The contents recorded remain the same forever, but with an obvious clause of enrichment and modification.

4. Content Mobility: The recorded learning materials can be delivered and accessed with internet throughout the globe. A person in Romania may learn about the perfect jute weaving techniques from a professional in Bangladesh. Proper utilization of ICT will facilitate bringing the world closer by removing the knowledge barriers of space and time. The learning materials can be accessed anywhere and anytime to suit the learner.

The ICT ENHANCEMENT

An attempt has been made to develop an ICT based higher education delivery framework to counter act the shortage of quality faculty, student-faculty ratio and instructional differences. This framework can also be tested for the Indian Sub-Continent with diverse geography, multilingual and cultural dissimilarities. This framework considers the learning styles of different learners for adaptive learning purposes and can be leveraged for Flipped and Blended model of classroom systems. The learning for each individual learner begins with a tailored learning path, wherein the learning materials are provided as and when required. These learning materials correspond to the learning style of the learner and is carefully calculated by the application of Artificial Intelligence integrated Learning Analytics. The content development framework is a versatile and innovative pedagogical approach to render all type of learners with different learning styles; Visual, auditory, read-write and kinesthetic. The delivery of the learning materials is conducted through a state of the art Learning Management System (LMS), which is a platform independent system without the constraints of time and place of study. This enables the learners to study through any Smart/ Mobile device which may be utilizing any operating system. The security aspects of the learning materials are maintained by the SCORM

compliance feature whereas, the learner security and privacy is maintained through the University Management System (UMS). It provides a seamless access with Single Sign On, capable of monitoring the learners through their entire learning path, thereby enhancing the student retention. This sustainable framework can be strategized, based on the level of internet connectivity and topographical features.

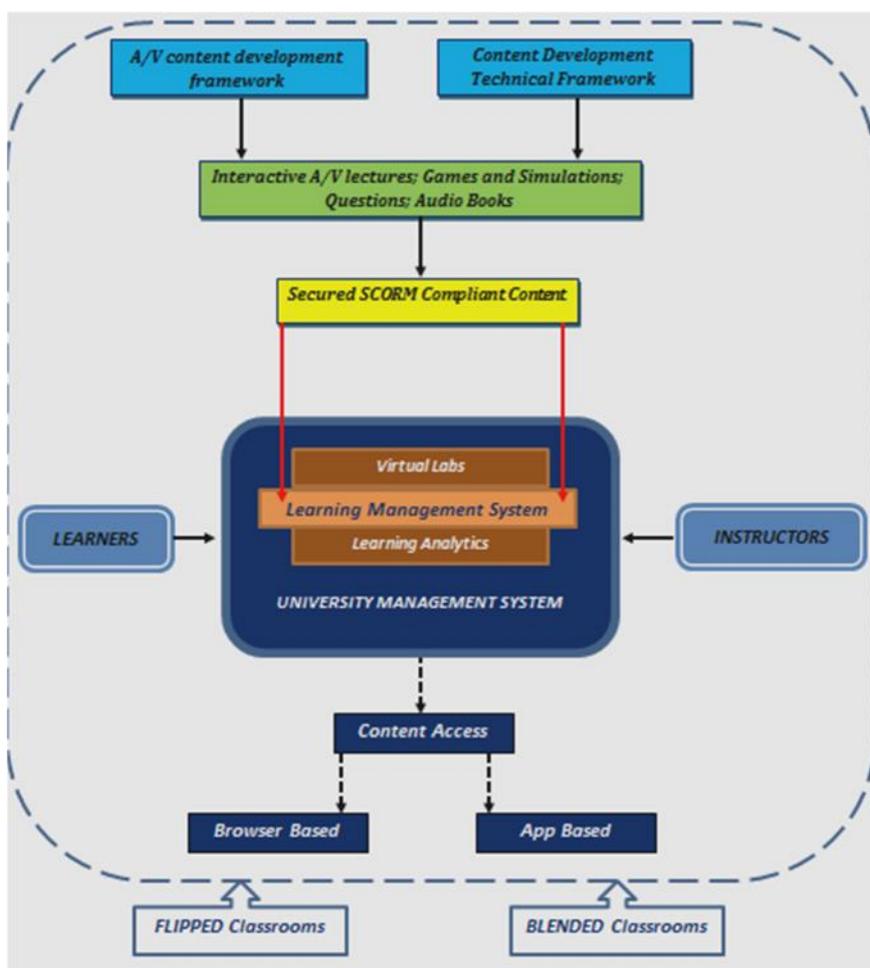


Figure 1 : ICT Framework; sourced: *Strategizing ICT resources, 2017*

The electronic learning materials in the form of recorded video lectures, audio books, e-books, games or simulations can be developed anywhere but is assimilated in the common knowledge repository. Relevant Open Educational Resources (OERs) can also be included in the repository as additional reference materials. This allows the real time delivery of multiple contents around the world. Moreover, the globalization of learning materials is promoted through this mechanism. The conceptual requirement of each content is determined with the involvement of instructional designers and subject matter experts, which in turn is transformed into best possible environments with interactive features. The selection of topics is an entirely individual approach for achieving maximum effectiveness of content along with maximum efficiency of expert faculty. The topic selection process comprises of sorting super syllabus followed by storyboarding and lesson planning.

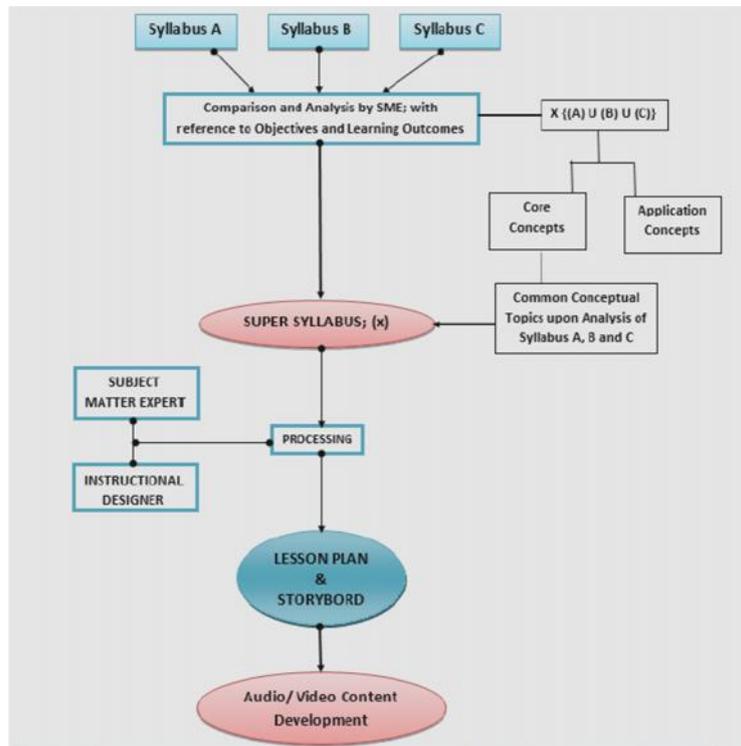


Figure 2 : Content Production Framework; sourced: *A Sustainable E-Learning Framework for Excellence in Education, 2017*

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Special Reference to:

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- [1] Dr. Manoranjan Pon. Ram, Anunay Sinha, *An implementation framework for Blended Learning in Engineering Education, 2017, ICDE conference, Pune*
- [2] Scott Freeman, Biologist, (2014), "Active learning increases student performance in science, engineering and mathematics", *Proceedings of the National Academy of Sciences*. <http://www.pnas.org>, Accessed on 21/12/2016
- [3] <http://northbridgetimes.com/happy-engineers-day-quotes-speech-sayings-whatsapp-and-facebook-status/5403>