Chapter 10
MOOCs for Enhancing Engineering Education

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ABSTRACT

All over the world, thousands of engineering institutions offer conventional engineering education. However, the quality of education, is a matter of concern. MOOCs (Massive Open Online Courses) permit learners to access and benefit from the teaching by renowned professors. MOOCs offer an unprecedented opportunity to revitalize education. These cause complete dis-intermediation of the university system, making them very affordable; however, they have several shortcomings in their present form. Students enrolling for a MOOC still have to conventionally study the subject for their degree. Complete absence of physical group activities in a class room under a teacher's mentoring, is another serious issue. Conduct of practical sessions in laboratories is an important aspect of engineering education, for which MOOCs offer no alternative. This chapter reviews the state-of-the-art of MOOCs in engineering education and provides suggestions as to how MOOCs can be effectively utilized for enhancing engineering education.

INTRODUCTION

Around the globe, educational institutions offering engineering education vary in their level of control over the program of study, syllabus, and examinations. This situation is prevalent in developing world where most engineering colleges are affiliated to different universities to offer conventional engineering education. In this case, universities exercise rigid control over curriculum and examination. Teachers in these colleges only do teaching with little room of innovation in learning.

The MOOC (Massive Open Online Course) is the latest buzzword in distance education. MOOC brings together high quality 'Ivy League' providers, online education and a low-cost model. MOOCs align with the approaches to teaching and learning advocated by the Kronberg Declaration (UNESCO, 2007). In these approaches, learners play an ever more active role in knowledge acquisition and sharing with the role of teachers and instructors decreasing. The basic design of individual MOOCs may not have moved too far beyond traditional pedagogical approaches. However, the concept of MOOC, being largely

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lecture-based in format, is learner-centered. MOOCs liberate students to access and engage with education. In the past six years the number of MOOCs being offered by universities around the world has expanded into the hundreds. Three MOOC platforms are leading the race, Coursera, Udacity and EdX, and all three are associated with the highest ranking US universities. By September 2013, Coursera offered over 403 courses from 86 different universities and institutions and had over 4.6 million registered users. EdX represents a partnership between Harvard and MIT, while Udacity, like Coursera, started at Stanford.

A MOOC aims to have large-scale interactive participation and open free access via the Internet. Rather than simply making resources or courseware freely available, MOOCs create the opportunity for learners to take part in learning activities, interact with other learners and connect with course instructors, albeit in a limited sense. Generally MOOCs have no fees, prerequisite qualifications, formal accreditation or predefined levels of participation (Liyanagunawardena et al, 2013). Taking part is voluntary and depends on the interest and motivation of the learner.

The term MOOC was coined during a course on 'Connectivism and Connective Knowledge' run by the University of Manitoba in Canada in 2008. The course design was based on 'connectivism'. Connectivism is an approach to networked learning advocated by the organizers of the 'Connectivism and Connective Knowledge' course, George Siemens and Stephen Downes (Littlejohn, 2013). As Kop (2011) describes it: "Connectivists advocate a learning organization whereby there is not a body of knowledge to be transferred from educator to learner...instead, knowledge is distributed across the Web, and people's engagement with it constitutes learning" (p.20). The MOOCs that have emerged from this philosophy of learning tend to be open in nature, non-hierarchical and largely learner-defined (Littlejohn, 2013).

Even in the short time of MOOCs' existence, however, a second type of course has emerged, with a distinct pedagogical outlook. The original MOOCs based on the connectivist approach, and now known as cMOOCs, have been overshadowed by their 'instructivist' cousin, known as the xMOOC. As Littlejohn (2013) put it, in xMOOCs "learning goals are predefined by an instructor, learning pathways structured by environment and learners have limited interactions with other learners" (p3).

MOOCs offer an unprecedented opportunity to revitalize education by complete dis-intermediation of the university system: making quality learning affordable and accessible. While MOOCs have several shortcomings in their present form, these shortcomings are fast diminishing due to advancements in the technology. Conduct of practical sessions in laboratories is an important aspect of engineering education, for which MOOCs have started to offer alternative through virtual labs integration in the MOOC platform. A flipped-class room model has been suggested for MOOCs to address the issue of absence of physical group activities.

In USA, a very small segment of higher education institutions (2.6%) were experimenting with MOOCs in 2013. A somewhat larger number of institutions (9.4%) were planning for using MOOCs. Most institutions (55.4%) remain undecided about MOOCs and 32.7% of institutions had no plans for a MOOC. While unconvinced that MOOCs represent a sustainable method for offering online courses, academic leaders believed MOOCs provide an important means for institutions to learn about online pedagogy. While not concerned about MOOC instruction being accepted in the workplace, academic leaders were suspicious that credentials for MOOC completion will cause confusion about higher education degrees (I. Elaine Allen & Je! Seaman, 2013).

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