International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 155-159
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

PERFORMANCE ANALYSIS OF MASSIVE OPEN ONLINE COURSE (MOOC) ON FUNDAMENTALS OF ELECTRICAL ENGINEERING COURSE

T. L. Singal
Professor, Electronics and Communication Engineering,
Department of Electronics and Electrical Engineering,
Chitkara University, Rajpura, Punjab, India

Abstract — **With continuous growth of wireless internet technology, the vast potential of Massive Open Online Courses (MOOCs) has opened up new vistas with thousands of motivated learners across the globe. This paper discusses the effectiveness of introducing an online open course titled `Fundamentals of Electrical Engineering-I', conducted by Prof. Don Johnson of Rice University Houston Texas USA. The study pattern, assessment criterion, and the outcome are presented here for this course offered to second year students of 4-years BE (ECE) program of Chitkara University Punjab. The performance was evaluated; the results were analyzed periodically and have been summarized here. The effectiveness of MOOCs in engineering education is established as useful supplementary learning course. The study can be extended for more than one allied courses and the outcome be analyzed.**

Keywords—**CGPA, Engineering Education, MOOC, Online Course, Performance Analysis**

I. INTRODUCTION

Most of the engineering students are interested to study mainly job-oriented courses, yet there are many students who focus on learning fundamental concepts and mathematical analysis. There has been a substantial diversification in the areas of teaching, learning, training and development. From classroom sessions, it has moved to simulations and then on-the-job training to give hands-on-expertise. The students are apprised with the importance of the subject matter covered in the course. Everyone is more willing to work longer and harder when there is a value to the task to be completed. There are many ways to show the direct application of the course material in the class such as problem-based learning, cases, scenarios, application problems, web-quests, or even application-oriented integrated projects. In the same way, open online courses have represented an important development for online education in the past.

Of course, teaching engineering is a complex profession. Perhaps the most important and an integral part of education is the social interaction between students and teachers, and students and students. The teachers should be absolutely knowledgeable in content with applications of the subject and its relation with practical social problems. But updating with latest technology and learning process including ethical conduct is equally important. Self introspection and assessment is a good measure for development. Creativity and research for teaching as well as student community at university level is also needed. Although technology is a great tool to enhance learning, yet it is required to create a fine balance between the use of technology and other hands-on materials to develop students' creative mind. In order to foster excellence in developing knowledge skills and attitudes in all students, teaching-learning process for regular 4-years engineering program is embedded with numerous theory and practical courses in India. While the advantages of using modern tools and technological innovations in the day-to-day-life are well recognized, the corresponding changes in the use of new technologies for teaching-learning process need to be adopted.

Massive Open Online Courses (MOOCs) represent an emerging methodology of online teaching-learning process. It is envisaged that MOOC will become one of key components of hybrid courses in future, providing world-class online education with a difference. Basically, MOOCs integrate the connectivity of social networking, the facilitation of an acknowledged expert, and a collection of freely accessible online resources such as internet. Perhaps most importantly, however, a MOOC builds on the engagement of several thousand active learners of different learning environments. It is yet to be seen whether the MOOC experience will serve the real needs of the students and their future employers. The success of MOOCs will also depend on the extent to which concerned faculty members act as facilitators for the participating students. Undoubtedly, the core experience of college education still remains with the face-to-face interaction and deep reading. In MOOC environment, however, the

International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 155-159
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

students either self-organize their participation according to learning goals, prior knowledge, technical skills, and common interests, or under the constant supervision and guidance of their facilitators. By removing the human interaction from education, in general, we might be further reducing the ability of our students to communicate effectively in the work force. [1].

Teaching-learning process is aimed to develop a number of qualities in students. The ability to put in sustained and disciplined hard work over a sufficient length of time is one of the key factors to success in professional life. Self-learning as well as group learning is a very effective means towards preparing professionals who are proactive in seeking and acquiring knowledge rather than having it imparted only in the classroom. Recently, some engineering students have adopted massive online open courses with the objective of enhancing their knowledge. The main challenge for participating student community remained as how to do introspection and self-analysis and in what way the online open course will help them to understand related curricula courses. [2]. In addition, they would like to know as how this course will add on values to their pursuit for higher studies, research activities, or finding a good job in industry.

II. ABOUT THE OPEN ONLINE COURSE

The delivery of contents without the physical presence of instructors has been around for hundreds of years for post-graduate and Ph.D. study. The feasibility of having a complete online program at the formative under-graduate level is yet to be established. With an objective of assessing the effectiveness of MOOCs in engineering education, Chitkara University Punjab implemented an open online course titled `Fundamentals of Electrical Engineering-I', conducted by Prof. Don Johnson of Rice University Houston Texas USA during January-April 2013. [3]. This course was offered to its second year students of 4-years Bachelor of Engineering (BE) in Electronics and Communication Engineering (ECE) program, run by the School of Electronics and Electrical Engineering (SEEE). The course was conducted online, in conjunction with their regular courses as prescribed by Chitkara University.

The students had studied the pre-requisite courses such as Differential and Integral Calculus, Engineering Physics, Network Analysis and Synthesis, Fundamentals of Electronic Devices in the previous semesters. The online course spanned across five major topics including Signals and Systems, Analog Signal Processing, Frequency Domain, Digital Signal Processing, and Information Communication. The whole online course was scheduled to be covered in 12 weeks time during the same period as the current semester study.

For the purpose of selection of this course, it is worthwhile to mention here that the students were already enrolled in their regular courses comprising of Design and Analysis of Electronic Circuits, Signals and Systems, Principles of Communication Systems, Electromagnetic Field Wave Theory, Control Systems, and Microprocessors. It may be noted that some topics of offered online course were almost similar to that of regular courses whereas other topics were to be studied in the coming semesters. But it was required to submit all the assignments on weekly basis within the specified deadlines, as specified in open online course scheme. The students also complied with the guidelines set for regular courses such as taking up class assignments, mid-sessional tests, and end-term university exams.

III. IMPLEMENTATION STRATEGY

The prime requirement of taking-up open online courses under MOOC scheme is mainly confined to self-learning or learning in isolation (at the most with the help of additional reading material from reference books and allied video lectures available on the web from other sources). But online instructions can only compliment the traditional classroom setting. Teachers focus on developing innovative approaches such as design and analysis, problem solving, team work, communication skills and preparing students for life-long learning. The teacher use modern teaching-aids, interactive lectures, guided case studies, regular lab assignments, literature survey, project work supported by critical and creative thinking. Keeping all these aspects in mind, slightly different strategy was adopted to implement one allied open online course (as mentioned in the previous section) on an experimental basis. Fig. 1 depicts implementation chart to run the selected course with some add-on in-house activities.

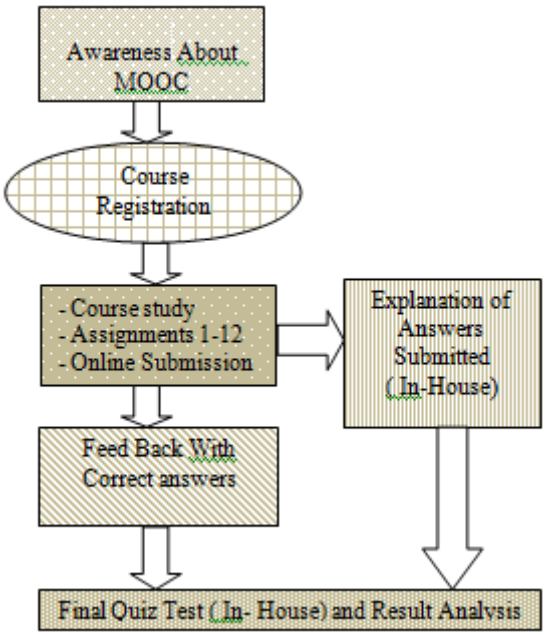

Fig. 1. MOOC ImplementationChart

Firstly, two facilitators were associated with the students for general queries, mainly related with the interpretation of the questions and entering the answers in proper format. Secondly,

International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 155-159
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

combined technical sessions were also organized for about two hours a week in which video lectures of the course expert were displayed and deliberated upon. The students, of course, were discouraged to share their answers with their colleagues prior to online submission so as to have fair and independent assessment. Thirdly, the students, however, were allowed to share the information of previous assignments, if required. The students submitted their individual answers online within the stipulated time, as desired.

In addition, they were asked to prepare and compile the detailed explanation of each answer for review by the department faculty at a later stage. This helped the students to receive feedback on the short-comings in their attempt. Many students appreciated these measures and showed keen interest in order to assess the utility of open online course.

IV. Performance Analysis

As mentioned earlier, there were total 12 assignments for the open online course which were submitted online by all the participating students, as per the given schedule. The results were provided online by the course expert one week after the submission of weekly assignment. In addition, the correct answers were also provided by him for revision of related topics. Fig. 2 and Fig. 3 depicts the average performance of the students after first six assignments i.e. after completion of 50% course, and that of for the last six assignments. [4]

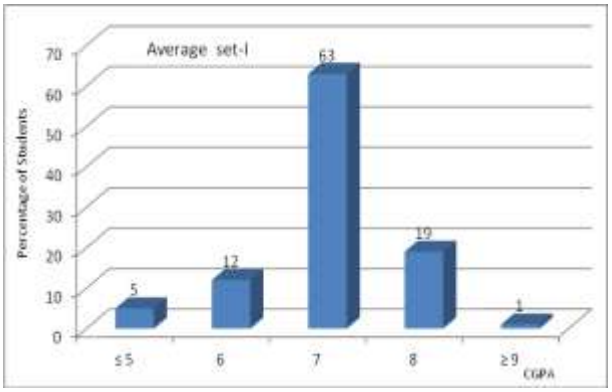

Fig. 2. Performance of Topics 1-6

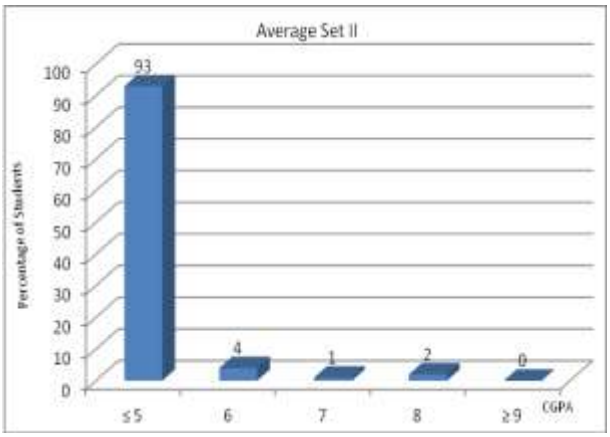

Fig. 3. Performance of Topics 7-12

From Fig. 2, it is observed that about 80% students scored CGPA of more than 7. This was mainly due to the fact that most of the topics covered under online course till this point mostly matched with that of related regular courses. Clearly, the online course and other allied regular courses being studied by the participating students together enabled them to perform well. From Fig. 3, it can be seen that there was significant degradation in the performance as compared to the earlier one. The reason was simple – the topics covered during this phase of online course was quite different that of other regular courses. The students were to cover the allied courses in the forthcoming semester.

For the sake of completing the analysis, Fig. 4 shows the overall performance chart. Surprisingly, the overall results are far from expected one. Only 22% students scored more than CGPA of 6 and remaining students found the difficulty in grasping the concepts presented in the open online course. This can be attributed to many factors such as lack of getting the doubts cleared on the spot from the subject expert, difficulty in understanding the pedagogy of the prescribed text-book available online, not-so-adequate explanation given in video lectures, high pace of the course, imbalance between the level and depth of the topic(s) vis-a-vis those of regular courses, etc. [5].

This clearly indicates that open online course of this nature cannot replace other related courses but can only supplement them. In the absence of direct interaction between the course expert and the students, the level of understanding the core enginnering aspects remains limited with the students. There is no doubt that the online course did help the students to perform equally well in regular courses. The overall confidence level of the students also showed remarkable improvement. Thus, by making the learning more interactive and try making the center of discussion around the topic which students would like, expert guidance does make the difference. [6].

International Journal of Engineering Applied Sciences and Technology, 2017
Vol. 2, Issue 5, ISSN No. 2455-2143, Pages 155-159
Published Online March-April 2017 in IJEAST (http://www.ijeast.com)

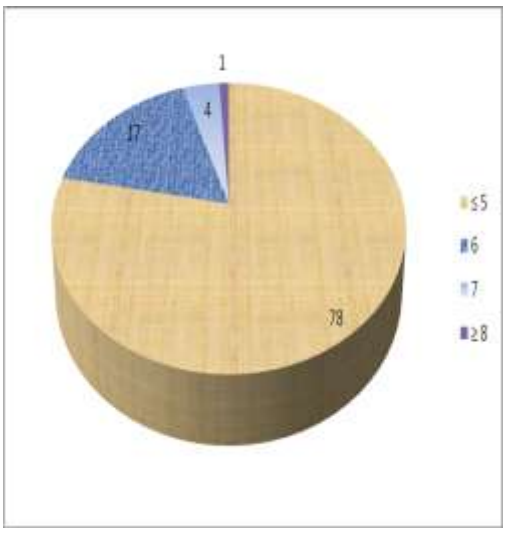

Fig. 4. Overall Performance Analysis for Open Online Course

V. DISCUSSIONS

From the analysis presented here, it is not unfair to say that MOOCs in the present form, unlike more traditional online courses, do not have a track record of success – may be quite the opposite. The fact is that they are free or very inexpensive means nothing if students are not able to utilize them successfully. Excellent teachers create fluent and frequent high-level discussions that engage students with one another at multiple levels (intellectual and personal). Indeed, college campuses are not just places where information is transmitted from one person to another; they are places where information is created and discovered. [7]. MOOCs do not reasonably or realistically have the possibility to recreate this aspect of a college education. Distribution of information by any means is not the same as delivery of effective education, otherwise participation from students might become passive and very little is expected of them. Optimizing the goal of higher education is to prepare people for life in the real world.

MOOCs cannot and should not serve as a replacement for accredited courses. But they do allow people to enhance their learning using technology. [8]. A MOOC takes this to the next level in two ways: the course content is more advanced (while still not meeting the standards of a credit course) and they serve masses of people. Therefore MOOCs could make the world a better place, but as continuing education rather than as college education. Teachers actually care about students getting educated, and MOOCs don't allow for any type of instruction that meaningfully develops higher reasoning skills. MOOCs alone lack of appreciation for the value of attentive guidance. However, it can supplement the information being made available by the subject expert across the globe.

VI. CONCLUSION

Undoubtedly, massive open online courses have opened up access to well-organized delivery of full-fledged contents on specific subjects by the experts across the world. Moreover, with the availability of internet to most of learners of higher education, thousands of motivated learners can adopt these courses and derive benefits. However, the extent of effectiveness for engineering education is still under debate and yet to be established. The study pattern, implementation strategy, assessment criterion, and the outcome presented here for a particular engineering course on an experimental basis shows the mixed results. The facilitators along with participating students were quite anxious to analyze the pros-and-cons of such methodology. As the results indicate there is a lot more to be done in terms of selection of the right course at the right time and exploring the optimum way of utilizing this opportunity. Right now the MOOCs are little better than a text-book alone, and to properly teach them (of course teaching depends on the student more than the teacher) would require concerned teachers to be with enrolled students in open online course and help them understand the part that they cannot otherwise. In a nutshell, we can say that MOOCs are basically good books with video lectures delivered by the subject-expert offline but easily available online. So it is recommended to extend various types of similar experiments by different institutes for variety of courses across all disciplines of engineering and technology and the outcome published.

VII. ACKNOWLEDGEMENT

The author would like to acknowledge the contribution made by the associated faculty and staff of ECE Deptt of Chitkara University Punjab, in successful implementation of Massive open online course titled `Fundamentals of Electrical Engineering-I', conducted by Prof. Don Johnson of Rice University Houston Texas USA in the academic year 2013. Special thanks to participating engineering students of B.E. (ECE) who studied this course in conjunction with their prescribed curriculum. This enabled to assess the effectiveness of MOOCs in engineering education, as a case study, and presented in this paper.

VIII. REFERENCES

[1] K. Masters, A Brief Guide To Understanding MOOCs, The Internet Journal of Medical Education, vol. 1, No. 2, 2011.

[2] J. Mackness, S. Mak, R. Williams, The ideals and reality of participating in a MOOC, Paper presented at the Seventh International Conference on Networked Learning, Aalborg, Denmark, 2010.

[3] www.coursera.org

[4] R. Hooda, T. L. Singal, Developing and Implementing Process for Internal Quality Assurance – A Case Study, NAAC Sponsored National level Seminar on Internal Quality Assurance: Developing Processes for Positive Outcomes, Chitkara University, Punjab, July 25-26, 2013.

[5] P. Hutchings, Opening Doors to Faculty Involvement in Assessment, National Institute for Learning Outcomes Assessment Occasional, April, 2010.

[6] B. Means, Y. Toyama, R. Murphy, M. Bakia, K. Jones, Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning, Center for Technology in Learning, U.S. Department of Education, 2010.

[7] M. E. Huba, J. E. Freed, Learner-centered assessment on college campuses: Shifting the focus from teaching to learning, Boston: Allyn and Bacon, 2000.

[8] J. Aczel, S. Cross, A. Meiszner, P. Hardy, P. McAndrew, D. Clow, Some issues affecting the sustainability of open learning courses, EDEN - 2011 Annual Conference, Dublin, Ireland, 19-22 June 2011.