Instructional Strategies of MOOC that We Can Use

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Abstract - In 2011, Stanford University launched the online course entitled “Introduction to Artificial Intelligence”. It was facilitated by Sebastian Thrun and Peter Norvig. Enrollment quickly reached 160,000 students. Since then the term, MOOC, Massive Open Online Course, has become widely known internationally. Together with these online courses, we also see the establishment of various MOOC platforms such as Coursera, edX, Udacity and Udemy. Other innovations, such as SOOC, MOOL, MOOR and even SPOC began to appear in researchers’ vocabulary. In spite of its popularity, MOOC have attracted many academicians to debate their upsides and downsides. Many academicians have pointed out that the attrition rates of MOOC are very high. At the same time, there are academicians who pointed out the sheer number of people who have benefitted from participating in MOOC. For example, there were 155,000 students from 162 countries in the MIT course on circuits and electronics. 7,200 students passed the course. By itself, 7,200 represented only 4.6% of 155,000. But it would take a professor to teach the same course twice a year for 40 years in order to achieve this number. The purpose of this paper is to discuss the rationale of MOOC and then highlight some instructional strategies of MOOC which we can adopt in our e-learning implementation. Some of these include the flipped classroom, virtual science experiments, access to actual telescopic installations, peer review and marking of assignments, governmental support for critical technologies like Data Sciences and Analytics and adopting an appropriate business model for universities joining the MOOC bandwagon. In addition, the author will examine some challenging issues for MOOC. One challenging issue is on the accreditation and recognition of MOOC. He will also offer his views on the future of MOOC and e-learning in general.

Keywords - MOOC, Instructional Strategies, Interactive Learning, Peer Learning, Assessment

I. INTRODUCTION

This paper examines some MOOC teaching approaches or strategies which can be used in e-learning implementations in a training or educational setting. Besides that the author will examine some challenging issues facing MOOCs.

Over the past two to three years, massive open online courses, or MOOCs, have erupted in the higher education landscape. We began to read of MOOCs with hundreds of thousands of online students enrolled. In addition, there is a wide variety of courses offered by universities in many different countries including those from US, UK, China, Japan, Australia, Malaysia and Singapore. Many of these courses do not require registration or course fees to be made. So, what are MOOCs and how are they able to reach out to appeal to so many students unlike the traditional online courses?

II. WHAT IS A MOOC?

A MOOC, or massive open online course, is an online course that is open, distributed and supports life-long learning [6, 13, 17, 29].
According to ([29], p. 6), MOOCs “offer a middle ground for teaching and learning between the highly organized and structured classroom environment and the chaotic open web of fragmented information”. Using web-based tools and environment, it is able to deliver classes without regard for geographical boundaries, time zones, and large number of participants. Thus, a student in a far-flung location can take a particular lecture in his or her own time zone or a student may also make up for missed lectures at his or her convenience.

The term, MOOC, was coined in 2008 by Dave Cormier and Bryan Alexander. They were responding to an online course called Connectivism and Connective Knowledge which was led by George Siemens and Stephen Downes, well-known educational researchers in the field of online learning [9, 17, 29]. In addition to providing traditional course materials such as videos, readings, and assignments, MOOCs provide interactive user forums that help build learning communities for students, professors, and teaching assistants. MOOCs are popular amongst students as it offers a freer and unrestricted way of learning when compared to traditional face-to-face courses. Learning in MOOCs is flexible and self-paced, so students can revisit the learning materials as necessary for them to understand the concepts. Almost all current MOOCs generally have the following features [15]:

- **Massive** - i.e. access to a large group of students, e.g. from 5,000 - 100,000.
- **Open Access** - i.e. not requiring a test of prior knowledge before starting the course.
- **Open** - i.e. do not require payment just for access to content and peers. However, there may be payments for other things (like tutor support, assessment, participation in ancillary events).
- **Online** - i.e. online web delivery. Contents may be in multiple modes - video, audio, text and animation.
- **Course** - i.e. having a course of study with a set of learning outcomes.
- **Online Course** - i.e. incorporating interactions with students and course facilitators.

To bolster instructional content, many lecturers are experimenting with how to integrate third-party content into their classes or online courses. Whole disciplines (like computing) have transitioned to a point where learning at home coupled with hands-on work in class is the norm [8]. So presuming that MOOCs are just one of many content sources that can be leveraged by professors experimenting with their teaching strategies, the professors could serve as a valuable resource as more and more classes get re-engineered towards self-directed learning, a key component of transformative education in the 21st century. MOOCs play a significant role by bringing high quality & interactive learning content accessible to anyone at anytime.

### III. MOOC PLATFORMS

In order to launch a MOOC, the university has to have the necessary infrastructure to support the huge number of students accessing, using and interacting with other users on the computer system [33]. This is where the university has to get its platform right from the start. Essentially, a MOOC platform refers to the underlying computer system on which application programs can run [25]. These application programs help to deliver the online courses. Currently, there are a quite few MOOC platforms that are widely used to deliver MOOCs. These include Coursera, edX, Udacity, Udemy, Moodle, or even Google Course Builder [12]. To illustrate the differences, a comparison of the three of the more main platforms (in terms of the range of courses offered, accreditation and the technology used) is shown in Table I.
TABLE I
A COMPARISON OF MOOC PLATFORMS [30]

<table>
<thead>
<tr>
<th>Provider</th>
<th>Available Languages</th>
<th>Accreditation</th>
<th>Courses offered</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coursera3</td>
<td>English, Spanish, French, Chinese, Arabic, Russian, Portuguese, Turkish, Ukrainian, Hebrew, German, Italian, Arabic, Greek, Japanese</td>
<td>American Council on Education College Credit Recommendation (for five courses)</td>
<td>Broad range of courses e.g. physics, engineering, humanities, medicine, biology, social sciences, mathematics, business, computer science, and many more</td>
<td>Closed platform</td>
</tr>
<tr>
<td>edX2</td>
<td>English, Mandarin, French, Hindi, Spanish</td>
<td>Universities do not offer formal academic credit for edX coursework</td>
<td>Courses from top universities for post college / lifelong learning</td>
<td>Open platform</td>
</tr>
<tr>
<td>Udacity4</td>
<td>English</td>
<td>Tie up with Georgia Tech university to offer MS in Technology</td>
<td>Focus on Vocational courses / courses in STEM fields</td>
<td>Closed platform</td>
</tr>
</tbody>
</table>

Programs in platforms such as edX (shown above) use open source software which allows the source code to be made available to others for modification and enhancement. Open source software or open platform refers to the operating system used in the computer system. It is usually free of charge and has unlimited licensing under different usage licensing [22]. The source code is freely available to the public and users can modify the codes depending on certain conditions. This gives software developers the option to look deeper into the code and alter things as they wish. By having an open source software program, you allow developers to alter large amounts of the code to their own preference.

On the other hand, closed source software or closed platform is proprietary, e.g. owned by some entities like Microsoft or Apple. The software is not available for free. The source codes are not alterable but need to be licensed. This means legitimate users need to register the software with the original developing company. A closed system or platform does not allow the developers to change anything that deals with the operating system software. However, the application developers are given some privileges with a set of tools that let them develop the software to support the delivery of the online courses. There are advantages and disadvantages in either platforms.

There are three main kinds of MOOCs, with each predisposed towards a specific kind of pedagogical approach: cMOOC, xMOOCs and quasi-MOOCs [29]. The connectivist cMOOC is driven by social constructivist approach to learning. It harnesses the power of social media and interaction with peers for social learning. It focuses on knowledge generation and creation. In contrast, xMOOCs are primarily driven by a behaviorist principle of acquiring knowledge through repetition and testing [24]. It is content focused, and is geared towards duplication of knowledge. Quasi-MOOCs offer web-based tutorials such as those by Khan Academy and MIT’s OpenCourseware (OCW). They consist of “open education resources supporting learning specific tasks that do not offer the social interaction of cMOOCs or the automated grading and tutorial-driven format of xMOOCs” [29].

IV. TEACHING APPROACHES IN MOOC

Undoubtedly, the success of any MOOC depends very much on the teaching approaches adopted. MOOCs’ course design, in general, should be guided by sound pedagogical approaches such as interactive learning, self-directed learning, peer assessment and constructive feedback. Only then can there be improved student learning outcomes [4] and [1].

In her blog post entitled “A Tale of Two MOOCs @ Coursera: Divided by Pedagogy”, Morrison [19] analyzed and shared the thoughts on the success and failure of the two online courses she attended: “Fundamentals of Online Education (FOE)” course and the “e-Learning and Digital Cultures” course. She pointed out learning was disadvantaged in FOE course as it adopted the instructor-led model with the instructor directing the student learning with little interactive learning. In contrast, the other more successful
“e-Learning and Digital Cultures” course Morrison observed adopted the learner-centric and self-directed learning approach. Students were more engaged as they were given choices on participation using social media and access to open resources on the Web for content [19].

Morrison was not alone in her observation. Several professors from various universities such as MIT and the Australian Catholic University [1, 18] have also pointed out that MOOCs should not be conducted in the traditional didactic manner with the instructor moving everyone at the same pace regardless of their understanding. The online environment requires more of the active engagement of learners’ minds than the passive absorption of knowledge. One should not underestimate the power of learner engagement and peer learning in MOOCs. In reflecting on his delivery of his MIT MOOC course on circuits and electronics, Agarwal [1] shared that he was concerned on his inability to monitor the forum discussions and answer the questions from the 150,000 odd students with his one technical assistant. Fortunately, he found out that whenever questions were raised by some students, other students started to provide answers. This was despite the fact that his students came from different countries. This illustrated the power of peer learning in MOOCs.

Online, instructors can utilize automatically graded assessments in MOOC offer the opportunity for students to receive instant feedback which allows them to stay engaged in their task. Students need to receive clear goals, receive immediate feedback in real time about their progress, and affirmation in the form of rewards linked to mastery of appropriate skills. With thousands of students enrolled in some MOOCs, it becomes impossible for the instructors to review the answers, essays or other open-ended work as they do in smaller face-to-face classrooms. Relying on quizzes and other single “right” answer type of assessments inhibits the potential for MOOC providers if they want to offer a wider range of courses. In order to remove this limitation, MOOC providers are now looking to peer-based assessments, in which students learn to review the work of their cohorts [11]. This is an approach which educators should consider.

Finally, learning through MOOCs can become even more effective if there is an authentic face-to-face interaction between students and teachers; this is possible with a Flipped Classroom model, where students go through MOOCs online and teachers clear their doubts during class hours [8, 11]. In delivering MOOCs, one needs to take great care in managing the online learning platform tools and learners. Concluding his study on MOOCs, Grainger ([13], p5 and 35) suggested some practical pointers on MOOC delivery educators might need to take note of. They include:

- Well-designed announcements (beginning and end of each week) articulating the topic coverage, learning activities and assessment methods to maintain student interest and motivation.

- Effective strategy for managing the forums to control negative behavior of minority while maintaining the openness of discussion areas. This is done so as not to let the majority of students get affected by negative online behavior of the minority.

- Regular communication, but not too regularly such as once or twice a week as students appear to respond readily to emails when compared to static announcements on the MOOC session site.

- Responsiveness to student feedback. If a single learner raises an issue in the forums, it is worth noting. If 20 or 30 students raise the same issue in the forums, it is wise to act quickly by confirming that the issue has been noted and action taken where possible.

As discussed, there are indeed a variety of different approaches and ways which we can
enhance the effectiveness of MOOCs. We will now examine a couple of teaching innovations in MOOCs, more specifically for Science and Engineering courses.

V. VIRTUAL “iLABS” IN MOOCS

The challenge in MOOCs for science courses includes the difficulties of replicating science experiment environment online, and the costs of having to do so. Notwithstanding, Universities elsewhere have sought to overcome this hurdle through different means.

With the aid of his graduate students in Stanford University, Professor Lambertus Hesselink was able to set up a virtual lab which allowed MOOC students to carry out a Physics diffraction experiment. This was done through squeezing two lasers, a diffraction grating, multiple lenses and other equipment into a picnic basket sized box. Snapshots of every possible experimental setup were taken and stored in a database. Students can log into the database and interact with the same controls and video view as would be used during a real experiment. When students change the laser color from blue to red, they observe the prerecorded state within this virtual lab [14]. Not only has Professor Hesselink succeeded in creating a virtual lab online, he has also made the virtual lab affordable and accessible, with the experiments can be made low risk and low cost. These experiments can also be accessed by hundreds of students. An added advantage is that the virtual lab also requires significantly less maintenance when compared to a real lab [5].

Some MOOCs allow students to access expensive resources such as the telescope. For example, Skynet University offers online courses that allow their students to access their global university network of fully automated, or robotic, telescopes. Their students are also able to access the 7 million images that were taken with their telescopes which span four continents [26]. Another example is the Faulkes Telescope Project which provides students in the UK with free access to two high-powered robotic telescopes, one in Hawaii and the other in Australia. The students are able to use these telescopes remotely to carry out their own scientific investigations [3]. These are some examples of MOOCs providing access to equipment which otherwise would not have been made available to students due to forbidding costs.

VI. CHALLENGES IN MOOCS

MOOCs have now become so widespread that many universities are even giving credits to their applicants who have successively completed their MOOCs. One example is NTU’s initiative to allow their existing students to transfer the credits earned by the students to the courses they are studying [20]. This bodes well for the future of MOOCs. However, there are still challenges confronting the even widespread use and adoption of MOOCs.

One big challenge is the accreditation and certification issue for any MOOC. Currently, there is no central body or standards on which accreditation and certification can be benchmarked. It is interesting to note that some Universities have started accrediting courses. One of the accrediting bodies is American Council of Education, a non-profit association representing the leaders of US accredited degree-granting two- and four-year colleges and universities [32]. Another example is the US’s Distance Education and Training Council (DETC, http://www.detc.org/) which has accredited courses by University of the People (http://uopeople.edu) since February 2014. However, such examples of accrediting bodies are far and few in between.

The next challenge for MOOCs is to expand access to more people in other countries. Currently, people in many countries do not have the technology and the tools to access MOOCs. The Internet infrastructure in their countries is also poor. Some MOOCs are also blocked in certain countries for political
reasons. Yet, another challenge is to have their MOOCs made mobile friendly. The world is going mobile but only some MOOCs (e.g. MobiMOOC and UnX) have their learning materials in the mobile format [9].

The other challenge is to raise student motivation. Currently, most MOOCs suffer from low student completion rates. This can be attributed to low student motivation and engagement. This low learner motivation needs to be addressed if schools, companies, or other organizations interested in using MOOCs as part of a full curriculum. The discussion in this paper on the instructional strategies of MOOCs is timely as the author believes that student centric instructional strategies in MOOCs can help to increase both student motivation and engagement.

The final challenge faced by MOOCs will be its integration with the classroom lessons. With different modes of teaching - i.e. face-to-face classroom teaching, online courses and MOOCs, more people are interested in using MOOCs as supplements to, rather than replacements for the traditional courses [2]. Notwithstanding the challenges, MOOCs faces unlimited prospects in promoting learning and uplifting standards of competencies and knowledge amongst masses.

VII. CONCLUSION

The Straits Times reported that two years after the Coursera education platform was set up, about 55,000 students from Singapore signed up for courses on the Coursera platform [7]. This was very encouraging. It showed that people in Singapore were very enthusiastic about lifelong learning. There are many good teaching and learning practices in MOOCs that our universities and training providers can adopt. The key to all these is student engagement. With MOOCs the instructor can use peer assessment and grading in order to assess other students. However, not everything can be accomplished using MOOCs. Students doing any MOOC will need to become self-determined learners with high motivation.

Together with the relevant instructional strategies, the author believes that MOOCs can supplement the usual online and face-to-face classroom sessions. Ultimately, as pointed out by [19], courses that do not engage the students well enough will simply disappear. Those MOOCs that engage their students using the appropriate instructional strategies will become very sustainable. Yet again, it is possible that more people will be able to access sophisticated lab equipment when they are learning science and technology courses.

REFERENCES

(Arranged in the order of citation in the same fashion as the case of Footnotes.)


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