

## INSTRUCTIONAL STRATEGIES AND CHALLENGES IN MOOCS

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*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. Because of the massive student enrolment, course providers have devised teaching approaches and strategies for MOOCs to engage students in learning. The purpose of this paper is to examine some MOOC teaching approaches or strategies which can be adopted in e-learning implementation. In addition, the author examines some challenging issues facing MOOCs.*

**Keywords:** Technology integration, electronic study guides, higher education.

### INTRODUCTION

The discussion in this paper on the instructional strategies and challenges in MOOCs is timely as the author believes that student centric instructional strategies in MOOCs can help to increase both student motivation and engagement. Over the past three years, massive open online courses, (MOOCs), have emerged rapidly on the higher education landscape with hundreds of thousands of online students enrolled in MOOCs. Today, there is a wide variety of courses offered by universities in many countries including those from US, UK, China, Japan, Australia, Malaysia and Singapore. Many of these courses do not require registration or course fees. So, what are MOOCs and how are they able to reach out to appeal to so many students?

### WHAT IS A MOOC?

A MOOC is an online course that is open, distributed and supports life-long learning ([McAuley et al., 2013](#); [Siemens, 2013](#); [Grainger 2013](#); [Cormier, 2010](#)). According to Siemens (2013), 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” (p.6). MOOCs play a significant role by bringing high quality and interactive learning content accessible to anyone at anytime. Using web-based tools, MOOCs are able to deliver classes without regard for geographical boundaries, time zones, and the number of participants. Thus, students in disparate locations can take particular lectures in their own time zone or students may make up for missed lectures at their own 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 ([de Frietas, 2013](#); [McAuley et al., 2010](#); [Siemens, 2013](#)). 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, instructors and teaching assistants. MOOCs are popular amongst students as they offer a freer and less restricted 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 ([Lukeš, 2012](#)):

- **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 (e.g., computing) have transitioned to a point where learning at home, coupled with hands-on work in class, is the norm ([Degree of Freedom, 2013](#)). For instructors searching for a range of content, instructional strategies and modes of delivery to enhance their courses, MOOCs could serve as a valuable resource as increasing numbers of courses are re-engineered towards self-directed learning, which is a key component of transformative education in the 21<sup>st</sup> century.

## MOOC PLATFORMS

In order to launch a MOOC, a university needs the necessary infrastructure to support the potentially large number of students accessing, using and interacting with other users via the computer system ([Yuan, Powell & Oliver, 2014](#)). Essentially, a MOOC platform refers to the underlying computer system on which application programs can run ([Rouse, 2006](#)). These application programs help to deliver the online courses. Currently, there are a quite few MOOC platforms that are widely used to deliver MOOCs.<sup>1</sup> These include Coursera, edX, Udacity, Udemy, Moodle, and even Google Course Builder ([Ferenstein, 2012](#)). To illustrate the differences, a comparison of three common platforms (in terms of the range of courses offered, accreditation and the technology used) is shown in Table 1.

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<sup>1</sup> These platforms might be classified according to whether they are commercial (for-profit) or non-profit. Both Coursera and Udacity are commercial platforms whilst edX and FutureLearn (from the UK) are non-profit platforms.

**Table 1***A Comparison of MOOC Platforms*

<b>Provider</b>	<b>Available Languages</b>	<b>Accreditation</b>	<b>Courses Offered</b>	<b>Technology</b>
Coursera <sup>2</sup>	English, Spanish, French, Chinese, Arabic, Russian, Portuguese, Turkish, Ukrainian, Hebrew, German, Italian, Arabic, Greek, Japanese	American Council on Education College Credit Recommendation (for five courses)	Broad range of courses e.g. physics, engineering, humanities, medicine, biology, social sciences, mathematics, business, computer science, and many more	Closed platform
edX <sup>3</sup>	English, Mandarin, French, Hindi, Spanish	Universities do not offer formal academic credit for edX coursework	Courses from top universities for post college / lifelong learner	Open platform
Udacity <sup>4</sup>	English	Tie up with Georgia Tech university to offer MS in Technology	Focus on Vocational courses/ courses in STEM fields	Closed platform

Source: [Taneja & Goel, 2014](#)

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.<sup>5</sup> 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 ([Open Source Initiative, 2014](#)). 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, developers can 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 entities like Microsoft or Apple. The software is not available for free and 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 developers to change anything that deals with the operating system software. However, 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 to both platforms.

<sup>2</sup> Coursera is an open-source educational learning platform started by two Stanford professors. It partners with top universities to offer courses online for free. It has a proprietary platform on which content provided by participating universities is hosted.

<sup>3</sup> edX is an open-source platform that was founded in partnership between MIT and Harvard. It is non-profit driven and aims to enable open access to quality online delivery.

<sup>4</sup> Udacity started out as a Stanford University experiment which offered a free online Artificial Intelligence course to anyone. Its aim is to bridge the gap between education, employment and skills.

<sup>5</sup> Other platforms also using open source software include Google Course Builder and Moodle ([Swope, 2014](#)).

There are three main kinds of MOOC each of which is predisposed towards a specific kind of pedagogical approach: cMOOC, xMOOCs ([Downes, 2013](#)) and quasi-MOOCs ([Siemens, 2013](#)). 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 behaviourist principle of acquiring knowledge through repetition and testing ([Roderick, 2008](#)). They are content focused, and are 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" ([Siemens, 2013, p.8](#)).

## TEACHING APPROACHES AND STRATEGIES IN MOOCS

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 ([Buck, 2014](#); [Agarwal, 2014](#)).

In her blog post entitled "A Tale of Two MOOCs @ Coursera: Divided by Pedagogy", Morrison ([2013](#)) analysed and shared 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 the FOE course as it adopted the instructor-led model with the instructor directing 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 ([Morrison, 2013](#)).

Morrison is not alone in her observations. Several professors from various universities such as MIT and the Australian Catholic University ([Agarwal, 2014](#); [McLoughlin, 2013](#)) 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 active engagement of learners' minds rather than 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 \(2014\)](#) shared that he was concerned about his inability to monitor the forum discussions and answer the questions from the 150,000 students with the help of only one technical assistant. Fortunately, he found 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 phenomenon illustrates the power of peer learning in MOOCs.

Online instructors can utilize automatically graded assessments in MOOCs that offer the opportunity for students to receive instant feedback in real time, which allows them to stay engaged in their tasks. Students need to receive clear goals, immediate feedback about their progress, and affirmation (in the form of rewards) for 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 assessments can also inhibit 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 other in their cohort ([Duhring, 2013](#)). This is an approach which educators can also consider.

Finally, learning through MOOCs can become even more effective if there is an authentic face-to-face interaction between students and instructors; this is possible with a Flipped Classroom model, in which students go through MOOCs online and instructors clear their doubts during class hours ([Davie, 2014](#); [Degree of Freedom, 2013](#)). In delivering MOOCs, instructors are to take great care in managing the online learning platform tools and learners. Concluding his study on MOOCs, Grainger (2013, p.5 and p. 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 forums to control negative behaviour of a minority while maintaining the openness of discussion areas, which is done so as not to let the majority of students get affected by negative online behaviour 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; and
- responsiveness to student feedback. If a single learner raises an issue in forums, it is worth noting. If 20 or 30 students raise the same issue in forums, it is wise to act quickly by confirming that the issue has been noted and action taken where possible.

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

### **VIRTUAL "ILABS" IN MOOCS**

The challenge in MOOCs for science courses includes the difficulties of replicating science experiments online, and the costs of doing so. However, some universities have sought to overcome this hurdle through different means. For example, with the aid of his graduate students at 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 by 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 onto the database and interact with the same controls and video view as would be used during a real experiment. When students change the laser colour from blue to red, they observe the pre-recorded state within this virtual lab ([Hesselink, Rizal, Bjornson, Paik, Batra & Catrysse 2003](#)). Not only has Professor Hesselink succeeded in creating a virtual lab online, he has also made the virtual lab affordable and accessible. 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 ([Carey, 2013](#)).

Some MOOCs allow students to access expensive resources such as a telescope. For example, Skynet University offers online courses that allow students access its global university network of fully automated, or robotic, telescopes. Its students are also able to access the 7 million images that were taken with these telescopes, which span four continents ([Skynet University, 2011](#)). Another example is the Faulkes Telescope Project which provides students in the UK free access to two high-powered robotic telescopes, one in Hawaii and the other in Australia. Students are able to use these telescopes remotely to carry out their own scientific investigations ([Brown & Adler, 2008](#)). These are some examples of MOOCs providing access to equipment which otherwise could not be made available to students due to prohibitive costs.

### 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 in Singapore is Nanyang Technological University's initiative to allow its existing students to transfer credits they have earned to the courses they are studying ([NTU Academic Services, 2014](#)). Such a trend bodes well for the future of MOOCs. However, there are still challenges confronting the widespread use and adoption of MOOCs.

One major challenge is accreditation and certification for MOOCs. Currently, there is no central body or set of standards against 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 the American Council of Education, a non-profit association representing the leaders of US accredited degree-granting two- and four-year colleges and universities ([Voss, 2013](#)). Another example is the USA's Distance Education and Training Council (DETC, <http://www.detc.org/>), which has accredited courses by the University of the People (<http://uopeople.edu>) since February 2014. However, such examples of accrediting bodies are small in number.

The next challenge for MOOCs is to expand access to more people in more countries. Currently, people in many countries do not have the technology and the tools to access MOOCs. Also, the Internet infrastructure in some countries is poor. Moreover, some MOOCs are also blocked in certain countries for political reasons. Yet, another challenge is to have MOOCs made mobile friendly. At a time when many people in the world are increasingly accessing mobile content, only some MOOCs (e.g., MobiMOOC and UnX) have learning materials in mobile accessible formats ([de Freitas, 2013](#)). Another 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 intend to use MOOCs as part of a full curriculum. The final challenge faced by MOOCs will be their integration with classroom lessons as part of blended learning and as supplements to, rather than replacements for, traditional courses ([Blake, 2014](#)). Notwithstanding these challenges, MOOCs face unlimited prospects for promoting learning and uplifting standards of competencies and knowledge amongst wide numbers of learners.

## CONCLUSION

After the Coursera education platform was established, about 55,000 students from Singapore had signed up for courses on the Coursera platform ([Davie, 2014](#)). This shows that people in Singapore are very enthusiastic about lifelong learning via MOOCs. There are many good teaching and learning practices in MOOCs that universities and training providers can adopt. It is also possible that more people will be able to access sophisticated lab equipment and conduct experiments when they are learning science and technology courses through MOOCs. However, not everything can be accomplished using MOOCs. Students taking MOOCs will need to be self-determined learners with high motivation. Together with relevant strategies, the author believes that MOOCs can help supplement the usual online and face-to-face classroom sessions. Ultimately, as pointed out by Morrison ([2013](#)), courses that do not engage students well enough will simply disappear. Those MOOCs that engage their students using the appropriate strategies or approaches and rise to the challenges outlined above will become sustainable.

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