Adapting massive open online courses for medical education

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INTRODUCTION

Massive open online courses (MOOCs) have seen phenomenal rise in the last few years as a medium of delivering quality course content to learners at their doorstep. Typically, a MOOC comprises of a set of educational material hosted on an internet site, accessible to the learners through their devices. The popularity of MOOCs have stemmed from them being online and open, the features which allow students from all across the world to enrol freely. A large number of these courses are provided without any cost, and a student can choose and pick as many courses as he/she wants. Due to their convenience and appeal, some of these courses have attracted thousands of students and hence have been acknowledged as massive.

The history of MOOCs is relatively short with the first such course probably developed by David Wiley in 2007. The term was coined by David Cormier in 2008 for a course offered by George Siemens and Steven Downes at the University of Manitoba. MOOCs gradually grew in popularity and two courses conducted by Stanford University professors enrolled 90,000 and 160,000 students, respectively. Since then, MOOC technology providers, such as edX, Coursera, and MITx, have expanded the number and variety of courses provided and have provided courseware to millions of students worldwide.

The structure of a typical MOOC consists of a course of few weeks duration. The course is broken down into weekly modules. Each module discusses a single or few topics related to the subject. The format of teaching is through video lectures, demonstrations, essential readings and quizzes. Students can put forth their questions and opinions in discussion boards moderated by content providers. Courses typically require somewhere between 3 to 10 hours of participant involvement per week. Assessment of the participants is typically through multiple choice questions, extended matching questions and true–false type questions. Some courses also incorporate essays, peer assessments and writing program codes as a part of their assessment process. However, evaluation of such submissions from a large number of students is usually done by peers or automated computer programs. The participants who satisfactorily complete the course are issued certificates. Participation in a MOOC is typically open to all, though some courses specify familiarity with a particular skill (for example, programming in a particular language for a MOOC in computer science). The concept and structure of MOOC is graphically depicted in Figure 1.

A wide variety of courses have been offered in MOOC format, including basic to advanced statistics, computer programming, critical appraisal of poetry, public health case scenarios, nutrition, genomics, and astrophysics. The format and teaching–assessment methods vary from

**Figure 1:** The concept and structure of MOOC
one course to another. For example, courses on computer programming may require submission of lines of code, while courses on public health may require submission of an essay for grading.

**ADVANTAGES AND DISADVANTAGES**

MOOCs offer several advantages that have led to their growing popularity. One of the biggest advantages of MOOCs is their ease of access. The content is hosted online and is accessible to the learners at a place and time of their convenience. The course videos are pre-recorded and are not real-time, avoiding last-moment technical glitches. Often these courses attract students from all over the world, offering a chance of cross-fertilization of ideas from different parts of the globe. Globally renowned professors may reach out to a large number of students through these courses, which they might not be able to cater through regular classroom-based courses. Also, a course once made can be delivered a number of times, thus reducing the recurring efforts and costs. The MOOC format of teaching translates to less administrative hassle and lower costs of delivery of the educational content.

Though the above-mentioned advantages of the MOOC make them an attractive proposition, certain limitations should also be considered. One of the major limitations of MOOCs is their high dropout rates. MOOCs may see enrolment of thousands of students into a course, but fewer actual completers. This may occur as many individuals enrol for MOOC courses without being seriously committed toward it. Also, assessments in MOOCs rely on self-reported fidelity to honor code. As the examinations and end assessment are not supervised, possibility of use of unfair means cannot be ruled out. Also, MOOCs are usually introductory short-duration courses which can hardly be substitutes of in-depth full-time courses. How the employers and funders would appraise these MOOC courses while deciding upon employment and research opportunities is not very clear. There is limited financial incentive for course content developers, as these courses are usually free. University clearances may become contentious issue as many stakeholders may lay claim upon the intellectual property delivered through MOOC. The MOOC also require stable internet connection at the learner’s end, which may be difficult in certain parts of the world. While MOOCs are successful in teaching–learning in the cognitive (knowledge-based) domain, they need to be creatively adapted to be able to impart training in the skills domain. Expertise in skills like abdominal examination or suturing a clean wound are skill based and may require close personal supervision, and can hardly be catered through MOOC.

**ADAPTING MOOC FOR MEDICAL EDUCATION**

MOOCs has been successfully used for teaching subjects like statistics, computers, history and ethics. They have also been utilized for life-sciences-related areas reflected through courses like ‘An Introduction to Global Health’ (Coursera), ‘Bioinformatics: Introduction and Methods’ (Coursera), ‘Myths and Realities of Personalised Medicine: The Genetic Revolution’ (Coursera), ‘Behavioral Medicine: A Key to Better Health (EdX) and Medicine in the Digital Age’ (EdX). But adaptation of MOOC to medical education poses certain challenges. Teaching theoretical concepts traditionally delivered through classrooms may be amenable through MOOC. For example, anatomy and physiology of the heart may be easily adapted to MOOC format utilizing videos, demonstrations and multimedia. Information about electrocardiogram (ECG) and heart sounds can be added as an ancillary measure. Audio clippings of heart murmurs may serve as a primer for further learning in a real-world setting. However, teaching of specific skills like auscultation that require close supervision may not be amenable to teaching through MOOC. Basic life support which is a skill-based program would be best delivered in a hands-on workshop. Hence, careful consideration is required for deciding course topic and content.

One of the tenets of MOOCs is being massive. The term massive would be applicable as the number of students being taught in the course is large. Focused and extremely specialized courses like one dealing with neurosurgical complications may not attract a large audience of learners. On the other hand, a broad-based program about cardiac health and healthy lifestyle with a segment upon common cardiac diseases and treatment may draw more takers. An important intertwined question is who would be the audience for these courses. The more general the target audience, the lesser depth the course should aim for. If a course is designed for a medical professional, it should have adequate depth to stimulate as well as enrich the professional. For example, a course dealing with pharmacology of endocrinological disorders may consider having information about not only various insulin formulations, but also the history and biotechnology behind the present insulin preparations available. However, a generalist course aiming for a wider audience would focus less upon details and specifics.

Designing a MOOC on a medical subject also requires attention to the assessment method planned. Assessments for theory-based MOOCs can be done through multiple choice questions, extended matching questions, true and false questions and numerical answers responses.
In fact, these assessment methods are frequently used in summative examinations like the USMLE. One potential issue, especially with the easy access to information through the internet, is the maintenance of fair means of conduct. MOOCs rely on individual learner’s self-proclaimed affirmation to honor code. Other methods of assessment like posting in discussion boards and submissions of essays have also been utilized. Essays encourage synthesis based upon conceptual understanding. For a hypothetical course in assisted reproductive techniques, a typical topic for essay might include future of stem cell research and cloning.

Another cause of concern pertains to the accreditation of these courses. There is a concern how the MOOC courses can be standardized and the course content validated. For classroom-based courses, the accreditation authority like Medical Council of India prescribe the required course content and lay down guidance of competence. Whether those who take up MOOCs would be considered at par with individuals taking regular classroom courses need to be pondered upon. Medical courses are usually bound to health care professionals or be opened to others. Potential sample scenarios for use of MOOCs in medical and allied fields are stated in Table 1.

| Table 1: Potential sample scenarios of adaptation of MOOC to medical education |
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| MOOC title: Psychopathology 101 (psychiatry) |
| Target audience: Medical students, psychologists, general public. |
| Format: Video lectures, notes and power point presentations; 5 weeks covering perceptual abnormalities, delusion and problems with thought, motor and speech abnormalities, cognitive function and others/summary. |
| Potential issues: Acceptability, adequacy of training. |
| Assessment: MCQs, “description” of a psychopathology element like hallucination, peer grading of the description. |
| MOOC title: Hearing and its problems (surgical) |
| Target audience: Medical students, paramedical, others. |
| Format: Lectures, demos, multimedia presentations; 6 weeks covering aspects from anatomy of hearing apparatus, noise and its consequences, testing of hearing, common ailments and themes of their treatment. |
| Assessment: MCQs, true–false questions, extended matching questions. |
| Potential issues: Accreditation, acceptability, comprehensive course likely to deter participation/lead to drop outs. |
| MOOC title: Medication side effects (medicine) |
| Target audience: Medical students, paramedical, nursing students, others. |
| Format: Lectures, demos, multimedia presentations, problems and case discussions, discussion board; 4 weeks dealing with basic pharmacology, common side effects, categories of side effects, differentiating side effect from unrelated adverse event, emergencies and referrals. |
| Assessment: Participation in discussion, MCQs, true–false questions, homework tasks of finding side effect profile. |
| Potential issues: Complexity may be a deterrent, difficulties in conveying concept of causality, future use and value, should the audience be limited to health care professionals or be opened to others. |

MCQ = Multiple choice questions, MOOC = Massive open online courses

To conclude, MOOCs have gained popularity in recent times and have attracted many from all over the globe. The reason of their popularity seems to stem from convenience and easy accessibility. These courses also give access to course content of some of the leading academicians globally without great investment on the part of the learner. Feedback to these courses has been largely positive among the students and teachers alike. While students appreciate the ease of access to these courses, teachers acknowledge the large international body of students catered to the MOOC courses. But concerns have been raised about the efficacy of teaching through MOOC in the absence of a teacher. Adapting MOOC for medical-related topics seems to be a logical approach.
next step for expanding medical education delivery. While some theoretical aspects of medical education can be easily adapted to MOOC format, other skill-based ones may be more difficult to implement. As of present, more efforts are required to create and successfully deliver MOOC courses related to the medical field.[8] At the same time, it is required to systematically assess who takes these courses, who completes them, what feedback is received and how these courses help career progression.

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