WHAT THREATS AND BENEFITS DO FREE ONLINE MATHEMATICS COURSES POSE TO TRADITIONAL UNIVERSITIES?

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Massive open online courses (MOOCs) are a recent phenomenon reaching millions of people globally. Drawing on my experience as a participant-observer in five mathematics MOOCs I consider what stands in the way of MOOCs making a significant impact on higher education in South Africa, how these courses can benefit universities and whether universities should be concerned that they will lose students.

BACKGROUND

The participation rate in South African higher education is defined as the total headcount enrolments in some form of post-secondary education divided by the total population, both for the 20-24 years age group (Council on Higher Education 2009). Although this rate has been increasing, it seems unlikely that the target of 20% (Department of Education 2001: 16) will be attained by 2015. Furthermore, there is a low graduation rate for those that enroll in higher education. In 2007, the dropout rate for first year students was 30%, with a further 20% dropping out in their 2nd or 3rd year (Breier & Mabizela 2007). Exclusion from studies for academic, financial, social or other reasons has devastating consequences for the thousands of students and their families who see a university qualification as a means to social advancement.

Massive open online courses (MOOCs) exploded into the higher education scene in 2012, with 2013 seeing the first MOOCs on topics common to first year mathematics courses in South Africa. This is also the first year that credits from selected MOOCs will be accepted at over 2000 universities and colleges if exams are written in supervised environments for a fee of $130 (R1 200) per course (College Credit Recommendation Guidebook 2013). To date, no South African universities have joined the list of (predominantly American) institutions prepared to accept MOOC credits. The value to South African students in taking mathematics MOOCs might be in preparing them for first year Calculus so that they are more likely to pass well the first time they take a first year mathematics course at their traditional higher education institution.

It is too early to say whether the interest in MOOCs is a passing fad (Wood 2013) or if MOOCs can make a significant impact in higher education, particularly in terms of increasing participation in the most needed fields and in terms of improving teaching and learning. Headlines regarding MOOCs are often dramatic, for example “MOOC

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mania" (Mangan 2012) and "Elite education for the masses" (Anderson 2012). Herman (2012) provides a good overview of the development of MOOCs, naming the main MOOC providers as Coursera, edX, Udacity and Stanford University, whose combined offerings are listed on http://www.class-central.com.

OBJECTIVES

The availability of MOOCs that are similar in content to standard first year mathematics courses offered by South African institutions raises some interesting questions. This paper will address three:

(1) What could prevent MOOCs making a significant impact on higher education in South Africa?
(2) How can these courses benefit universities?
(3) Should universities be concerned that they will lose students?

METHOD

I draw on first-hand experience as a participant-observer in the first five mathematics MOOCs offered that have relevance to first year undergraduate mathematics and a literature search to outline potential limitations and benefits that these courses have for South African universities. The courses, all offered through the company Coursera (coursera.org), were:

- Introduction to Mathematical Thinking by Keith Devlin (2012)
- Calculus: Single Variable by Robert Ghrist (2013)
- Calculus One by Jim Fowler (2013)
- Algebra by Sarah Eichhorn & Rachel Cohen Lehman (2013)
- Pre-calculus by Sarah Eichhorn & Rachel Cohen Lehman (2013)

Data sources were my journal entries, discussion forums in the courses and in the case of Keith Devlin's course, a blog and articles giving the lecturer's perspective on teaching a MOOC and other literature on MOOCs.

FINDINGS

The findings are given in relation to the three objective questions outlined above.

What could prevent MOOCs making a significant impact on higher education in South Africa?

Access to internet

Smartphones that can connect to the internet are a common sight amongst university-aged youth, even in less affluent communities. Home internet connections are available through a wider range of service providers than ever before. However, despite the seeming ubiquity of internet access, online course require many videos to be downloaded and this can be very slow and expensive. Submitting quizzes or taking time-constrained tests would be difficult with a poor internet connection.

Cheating

For students who use MOOCs for their personal interest or growth, there is little value in submitting the work of others as your own or using resources in a test that are not allowed, for example, no calculators, software, textbooks or notes may be used during tests the Calculus: Single Variables course. Before submitting tests, students must confirm that the work is their own and that they abide by the code of conduct. For credits to be acceptable at a higher education institution that accepts Coursera credits, a fee is payable and the exam must be written in a controlled environment, such as a university. This reduces the chances for cheating to about equivalent a traditional university course with online tests or exams. However, the fee is still very high in South African terms (approximately R1200) and alternative ways of verifying the identity of the test taker should be investigated.

Test questions that contain links to videos or online textbooks on the topic might seem like a form of cheating compared to traditional closed-book tests. When I had overcome my initial shock of such support in a test, I found that having relevant links promoted honest self-assessment. A test-taker is able to acknowledge areas of weakness and immediately improve on them.

'Big name' universities may not accept MOOC credits

The list of over 2000 universities and colleges that will accept MOOC credits when exams are written in a controlled environment notably excludes the most well-known ones. Why won't most top-level universities accept MOOC credits? Is this brand protection? Which South African higher education institutions would be willing to accept students with MOOC credits? When it is possible, it would be worthwhile to gather statistics of pass rates in 2nd year mathematics courses of students who entered with MOOC credits versus credits from the university. It is likely that results from MOOC students would depend on many factors, for example previous education background, motivation or whether the student is studying full or part time, which adds to the complexity of assessing MOOC credits.

Even if MOOC credits are not accepted at South African universities, students might be able to accelerate through similar courses, perhaps paying a lower fee and only writing exams. Large first year courses are 'cash cows' for universities because they enroll so many students and use very few full-time staff. Losing large first year classes may bring the financial viability of some mathematics departments into an uncomfortable focus and this may lead to a different model for assessing the workload of mathematics lecturers.

Lecturers might feel threatened by MOOCs

If students can get a better quality course for free by a world leader in a field, why should they attend a live class with an average lecturer? One reason is that people appear to enjoy experiencing an event in the company of other people. Another reason why local lecturers may be preferred to MOOC lecturers is their ability to contextualize. A local lecturer might be more able to give examples relevant to the

region or with fewer unfamiliar metaphors or cultural references. The accent or language of the MOOC lecturer may be difficult or annoying. A possible model that MOOCs might adopt is to have a single MOOC course delivered in one of a variety of styles, using a diverse range of lecturers. Students could choose the lecturer or style theme that they prefer, similar to the model in contact universities where there are multiple lecturers for large courses with the same assessments. This also allows for translated versions of the same MOOC which could make them accessible to a wider audience.

Epistemological access

It may be the case that some students find studying through a MOOC difficult compared to the traditional experience of learning in a physical group of peers who are learning the same content at the same time. MOOCs have been addressing this by strongly encouraging students to engage with course-mates and lecturers through online discussion forums embedded in the course website, or meeting in alternative spaces, online or even face-to-face. Many students are comfortable using writing-based means of communication such as Facebook and Twitter, and this may work in favour of MOOCs.

In the future, MOOCs might be able to incorporate other ways to ask questions of students, maybe including students' questions via webcam videos. Currently lectures are linked to multiple choice questions or other questions based on the recently lectured material for students to check if they are following and to keep them alert. In many courses the quality of teaching is not very high, with low-cost, talking head videos being the dominant format (Weiland 2012).

Syllabus differences

A first-semester Calculus course for students needing to study 2nd year mathematics is fairly standard but there may be some sections omitted in a MOOC. A solution might be for universities to offer a short MOOC-converting course for a smaller fee. Eventually MOOCs could be customized, for example the same MOOC course could be taken but according to the student’s interests, examples could be taken from a relevant field, for example, a Calculus MOOC could have options with examples from chemical engineering, civil engineering, business or life sciences.

How can these courses benefit universities?

A possible solution to the barrier of internet access would be to allow MOOC students to use universities' internet connections. Why would universities allow this? Firstly, fewer students would fail traditional courses because they have familiarity with some course content through MOOCs. Secondly, students would be able to try out fields before committing to study them and this may reduce the number of drop-outs caused by a poor match of a course to a student's interests and aptitudes.

A positive spin-off from considering the content and level of first year mathematics MOOCS is that it might make universities more closely align later courses with pre-

requisite courses. Embedding website links to the earlier material (which could include links to relevant MOOCs) can provide easy-access revision in later courses.

If the validation of MOOC credits has sufficient demand, there is an opportunity for universities to provide a service to MOOC students while making use of their facilities for testing large numbers of students. Universities could generate employment and revenue by being venues where proctored MOOC exams can be written.

Should universities be concerned that they will lose students?

Traditional, residential universities in South Africa offer a greater package than simply gaining knowledge through the courses studied. For those who can afford it, the experience of full-time study in the presence of interesting peers and inspiring lecturers and with a wide range of extra-curricular activities will continue to be rewarding and sought after. This view is shared by the co-founder of a major MOOC provider Udacity, David Stavens (Ripley 2012).

Some students will find that their learning needs can be met through online study that can be flexibly integrated into their lives. These students may not aspire to a traditional tertiary education experience and get around the need for formal qualifications by creating their own businesses. On the other hand, universities may gain other students who have made informed career choices by trying out free online courses before committing to full- or part-time study at a traditional university. MOOCs might prove to be more attractive to students whose choices are not between an online or a traditional course, but between an 'online class or no class at all' as a student in a sociology MOOC reported (Weiland 2012).

CONCLUSION

The education crisis in mathematics education in South Africa (Strydom, Mentz & Kuh 2010) is unlikely to be met by traditional means. Technology is beginning to make it possible for greater participation in higher education in ways that can more easily be accommodated in busy, multifaceted lives. At the same time, MOOCs threaten to disrupt traditional teaching by opening up to public scrutiny the ways of learning common to many university courses and this is likely to result in greater dissatisfaction with mediocre learning experiences at traditional institutions. When students have experienced learning in a MOOC environment, they might have heightened expectations for contact courses at South African universities. This may bring new demands to lecturers but also examples of teaching that might show us how to make our teaching even more effective. MOOCs are not going away and we should start to make use of the benefits they offer, even within traditional face-to-face classes.

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