How To Make MOOCS Really Effective:
Lessons from 20 Years of Research into Online Learning

Tony Bates
Tony Bates Associates Ltd, Research Associate with Contact North, Ontario's Distance Education & Training Network

Well, good morning, everybody. It's a great pleasure and privilege to be here. I'm being very impertinent coming to an organization that is fundamentally research based suggesting that we can make MOOCs more effective by looking at some of the research that's already been done in the past rather than in the future.

Quick overview of what I want to talk about. I will speak very briefly about the differences between open learning, online learning, and MOOCs. But I will talk a little bit about standards, quality standards, in online learning and the tension between best practice and innovation. I then want to look at three basics of online learning: the pedagogy, the learner support, and the costs. And I would like to take those three areas and suggest how MOOCs could be made better by focusing on some of the previous research that has been done in this area.

Sir John really gave a much better overview of the history than I can. But we've had 40 years, at least, of open universities. We've had 25 years of online learning. I taught my first online course at the Open University in 1989 before the World Wide Web. New Jersey Institute of Technology, in fact, was the first institution. The first faculty were Murray Turoff and Roxanne Hiltz in 1979, and they had a kind of blended version of online learning. The other important point is that there are over 50 journals which focus on research into online learning, so there is a mass of literature out there.

MOOCs are various designs, but most of them have been primarily driven by computer scientists, computer scientists who've led the charge in many ways. Created the platform as computer scientists, as you'd expect, but also have brought computer science views of teaching and learning, which is often not shared by many people on the education side. And I want to talk about that gap as well.

And often – and I'm excluding MIT and edX here – but looking at many of the other MOOCs, it's quite clear that pedagogical research has often been ignored in the design of those courses, and in particular, the emphasis on recorded lectures and particularly 50-minute lectures. And I'll talk a little bit more about that.

First of all, let me talk about quality standards. This is from my own website. I have a list of about 20 different quality standards for online learning in different countries, and they cover different sectors. They cover high school. They cover universities. They cover corporate training. So there's usually quality standards in each sector.

These are based on experience and research on what works and what doesn't in online learning. They're all quite similar. They're what I will call "input focused." They look at what you have to do for a good online course, what the steps you have to go through to get a good quality online course. They're focused on the processes of getting good courses, like having instructional designers working with faculty, for instance. But these are often unknown or ignored by many instructors who begin to teach online. So there is a big gap between the theory, if you like, and the practice here.

I want to say a little thing about standards. Standards are based on common processes. These are processes that are shared by everybody who's doing an online course. They are tried and true. But they must only operate in similar kinds of contexts. Now, the first innovative step is a unique process initially. It's risky, and it operates often in new contexts. And MOOCs, of course, are very much an innovation in that sense. They have, in a way, jumped over all the previous work on online learning and done something very different.

Now, as most engineers know, innovation and standards start to come together. So once you do the jump into innovation, you find some things work and some things don't, and you start looking back at where the standards were and try to bring those closer together. And I'm suggesting that at MOOCs now, we're at that stage where that big leap has been made, but now we should be pulling back a little bit and looking at some of the standards and what ones work and what ones don't work for MOOCs.

So here's the challenge for me for MOOCs. The good (more goods than bads, as you will see): easy to access, minimal cost to learners, extremely high quality content so far because they're coming from the elite Ivy League universities mainly, massive numbers. And to me, with sort of 40 years experience of working with technology in education, they remind me very much of great educational broadcasting. In fact, an advance on educational broadcasting because they provide feedback.

But they're like the History Channel. You don't watch all the programs. If you have an interest you watch something, you learn something. Nobody expects you to take an exam at the end of it, and you walk away with something very valuable, and that's good.

The bad is, as we see: the massive non-completion rates, usually under 10%, often under 5%, and difficulties with accreditation. And it can be argued that we shouldn't worry about that. If we see them as a form of educational, open broadcasting, then don't mess about with them. They work very well.

But I think the real challenge is that for many countries there is a shortage. There's a shortage of capacity for higher education. They're looking to see if MOOCs can be of help to them getting qualifications and credit, and I think we could be working more on MOOCs to enable them to give those kinds of qualifications and credit.

Let's look at the course completion rates for credit-based online courses. I take one example here, a Canadian example of Ontario. The Ontario Ministry of Higher Education surveyed all the universities in the province and asked about their completion rates for credit online courses: 500,000 student enrollments in credit online courses in Ontario, 24 universities.

Their completion rates were about 85% to 95%. That was the range for all the universities. They were about 5% below the completion rates for face-to-face classes on average. So they're pretty good. And you would expect, also, to have a slightly lower completion rate because students were often taking the online courses because they couldn't get to campus because they were working part-time, et cetera, et cetera.

If we look at the Open University in Britain when it started with completely open access. Nearly all the students who started in the early days of the Open University would not have qualified for university entrance in the UK. At that time, only 8% of students went on to universities in the UK.

Over a seven-year period, 42% of the students who enrolled in the first years graduated, and that's not very different from the standard graduation rate now of many American universities over seven years. So you can get high numbers of students to qualify for full degrees using online and open learning.

So how could we actually improve the completion rates of MOOCs? I'm going to look at three areas. The first one is pedagogy, and I want to talk about the difference between the transmission of information versus knowledge construction. We know there are problems with lectures. There's a large amount of research on this to show that students don't learn a great deal from lectures. Mostly, learning takes place outside the lecture when they do their homework, and we saw the effect of homework on the students' performance.

The other issue is 21st century skills. We're not just trying to teach students to know stuff, we're trying to get them to do something with that knowledge. Can they apply that knowledge and use that knowledge to solve problems, critical thinking, manage knowledge – increasingly important because their knowledge becomes out of date very quickly, so can they go on managing their access to knowledge – and independent learning? These are really important skills we want to teach our students, and lectures are very bad at developing those kinds of skills.

Sanjay talked about the magic of the campus. The magic of the campus – it's because it focuses on those kinds of skills, and if we miss those out in our online learning then we're shortchanging our students.

The other concept that's really important is that knowledge is not a thing that you dump into somebody's head but is constructed. Let me give you an example of heat. When we're young babies or young children, we understand what hot is when we put a hand on a stove and we burn ourselves. That's a concept of heat. So we get a bit older, we realize you can put numbers on it. Minus 2 degrees is cold, and plus 20 degrees Centigrade is hot as weather goes, unless you're in Regina in Canada when minus 2 degrees is quite warm!

As we get through high school, we realize that heat isn't a thing, it's actually a process. It's a transfer of heat. And obviously, when you get to MIT, you will learn a lot more about heat than you would in a high school. So your knowledge of something is progressively being constructed and changing. and what we want is an education system that allows students to construct their knowledge.

There's been a lot of research on the difference between deep and surface processing done in Sweden by Säljö and Marton back in the 1970s, and since then. Basically, some students just try to get through the exams and learn what they need to do to get through the exams, but they don't fully integrate what they've learned. And often they forget it immediately, they leave that course and go on to another course.

One of the big problems in engineering is that students forget their first and second year maths when they come to need it in the third and fourth year, for instance. That's what would be called “surface processing.” If they had deep understanding, that would carry over and be applicable.

Scaffolding is helping students move from the known to the unknown. I'm grossly oversimplifying the Russian psychologist, Vygotsky, that says you can't learn in too big steps. You have to have small steps that allow you to gradually progress. The other thing is that if you're trying to develop skills, then they need practice and they need feedback. We've heard about important feedback, but we also need to provide practice for those skills.

That puts the faculty member in a slightly different role of not transmitting information, providing access to the information, guiding the students on what information they need; but guiding and facilitating them in their knowledge construction. So on a massive scale, knowledge transmission is easy. As we've seen, we can do satellite broadcasting. We can do MOOCs. But the construction and development of knowledge, on a massive scale, is much more difficult. And the reason for that, is the need for learner support, in order to do this.

So this is the second basic of online learning. There is a tremendous amount of research that shows that learners who study online need a lot of support. And they need structured activities – read, collect, research, discuss, evaluate, and do. These activities require evaluation and feedback, and in particular, the instructor's online presence is critical. That means communicating, communicating, communicating with students, which is very difficult to do for one instructor when you've got 100,000 students. So I'm going to come back to that issue as a challenge for MOOCs in a moment.

But in particular, knowledge construction requires mainly qualitative assessment and feedback at a high level of subject expertise. Because if students are constructing knowledge and coming up with their own perceived understanding of the knowledge, they need some kind of discussion with an expert as to whether they're correct or incorrect, or original rather than just repeating what the instructor is saying.

And the third area of research in online learning that I think is really important for MOOCs – and this is particularly important for those of you from institutions here who want to create your own MOOCs who don't have $60 million behind them as Harvard and MIT do – what are the costs of MOOCs? Now, what I've got here is the costs from a fully online masters program offered by the University of British Columbia in Canada.

This is the cost over seven years of a learning management system-based course, not video lectures, and you see how they break out. And the main cost, of course, is course delivery because that's the learner support costs. That's a third of the costs. So the development of the course, actually, is quite small. It's less than 15% of the cost, the actual development of the course. The support of the course that gets students through the exams is two to three times the cost of development. What MOOCs have done is removing, almost completely, that course delivery cost. Now, some have teaching assistants and so on, and so there is a cost there. But their costs are very different, and that could be good, or it could be bad. But you have to understand that for credit programs, the cost factor is very different.

So MOOCs have very high development costs. I don't know what the cost is for edX, but looking at some of the Coursera programs, they're looking at $100,000, which is two to three times the cost of a credit online course of the same length. And I'm not quite sure the reasons for that. It might be because they're using much more highly-paid professors than the other universities, therefore they have to compensate adequately. But they're pretty high, and I think one of the reasons is because of the technology used, which is lecture capture which requires editing. And there's hardware costs involved as well, and there's also the platform costs. Moderate maintenance costs of $30,000, but again, it's still pretty high for me working with credit programs. Low delivery costs, but poor completion rates. So the research question for me is how to improve the completion rates and the quality on a massive scale.

So here are three suggestions offered not in humility, but maybe it should be. First of all, more constructivist approaches. Now this is hard. This is not quite a subject-based thing. Carl Wieman, for instance, who's now teaching at UBC, and he's a former student here, I think, is looking at constructivist approaches to teaching science. So I'm hesitant to say that constructivist approaches work best in humanities and don't work so well in the sciences.

If we're trying to get away from information transmission and into the magic that Sanjay talked about, then we have to look at more constructivist approaches in engineering and teaching as well. Incidentally, on my blog, the blog post that has the most comments, and that's been going on for five years is: "can you teach real engineering at a distance?" And students and professors are still discussing that on my blog after five years. So there's a real challenge here. Can you teach real engineering at a distance?

So in the constructivist approach, students find, evaluate, apply information, and develop high level skills. So faculty are more as teaching consultants, where they define the curriculum and the learning outcomes, oversee the learner support and assessment; but may not necessarily do the assessment themselves. They may set the rubrics, but have the assessment done, perhaps, through computers and so on, and obviously use the peer-to-peer learning and better computer assessments.

When I say better ones, ones that reflect more qualitative thinking such as critical thinking skills. How do you test for originality in a student's response? A student response may be correct, but not marked correctly because it's not within the parameters of the computer marking. Can we design computer-marked assignments so they can look at original responses that could be right, or could they flag them so that a human could look at it and say, yes, that is a good answer?

Another way is improving learner support. Could we increase the faculty online presence? I think the Khan Academy is a good, possible model. What students want to feel is that when they're online, the teacher is there. Now if it's 100,000 or 20 students, they still want to feel that teacher is there. You don't have to be there all the time. You don't have to respond to every student's comment, but if you ever have a discussion forum, and you see a common pattern of student responses and you respond quickly enough, then students really appreciate that.

And one of the things that I like about the Khan Academy approach – the research came on audio cassettes combined with print, originally, at the university back in 1970. It was found that when a professor talked students through the formula on the paper, the students said, it was like having my own personal tutor looking at me over the shoulder as I'm studying. That's what I mean by a learner presence. Now, can we create that learner presence for 100,000 students with the original faculty member, the top Harvard and MIT professor, giving that feeling over the student's shoulder by doing something

like the Khan Academy? Like taking out little segments that they know students find difficult and talking them through it as if they're talking to them personally.

So I'm suggesting that, maybe, you could have judicious massive online interventions in discussions and assessments. Don't just leave it to the TAs to do this. Have a look at some of the discussions. You don't have to look at all of them, you can't with 100,000, but take a small sample and see where the students are going with the discussions and then jump in. Could we design the online discussion so that if you typed in one comment, it would go across all the online discussions, for instance?

Greater use of well-trained adjuncts, maybe not TAs because of the need for subject expertise at a fairly high level, but supervised by faculty. Think of teaching like a medical consultant. You have a team of people working for you. You're providing the overview, but you're making sure the people underneath you understand what kind of quality assessment we want.

Could we design a computer model of scaffolding of the kinds of things that enable students to construct knowledge? Now, we can actually sit down and write down most of the things that encourage scaffolding. I mean, for instance, we know that the steps in learning mustn't be too great. Could we measure, when we put our lectures up, whether we're moving too fast for the majority of students or too slowly, for instance? Is there a way to measure that?

The third is to redistribute or rethink the costs of MOOCs. Maybe spend less on development and production. Maybe move away from the video lecture because that's more expensive to tech space. Incidentally, that would work a lot better for students in developing countries and mobile phones as well, because many of them just can't download videos in developing countries. So could we spend more on learner support and less on development?

Should they be free or low cost? Now, I like this one. I was driving around Boston on Sunday. Now, Sunday, parking is free on Sundays, but it's not open. You can drive round and round and round looking for a parking spot. It's free, but it's not open, right? So Stanford found that when they charged a small fee, $50, I think it was, for taking the exam, their completion rates went up. So could you generate some revenues at a low cost that would enable students to get better learner support? If you're thinking of 100,000 students paying, say, $20, maybe for an exam which may be automated, but use that money for learner support, you might get a lot of learner support for that.

Can you outsource learner support with quality controls? And that's beginning to happen in some institutions partnering with edX, like San Jose State, to provide that learner support. So what I'm suggesting is that we identify the quality issues and the high-cost areas and seek quality computer solutions for those high-cost areas of online teaching.

So why not rethink a MOOC to develop skills as well as content: increase learner engagement and activity; increase interaction with and between students; get students to find, analyze, and apply information; and get students to demonstrate learning through multimedia and assess. Have I got one minute?