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Mutual Learning and Exchange of Health Informatics Experiences from Around the World - Evaluation of a Massive Open Online Course in eHealth

Sabine Koch, Maria Hägglund

Health Informatics Centre, LIME, Karolinska Institutet, Stockholm, Sweden

Abstract

We report our experiences from the Massive Open Online Course (MOOC), "eHealth – Opportunities and Challenges". run by Karolinska Institutet using the edx platform both as session-based and self-paced versions between 2015 and 2016. In total, 13,302 students from 162 different countries were enrolled in our courses during the two-year period whereof 573 completed them. 331 students answered an exit survey after finishing the course which was analysed using quantitative and qualitative methods. As positive outcomes of the course, students highlighted set-up and content of the course, the pedagogical approach and the consistent international focus. Students lacked more practical case studies, more interactive discussions and proposed advanced follow-up courses on certain topics. Faculty lacked better functions for management of the discussion forum. Major advantages of the MOOC were mutual learning and exchange of health informatics experiences from around the world that would have been difficult to achieve in traditional learning contexts.

Keywords:

Education, Distance; Medical Informatics; Surveys and Questionnaires

Introduction

Although online education, virtual learning environments and distance learning platforms have been around for many years, it was not until 2008 that Dave Cormier coined the term Massive Open Online Course (MOOC) based on a large online course run by Siemens and Downes [1]. Massive Open Online Courses (MOOCs) offer new possibilities to reach large numbers of students with very different disciplinary and cultural backgrounds. Health informatics as a subject is interdisciplinary by nature. The challenges and opportunities of the field are global. Thus MOOCs may provide a good platform to address the global aspects of health informatics in an international environment.

Motivation to provide a MOOC

Since 2010 we run a global master's programme in health informatics at Karolinska Institutet as a joint collaboration with Stockholm University [2]. When Karolinska Institutet joined the edx consortium for MOOC-based education [3], we decided to design a basic course for a diverse target group with the aim to reuse parts of the course as a "flipped classroom" model for our own master's programme, but also to market health informatics at Karolinska Institutet, to raise awareness for our education and to attract highly motivated and competent students for our campus education [4]. We ran different instances of the course, both as session-based and self-paced versions. Without any prior experience in providing MOOCs we offered a course that is broad in content and has an inhomogeneous target group. Thus we were interested in evaluating how students and teachers perceived the course and in how far our initial pedagogical considerations were valid.

Methods

Set-up and content of the course

"eHealth – Opportunities and Challenges" is a six-week introductory course in eHealth and health informatics targeting a broad student group without prior specific knowledge in the field [5]. Some experience with the health sector either as patient, care professional, IT and healthcare manager or policy maker is, however, recommended for following the course. The overall learning objectives of the course are to enable students 1) to describe different eHealth applications as well as enablers and barriers for their implementation; 2) to explain the importance of context, health informatics standards and terminologies for the design of eHealth applications and 3) to analyze eHealth strategies and discuss them in relation to the student's specific context.

The course is divided into six weeks, each covering a distinct topic (table 1). The content is released at the beginning of each week. Each week starts with an introductory video lecture about the topic of the week followed by a series of short videos (5-10 minutes) about sub-topics and by accompanying literature. Smaller learning tasks and quizzes are provided in each of the weeks. Every second week students have to complete a course assignment that covers the content of the preceding two weeks. The estimated workload is 4-6 hours per week. The course was given in three different versions:

- As session-based course, provided free of charge without the possibility to opt for paid-for-certificates (April-June 2015).
- 2. As self-paced course (same content as 1 and free of charge) (Dec 2015 May 2016)
- 3. As session-based course with some revised/added content, provided free of charge with the possibility to opt for paid-for-certificates (Oct Dec 2016)

Week	Topic	Content	Special videos
Week 1	Introduction	 eHealth definitions and concepts Types of eHealth applications History of medical informatics Opportunities and challenges of eHealth 	 Interview with an eHealth pioneer Interviews with care professionals, IT developers, patients and informal carers
Week 2	eHealth for care professionals	 Health systems and healthcare or- ganization eHealth for care professionals 	- Interviews with different healthcare professionals in their respective work settings
Week 3	eHealth for pa- tients and citizens	 ePatients and quantified-self Ethical questions regarding owner- ship, access and use of data 	- Videos about concrete application example
Week 4	eHealth design	 Techniques for eHealth design Importance of context and user in- volvement 	
Week 5	Technical prereq- uisites	 System architecture Technical infrastructure Standards and terminologies Mobile eHealth 	- Use of a clinical scenario
Week 6	eHealth strategies	 Frameworks for set-up, analysis and implementation of eHealth strategies 	- Interviews with stakeholders from different countries

Table 1 - Set-up and content of the course

Pedagogical considerations

As described above, we saw the possibilities of MOOCs to provide a good platform to learn the global aspects of health informatics in an international environment. Targeting a varied student group the MOOC was sought to enhance interprofessional education (IPE) where students learn from, with and about each other, a practice that is lacking in many training programs [6]. Despite the advantages of IPE, the following challenges need to be considered: a) learning materials need to be presented in a congruent way; b) learning materials need to be adapted to the different levels of knowledge and experience of the students; and c) teachers need to enable each student to find her own learning track.

To tackle these challenges, we specifically considered two methods. First, we worked with video clips in the form of interviews with clinicians, industry representatives, policy makers, patients and informal carers from different parts of the world to bring practical experiences to the MOOC; and second, we worked with hand-drawn illustrations of patient scenarios to describe informatics challenges and technical prerequisites. Interactions with the students during the course were limited to one teaching assistant and the teacher responsible for a certain week answering questions in the discussion forum.

Evaluation methods

We distributed a link to an exit survey at the end of the course. The survey consisted mainly of structured questions and some open-ended questions. The structured questions were all based on a five point Likert scale and directed towards the following areas: Goal achievement; Value of different tools (videos, quizzes, assignments, and discussion forum) to achieve the learning outcomes; Common theme throughout the course; Skills development; Course satisfaction. Structured questions were answered with (To a very small extent (=1)...To a very large extent (=5)). Open-ended questions were related to

personal goals, course highlights and improvement suggestions. Open-ended questions and entries in the discussion forum related to opinions about the course were analyzed by inductive thematic content analysis. The questions resemble standard questions used for all course evaluations at our university and are used for continuous quality improvement and comparability between courses.

Results

Course participants

In total, 13302 students had enrolled in the courses and 573 (4.31%) students completed one of the course instances. Most students were between 26 to 40 years old with a median student age of 32 years. 40.7% were female, 59.3% male. Most of them were highly educated with 49.8% having an advanced degree. Students came from 162 different countries whereof the most represented countries were the United States 15.9%, India 9.7% and UK 4%. Course participants had varying backgrounds. 44.6% had a healthcare background, 24.1% had a background in computer science, 7.9% were health informaticians, 1.9% policy or decision makers, 1.6% patients or representatives for a patient association and 1.2% informal care givers. Students' personal learning goals varied. Most of them had a personal and professional interest in the topic and wanted to broaden their knowledge about eHealth. Figure 1 gives an overview over the participants in the respective courses.

	Session-based Course 2015	Self-paced Course 2016	Session-based Course 2016
Duration	6 weeks	4 months	6 weeks
# Participants	5 329 40% female, 60% male Median age: 32 51% have an advanced degree	5 239 42% female, 58% male Median age: 31 47% have an advanced degree	2 734 40% female, 60% male Median age: 33 51.4% have an advanced degree
Background	46.5% Healthcare 25.7% Computer Science 7.9% Health Informatics 2.5% Policy/Decision makers 1.9% Patients or representa- tives for a patient association 1.4% Informal care givers	46.0% Healthcare 24.6% Computer Science 8.8% Health Informatics 1.2% Policy/Decision makers 1.0% Patients or representatives for a patient association 1.6% Informal care givers	41.2% Healthcare 22.0% Computer Science 6.9% Health Informatics 10.0% Entrepreneurs 2.1% Policy/Decision makers 1.9% Patients or representatives for a patient association 0.6% Informal care givers
Countries	160 countries (U.S. 18.3%, India 11.1%, Sweden 5.1%)	162 countries (U.S. 15%, India 11%, UK 4%)	134 countries (U.S. 14.3%, India 7.1%, UK 4%)
Completed course with honor cortificate	342 (6.42%)	145 (2.77%)	86 (3.15%) completed ; 36 (of 70 paid certificate)

Figure 1 – Background of course participants

Quantitative results from the exit survey

331 students filled in the exit survey. 71.6% (n=237) perceived that they achieved all learning outcomes of the course to a large or very large extent. 56.1% (n=186) reported that they achieved their personal goals for taking the course to a large or very large extent.

74.9% (n=248) found to a large or very large extent that there was a common theme running throughout the course. 49.5% (n=164) said that they developed valuable expertise and skills to a large or very large extent.

Regarding the different learning activities during the course students enjoyed the videos most. 83.7% (n=277) found them valuable or very valuable, followed by the quizzes (78.2%; n=259) and the course assignments (73.1%; n=242). The discussion forum was considered valuable or very valuable by only 37.2% (n=123) of the students. 69.8% (n=231) were satisfied or very satisfied with the support offered by the staff and teaching assistants.

87.3% (n=289) agreed or strongly agreed to recommend the course to other students.

Table 2 gives a comparative overview over the quantitative results between the three course instances.

Table 2 - Quantitative data analysis results (weighted average of Likert scale (1-5 where 5 is best)

Question	First MOOC (n=184)	Self-paced MOOC (n=64)	Revised MOOC (n=78)
In my view, I have achieved all the learning outcomes of the course	3.9	3.8	3.9
In my view, I have reached my per- sonal goal for tak- ing the course	3.9	3.6	3.5
In my view, there was a common theme running throughout the course	4.0	4.0	4.0

In my view, I developed valuable expertise and skills	3.6	3.3	3.7
How valuable were the videos to help you reach the learning outcomes?	4.4	4.3	4.3
How valuable were the quizzes to help you reach the learning outcomes?	4.1	4.0	4.2
How valuable were the course assignments to help you reach the learning outcomes?	4.1	3.8	4.0
How valuable was the discussion forum to help you reach the learning outcomes?	3.2	3.1	3.0
How satisfied were you with the support offered by the staff and teaching assistants?	3.9	4.4	3.8
I would recommend this course to others	4.4	4.1	4.3

Qualitative results

What did students enjoy most?

Analysis of the open-ended questions of the exit survey, discussion forum entries and open course evaluations on the Internet resulted in the following benefit categories: Comprehensiveness, International Focus and Pedagogical Approach (table 2). Students highlighted set-up and content of the course that was considered to give a holistic, worldwide overview over the eHealth landscape. The global, multidisciplinary perspective of the course and the consistent worldwide aspects in the material were acknowledged by many students. The course was considered very educational and easy to understand. Especially the inclusion of practical knowledge provided through numerous interviews with different stakeholders was highly appreciated.

What can be done better?

Improvement suggestions were related to Content and Interaction and Feedback (table 2). Students lacked more practical examples in form of case studies, requested further deepening of technical issues as well as eHealth implementation and proposed more advanced follow-up courses on these topics. One student also proposed to provide a complete online master program in MOOC format. Students further asked for more interaction in the discussion forums and feedback on their assignments. They proposed less multiple choice quizzes and addition of online conversation.

Theme	Category	Category description	Example quotes
Benefits	Comprehensiveness	In this category remarks and comments regarding the inclu- siveness and understandability of the content as well as the structure of the course were included.	"It [the course] is covering the HIT landscape of whole of the world. I am a volunteer with the state government of [an Asian country] on e-health projects and I have recom- mended this MOOC to the team for its sheer brilliance and comprehensiveness. Especially the resources and the time- line in which they have been structured. This MOOC is the perfect example of congruence." "I have been very energized by going through the eHealth online course. From doing piecemeal work on individual eHealth modules starting 10 years ago, we have switched to preparing for the next generation electronic health rec- ord system and have gathered a multi-disciplinary team of medical informaticians spending up to 50% of our time in this field. I have encouraged my team members to enroll in this ehealth course and learn together. "It [the course] glued and streamlined different concepts in the perfect big picture." "I have now the language and knowledge to discuss quality assurance issues at work with senior managers."
	International Focus	In this category remarks and comments concerning the focus on international and global con- texts were included.	"I liked the approach of teaching eHealth from different, global perspectives." "The course showed the power of MOOC not only to reach a lot of students but also get their contributions."
	Pedagogical ap- proach	This category includes remarks and comments regarding the use of interviews, scenario descrip- tions or other ways of present- ing the content.	"The course was very insightful and above all innovative in its presentation by incorporating experiences and chal- lenges from real professionals into the course lectures. This gave a very good contextual richness to the materials taught." "Care professionals' experiences add great insight into learning this course. It brings the lectures to life and places topics discussed into proper context and perspectives. Thanks for the innovation in the course presentation." "Sufficient care was taken to present lectures in a way that even students like myself from a different cultural back- ground could grasp concepts easily."
Areas for improvement	Content	This category includes remarks and comments regarding addi- tional content.	"It would be great to have practical case studies from dif- ferent countries, more examples of IT systems used includ- ing screen-dumps." "Add more references about implementation support and integration guidance in the second version of the course." "I noted that in Healthcare Informatics Standards FHIR was only named. I strongly recommend one whole week for FHIR standards." "Please develop an advanced level to this course offering." "I propose an advanced course where computer skills are a pre-requisite."
	Interaction and Feedback	In this category comments and remarks about the interaction between students, students and teachers and feedback from teachers or teaching assistants.	"The discussion forum was crowded. Course leaders could identify entries each week and feedback on them." "Provide a mobile App for course interaction." "The addition of a peer graded assignment would be an interesting consideration for future courses."

Table 3 - Qualitative data analysis results

Discussion

We exploited the advantages of a diverse, international student group by highlighting similarities and differences between countries. Many students were inspired by this approach. As an example, one of the most discussed points in the discussion forum in our first course dealt with the question whether electricity is a prerequisite for eHealth or not. Many participants had not even thought about this being a major limitation in low income countries. As also highlighted in the exit survey, interactivity between students and between students and teachers was considered to be an area for improvement. Interestingly, there were no major differences in students' perceptions between the session-based courses vs. the self-paced one (table 2), except in regard to satisfaction with staff support. Staff support was evaluated better in the self-paced course which might relate to the fact that it was

clearly stated in the instructions that support was not offered. So students were happy when getting some support anyway. Chen et al consider student-faculty interaction and peer-topeer collaboration essential parts in student engagement which is positively related to the quality of the learning experience [7]. Experiences from this course are that the current edx platform does not sufficiently support such student engaging activities, which is in line with criticism towards xMOOCs [8]. Although the discussion for awere meant to facilitate student-faculty interaction, their cumbersome design hindered this. If the learning platform in use does not meet these requirements, we suggest complementing with tools that support more student-faculty interaction as well as peer-topeer collaboration. An alternative approach would be to use more interactive online tools, e.g. a combination of live broadcasting via periscope with live chat possibilities in twitter. Online learning is not only a question of having access to content; rather, it should also provide opportunity for social learning through interaction and connectedness [9]. If the learning platform in use does not meet these requirements, we suggest complementing with tools that support more studentfaculty interaction as well as peer-to-peer collaboration. Also the integration of tools for adaptive eLearning would be valuable to adapt the learning to individual students' profiles and behaviors [10].

Today, videos are reused for classroom teaching. Its' potential impact on student recruitment for our Master's program is too early to state as we only could monitor one round of admissions so far.

Possible future directions could be to reuse the course material as Small Private Online Course (SPOC) for continuing education and to develop more in-depth courses for certain topics [11]. A major drawback is however the lack of incentives in our current reimbursement system for MOOCs.

Conclusions

Experiences from our MOOC with participants from 162 countries highlighted both challenges and benefits. A difficulty encountered by both students and staff during the course was the poorly designed discussion forum which affected the interaction in the course negatively. A major advantage of the MOOC was the mutual learning and exchange of health informatics experiences from around the world – a learning that would have been difficult to achieve in traditional learning contexts.

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References

- Cormier D, Siemens G. Through the open door: open courses as research, learning, and engagement. EDUCAUSE Review. 2010; 45(4): 30-9
- [2] Joint Master's Programme in Health Informatics, Karolinska Institutet, Stockholm, Sweden. Available at http://ki.se/en/utbildning/5hi12masters-programme-in-health-informatics (last accessed April 11, 2017).
- [3] edx Consortium. Available at https://www.edx.org/ (last accessed April 11, 2017).

- [4] Alvarez B. Flipping the classroom: Homework in class, lessons at home. Education Digest: Essential Readings Condensed For Quick Review. 2011; 77(8): 18-21.
- [5] eHealth Opportunities and Challenges. MOOC delivered by Karolinska Institutet. Available at https://www.edx.org/course/ehealthopportunities-challenges-kix-kiehealthx#! (last accessed April 11, 2017).
- [6] Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, Zurayk H. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet. 2010; 376(9756): 1923-58
- [7] Chen PSD, Gonyea R, Kuh G. Learning at a Distance: Engaged or Not?. Innovate: Journal of Online Education 2008; 4(3)
- [8] Vardi MY. Will MOOCs destroy academia? Commun. ACM 2012 Nov 01;55(11):5.
- [9] Brindley JE, Walti C, Blaschke LM. Creating Effective Collaborative Learning Groups in an Online Environment. The International Review of Research in Open and Distributed Learning. 2009; 10(3)
- [10] Shute V, Towle B. Adaptive e-learning. Educational Psychologist. 2003; 38(2): 105-114.
- [11] Fox A. From MOOCs to SPOCs. Communications of the ACM. 2013; 56(12): 38-40.

Address for correspondence

Sabine Koch, PhD, FACMI Professor and Director Health Informatics Centre Department of Learning, Informatics, Management and Ethics Karolinska Institutet 171 77 Stockholm SWEDEN e-mail: sabine.koch@ki.se