

Teaching and Learning with MOOCs: Computing Academics' Perspectives and Engagement

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ABSTRACT

During the past two years, Massive Open Online Courses (MOOCs) have created wide interest in the academic world raising both enthusiasm for new opportunities for universities and many concerns for the future of university education. The discussion has mainly appeared in non-scientific forums, such as magazine articles, columns and blogs, making it difficult to judge wider opinions within academia. To collect more rigorous data we surveyed teachers, researchers, and academic managers on their opinions and experiences of MOOCs. In this paper, we present our analysis of responses from the computer science academic community (n=137). Their feelings about MOOCs are highly mixed. Content analysis of open-ended questions revealed that the most often mentioned positive aspects included affordances of MOOCs, freedom of time and location for studying, and the possibility to experience teaching from top-level international teachers/experts. The most common negative aspects included concerns about pedagogical designs of MOOCs, assessment practices, and lack of interaction with the teacher. About half the respondents claimed they had not changed their teaching as a result of MOOCs, a small number used MOOCs as learning resources and very few were engaging with MOOCs in any significant way.

Categories and Subject Descriptors

K.3.1: Computer Uses in Education – *computer-managed instruction, distance learning*

K.3.2 [Computers and Education]: Computer and Information Science Education – *computer science education*

General Terms

Human factors

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Keywords

MOOCs Massive Open Online Courses; e-learning; distance learning; open learning; computing academics; pedagogy

1. INTRODUCTION

The term Massive Open Online Course (MOOC) was coined in 2008 to describe an open online course offered by the University of Manitoba. In 2011, this phenomenon exploded into wider awareness among academics, when top US universities started to give MOOCs and new educational providers joined the field. Since then, discussions on MOOCs have proliferated in blogs, newspaper columns, and magazines [1, 5, 7, 14]. Most discussions are centered on instructional methods, the quality of instruction, and the potential disruption to traditional university education.

Academic research relating to MOOCs has only recently started to appear in journals and conference proceedings. However, most research has focused on the learner perspective and institutional threats and opportunities, leading to a lack of published research on academics' experiences and practices [8]. Teachers are the central stakeholders in this issue. We therefore carried out a survey to learn about academics' awareness, attitudes, and perceptions of MOOCs, as well as their concrete initiatives in relation to MOOCs. Our research focuses on *What are academics' perspectives on current trends relating to MOOCs?* We collected data using a web questionnaire distributed internationally to the computer science/IT education and broader academic community. In this paper, we especially investigate *the computer science/IT academic community views of the pros and cons of MOOCs from the aspect of teaching and learning (RQ1)*. We also investigate *how teachers incorporate MOOCs into their own teaching and their own development of MOOCs (RQ2)*.

In the next section we discuss related research. In Sections 3 and 4 we present our research design and findings, and we discuss and conclude the findings in Sections 5 and 6.

2. RELATED RESEARCH

MOOCs are online courses which are offered free of charge, require no entry requirements, and give no formal accreditation [10]. They typically integrate social networking and are characterized by the provision of online resources. MOOCs are often facilitated by an acknowledged expert in the field. A number

of elite universities have led the development of MOOCs: edX, a non-profit organization from Harvard and MIT delivers MOOCs in humanities, computer science, health research, and chemistry; Coursera, an education company that partners with universities, provides some of their existing courses in sciences, humanities, business, and math; and Udacity, a private educational organization focuses on computer science. More recently other universities worldwide have developed MOOCs and number of other platforms now support MOOCs: Futurelearn (UK), OpenHPI (Germany), OpenupEd (pan-European), and Open2Study (Australia).

A recent worldwide survey of educators [15] shows that in 2013 only 13% of higher education institutions offered a MOOC; but 43% plan to offer MOOCs by 2016. The survey found that 84% of the educators surveyed believe that MOOCs complement the education offered by higher education institutions and are most appropriate for continuing education courses. The survey also found that 41% of the educators view the lack of a consistent review and grading system as the biggest drawback of MOOCs.

A number of MOOCs are offered in computer science subjects. Ben Ari [2] proposes that MOOCs offer new opportunities for both students and instructors, and are likely to have an impact on university level computer science courses because of their convenience, potential to lower the costs of running a course, and accessibility to large cohorts of students. Teachers are able to supplement on-campus courses with recorded lectures from MOOCs, facilitating implementation of the “flipped classroom” model where class time is used for discussion of problems with students [9] and to focus more on software development and less on learning syntax [13]. MOOCs also provide the facility to present information to students using different approaches such as instructor-directed, collaborative, or blended learning [3].

For an individual teacher running a MOOC, there are many challenges. The course material may need to be constantly updated and this entails considerable time and effort [17]. Johnson [6], reporting on an experience running a MOOC, claimed that preparing video lectures and composing problems for homework took significant time.

In 2013, a survey [4] of 112,000 undergraduate students about their technology experiences and expectations revealed that students prefer blended learning environments while beginning to experiment with MOOCs. The need to support and challenge students and give them the benefits of interaction with peers remains an unresolved issue [6]. Vardi [16] argues that MOOCs suffer from a lack of clear pedagogical foundations and an inability to cater to the needs of individual students.

Assessments in MOOCs are problematic, as automatic assessment has limited scope, and peer assessment can be too superficial to be truly effective [2, 3]. Another area of concern is the detection of plagiarism and the validation/certification for original work [3]. However, the biggest challenge for MOOC organizers appears to be low completion rates as students drop out in large numbers. A recent study [12] of a million users through 16 Coursera courses shows that course completion rates average only 4% across all courses, with higher completion rates for courses designed with less homework assignments and workload for students.

3. RESEARCH DESIGN

To learn about computing academics’ awareness, attitudes and perceptions concerning MOOCs we constructed an online questionnaire, which consisted of both closed, mostly multiple

choice or Likert-style questions, as well as several open-ended questions. We constructed the questionnaire¹ as a joint effort of our research team, adopting ideas for questions from the literature and ongoing discussions on several forums. The questionnaire consisted of two parts. The first part (9 questions) was aimed at all academics regardless of prior knowledge or firsthand experience of MOOCs. The second part (11 questions) was aimed at those respondents who had more experiences with and knowledge of MOOCs.

The questionnaire was piloted with a group of 20 academics from different engineering education fields and minor modifications were made based on feedback. Invitations to complete the final questionnaire were posted to several mailing lists (e.g. SIGCSE, PPIG, CSEd) as well as our own personal contact lists in May – June 2013. We also asked our respondents to forward the invitation to their colleagues.

We acknowledge that our data represents only a small number of all computing academics’ perceptions at a certain point of time. However, since we were able to receive responses from five continents, 19 countries, and more than 90 universities, we are fairly confident that the results highlight many of the MOOC related topics that are discussed by the international community of computing academics. The questionnaire provided us with rich data. Many respondents had taken the time and effort to elaborate on pros and cons of MOOCs and to provide arguments in open-ended questions. Many of the responses to the open-ended questions were several sentences (or even several paragraphs) long. To enhance the credibility and trustworthiness of the data analysis we provide a description of the analysis procedure in the following paragraphs and in reporting the findings we provide some example quotes from the data to explain and support our conclusions.

3.1 Data analysis

To answer our research questions we analyzed responses from three open-ended questions: “What positive aspects do you see in MOOCs?”, “What negative aspects do you see in MOOCs?”, and “If you have changed your teaching, please elaborate here on what you have done and your reasons for any changes”. In addition, we analyzed responses to a couple of closed questions concerning academics’ background, attitudes towards MOOCs, and what effect MOOCs have had on respondents’ campus-based courses. The remaining survey questions are not relevant to our current research questions. They will be reported elsewhere.

As there was a scarcity of previous research on academics’ perspectives on MOOCs and no relevant frameworks or models were found, we decided to conduct an inductive content analysis [11] to analyze the open-ended responses relating to pros and cons of MOOCs. We proceeded stepwise in our analysis. Four members of our research team individually read the answers to the open-ended questions and made notes on what kind of themes might emerge from the data. They then compared notes and agreed on preliminary categories. To verify that they had a common understanding of the categories two researchers together analyzed about 20% (n=30) of the responses to the question about the positive aspects of MOOCs (positive quotes) and the other two researchers analyzed 20% of the responses to the question about the negative aspects of MOOCs (negative quotes). After that they interchanged the quotes (but not the categorizations) and analyzed them again. They then compared the results, discussed possible

¹ http://users.cse.aalto.fi/pakinnun/MOOC/Eckerdal-14_MOOC_questionnaire.pdf

disagreements and made small adjustments to their categories and categorization rules. This process was continued until harmonization was achieved between the coders. After this initial phase of analysis, two members of the team analyzed the rest of the positive quotes and the other two the negative quotes.

The responses to the question concerning the effect of MOOCs on respondents' campus-based courses were analyzed by two researchers. At first one researcher categorized the themes found in the responses and then the other researcher reviewed the results to verify the analysis.

4. FINDINGS

The total number of responses to the survey was 236 of which 137 were teachers from the computing or IT disciplines. Our study focuses on this group.

The gender profile of the computing and IT academics was 71% male and 27% female, with 2% not responding to this question. Most respondents were from North America (43%) or Europe (33%) with the remainder from Australasia (11%), Asia (2%), Middle East (1%) or Africa (1%) and 9% not responding to this question. Overall, 89% of respondents were working as teachers, with the remainder having roles as researchers, educational developers, or postgraduate students. However, all respondents had some teaching experience, with 84% indicating more than 5 years and 74% more than 10 years.

4.1 Attitudes towards MOOCs

This section reports findings related to our first research question (RQ1). The survey participants were asked to identify any attitudes towards MOOCs that they had perceived from discussions amongst their teaching colleagues. The results are shown in Figure 1. The most common attitude amongst teachers was one of concern (55%) or positive (36%). Few were uninterested (14%). Note that multiple responses were allowed for this question.

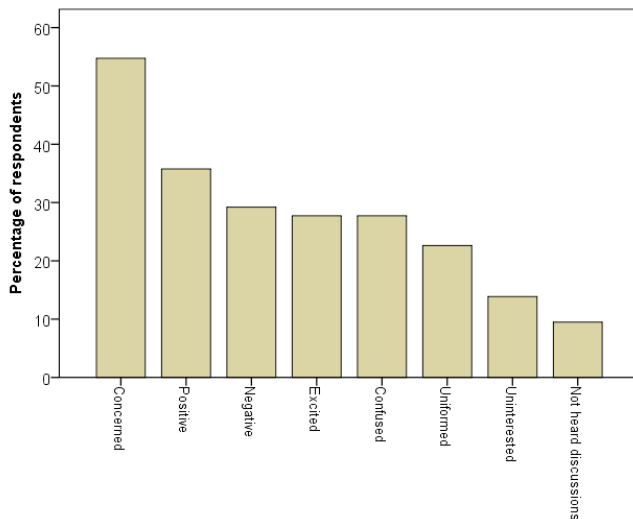


Figure 1: Attitudes of academics towards MOOCs (note that multiple responses were allowed).

We asked the respondents to elaborate on positive and negative aspects of MOOCs in two open-ended questions. A total of 106 (77% of 137 respondents) responded to the open-ended question regarding negative aspects of MOOCs and 107 (78%) answered the question regarding positive aspects. The analysis revealed seven topics that respondents related to being positive and/or negative: *teaching and learning, power issues, resources,*

educational outcomes, cultural issues, recruitment, and general experience. Guided by the research questions in this paper we concentrate only on teaching and learning topics raised by our respondents. A more detailed analysis of the teaching and learning topic indicated that it could be divided into five subcategories (*pedagogy and learning environment, affordances of MOOCs, interaction and collaboration, assessment and certification, accessibility*), which we discuss in more detail below. An individual response often included several topics and we therefore included such responses in multiple categories. The most often mentioned positive and negative aspects were related to pedagogy and learning environment and affordance of MOOCs, whereas access to top teachers evoked no negative comments.

4.1.1 Pedagogy and learning environment

Aspects relating to how MOOCs have been designed, the kind of pedagogy that is used, and the quality of courses was one of the most discussed topics in the open-ended questions. Well over half of the responses included this topic. The topic was the one that raised the most negative comments and only about a quarter of the comments on the topic were positive.

The most common focus of the positive comments was the potential for pedagogical improvement. The respondents saw the challenges of MOOCs, i.e., using new technology, dealing with massive numbers of students, and having teaching openly exposed, as factors that may encourage pedagogical development.

The hype around MOOCs will cause educational institutions to more carefully evaluate their educational outcomes. Moreover, large lecture classrooms supporting a transmissionist view of education will be strongly encouraged to adopt evidence based pedagogical practices which better engage the students.

Other positive aspects mentioned were that online delivery of content caters to different learning styles more than traditional lectures and that presenting course material online can help “*freeing resources for interactive learning/teaching (tutoring)*”.

For many subjects, being able to see concepts illustrated in video is far superior to reading about it in a book or listening to a passive lecture.

Many of the negative comments, however, pointed out that many MOOCs today are based on a transmissive pedagogy rather than on a pedagogy which encourages students to actively interact with peers and experts, despite the research which shows this to be more effective for their learning. One respondent describes the current situation as “*a regression to an educational “stone age”*”.

I worry about the push of poor pedagogy in MOOCs - ignorance of what are appropriate or beneficial learning structures for online learning, and the use of very one-way based communications to drive learning.

Respondents also expressed concerns relating to lack of personal connection and ignoring the interactive nature of the teaching-learning process.

Education is not a one-way thing; it involves conversation back and forth between the students and the teacher. Taking the people out of it makes education dry and boring.

4.1.2 Affordances of MOOCs

The affordances of MOOCs were mostly discussed in positive terms. The most common argument is summarized in “*Possibility to study subjects which are not taught at home university*”. A common suggestion was that MOOCs could provide deeper and broader competences that would prepare students for professional

life, offer trendy topics, and supplement existing courses. One respondent reports “*we consider making some MOOC's classes part of the Curriculum*”.

In contrast to this, other respondents predicted that “*to obtain economy of scale, they can only target topics with broad appeal*”. Another limitation pointed to is that “*not all disciplines are suitable to online study*”.

A perspective voiced by a few respondents was the use of MOOCs as a resource for campus courses:

If well produced, the videos and other materials can be great resources, particularly for other instructors ... could allow faculty (at face-to-face institutions) to focus on facilitating in-class interaction over presenting background material.

Other respondents raised a warning to teachers considering using MOOCs as an addition to their own courses:

From the teacher's point of view, it is quite possible that many MOOCs will be closed “take it all as is or leave it” packages, with little opportunity for outside teachers to, e.g., compose their own courses from parts of several MOOCs and some study material of their own.

One respondent argued that MOOCs can help students find a future career: “*They offer a way to see if one is interested in a subject without a large up-front investment (tuition, fees)*”.

In contrast, respondents argued that MOOCs do not scaffold students’ professional identity development:

I believe that MOOCs don't support students in their identity development, as university education and education in the physical world can. I think it addresses foremost the students that are already motivated to learn a subject and somehow have a relation to the subject (an identity related to that). Other students might take the course out of curiosity and they might also learn from it, but not grow as a person engaging in a subject, which could be seen as one major goal of education

Furthermore, some respondents commented that MOOCs are not useful in helping students develop critical thinking, teamwork and collaboration, skills that are most important for a new graduate. On the other hand, respondents suggested that MOOCs can help professionals to refresh knowledge and skills “*especially in fields like computer science, where new technologies are frequently changing.*”

4.1.3 Interaction and collaboration

Only few respondents mentioned positive aspects relating to interaction and collaboration. These comments highlighted mostly the social networking or interaction between students: “*The peer chats encourage students to lean on and learn from each other, instead of reliance on the professor*”.

Negative comments concerning interaction related to limited interaction between students and teachers in MOOC courses - or lack of interaction altogether. In fact, this was the second most often mentioned negative aspect of MOOCs. Over one third of the respondents commented, for instance, on the quality of the feedback mechanisms or the type of interaction that is possible between students and teachers. Many respondents were concerned about the lack of individual feedback, or any other kind of interaction between students and teachers, due to the massive scale of MOOCs.

Students have very limited opportunities to receive individual feedback, have questions answered, have misconceptions corrected, etc.

On the other hand, respondents were also worried about how the lack of immediate feedback from students, that one receives when teaching face-to-face, might affect the instructional process.

Limited direct assistance. Limited feedback from students to instructor, i.e., the questions that come up during or right after a lecture that allow me to adjust immediately to student confusion.

4.1.4 Assessment and certificates

Very few positive comments were made about assessment related topics. In contrast, many negative aspects were identified in the responses. Assessment and recognition of course completion were viewed as being problematic by about one third of the respondents.

The responses conveyed concerns relating to what can be assessed and how assessment can be done in massive courses. For example, multiple choice questions and peer assessment were highlighted as having limitations. Another aspect of assessment mentioned by a number of respondents was related to plagiarism and acknowledgment of who has done the work.

Respondents also raised the issue of the types of certificates awarded to students and how the certificates would be recognized in relation to traditional degree programs and by employers. Several respondents remarked that existing degree programs and employers do not necessarily acknowledge certificates received from MOOC courses.

I have been told by some employers that they will not accept a PhD from internet based universities. I feel that many of the students that take MOOCs may not investigate this issue prior to taking online courses and will end up with credits that do not apply to any degree or are not accepted by employers.

4.1.5 Accessibility

Nearly one third of the respondents mentioned the possibility to take a MOOC “*anytime, anywhere, at one's own pace*” as positive. However, one respondent pointed out that time and place independence may also have negative consequences. Since students attending a MOOC may be spread around the world it can be difficult, if not impossible, to find a local group of students that can provide the social encouragement needed to endure long enough to pass the course.

Almost a quarter of the respondents also pointed out that MOOCs can reach students that do not have access to traditional higher education. Examples of such students are high school students, “*people who live far from Universities, people without income, people with peculiar work hours, [...]*”. On the other hand, many respondents pointed out that MOOCs are not well suited for all students. Many suspected that only highly motivated students who already have good study skills benefit from MOOCs. Students with weaker academic background will struggle or drop out, if they even enroll.

Furthermore, a quarter of the respondents mentioned “*access to world class teachers*” or “*opportunity to learn from experts in a field*” as being positive. There were no negative comments specifically targeting access to expert teachers, but as we have already reported, many respondents were concerned about the pedagogy used in MOOCs.

4.2 Academics’ engagement with MOOCs

This section reports findings related to our second research question (RQ2). When asked about the effect of MOOCs on their campus-based courses 49% of the participants claimed there had

been no effect. Some (15%) claimed that MOOCs had inspired changes in their teaching approach or they were incorporating a MOOC into their course. Only one respondent, an experienced teacher, indicated that the course was a MOOC (see Figure 2).

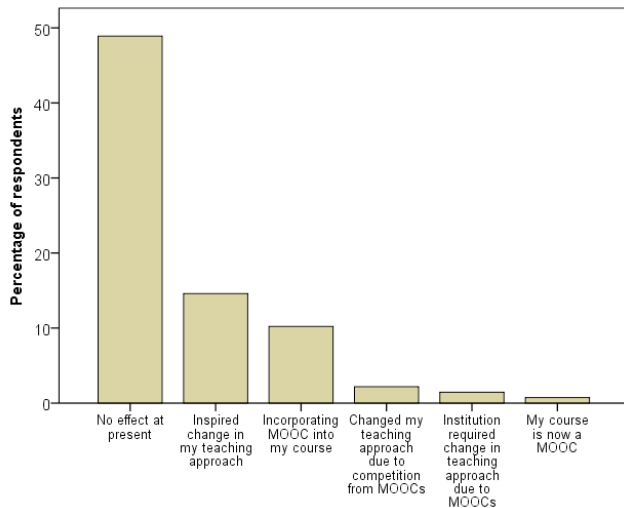


Figure 2: Effect of MOOCs on respondents' campus-based courses (note that multiple responses were allowed).

A question about participants' experience with MOOCs showed that a small number had developed a MOOC (6%) or intended to develop a MOOC (1%). However, a further 12% indicated interest in developing a MOOC. The participants were asked in an open-ended question to elaborate on what they had done to change their teaching practice in response to the MOOCs phenomena. Forty two (31%) responded and provided some explanation.

A number of respondents stated that they had made no changes to their teaching practice. A few mentioned that their teaching practices had or were changing to include elements that were similar to those used in MOOCs, but the introduction of these had not been influenced by the advent of MOOCs.

I am in the process of adding online materials and automated assessment to courses. This has nothing to do with the MOOC phenomenon. However, what I am doing could transition into something that could drive a successful MOOC.

A small number of respondents stated that they had made no change to their teaching, arguing that their current practices were superior to MOOCs-style education. As one respondent remarked:

I fail to see how MOOC can be realised without replacing much of the highly valuable personal interaction with domain experts with automated assessment and tutoring systems that mechanise education.

A couple of respondents expressed difficulties with introducing new practices into their local context.

In the context of MOOCs I have not altered my practise, however I am intrigued by some of the pedagogical changes which this kind of teaching evokes, particularly the social networking aspects.

A number of respondents reported different ways how their teaching practices had changed due to the MOOC phenomena. Some had incorporated elements of MOOCs into their course. Most common were resources such as online quizzes or short videos. One respondent mentioned a change to assessment practice:

The biggest thing I changed was the nature of student assignments. I have devised ways to force students to produce individualized coursework that cannot easily be plagiarized and that provides good evidence of whether they have actually learned. But such student assignments are more difficult to grade.

The most profound change to teaching practice was the introduction of the *"flipped (inverted) classroom"*. About a third of the respondents reported that they were using this teaching model:

Evaluating the strengths and weaknesses of MOOCs has made me realize the value of the classroom context in traditional teaching, and hence how to make better use of it. I've incorporated more inverted classroom concepts, and more hands-on and team activities into the classroom setting.

Only a small number of participants reported that they were using a MOOC. A few were incorporating MOOCs into their own courses, either using resources from an existing MOOC to supplement their own course: *"I am planning to use videos of lectures from a top-tier university to supplement my own lectures this fall"*. Or, in one case requiring students to complete an entire MOOC:

I am running a course in the fall where each student will sign up for a MOOC of their choice and we will compare/contrast. I want to come up with a proposal for the University's use of such courses.

5. DISCUSSION

The new phenomenon of MOOCs in higher education is clearly in an emergent phase. There is no clear vision of their role in the future. This is demonstrated by the highly mixed opinions in our questionnaire data - the most common attitudes were *"concerned"* and *"positive"*. When looking more closely at the arguments behind this split of results, we found slightly more positive aspects than negative aspects mentioned in our open-ended questions. The most commonly mentioned positive aspects were related to increased accessibility to new content (such that is not available locally) and expert international teachers, as well as the typical advantages of on-line courses: freedom of time and place for studying. Many respondents also pointed out that MOOCs can provide free education to non-traditional student groups. Some of these aspects have been mentioned previously in [2, 9, 13, 15].

The negative aspects in respondents' comments focused on the poor pedagogical models applied in MOOCs, e.g., returning to transmissive pedagogies instead of constructivist pedagogies. Other clearly negative aspects were lack of interaction between students and teachers, and the quality of assessment practices. Many comments also presented worries about plagiarism and difficulties to authenticating who was actually doing the work presented by the students. The value and role of MOOC certification thus remains an issue. Our respondents' concerns reflect similar issues being discussed by academics in other forums (see [2, 3, 15, 16]).

When looking at the data from another perspective, we can observe that the positive aspects were discussed in terms of the *potential* of MOOCs for access to content and teachers, and freedom of time and place. These are mainly curriculum and organizational issues. The negative aspects, on the other hand, focus on *current challenges* to the teaching and learning process: pedagogies, interaction, and assessment. Interestingly, accessibility to top level teachers is considered a positive aspect, while the pedagogies that are applied (which the teachers

implement) are sources of concern. Many respondents who reported the positive aspect seemed to consider the role of teachers mainly as content experts, not as pedagogical experts. This supports a conclusion that current MOOCs are emphasizing the old-fashioned lecturer-focused transmissive pedagogy.

The academics' descriptions of how the MOOC phenomenon had influenced their teaching further revealed a range of ways that teaching practice has been changed by MOOCs. A few seemed determined not to react to the hype, claiming they were offering students more valuable learning experiences with their current teaching. A number felt their pedagogies were somewhat aligned or aligning with MOOCs for example through providing students with short video 'bites' of lecture material and implementing the flipped classroom model. Others were seeking ways to use MOOCs in some way either as supplementary resources for their teaching, or to replace current course delivery. Very few academics had any deeper involvement with MOOCs.

6. CONCLUSIONS AND FUTURE WORK

MOOCs are a rapidly developing area. Thus, our results present a snapshot of computer science/IT academic community's perceptions and engagement with MOOCs in 2013. The big picture is clearly mixed with positive expectations as well as fears and concerns. Most people in the field are aware of MOOCs but only a small minority report actual changes in their teaching that are related to MOOCs.

The survey clearly identified aspects of MOOCs that need to be addressed by the global community. Firstly, MOOCs should be designed and used with pedagogical models that engage students in active learning. Otherwise there is a risk that their wider adoption forms a step back towards old-fashioned lecture-focused education with transmissive pedagogical thinking. Secondly, serious consideration should be given to the development and use of assessment practices that enable broader evaluation of students' knowledge and skills. It is inevitable that this calls for new research in automatic assessment and feedback methods. Thirdly, with the problems with authenticating student work in MOOCs it is imperative that universities seriously consider their policies in regard to accepting MOOC certificates as part of regular curricula. Overall, many comments in our data suggest that the emergence of MOOCs forces universities to rethink their on-site curricula with new perspectives - what could be the role of MOOCs and what parts of education are best taught in other ways?

We acknowledge that in this kind of research setting we cannot show that our target group forms a representative sample of the CS/IT teaching community. However, the large number of responses we received gives strong support to our belief that our findings reflect the attitudes widely. We intend to repeat the survey next year to find out how this phenomenon is evolving. Our survey has focused on CS/IT academics' perceptions of MOOCs. An equally interesting line of research would be investigating students' experiences of MOOCs. Some scattered research on individual MOOCs exist, but a bigger picture cannot yet be identified. The very recent large survey by Educause [4] found that only a small percent of undergraduate students have taken a MOOC and almost 3 out of 4 students did not even know what MOOCs are.

In the present paper we have focused on teaching and learning related issues in our data set. Our analysis also revealed several other aspects, such as economic issues and use of resources, power issues, and recruitment and dropout rates in MOOCs. We will deal with them in future papers.

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