

Massively Open Online Courses, Current State and Perspectives

Edited by

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Abstract

The Perspectives Workshop on “Massively Open Online Courses, Current State and Perspectives” took place at Schloss Dagstuhl on March 10–13, 2014. Twenty-three leading researchers and practitioners from informatics and pedagogical sciences presented and discussed current experiences and future directions, challenges, and visions for the influence of MOOCs on university teaching and learning. The first day of the workshop consisted of a series of presentations in which each participant presented those topics and developments he or she considered most relevant for the future development of MOOCs. The abstracts of these talks are given in the first part of this report. On the second and third day the participants divided into several working groups according to the main thematic areas that had been identified on the first day. This gives rise to a *Manifesto* to be published in the Dagstuhl Manifesto series and to identifying main research questions raised by the emergence of MOOCs: they are summarized in the second part of this report.

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1 Executive Summary

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Online education is not new; Massively Open Online Courses (MOOCs) are. Their uniquely powerful combination of classical digital teaching tools (videos, audios, graphics or slides), individualized tools for acquiring and validating knowledge, and appropriate use of dedicated social networks makes them a new and formidable means of accessing knowledge and education. If backed up with scientific and pedagogical excellence, MOOCs allow one to reach and teach simultaneously tens of thousands and even hundreds of thousand of learners in a new pedagogical dynamic.



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Editors: Pierre Dillenbourg, Claude Kirchner, John C. Mitchell, and Martin Wirsing



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Of the numerous MOOCs initiatives that have recently emerged, especially in the US and Europe, a few seem to be surfacing with an extremely important impact. This creates a very new situation and indeed can be considered as the informatics community's first main impact on knowledge dissemination and teaching. MOOCs will very likely induce a radical change in teaching mechanisms and their links to the economic and production systems. The consequences with respect to the transmission of culture and educational content, and on society as a whole, will be deep.

This situation raises many questions in a range of different disciplines with respect to ethics, intellectual properties, and data protection and privacy, necessitating an in-depth understanding of the current state of affairs and future trends in these research areas.

This Dagstuhl Perspectives Workshop brought together leading researchers and practitioners working in or on MOOCs initiatives in order to provide a forum for discussing participants' current experiences and initial feedback. Scientists from several key disciplines, including informatics, pedagogy, economy, psychology and sociology, have met to discuss the current state of the situation and envision the next steps. In particular, they have addressed questions relative to current research on the pedagogical engineering of MOOCs, economical models, ethical issues, the technical development of platforms, and sharing.

The first day of the workshop consisted of a series of presentations in which each participant presented those topics and developments he or she considered most relevant for the future development of MOOCs. On the second and third day the participants divided into several working groups according to the main thematic areas that had been identified on the first day.

From the working groups outcomes, a Manifesto has been worked out and will appear in the *Dagstuhl Manifestos Collection*.

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
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3 Overview of Talks

3.1 Crowdlearning

François Bry (LMU München, DE)

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This presentation reports on on going work at the University of Munich and the Saarland University on novel eLearning systems combining social learning, direct instruction, and enquiry-based learning.

A first system Backstage, deployed since 2012, is presented. Backstage is targeted at an immediate feedback and interactions in large class lectures.

The project Crowdlearning aims at going beyond Backstage by offering a platform for both class-learning and self-learning, learning Analytics for an immediate feedback to both learners and teachers, and building upon human computation peer teaching, peer marking, and teachers' collaboration.

3.2 Looking for New Efficient & Effective Educational Bundles

Carlos Delgado Kloos (Universidad Carlos III de Madrid, ES)

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In the industrial age, mass production was achieved by division of labour, synchronicity, and strict rules. When the Prussian education system was introduced 2 centuries ago making education compulsory, the same principles were used to achieve efficiency in education by dividing students by age, ideas into subjects, and days into periods. In an age where access to (rapidly changing) information is pervasive, new skills have to be taught, and technology allows new ways of interaction, the challenge is to find new structures that provide education in an efficient and effective way. In the second part of my talk, I report about three initiatives at Universidad Carlos III de Madrid of using MOOC-like technology and content in residential courses that complement our activity around MOOCs (in MiríadaX and edX). A number of different platforms have been used (Khan Academy platform, Google Course Builder, and open edX) for different purposes (review courses, SPOCs as a complement to residential courses, and reinforcement content for failing students). All these experiments intend to use MOOC-technology for removing inefficiencies in on-campus education, and finding new structures and models to improve residential education.

3.3 Design for scalability: Reflections on trade-offs in MOOCs


Yannis Dimitriadis (University of Valladolid, ES)

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Lesson learnt from the study of scalability in telematics may be useful for on-line education, such as the case of MOOCs. This position paper suggests the use of the “design for learning” approach in order to study the effects and trade-offs of scalability in MOOCs

3.4 MOOC? Inverted Classroom! Some initial Experience with an esruoC in computer science

Jens Dittrich (Universität des Saarlandes, DE)

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Main reference J. Dittrich, “Die Umgedrehte Vorlesung – Chancen für die Informatiklehre,” *Datenbank-Spektrum*, 14(1):69–76, 2014.

URL <http://doi.org/10.1007/s13222-013-0143-9>

In this talk I explain my experience with a flipped (aka inverted) university lecture in computer science. The experience was mostly positive. I describe things that worked and that did not work. In addition, I give recommendations on how to address minor things that did not work in future lectures.

3.5 Designing a research policy on MOOCs (preliminary investigations)

Gilles Dowek (INRIA – Paris, FR)

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New research problems emerge to design better courses and better platforms. MOOCs platforms are a measuring instrument for research in pedagogy.

3.6 Supporting Campus in the Cloud, Course Customization, and Instructional and Student Communities

Douglas H. Fisher (Vanderbilt University, US)

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Main reference D. O. Bruff, D. H. Fisher, K. E. McEwen, B. E. Smith, “Wrapping a MOOC: Student Perceptions of an Experiment in Blended Learning,” *MERLOT Journal of Online Learning and Teaching*, 9(2), June 2013.

URL http://jolt.merlot.org/vol9no2/bruff_0613.htm

I will summarize my experience with blended learning models that use MOOC material by other faculty, as well as material I have produced myself; followed by general observations about the implications of MOO Education (MOOE) for on-campus education, thematic and regional learning and teaching communities, and instructional collaborations that cross institutional boundaries.

3.7 Virchow-Villermé, a French-German experience on MOOCs in the field of Global Public Health

Antoine Flahault (Paris Descartes University, FR)

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URL https://www.france-universite-numerique-MOOC.fr/courses/VirchowVillermé/05001/Trimestre_1_2014/about?xtor=AL-3

This presentation will present an attempt of setting up a series of MOOCs in the field of global health and public health on a non US platform (France Université Numérique on Open-edX). A road map has been defined from an international consultation of experts, health professionals and students, leading to a selection of 70 MOOCs which were considered as expected to be proposed on a platform dedicated to public and global health. Four MOOCs are currently launched, and this first experience will be discussed. Questions on options for the economic model will be raised, and issues relative to confidentiality of students' data.

3.8 SPOCs Can Help Refactor Residential Course Offerings

Armando Fox (University of California – Berkeley, US)

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1. The current “one size fits all” model of residential course delivery is a poor fit for exploding enrollments as well as for faculty productivity in an era of tightening budgets.
2. Separating the scalable from the non-scalable parts of a course allows the two to be resourced separately. The scalable parts can serve the mass of the distribution while the non-scalable parts can be resourced in a way more tailored to utilizing the outliers, both the superstars and the stragglers.
3. MOOC technology in the form of curated SPOCs, with appropriate new teaching roles supporting the course, can play a role in both the scalable and non-scalable elements.

3.9 Open Linked Data and Models for MOOCs

Serge Garlatti (Telecom Bretagne – Brest, FR)

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Joint work of Garlatti, Serge; JM. Gilliot; I. Rebai

This position paper presents a MOOC toolkit for Inquiry-based Learning (called iMOOCs) or connectivism (called cMOOCs) approaches with peer assessments for learning. A toolkit, called SMOOPLE (Semantic Massive Open Pervasive Learning Environment), has been designed to support such type of learning. It consists in a set of social media tools used for producing and collecting content and communicate with peers, dashboards and semantic services. The explicit models (defined as ontologies: stakeholders, learning activity, peer assessment, etc.) were designed to support learning (a guide for learners and for monitoring, scaffolding, common language, etc.) and to annotate produced information. By means of Linked data, all information from social media tools and user interaction with dashboards can be linked to provide support and relevant information to the different stakeholders. Finally, some perspectives are pointed out.

3.10 MOOCs @ Institut Mines-Télécom

Serge Garlatti (Telecom Bretagne – Brest, FR)

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Joint work of Garlatti, Serge; JM. Gilliot, N. Sennequier; G. Simon

This position paper presents the main goals of Institut Mines Telecom (IMT) for MOOCs development. IMT plan to develop a catalog of MOOCs, around 10 per year, to be innovative in MOOCs and to integrate MOOCs in its training offer, that is to say sharing courses between IMT schools and enabling an ambitious, lifelong, training offer.

3.11 Analysis of attrition curves from 39 MOOCs (from Stanford) and what this says about student engagement

David Glance (The University of Western Australia – Crawley, AU)

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In their current instantiation, Massive Open Online Courses (MOOCs) represent a form of educational delivery with little or no barrier to entry. In part due to the extreme ease of enrolling, low completion rates have been a notable characteristic of MOOCs with as few as 5–10% of students who enrolled gaining a certificate of completion. Beyond these observations, little is known about the patterns of attrition, nor how they may vary amongst different groups of MOOC participants.

Activity data was analysed from log records collected from 48 MOOCs run by Stanford University between 2011 and 2013 on Coursera. There were 23 unique courses, some of which were repeated. A novel analysis was devised and applied to the data which showed that attrition varies little between at least two different groups of MOOC participants, those that audited the course and those that actively participated in assessments.

The results indicate that attrition is not influenced by levels of participation in a MOOC and attrition is further not influenced by attributes of the course.

3.12 Learning groups in xMOOCs: Potential and Pitfalls

Jörg M. Haake (FernUniversität in Hagen, DE)

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In this talk, it is explored whether and how positive experience with learning groups in Distance Learning courses could be mapped on xMOOCs. Issues and solutions for the different phases of group learning are presented, and results from a study of the effect of CSCL scripts on semester-long learning groups are briefly reported. Pitfalls/problems and solution ideas for applying learning groups in an xMOOC are discussed.

3.13 MOOC enrolments: searching for meaning in large numbers

Jeff Haywood (University of Edinburgh, GB)

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This presentation explores the features of the learners enrolled on University of Edinburgh MOOCs in their first few iterations on the Coursera platform. Age, prior educational experience, intentions for study, choice of MOOC etc are compared between different MOOCs and different iterations.


The demographics of the learners and their reasons for studying the MOOC on which they had enrolled were collected in an online pre-MOOC survey. There were 50k completed surveys in January 2013 and 45k completed surveys in the same MOOCs re-run at various times up to March 2014 (approx. 25% of enrolments).

The learners enrolled on later offerings of each MOOC were quite similar in age, gender, location and prior educational level to those on the first offering, which had been at a time when MOOCs were quite a new phenomenon, suggesting some stability in their different audiences. Despite their high educational levels (most had Bachelor or Masters degrees), learners were taking MOOCs in new subjects and not re-studying in the same subject as their qualifications. Younger learners were much more interested in certificates and MOOCs as support for their careers than were the (majority) older learners, but all were interested to learn new things, and many were interested in experiencing online learning, a key skill for the future. MOOC learners in the later course offerings were twice as likely to have already studied on a MOOC than in the first offerings, suggesting that these are increasingly repeat learners, and hence more like lifelong learners ('extension') than traditional students.

The Edinburgh data report can be found at <https://www.era.lib.ed.ac.uk/handle/1842/6683>.

3.14 Learning Analytics Techniques targeting Resource Usage in Online Courses

Heinz Ulrich Hoppe (Universität Duisburg-Essen, DE)

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Joint work of Hoppe, Heinz Ulrich; Hecking, Tobias; Ziebarth, Sabrina

MOOCs (but also other types of online courses) make intensive use of a variety learning resources provided online, including video clips, quizzes, but also student-generated content. This talk will present specific analysis techniques related to usage patterns around such resources. Our method relies essentially on a generalization of the clique percolation method for subcommunity detection to bi-partite student-artefact networks. In particular we uncover bipartite clusters of students and resources in those networks and propose a method to identify patterns and traces of their evolution over time. The approach is exemplified with a blended learning course on "Interactive Teaching and Learning Environments".

3.15 Inria for FUN

Claude Kirchner (Inria – Paris, FR)

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The profound digital revolution transforming our society is now fully impacting education.

The emergence of MOOCs is a strategical issue as it impacts knowledge transfert, pedagogy as well as the relationship between all the users of the educative systems. A much in depth individual and collective knowledge of the students behaviors, competences and abilities results from these new tools.

In this context and since two of its missions are research and knowledge transfert, Inria has created its MOOC Lab with four missions:

1. Provide a high scientific, pedagogical and ethical qualities platform alternative;
2. Develop contents, in particular in informatics and mathematics domains;
3. Help in the development of research;
4. Adapt and experiment the platform with new ideas and contents. To fullfil these objectives, Inria decided to use and adapt the openEdX software.

Because of its strategic importance and in order to help, share and mutualize the elaboration of MOOCs as well as their availability, the French ministry of higher education and research launched FUN (France Université Numérique) and in this context asked Inria to help setting up its MOOC platform. So Inria's MOOC Lab customized the openEdX software to adapt it to the French and FUN contexts, in collaboration with CINES (academic computing center) and Renater (association in charge of the French academic network). The platform has been opened in October 2013 for students registration and the first courses stated in January 2014. Beginning of March, there are more than 200 000 registered students to the 32 available courses.

Inria's MOOC Lab is now continuing to work on the software as well as contributing to develop multilingual contents and organizing research seminar on MOOC related topics in relationship with many universities and research centers locally and internationally.

This talk will present a short overview of these activities.

3.16 Observing an open learning process: a modeled trace oriented framework

Alain Mille (University Claude Bernard – Lyon, FR)

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After introducing the concept of observational semantics, a general framework to trace an open learning process will be detailed: listening the logs on the platform server, collecting chosen information on the learner browser, giving control of the tracing process to the learner, etc. The approach will be illustrated on a concrete example (a MOOC in Lyon). Further readings, bibliography and useful URL to contribute to the platform will be provided. It should be possible to make demos on line during the breaks.

3.17 Overview of goals, course development and research at Stanford

John C. Mitchell (Stanford University, US)

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URL <http://online.stanford.edu>

Over the last two years, over 100 faculty have developed close to 200 online course activities on campus and for public release. Our support team combines instructional designers, video producers, and software platform developers. We also are developing an iterative cycle combining course development with research. As research examples, the talk will summarize current research on attrition, interventions to increase success, and demographics of public course participation.

3.18 Designing Massive Scale Social Learning

Mike Sharples (The Open University – Milton Keynes, GB)

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A central challenge for developers of MOOC platforms and courses is to understand which pedagogies can be effective at massive scale, and how. One underpinning theory is Metcalfe's Law which states that the value of a networked product or service increases with the number of people using it. Thus, the effectiveness of networked or connectivist learning ought to increase with scale. But as Stephen Downes has indicated, people are not just nodes in a data network, they engage in meaningful communication, so we need to understand meaning making at massive scale – in particular how that can be orchestrated for productive learning. Other pedagogies may be impervious to scale – e.g. delivery or broadcasting of learning materials – but we should understand the distinctive changes in these pedagogies from face-to-face teaching, through small-scale online learning, to massive-scale access. Other pedagogies may degrade with scale, such as embodied learning (it is not as easy to teach a dance or surgery class at massive scale). What are the opportunities and problems of scale for pedagogies that are not currently supported by most MOOCs, including inquiry-based, reflective, collaborative, problem-based, game-based, and case-based learning?

3.19 Towards sMOOCs


Marcus Specht (Open University – Heerlen, NL)

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Legacy, experiences, and development around open online education at the OU and Welten Institute (former CELSTEC).

3.20 E-Learning and MOOCs at LMU


Martin Wirsing (LMU München, DE)

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Since more than ten years, LMU München is engaged in supporting learning and teaching by digital media. This includes research and teaching audio and video recordings with iTunesU, e-learning courses with the Virtual University of Bavaria (vhb), digital recording of large lectures, and e-learning research. LMU was also the first German university offering MOOCs on the Coursera platform. This talk gives a short overview of the e-learning and MOOC activities of LMU.

3.21 MOOC and Further Education – How universities with MOOC may impact the further education market

Volker Zimmermann (IMC AG – Saarbrücken, DE)

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Most MOOC initiatives today focus on the higher education segment. Universities produce MOOCs primarily for the target group of students. However the further education and professional training market is maybe the bigger market. Employees in companies can benefit very much from high-quality online education delivered by academic institutions, as otherwise there are not many alternatives when being full time at work. Going back to university in a face to face course is very difficult, but getting courses from the own university by using them online to get latest insight information and knowledge with link to research results if of great value for many academic employees in business. Volker Zimmermann presented the business experiences of conceptualization and realization of MOOCs for the professional training market. IMC AG explores how university MOOC strategies might look like when aiming to deliver education to companies. The design and implementation of MOOC might be different to the delivery to students. Development Methodologies and instructional designs should focus on the needs of this target group more. In addition, learning platforms will need different functionality to support the corporate specific use cases. Based on IMC Learning Suite and within the Corporate MOOC platform “OpenCourseWorld.com”, IMC has proved that there is interest and potential to serve the market of professional trainings for corporate employees.

4 Working Groups

4.1 Report of the Workshop on Multidisciplinary Research for Online Education

Douglas Fisher and Armando Fox

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URL <http://www.cra.org/ccc/files/docs/CCC-MROE-Report.pdf>

In February 2013 the Computing Community Consortium (CCC) sponsored the Workshop on Multidisciplinary Research for Online Education (MROE) (<http://www.cra.org/ccc/visioning/visioning-activities/online-education>). This visioning activity explored the research opportunities at the intersection of the learning sciences, and the many areas of computing, to include human-computer interactions, social computing, artificial intelligence, machine learning, and modeling and simulation.

The workshop was motivated and informed by high profile activities in massive, open, online education (MOOE). Point values of “massive” and “open” are extreme values that make explicit, in ways not fully appreciated previously, variability along multiple dimensions of scale and openness. The report for MROE has been recently completed and is online (<http://www.cra.org/ccc/files/docs/CCC-MROE-Report.pdf>). It summarizes the workshop activities and format, and synthesizes across these activities, elaborating on 4 recurring themes:

1. Next Generation MOOCs and Beyond MOOCs;
2. Evolving Roles and Support for Instructors;
3. Characteristics of Online and Physical Modalities;
4. Physical and Virtual Community.

5 Research questions

The development of MOOCs creates new research problems and new methods to address some of them.

The new research problems come from the will to make MOOC platforms and MOOCs more diverse, ethical, enjoyable, adaptive, evaluable, accessible, usable by underserved learners, aware of cultural diversity, etc.

Diverse: not all courses are organized around the talk of a professor. More research is needed to understand how to make MOOCs more diverse, by integrating multi-modal user interfaces, remote labs, etc. in order to implement active pedagogy in MOOCs.

Ethical: more research on ethic is needed to understand which kind of information should be accessible to whom, focusing on the privacy issues related to the data produced by the students. Besides defining goals, research is also needed to understand their implementation in MOOC platforms, requiring, for instance, to develop privacy models and methods to develop MOOC platforms in such a way privacy is enforced by design.

Enjoyable: children learn a lot by playing games. Learning is also often enjoyable. These two remarks led to the idea to investigate how courses could be gamified, that is transformed into educational games.

Adaptive: in a classroom pedagogy, there is little room for offering each learner a particular path through knowledge : a particular sequence of exercises adapt to the level and the difficulties of each student. With MOOCs, such an adaptation to the learner becomes possible, but a lot of research is needed to understand which algorithm permit this adaptation.

Adaptable: more research is needed to give the learners more feedback, by correcting exercises automatically or by the peers, and also to evaluate their success and deliver diplomas.

Evaluable: more research is needed to evaluate the quality of a MOOC, besides the number of learners, the drop rate, and the reputation of the course.

Accessible: current MOOC platforms are difficult to use by deaf, blind, etc. learners. More research is needed to understand how to make them accessible.

Usable by to underserved learners: MOOCs are sometimes thought as a way to drive illiterate adults and droppers back to school. But specific strategies, interfaces, etc. are needed for these specific learners.

Aware of cultural diversity: offering courses in different languages is essential for offering education to everyone. Besides the diversity of languages, more research is needed to present the courses and the exercises in a way that is compatible with the different (academic) cultures.

On the other hand, MOOCs platforms can serve as a measuring instrument in pedagogy. The history of each science can be divided into two eras : the first when the scientists do not use any measuring instrument and the second where they do. For instance, astronomy was first naked eye astronomy and then has been instrumented since Galileo's telescope, Biology has been instrumented since van Leeuwenhoek's microscope, but mathematics have been instrumented only since the middle of seventies (of the 20th century) and the use of a computer to prove the four color theorem. If the computer is the mathematician's telescope, the network may be the social scientist's telescope, as it permit to observe on a large scale social interactions. This is particularly the case with pedagogy: MOOCs permit to observe on a large scale how people teach, how people learn, etc.

Developping this instrumented pedagogy requires to develop the analysis of learner traces

Finally more research is needed to understand how MOOCs can integrate in current frameworks : how is it possible to transform on-line communities into geographical ones, what are the different business models to develop MOOCs and MOOC platforms, how to balance the efforts of private industry and public services, etc.

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