MOOCs and the AI-Stanford like Courses: Two Successful and Distinct Course Formats for Massive Open Online Courses

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Abstract

Open online courses (OOC) with a massive number of students have represented an important development for online education in the past years.

A course on artificial intelligence, CS221, at the University of Stanford was offered in the fall of 2011 free and online which attracted 160,000 registered students. It was one of three offered as an experiment by the Stanford computer science department to extend technology knowledge and skills to the entire world. The instructors were two of the best known experts in the subject of artificial intelligence. Although students would not get Stanford University grades or credit, 20,000 from 190 countries finished the course successfully receiving a "statement of accomplishment" from the tutors Sebastian Thrun and Peter Norvig. Udacity is a start-up from the authors of CS221 delivering similar massive free online courses. EdX, a joint partnership between The Massachusetts Institute of Technology (MIT) and Harvard University to offer online learning to millions of people around the world, is one of the most recent proposals in this realm.

Massive open online courses known as connectivist MOOCs (c-MOOCs) on the other hand have been delivered since 2008. They are based on the explicit principles of connectivism (autonomy, diversity, openness and interactivity) and on the activities of aggregation, remixing, repurposing and feeding forward the resources and learning.

In the research literature, newspaper and magazine articles both types of OOCs, AI-Stanford like courses (AI) and c-MOOCs, have been identified in many occasions as equivalent.

Distance education (DE) pedagogy can be classified through the evolution of three categories: cognitive-behaviourist, social constructivist, and connectivist. These three current and future generations of DE pedagogy have an important place in a well-rounded educational experience. To a large extent, the generations have evolved in tandem with the technologies and all three models are very much in existence today and are categorized by a set of conditions.

In this paper we study in detail representative courses from AI and c-MOOC formats. We establish that although they share the use of distributed networks the format associated with c-MOOCs, which are defined by a participative pedagogical model, are unique and different from AI. We further assign to the AI to a cognitive-behaviourist (with some small contribution of social constructivist) and MOOCs to connectivist pedagogy.

Keywords: Massive Open Online Course, MOOC, Distance Education Pedagogy.

List of Topics

- Introduction
- Research Methodology
- Evolution of Online Education
  - Connectivist MOOCs
  - CCK08
  - PLENK2010
  - MobiMOOC
  - EduMOOC
- The AI-Stanford Like Courses and udacity.com
- Two Very Different Online Course Formats
  - Analysis of the Tools Used
  - Who Were the Participants
  - Vast Lurker, No-lurker Participation and Dropout Rate
  - Accreditation

    - Role of Tutors and Facilitators
- Discussion and Conclusions
- References

Introduction

The vast potential of open online courses has keyed up theoretical interest for decades. In the past years thousands of motivated learners around the world with no interest in obtaining a degree have accessed courses offered freely obtaining sophisticated skills and knowledge.

In 2011 160,000 students from 190 countries enrolled in an Artificial Intelligence course, CS221, taught by two eminent computer scientists from Stanford University and Google Corporation. 20,000 successfully completed the course. Two other similar courses were simultaneously offered on the subjects of Machine Learning (104,000 registered and 13,000 completed the course) and Introduction to Databases (92,000 registered, 7,000 completed). Udacity a for-profit start up from the authors of the AI-Stanford course started delivering similar free online courses. For example, 90,000 students have enrolled in the CS101 on computer science (Python Programming and building a Search Engine). More recently, EdX (a joint partnership between from MIT and Harvard) and Coursera (an educational for-profit company founded by professors Andrew Ng and Daphne Koller from Stanford University) were added to the list of AI.

In addition, during the last years, online courses that don't align with the course content nor the instructor, but to other learners and their knowledge, commonly referred as c-MOOCs (Connectivist Massive Open Online Courses) have been carried out with great success. Examples are CCK08 (2008), PLENK2010 (2010), MobiMOOC (2011), EduMOOC (2011), Change11 (2011/12), DS106 (2011/2012) and LAK12 (2012).

They represent an emerging methodology of online teaching. Their structure was inspired by the philosophy of connectivism and the implementation requires conceptual changes in perspective from both "facilitators" (tutors) and learners. They all share being multispaced courses where the learner's blogs and personal spaces define much of the learning.

Their subjects covered connectivism and connective knowledge (CCK), personal learning environments and networks and knowledge (PLENK), Online learning for today and tomorrow (EduMOOC), Education, Learning and Technology (Change11), Learning Analytics (LAK12), the more technically involved on mobile learning (MobiMOOC) and Digital Storytelling (known as DS106) from the work of Groom & Levine (2011).

In a recent paper Anderson & Dron (2011) describe three generations of distance education pedagogy: cognitive-behaviourist, social constructivist, and connectivist.

They conclude:

- That all three current and future generations of DE pedagogy have an important place in a well-rounded educational experience.
- To a large extent, the generations have evolved in tandem with the technologies
- All three models are very much in existence today.

For each of these models of DE pedagogy a set of well defined conditions was outlined that characterizes each of them.

Dropout rate and behaviour of lurkers represents one of the most puzzling issues for most educators in online courses. A dropout is someone registered that ceases to participate in the course that he has signed up to participate in. We differentiate dropouts from lurkers in that lurkers choose to mostly follow in a silent manner and not participate actively in them, whereas dropouts started out participating and then either became lurkers or just ceased all connection with the course.

Dropout rates, lurker behaviour, the tools used, the accreditation mechanisms and the role of tutors and facilitators characterize distinctly OOC formats.

In many instances in the research literature (Rodriguez, 2010; Weller, 2012; Levin, 2012; Kolowich, 2012), and TV programs when referring to OOCs both the c- MOOCs and AI. formats have been identified as equivalent or evolutions from one to the other. For example, by stating that the AI resulted from mainstreaming the original c-MOOC concept or its institutionalization.

In this paper, we present results from a comparative study from representative courses of each format, AI and c-MOOCs, give details on how they are structured and of their implementations and show that although both types shear some common features they clearly differ on the learning theory and pedagogical model on which they stand. Furthermore, we postulate that c-MOOCs belong to the

connectivist DE pedagogy while the AI courses to the cognitive-behaviourist (with some constructivist contributions). Some hint to this difference is already given by Weller (2012): “The new institutional MOOCs look very conventional in their approach and subject matter”. Our conclusions coincide with the recent analysis by Siemens (2012b): “Aside from the surface level distinctions between our MOOCs and the Coursera/EDx model (yes, I’m “othering” them), some important differences exist in the underlying views of knowledge and learning that inform the different MOOC models.”

Research Methodology

In the present study CCK08, PLENK2010, MobiMOOC, EduMOOC were chosen as representatives courses for the c-MOOC format and the AI- Stanford CS221 and CS101 from Udacity for the AI format.

As a researcher I participated in MobiMOOC and EduMOOC, Change11 LAK12 and completed successfully the AI-Stanford course and CS101 (Building a Search Engine) sponsored by Udacity, the spin-off of the AI-Stanford class.

I was an observer during the courses, collecting qualitative and quantitative data through observation of activities and engagement.

For CCK08 and PLENK2010 the vast amount of data which exists in the form of surveys and research papers was used as the source of information.

Evolution of Online Education

The evolution of distance education has always been mediated by the advances in technologies necessary to span the temporal-geographic distance between the learners, teachers and institutions. Hence most classifications of DE have been based on the technologies used for delivery. A first generation was based on postal correspondence. Mass media of television, radio and film production defined a second generation. The third included the interactive technologies in audio, text, video web and immersive conferencing. Fourth and fifth generations of learning technologies are less defined. They introduce the concepts of intelligent databases, web 2.0 or semantic web concepts.

Although they span several decades none of the technologies used in each generation excludes the use of the previous ones. Basically an expanded set of tools become available to the educational world.

The pedagogies used are of course influenced by the technologies and vice versa.

In a paper by Anderson & Dron (2011), DE pedagogies are mapped into three distinct generations evolving chronologically and that are all still present: cognitive-behaviourist, social constructivist, and connectivist.

In their work they claim: “We have seen how different models of teaching and learning have evolved when the technological affordances and climate were right for them. Cognitive-behaviourist pedagogical models arose in a technological environment that constrained communication to the pre-Web, one-to-one, and one-to-many modes; social–constructivism flourished in a Web 1.0, many-to-many technological context; and connectivism is at least partially a product of a networked, Web 2.0 world”. And that “No single generation has provided all the answers, and each has built on foundations provided by its predecessors rather than replacing the earlier prototype.”

Connectivist MOOCs

MOOC, “Massive Open Online Course” is a term coined in 2008 by George Siemens and Stephen Downes after carrying out the online course CCK08 (Fini, 2009) that succeeded a number of previously successful OOCs (Fini et al., 2008). They represent an emerging methodology of online teaching. Their structure was inspired by the philosophy of connectivism and the implementation requires conceptual changes in perspective from both “facilitators” (tutors) and learners. MIT and other educational institutions through initiatives similar to the Open Courseware allowed content of courses to be scaled. Today social and networking activities and the c-MOOC format allows for the scaling of negotiated knowledge.

McAuley, et al. (2010), refer the c-MOOCs characteristics as “An online phenomenon gathering momentum over the past two years or so, a MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources. Perhaps most importantly, however, a MOOC builds on the active engagement of several hundred to several thousand “students” who self-organize their participation according to learning goals, prior knowledge and skills, and common interests.”

By “massive” it refers to the number of participants that can easily have thousand students simultaneously engaged in the course. “Open” is related to several concepts: the software used is open-source, registration

is open to anyone, and the curriculum is open (perhaps loosely structured and it can even change as the course evolves), the sources of information are open, the assessment processes (if they exist) are open, and the learners are open to a range of different learning environments.

"In connectivism, the starting point for learning occurs when knowledge is actuated through the process of a learner connecting to and feeding information into a learning community" (Kop & Hill, 2008). They also stated that "Connectivism stresses that two important skills that contribute to learning are the ability to seek out current information and the ability to filter secondary and extraneous information". In their work, Mackness, et al. (2010) found that when the theory of connectivism is situated in the practice of a c-MOOC, its network principles of diversity, autonomy, openness, and emergent knowledge are comprised.

CCK08

Connectivism and Connective Knowledge (CCK08), was facilitated by George Siemens and Stephen Downes in the fall of 2008 (Fini, 2009). CCK08 was an online course offered both formally through the University of Manitoba and also informally with enrolment being open to anybody in the world at no cost. A group of around twenty participants registered initially and paid for the course and to obtain credit. Once opened as a c-MOOC to those interested to participate but who were not interested in obtaining a credit, the registered number was 2300. Some of the participants took the course in a more "formal" manner in the sense that they earned credit from the University of Manitoba. For that reason they needed to complete the course and obtain positive grading of assignments. Informal refers to participants (the majority) attending the course and undertaking the activities at their own pace without receiving any type of academic certification or grading from the facilitators. Hybrid ways of attending were also possible in the course: one student enrolled in the course but was evaluated by her own institution. This course was also set up so as to investigate lifelong learner's attitudes towards learning network technologies.

The CCK08 did not represent the first open online course. In the 2007-2008 academic year the Social Media Open Education course by Alec Couros and the Introduction to Open Education course by David Wiley took place and had international repercussion (McAuley et al., 2010).

At the end of the c-MOOC a three-part survey was performed. The survey showed that the course attracted adult, informal learners, who were not concerned about course completion and was characterized by the use of a variety of technological tools available to the students. Some of the tools were selected by the facilitators proposing some others but as the course evolved participants suggested and used others. Twelve different tools and technological environments were used, ranging from LMSs (Moodle) to 3D environments (Second Life). The tools required by the course were only a personal blog and a tool to build concept maps. Participant's involvement happened in a number of ways: according to learning styles, personal objectives, and time availability. Which tools they preferred most probably related to the specific user's needs, purposes, and self-organization skills. It was interesting to see that participants made selective choices. For example they did not use tools with low usability nor the most popular social networks if they were considered not relevant to the course. The main factors for the choice of tools were: time constraints, language barriers, and ICT skills. The traditional mailing list (although passive) was preferred by the participants over interactive, time-consuming discussions forums.

PLENK2010

Personal Learning Environments, Networks, and Knowledge (PLENK2010) was a course sponsored and organized by the Technology Enhanced Knowledge Research Institute (TEKRI) at Athabasca University. It was offered in 2010 as a c-MOOC and was facilitated by George Siemens, TEKRI, Stephen Downes, NRC (National Research Council of Canada), Dave Cormier, UPEI (University of Prince Edward Island) and Rita Kop from NRC.

The course started with 846 participants, and increased to 1,616 by the final day. The purpose of the course was to clarify and substantiate the concepts of personal learning environments and networks. Course facilitators and participants analyzed the research literature and evaluated it against their own experience with the intent of developing a comprehensive understanding of personal learning environments and networks.

As in any connectivist course materials and course content were defined by participants as the course progressed, rather than prior to the course by instructors. Though the course outline defined a set of selected topics, they only served as indications for an iterative process of search, practice and reflection. The course participants were encouraged to develop their own course supports and to share those with other participants. Examples included, among other things, concept maps, Google groups, Second Life sessions, in-person, and course meetings. Facilitators participated in these additional supports as possible given time and facilities constraints.

PLENK2010 started in September 2010 and developed for 10 weeks. The following topics were addressed as the course developed: A tour of PLEs and PLNs, Contrasting personal learning with institutional learning, PLEs with LMSs, Understanding the neXt/eXtended Web, PLE/PLN and learning theories, Evaluating Learning in PLE/Ns, Using PLEs successfully (skills, mindsets, and critical literacies), PLE/N

Tools - What Exists, What is Being Built?, PLE/Ns and personal knowledge management, PLE/Ns in the classroom (PLE/Ns and blended learning), Critical perspectives on PLE/PLN.

In many respects PLENK 2010 organization was very similar to that of CCK08.

MobiMOOC

MobiMOOC was a six-week course that started in April 2011, organized by Ingatia de Waard from the Institute of Tropical Medicine Antwerpen (ITM) in Belgium. It focused on mobile learning (mLearning) and used the c-MOOC format to deliver course resources and provide an interactive environment for all participants. The course was free to anyone interested in the topic of mLearning, fitting it within the idea of Open Educational Resources.

Every week focused on a different aspect of mLearning and was facilitated by a different mLearning expert. The course started off with an introduction week on mLearning so that participants could have the same starting level. The following weeks included: mLearning planning, mLearning for development, leading edge innovations in mLearning, interaction between mLearning and a mobile connected society, and mLearning in K-12. The role played by facilitators was more as guides on the side than tutors. They had total freedom so as to put forward as many learning actions and follow-ups as they wanted.

Many of the participants utilized mobile technologies to access the materials and follow the course, even though this was not a requirement to participate in the course. The final survey asked for the reason they preferred to use their mobile devices to access the course materials. The predominant factor was the location independence afforded by mobile devices. They could freely participate from wherever they were located. Temporal independence was also an important factor. Participants could access materials at a time and place which was convenient for them. A further alleged reason for mobile use was simply because it was just there.

A very interesting difference with the other three c-MOOCs analyzed in this paper was the fact that two surveys were carried out during the duration of the course: one at the start and one at the finalization (de Waard et al., 2011a). This allowed extracting interesting conclusions (de Waard et al., 2011b).

This c-MOOC was set up to test the idea that the combination of c-MOOCs and mLearning strengthen knowledge construction in general and informal and lifelong learning in particular.

In MobiMOOC, 556 participants joined the Google group over the six weeks when the course was running although only a limited amount of people actively posted ideas or comments to the group discussions. If one took out members that did not post anything and those that only posted a welcome message, there were 74 active (contributing) members. 1,827 discussion threads were started. 1,123 Tweets sent from the #mobimooc hashtag. 335 mLearning links were shared amongst the participants via the social bookmarking site delicious. 32 participants completed the course as memorably active participants. 40 participants completed and submitted the MobiMOOC survey.

MobiMOOC showed a very interesting development. During the course a group of participants self-organized in a research team. The outcome of this interaction was the publication of two research papers (de Waard et al., 2011a, 2011b). The latter was awarded the best paper Award of “mlearning 2012 Conference”, Beijing, China, one of the most prestigious conferences in mobile learning. Until the conference none of the authors knew each other in person.

EduMOOC

EduMOOC was an 8 week course delivered from June to August 2011, on the topic of “Online Learning Today... and Tomorrow”. It was convened by Ray Schroeder professor emeritus and director of the Center for Online Learning, Research and Service (COLRS) at the University of Illinois, Springfield (UIS).

It was sponsored by the University of Illinois at Springfield as a not-for-credit c-MOOC devoted to examining the state of online education and to establish the future trends of e-learning. 2,700 participants registered.

Key trend areas in online education were identified by the COLRS staff. Twenty leaders in the field participated as panellists. Professors Karen Swan and Michael Cheney assumed the responsibilities as moderators of sessions. An e-learning strategist at the sister campus in Urbana-Champaign, Glenda Morgan helped to moderated another of the sessions.

Eight topics were selected – one for each week. A Web page was used as the centralizing point of activities. It included details about the topic for each week, including links to timely resources including articles, Websites, Twitter hash tags, blogs, wikis and more relevant to the topic of the week. Collectively at the end of the course, a big database was built. On Thursday of each week a live one hour Webinar panel discussion was held with experts on the specific weekly topic.

Those registering for the course – were invited to join the Google Group “eduMOOC” where threaded

discussions were held. This mailing list was where networking happened among those attending the c-MOOC. After a participant accepted the email invitation to the Google Group, he would set his nickname and email delivery options.

One of the most active forums was proposed Wayne Mackintosh, director of the OER (Open Educational Resources) Foundation on the topic: Can we c-MOOC the OERu (OER university)? It was organized as an eduMOOC study group which was hosted using WikiEducator.

Figure 1 shows the geographical distribution of participants to eduMOOC.

The following list characterizes the eduMOOC in numbers:

- Number of registered participants 2,700
- Total number of mails sent in 8 weeks was 1,108. [June: 587 (daily average 74), July: 469 (daily average 16) and August: 52 (daily average 5)].
- 50 % of the mails were sent by only 10 participants.
- 8 % of the participants in Google list sent 1 mail each.
- 16 % of the participants in Google list sent less than 10 mails each.
- 30 % of the participants in Google list sent introductory mails.
- Total number of participants in the Google Group 1425.
- Google group members who sent mail to “introductions”: 245
- Number of members in the eduMOOC Wikispace: 137
- Average number of daily unique visitors to Wikispace Week 1: 230, Week 7: 50
- Daily Average number of members who edited Wikispace Week 1: 6, Week 7: 1.
- Members in the Diigo eduMOOC group: by Week 4: 79, by Week 7: 84 :
- Items in Diigo by Week 4: 55, by Week 7: 64
- Visits to Diigo: by Week 4: 308, by Week 7: 342
- Number of Delicious bookmark: 383
- Number of members in Facebook #edumooc : 107
- Number of members in Moodle: 99
- Number of views in scoop.it edumooc: 618
- Number of views in scoop.it EduMOOC 4 ALL: 846
- Average new daily spoters in paper.li: 5.

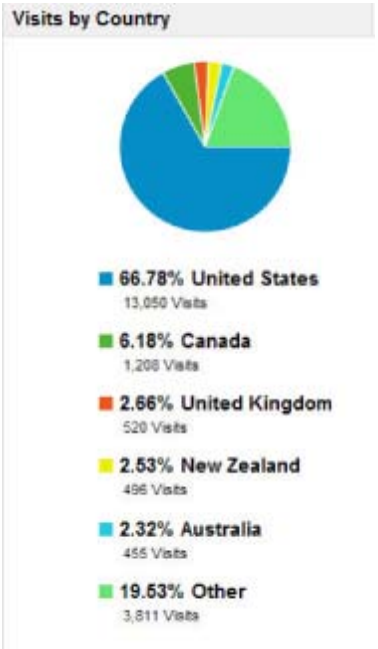

Figure 1. Visits to the eduMOOC centralizing web page separated by country.

The AI-Stanford Like Courses and udacity.com

The 2011 graduate level AI-Stanford class, CS221: Introduction to Artificial Intelligence, taught by Sebastian Thrun and Peter Norvig was a massive open online course with 160,000 registered enrolees of which 20,000 completed all coursework. In the words of their creators it was “A bold experiment in distributed education”. It was offered free and online to students worldwide from October 10th to December 18th 2011. The course included feedback on progress and a statement of accomplishment. The curriculum drew from that used in Stanford's introductory Artificial Intelligence course. The instructors offered similar materials, assignments, and exams.

An additional 200 registered for the course on campus, but a few weeks into the semester, attendance at

Stanford reduced to about 30, as those who had the option of seeing their professors in person decided they preferred the online videos.

Besides the Artificial Intelligence course, Stanford offered two massive open online courses during 2011: Machine Learning, and Introduction to Databases. In 2012 the university announced it would have 13 courses open to the world, including Anatomy, Cryptography, Game Theory and Natural Language Processing.

The Massachusetts Institute of Technology which has been posting course materials online for 10 years announced the offering in 2012 of a massive open online course on circuits and electronics course. The course will serve as the prototype for its MITx project, which will eventually offer a wide range of courses and some sort of credential for those who complete them.

KnowLabs is a for-profit company that was setup for the CS221 class. An evolution soon took reality: Udacity.com. The idea: to create a menu of high-quality courses offered free and online that can be rerun and improved with minimal involvement from the original instructor. The name is a mash up of *audacity* and *university*. The first courses have concentrated on computer science. Eventually it is supposed to expand to other disciplines including engineering, physics, and chemistry. KnowLabs, through Udacity plans to work with top professors with the capability of creating dynamic, interactive videos. The classes will have a production team and the professor will become an actor-producer.

There are several options considered as potential business models. One possibility goes in the direction of charging students a minimal fee or that people might eventually pay for add-ons, study aids, or offline materials.

Others see other revenue streams. At the end of term for example emails were sent to the top 1,000 students, the ones with perfect or near-perfect scores on homework and tests. The email contained the subject: the possibility of job placement.

Recently the company secured a sizable amount of investment money from venture capital firms specializing in early-stage investments.

At the end of March 2012 the following courses were already being offered: CS 101 Building a Search Engine, CS212 Design of Computer Programs, CS253 Web Application Engineering, CS262 Programming Languages, CS 373 Programming a Robotic Car, and CS 387 Applied Cryptography.

Two Very Different Online Course Formats

Analysis of the Tools Used

The following tools were used in CCK08 and PLENK2010: a mailing list, which was called *The Daily* and was managed by one of the facilitators. The subscribers received a daily message with a summary of the key topics of the existing conversation, such as the most interesting posts, usually with comments; Moodle, with wiki (an open source course management system, generally used by institutions for managing online courses which was used mainly for discussions in web forums); Elluminate (a synchronous web conferencing system); Ustream (a video streaming system); Pageflakes and Netvibes (which are services that allow aggregation of RSS feeds); Facebook (a popular social network service); Linkedin (a social network service oriented to business contacts); Twitter (a micro-blogging service, based on short messages); Ning (a service that allows users to create their own personalized social networks); Second Life (a 3D virtual world in which users act as avatars in a immersive environment and can create their own artefacts); Twine (a semantic web service for collecting and connecting content by topic); Flickr (a popular photo sharing service); Social bookmarking (a generic term for services that allow users to store and share bookmarks on the Web); Conceptual maps (web tools to collaboratively edit conceptual and mental maps). In PLENK2010 more than 75 % of the respondents to the survey indicated that course resources such as the Daily newsletter, the Moodle and the wiki were sufficient so as to understand what the course intended.

In MobiMOOC the use of social media tools were central to c-MOOC communication and participation, using a variety of web-based tools. Different from CCK08 and PLEN2010, the organizers used only two major web-based spaces: a MobiMOOC Google group for the handling of the mailing list and a MobiMOOC wikispace where the course outline was outlined and resources were shared. Participants were kept informed of changes via RSS. The Google group centralized discussions. The wiki took the task of providing the online syllabus. YouTube, Twitter, Facebook and Delicious, were used throughout the course for sharing specific content. Participants added other spaces during the MobiMOOC complementing those proposed by the coordinators: MobiMOOC Crowdmap; MobiMOOC LinkedIn group; MobiMOOC Posterous blog; the Zotero MobiMOOC group and a MobiMOOC map. In many cases the content was also accessed via mobile devices.

The tools used for EduMOOC were similar to those used in MobiMOOC. A centralizing web page hosted in Google was used. This was where the course was outlined and new announcements made. Participants

needed to visit the page daily. A mailing list was set up as a Google group. All discussions happened there. Participants received emails on different threads and could easily comment or start a new one.

The tools used in AI-Stanford CS221 consisted basically in a centralizing web page where every week students found a new class in video form hosted in YouTube. At the end of most classes a small test was offered in the form of multiple choices or the student had to create computer code which was corrected instantly online. Answers were submitted directly into the browser.

The exercises associated with the lectures did not count for the certification. After the first week a series of "homework" was detailed in exactly the same format as the tests previously described. The videos in YouTube described the question and gave hints to the multiple choice test or computer code requested. The homework had a deadline. Once past the deadline the results of the homework could be seen by each participant. Several exams were taken during the course: A midterm and final. A combination of homework, tests and exams decided the final score. Those obtaining more than an established grade obtained a signed letter of recognition from the tutors.

More than 100 volunteers signed up to translate the lectures into 44 languages, including Bengali. A dozen or more discussion groups formed on Facebook, and students organized virtual study sessions via Google+ and private IRC channels. Questions could be posted on the Q&A site Aiqus and on Reddit discussion boards at all hours of the day and night and received explanations and tips from around the world in near real time. On Aiqus alone, more than 4,000 questions were posted, and they received more than 13,000 answers.

CS101, run by udacity.com had exactly the same format as AI-Stanford CS221 course described in the previous paragraphs. The final exam was divided into the Regular questions, and the Starred questions. If you were able to solve at least 3 of the Regular questions, you would earn a "Certificate of Accomplishment" for the course. Higher level certificates were awarded to students who are able to answer more of the Regular questions correctly, and the highest distinction required answering some of the Starred questions in addition to the Regular questions.

Social networking existed in both AI courses between students, but there was little feedback to the tutors with the exception of what were called office hours. The idea behind office hours was that participants would propose questions and votes from other participants would finally decide which (very limited number) would be answered by the tutors.

Who Were the Participants?

Participants in c-MOOCs were mainly employed professionals in education, research and design, and development of learning opportunities and environments. They were teachers, researchers, managers, mentors, engineers, facilitators, trainers, and university professors.

The gender and age diversity indicated that the c-MOOC format appeals to people across the traditional dichotomies of gender and age. Many participants were well into their professional careers, which gave a certain level of compromise.

In the case of MobiMOOC the network between the participants remained active even after the course completion. This indicated certain strength in the efficacy the participants felt towards the MobiMOOC community.

In CCK08 eighty-three people completed the survey (34 females, 49 males). The overall age range of respondents was 28 to 69 years old (M = 48 yrs, SD = 9.75, N = 83). In MobiMOOC participants showed similar characteristics in gender (23 males, 17 females). Ages spread from 21 to 79 (average around 50yrs).

The AI courses had many computer-programming experts in the field. The range of participants went from junior-high school students and humanities majors to middle-aged middle school science teachers and more than 50 retirees.

It should be remembered that some knowledge of mathematics was needed as was detailed in a small disclaimer on the AI course website: *Prerequisites: A solid understanding of probability and linear algebra will be required.*

Average age was 30, 65 % from outside the US, 85 % had a BA/BS degree. More than a thousand were required by their school to take it.

Vast Lurker, No Lurker Participation and Dropout Rate

Participation in open online courses is just a registration and the will to realize the course. Participants can take one of two ways: lurker or active.

Lurker is a term used to define a participant that just follows the course, looks at the recordings, and

browses the available course resources. He is mostly behind the scenes waiting for some interesting event.

Table 1: Shows the number of new and returning daily visitors to EduMOOC´s main web page. W0 is the week before the start and W8 the ending week. Thursday was chosen as the sampling day. The total number of unique visitors during the 8 weeks was around 10,000.

	W0	W1	W2	W3	W4	W5	W6	W7	W8
New visitors	1,079	270	192	97	144	65	96	43	44
Returning visitors	541	665	371	306	242	187	152	124	133

In c-MOOCs, participants can even take different roles at different times or even participate in just one segment of the course. There are different factors that will influence the degree of his participation like for example time pressures of his daily activities or the fact that it can be postponed for a future instance.

Figure 2 (obtained using Google analytics applied to the home page of EduMOOC 2011) and Table 1 represents a typical behaviour pattern of those participating in a c-MOOC. A big number register (2,700 in this case) but after a few weeks the active participants reduce to less than 10 %. Activities like online meetings do not register more than a few tens. Participation in surveys is also small as can been seen in Table 2.

Table 2: Number of registered participants for the c-MOOCs analyzed in this paper and information on surveys. Surveys with the exception of MobiMOOC were only carried out at the end of the courses.

	Length in weeks	Number of registered participants	Number of initial survey participants	Number of final survey participants
CCK08	12	2,300	Was not done	83
PLENK	10	1,616	Was not done	40-60
MobiMOOC	6	556	227	40
EduMOOC	8	2,700	Was not done	27

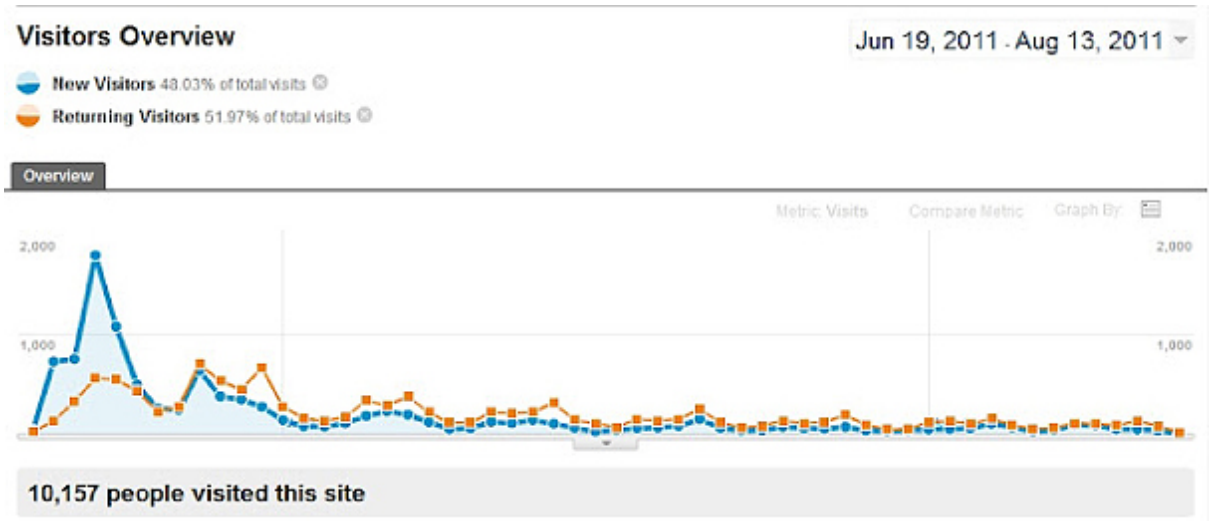

Figure 2. Shows the number of visits from new visitors (dots) and returning visitors (squares) as defined in the Google Analytics analysis of the main web site in EduMOOC for the period extending a week before the start until one week after.

Then the following important question emerges: have more than 90 % of registered participants dropped the course? How many participants are lurkers who still find that following the course from the sidelines adds to their knowledge? Is there some way to quantify the number of lurkers?

Figure 3 shows the number of page views as recorded in the blog from a c-MOOC participant. Until the date indicated by the arrow in the horizontal axis, his participation had been as a lurker and had never posted anything to his blog. On that date he posted a contribution that was announced through “The Daily”. The number of page views in the succeeding 5 days is also depicted. This particular blog post had a total of

nearly 1,200 page views. This corresponded to approximately half of those registered in the corresponding c-MOOC.

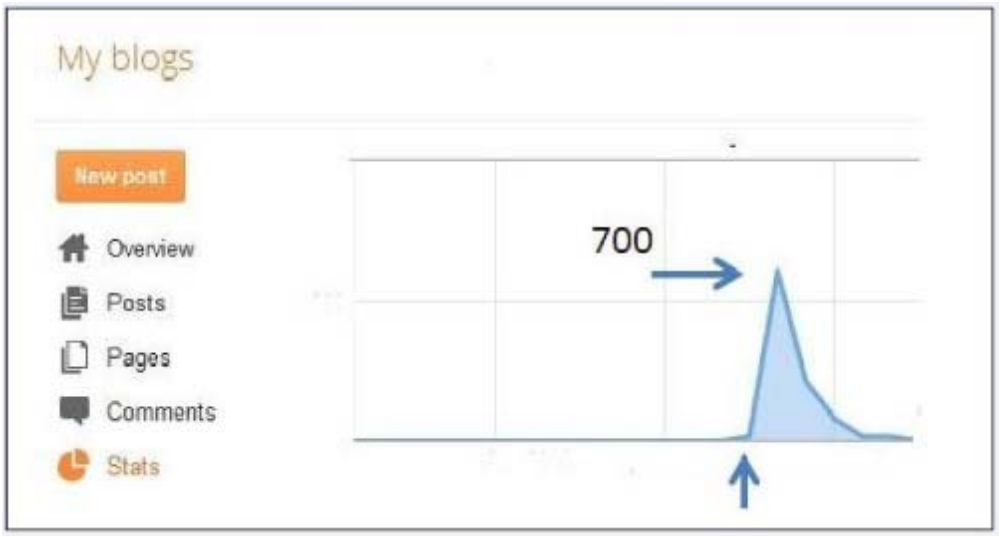

Figure 3. Pageviews to a blog correponding to a particular post published in blogger.com during a c-MOOC participation. The peak spans five days.

Cormiere & Siemens (2010) referring to c-MOOCs wrote: "The most disconcerting issue for many educators running an open course is the dropout rate", and Siemens (2012), "While active participation in our courses declines as the course progresses, subscribers to the Daily increase. I'm not sure what to make of that. If I was getting five emails a week on something I wasn't interested in, I would unsubscribe. Does that mean we can view Daily subscribers as a) people are still engaged, b) people can't find the unsubscribe link, or c) that we've subjected over 15,000 people to guilt about not being active in c-MOOCs?"

The answer to the last question is a). People are still engaged and in reality the most disconcerting issue to those running a course comes from not realizing that lurkers might conform a high percentage which is more than 50 % of those registered but difficult to quantify precisely.

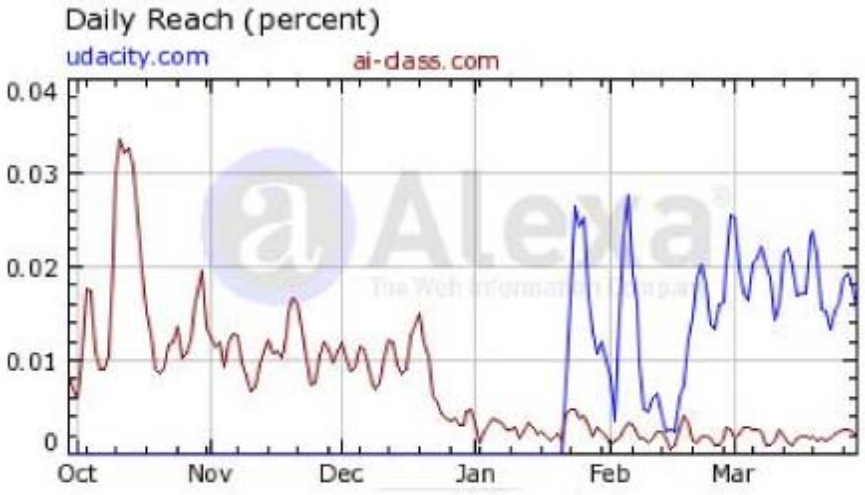

Figure 4. Comparison of number of daily visitors to ai-class.com and udacity.com khanacademy.org would have an average of 100,000 daily visits (0.04 in this scale).

Figure 4 shows the number of participants through the duration of the CS221 AI-Stanford course expressed as daily reach (analytics extracted using alexa.com). A huge peak surges to nearly 100,000 (the daily reach of Khanacademy.org) around October 10th (the beginning of the course). Very rapidly it stabilized at 25,000 active participants. The smaller peaks are linked to the weekly obligatory exams

In Figure 4, we also show the daily reach of udacity.com. Two parallel courses were staged during the period what represents an average for each course similar to the 25,000 of ai-clas.com.

Lurking in the Stanford AI like courses is practically inexistent. There is really no opportunity to lurk due to the structure of the courses. Those that didn't follow the lectures and completed the weekly quizzes will effectively a dropout. The change from the 160,000 registered to 25,000 simply represents 85 % of dropouts.

Accreditation

Perhaps one of the biggest challenges for OOCs is how one assesses what is being learned. Within the realm of open online courses the traditional accreditation models become inappropriate.

In the case of c-MOOCs the first difficulty is how to assess or give credit when all participants are not doing the same work. The fact that many participants are peripheral also becomes an issue. Since the course content evolves while its being developed it becomes difficult for learners to know if a course will help them and commit. Most of the surveys indicate that many participants think that it's not even necessary to have a form of accreditation. Students could use c-MOOC courses before enrolling in a formal accreditation program or the process of accreditation could be totally separate from the running of the course.

CCK08 was an example of a hybrid model where some participants were evaluated and received the corresponding accreditation if successful. Formally through the University of Manitoba participants earned credit from the University of Manitoba and for that reason they had to complete the course and obtain positive grading of assignments. According to Fini (2009), one student enrolled in the course but was evaluated by her own institution which was not an organizer of the course.

Those who successfully completed the CS221 AI Stanford class received an official Statement of Accomplishment, a letter saying such from Sebastian Thrun and his co-teacher Google's Peter Norvig. That is similar to what MITx has announced will give its students when that program launches in 2012. In this case, it will have a cost. Until now, universities that support their online courses make it clear: these letters cannot be considered credits from Stanford or from MIT.

In CS221 there was an opportunity to take the midterm and exam at the University of Freiburg. Those that passed the exams, obtained a certificate (in German: Schein) signed by Prof. Wolfram Burgard that they had passed the exam of the course and that this was equivalent to the AI course at the Department of Computer Science of the University of Freiburg.

The letters of completion from a Stanford-sponsored or MIT-related effort might still count in for employers. Some job applicants for engineering jobs in Silicon Valley are including "Stanford" on the list of schools they've attended, simply because they took CS221. The question is open now as to whether such an accreditation will be considered of value for enterprises such as Udacity that have no link to prestigious institutions.

Role of Tutors and Facilitators

What is the role of the educator in a c-MOOC? In three of the analyzed c-MOOCs the term "facilitators" was used for the group that was responsible. EduMOOC represented an exception with only one "organizer". In many opportunities in MobiMOOC (2011a, 2011b) the concept of "teachers on the side" appeared to describe their role.

The c-MOOC concept does to negate the role played by the person who conducts it. But it adjusts their role with respect to access to new content and engagement tools which is now under the control of the learner. As stated by Cormier & Siemens (2010): "Educators continue to play an important role in facilitating interaction sharing information and resources, challenging assertions, and contributing to learner's growth of knowledge". They clearly indicate the following roles: amplifying (to draw attention to important ideas/concepts), curating (arrange readings and resources so as to give help for the understanding of new concepts), way finding (assist participants to use social networking for their doubts), aggregating (clarify discussions and content via extracting patterns), filtering (help participants to be able to exclude non useful information in the networks), modelling (show successful information and interaction patterns), staying present (be a continual supervisor of the course and activities).

In the case of AI courses the teacher or tutor played a very similar role close to that in conventional classes. In these cases tutors would give the lectures via video format, explain hints for the exercises, comment on the evolvement of the course, prepare the exams and using video read the questions and related hints. During what were called office hours, the tutor would answer selected question from a pool proposed and voted by participants. There was never a direct interaction of the tutors with the students.

Discussion and Conclusions

If one applies the classification proposed by Anderson & Dron (2011), on DE pedagogy to AI and c-MOOCs it becomes clear that the AI-Stanford like courses fall predominantly into the cognitive-behaviourist category (with some small components from social constructivism) and the c-MOOCs into the connectivist. This analysis is similar to that made by Zelenka (2012) for the Stanford machine learning class by Andrew Ng and the LAK12 c-MOOC.

Teaching, social, and cognitive presence in AI and c-MOOCs characterize very different formats of massive

open online courses. As stated by Siemens (2012a): “Interest in open online courses – and start-ups see this as an opportunity to automate and scale education. In a recent interview by Tamar Lewin for NYTimes, I stated that while you could call Udacity, Coursera, and Codeacademy examples of c-MOOCs (Massive open online courses), they are largely instantiations of existing educational practices. Their primary innovation is scaling”.

In the work of Quinn (2012) he clearly finds a distinction between the solo approach and the social approach to learning. He defined the Stanford AI course as a set of videos, some online interactive exercises, and tests, as being predominately solo. The learner works by himself with the material. And this is in contrast with the social kind of course founding the c-MOOCs. Basically, he claims in c-MOOCs the action of the course is predominately interaction with each other.

Openness in each of the formats has also a different meaning. In c-MOOCs means that novices and experienced people are able to merge together in the same space and communicate and interact with each other. In AI it is more related to the fact that the courses are open for anyone to take.

In each of the formats, participants have different goals and preparation. In c-MOOCs experienced so far, students already need to have some level of understanding and an ability to learn independently, and to think critically. The AI courses address participants with no knowledge in a technical subject.

Our comparative study has exposed some important facts related to the nature of two distinct open online course formats: AI and c-MOOCs

Both types bear some common features:

- Geographical spread of participants
- Big dropout rate, although in AI courses is much higher than in c-MOOCs (85 % vs. approximately 40 % respectively).
- Massiveness, although AI course have orders of magnitude higher number of registered learners.

But, they clearly differ in many fundamental aspects (especially in its pedagogical content) so as to establish two very different course formats associated with AI-Stanford like courses and c-MOOCs:

- The AI fall into the cognitive-behaviorist pedagogy category and the c-MOOCs into the connectivist.
- The AI participants have totally different learner's goals and preparation than those in c-MOOCs.
- c-MOOCs have a vast number of lurker participants while AI have no lurkers.
- Tutors and facilitators bare very different roles.
- Openness in each of the formats has also a different meaning. In AI it is more related to the fact that the courses are open for anyone to take. In c-MOOCs it refers to: openness to the personalization of learning, to the dialogue, debate, and conversation; to the novel, divergent thinking, and creative thinking; to the participation based on connection, collaboration, and sharing.
- c-MOOCs are based upon by connectivist of learning. AI is based on a hub and spoke model as has been affirmed by Siemens (2012): “The Coursera/EDx MOOCs adopt a traditional view of knowledge and learning. Instead of distributed knowledge networks, their MOOCs are based on a hub and spoke model: the faculty/knowledge at the centre and the learners are replicators or duplicators of knowledge”.
- Generative and declarative knowledge reflect the epistemological distinction of c-MOOCs and AI respectively
- c- MOOCs establish a many to many relation to develop massive interconnectedness. AI establishes a one to-many relationship to reach massive numbers.
- In c-MOOCs knowledge coherence is only guided by a facilitator and then it’s the learners that form it by exploration and deepening of the exposed ideas.
- Multiple spaces, tools, technologies and a distributed interaction govern c-MOOCs. AI has a platform around which all the course is centred.
- Synchronization is fundamental as learning happens in c-MOOCs. An alignment happens between learners and their knowledge.
- AI essentially gives traditional education a digital face lift.
- A hub and spoke model is associated to AI and a knowledge network model to c-MOOCs.
- In c-MOOCs a vital concept relates to what learners do for themselves with tools from a digital world and networking. They promote a self-regulated, highly motivated and autonomous learner. The knowing part of learning (epistemological development) and becoming a certain type of person (ontological development) go hand in hand.

Siemens (2012) states: “...Coursera/EDx emulates the existing education system, choosing instead to *transfer* it online rather than *transform* it online.”

Massive open online courses represent an important development in open education. Here we studied and compared two distinct course formats that have been applied with great success. Although these courses represent a huge step in OOCs, many issues and questions remain open and need to be addressed in future research.

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