MOOCs Concept and Design using Cloud-based Tools: Spanish MOOCs Learning Experiences

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Abstract

New forms of education and media technologies as well as the availability of affordable devices, free services and open content have strongly influenced modern learning settings. The advent of open courses have demolished organizational restrictions and dramatically increased the number of participating students. MOOCs have become increasingly popular. This situation has motivated research and development of MOOCs making use of cloud-based learning tools and online tools as well as learning support specifically for Spanish speaking learners. Experimentation and findings from two MOOCs experiences have shown promising results in terms of motivational, emotional and educational aspects. On the negative side there is still a high dropout rate and challenges with interaction and collaboration among peers.

1. Introduction

Over the last decades, technological developments have significantly changed and influenced the way society access, communicate, collaborate and share knowledge. Given the demands of competing work and life balance and the commitment to life-long learning, today's generation of learners expect flexibility in accessing quality education. Modern pedagogic practices integrating socio-cultural approaches to support learners in a rich learning environment must be considered to ensure positive learning experiences and outcomes. Modern information and communication technologies and tools such as Web 2.0, Learning 2.0, cloud-based learning tools, open content and open source learning tools have all provided the ground for innovative and affordable learning settings [7];[2];[10]. As a consequence of these technological affordances, many learning institutions have begun to address the 'learning in demand' stance by introducing open online courses that can be accessible by learners from all over the world.

Early examples were Galileo University in Guatemala with Rocael Hernández Rizzardini and colleagues offering a course on 'Creating Webpages' to some 800 participants in 2005 [9]. In 2007, David Wiley at Utah State University offered the 'Introduction to Open Education' course [13];[18], and George Siemens and Stephen Downes ran a 'Connectivism and Connective Knowledge' to some 2200 participants in 2008 [15]. The large number of participants has motivated the term *MOOC* which stands for *Massively Open Online Course* [4];[6];[9];[13]. The characteristics of a MOOC can be summarized as open and free of charge, active involvement and participatory and the contributions are shared for the learning community, and the communication and collaboration tools and resources are widely distributed. Two types of

MOOCs can be distinguished as *cMOOCs* which are based on connectivism and networking, and *xMOOCs* are based on behaviourism [13];[14].

The literature reveals that the advantages of MOOCs include accessibility to courses regardless of the social and cultural background allowing participants to connect with a diverse learning group of learners [4];[6];[12]. MOOCs support self-regulated learning with a multitude of learning tools allowing participants to access, collaborate and contribute to the learning. The disadvantages include the feeling of isolation and disconnection, high dropout rates, insufficient support in the learning activities and restrictions to simple form of assessment rather than providing feedback and guidance [4];[6];[12];[14];[15];[17]. The literature highlights continual effort is required for educators to design MOOCs with access that requires facilitation involving large-scale interaction and feedback. This situation has motivated collaborative research between institutions from three countries: Curtin University of Technology, Australia; Graz University of Technology, Austria and Universidad Galileo, Guatemala.

This research is focused on providing tools for learners to collaborate, interact, and learn in a MOOC environment. This involves using cloud-based learning tools and online tools. This paper describes the MOOC experience which was specifically set up to support a group of Spanish speaking learners with little or no English literacy. The paper is organized as follows: Section 2 presents the pedagogical approach of the MOOCs. Section 3 outlines the MOOC learning environment and tools used to support the learning process. Section 4 discusses and reports on the learning experience followed by a summary and future work in Section 5.

2. Pedagogical Approach and MOOC Design

The MOOC learning environments presented in this paper were based on literature survey and previous MOOCs experiences at Galileo University [9]. In this paper, we focus on two free open courses that were offered by Galileo University to Spanish speaking learning community. Both courses *Introduction to e-Learning* and *iPhone Development* were strongly influenced by MOOC sites such as Coursera (www.coursera.org) and Udacity (www.udacity.com), and a MOOC on "Artificial Intelligence" by Norvig and Thrun [3]. Considering the differences between xMOOC and cMOOC [5];[15] and with reference to the Stanford experience [16], we chose to use xMOOC as this format promotes a teaching model emphasizing 'cognitive-behavioral' which has more of a traditional approach to online learning. The content was designed and developed in Spanish in order to reach a large amount of Spanish speaking participants from the Iberoamerican region. Both MOOCs were built on the .LRN learning management system and utilized different cloud-based learning tools (see Table 2). An overview of the main aspects of the two MOOCs is provided in Table 1.

MOOC Learning Experience	**(a) Introduction to e-Learning**	**(b) iPhone Development**
Learning and instructional objectives	Understand the e-Learning fundamentals, the related technology concepts and tools, and apply these knowledge by designing and creating an online course	Learn how to develop applications for the iOS platform including iPhone, iPad and iPod Touch international quality and develop applications to the App Store
Number of learning units	4 units (1 unit per week, 4 weeks in total)	15 units (10 weeks in total for the course)
Collaboration type	Non-guided discussions. Question and Answers (Q/A) forums.	Non-guided discussions. Question and Answers (Q/A) forums.
Assessment type	Peer assessment	Peer assessment

MOOC Learning Experience	(a) Introduction to e-Learning	(b) iPhone Development
Final product	Create an Online Course	Develop Application for iPhone
Course offered	October 2012	June 2012
Tutors	2	4
MOOC pedagogical approach	xMOOC (cognitive-behavioral teaching model)	xMOOC (cognitive-behavioral teaching model)

Table 1. General description of MOOCs

Based on the xMOOC approach of a cognitive-behavioral teaching model, the MOOCs learning experiences were designed with a semi-autonomous self-guided and individual learning approach. Each course was organized with a set of learning units, one or more units and topics for each week, and the course organization schedule was on a weekly basis. This included learning content and assignments as well as peer discussion and assessment activities. For each topic, short videos representing the main resources of the learning content were recorded for the learners. Complementary readings of pre-selected documents and hyperlinks were made available to the participants. Given that both courses require the use of software or learning tools in the cloud, a set of tutorial videos and written instructions were created to support students to complete their assignments.

Special focus was given to peer-assessment and online collaboration through discussion forums. To overcome the problems of fragmented communication channels, the communication facility was restricted to only one tool to ensure a simple way of communication. The online collaborative forums followed a gamification [11] approach. Badges were used as electronic rewards for students based on their contributions to the course learning community. A quantitative method was also used where a summative course value was earned by the student. This was based on the overall contribution and performance on questions asked and answered, the responsiveness and the most valuable contributions by the students, all rated by the learning community. This setting was selected with the intention to ensure students' active involvement and to also overcome the issue of lurking. Two tutors were available for the e-Learning Introduction course and four tutors for the 'iPhone Development' course. The duties of the tutors include monitoring and helping learners through the forums, raising community awareness of key concepts, asking common and critical questions, and making sure that the communication flows of the contributions. The tutors also moderate where required.

A rubric was created for each learning activity and students used the rubric to assess their peers. To students had to first of all complete their own assignment before assignments were randomly chosen for a blind peer-assessment process. The participation and the level of quality contributions of the peer-assessment were counted towards the course grading.

At the beginning of each MOOC, an adaption and introductory week was given to students to familiarize themselves to the learning environment and understand the overall course structure, concepts, expected performance and learning activities. The students were also required to set up their workspace at home and obtained the required tools. Every learning unit had a set of instructional objectives and learning activities, and students were expected to complete a set of assignments. All assignments had a summative value. The mastery of the units was determined by a successful completion of all the assignments and positive peer-assessment.

Previous experiences on offering online courses to a large scale of audience and the literature supported the idea of using a limited number of cloud-based tools for learning activities. To ensure the education objectives and interaction among students-to-students and tutors-to-students were met, only a set number of tools was allowed to complete the learning task. The selection of cloud-based tools was based on the digital classification of Bloom's taxonomy [1] which described a mapping from different thinking skills orders to digital tools. To this, we added the instructional and learning objectives with learning activities and the corresponding cloud-based learning tools. A summary of activities and tools and the application in the MOOCs are given in Table 2.

Instructional Objectives	**Activity and Cloud-based Tools**	**MOOCs**
Content acquisition	Videos and documents access by .LRN[1]	(a), (b)
Demonstrate an understanding of unit contents	Summarize in a word processor	(a), (b)
Structure for knowledge representation	Mind-map creation using Mindmeister[2]	(a)
Create their own LMS	Basic configuration at LMS instance at Milaulas[3]	(a)
Analyze, evaluate: organize, outline, structure the concepts of an LMS, the learning-teaching process, critically evaluate different types of LMS	First, create a mind-map using one mind mapping tool: Mindmeister, Cacoo[4] , Bubble.us[5] Second, create a presentation and publish using Slideshare[6]	(a)
Create, analyze: outline, design and produce online learning units using the guidelines provided for high quality e-learning courses.	Mind-map of student's first learning unit built using Cacoo and then create actual learning unit filling word processor templates. Learning activities designed and built with Educaplay[7]	(a)
Create, produce the online course based content templates, design and build a new introductory unit that includes a welcome video-message.	Using the LMS instance at Milaulas	(a)
Be familiar with objective C programming language and syntax and explore the initial Xcode templates that are provided for development. Learn how to create properties, classes, methods, objects and see how they work. Comprehend that the data source must respond to a specific set of messages. Recognize the importance to be able to define a set of behavior that is expected of an object in a given situation. Learn the framework to deal with location services.	Using iOS Software Development Kit (SDK[8]), XCode 4 Online OS X environment for development Macincloud[9] (for those who did not have a MAC to be able to develop) OS X Virtualization to run over Windows OS.	(b)

Table 2: Instructional activities and corresponding activities and tool

[1].LRN (www.dotlrn.org); [2]Mindmister (http://www.mindmeister.com); [3]Milaulas (http://www.milaulas.com);
[4]Cacoo (https://cacoo.com/); [5]Bubble.us (https://bubble.us); [6]Slideshare (http://www.slideshare.net);
[7]Educaplay (http://www.educaplay.com); [8]SDK (http://developer.apple.com/xcode/); [9]Macincloud (http://www.macincloud.com/)

3. MOOCs Environment and Learning Tool Support

Both MOOCs learning experiences had the LMS as a central access point although both MOOCs relied heavily on external tools and software. The LMS at Galileo University is an extension of the .LRN LMS [9]. New requirements have arisen to support a MOOC experience. One of the initial challenges was to have the correct hardware resources and the computational tuning to scale when usage peaks.

New and customized templates were required for the proposed structure of the MOOCs. This included the look and feel, content organization and user interfaces. Each MOOC had an entry page where the course outline was presented. Information about enrolment numbers and students' country of origin were also available on the same page. For promotional activities, each of the MOOCs had a Facebook page which contained information about the course and enrolment. Students were also able to log in from the Facebook page. Figure 1 shows an exemplar of the homepage of 'Introduction to E-learning' MOOC.

Figure 1. Homepage of the 'Introduction to E-Learning' MOOC

As mentioned previously, the xMOOC learning approach was designed with a limited number of tools per learning activity for both the cloud-based tools and standalone software. The development of the two MOOCs using various cloud-based and standalone tools are described as follows.

As a Mac computer and the OS X operating system is deemed to be expensive especially in developing countries, two alternative solutions were considered for the 'iPhone Development' MOOC. The first option was to enable a larger audience to access MOOC with an agreement with the service Macincloud, an online version of the OS X. This enabled users to fully use a real OS X installation over a browser in the cloud. This approach had some performance issues because of the network connectivity and high performance penalties of the cloud infrastructure provider running the virtual OS X instances. The second option was to run a virtual machine with OS X that was capable of running in Windows. Instructions on how to do this were provided to the students. Students with no background on virtual machines may find this option a challenge. For the 'Introduction to E-learning' MOOC, the cloud-based tools selected were not integrated in the .LRN LMS and the interfaces were not adapted, as such, the tools require their own login management.

The online forums tool called OSQA (www.osqa.net) was selected as a collaboration tool and this was based on reported experiences on computer supported collaborative learning [8] and the successful use of the tool at Udacity. This tool had proven technical scalability and was capable of administering to a large group. There was also a seamless integration between LMS and OSQA with the OSQA having the same look and feel as the LMS. Students were mostly unaware that different systems were used and the forums were presented natively in the LMS. Another vital component of OSQA was that it had a default facility for the gamification approach.

For assessment purposes, a rubric was created to support peer-assessment. Once the students have submitted their own assignments, the rubric tool will perform a random selection of one or more peers' assignment to start the process of a blind peer-assessment. After the assessment marking, students can access the peer assessment results. It is expected that the peer-assessment process will reinforce learning. The tutor can use a mean peer grading of the assignment and also moderate accordingly.

4. MOOC Experiences and Discussion

The planning of the MOOCs involved a promotion and enrolment phase of some 6 weeks. Following this, a week was set aside for orientation and familiarization with the tools. Basic demographics information about the students was also collected during this time. For those enrolled in the 'Introduction to e-Learning' course, more detailed information was collected. During the course, students accessed the MOOC content, interacted with their peers and tutors using collaborative forums and completed learning activities and assignments using different tools. Students also carried out peer assessment. Students who had successfully completed the MOOCs were asked to provide an evaluation of the MOOCs experience especially in the areas of MOOC usability, motivational and learning aspects and comments in general. In terms of the two MOOCs offered at Galileo University, the descriptive statistics for this are provide in Table 3. Some selected aspects and preliminary findings will be discussed in the remainder of this paper.

As shown in Table 3, as a first impression, the mean of final grades of students who had completed the courses was satisfactorily high (88% and 81% respectively). On the contrary, the dropout rates were also very high. The high dropout rates are consistent to those reported in the literature. There were more male students than female students, in particular the 'iPhone Development' MOOC had more male students enrolled in the course. However, it was not unexpected to have more male students in the 'iPhone Development' course.

The tutors commented that the students had completed all learning activities, accomplished the instructional objectives, and acquired the knowledge and skills covered in the MOOC. The students also provided the following positive comments, *'the course content was great, the teacher's explanations very clear. This course demands a lot of free time but definitely worth it',* '*I really enjoyed the learning experience, I think the content, activities and methodology used were appropriate'*. Despite this, there were also some negative comments such as *'*[I] *would have liked more feedback about my activities'* and *'The course should be more organized'*. *'The use of the forum was confusing, there were many posts and was difficult to follow'* and *'Feedback was not directly from the teacher'*. With the last comment, students may not be familiar with peer-assessment and did not see the value of receiving feedback from their peers. There were also comments in general such as *'I loved the course because I learned to use new tools'* and *'I liked that they provide a variety of resources, not just PDF'*.

By narrowing down to learning content aspects and tools support, the following analysis is provided. Following the xMOOC approach, both MOOCs relied heavily on videos for content acquisition. A student commented on the experience that – *'for me it was very practical to learn from video tutorials'* and another student stated that *'I really liked that the videos were not so extensive'*. On the negative side, *'I believe that the theoretical explanation on videos should be more interactive or add animations to be a bit more attractive'* and *'in some videos the audio quality was not very good'*.

	(a) Introduction to e-Learning	**(b) iPhone Development**
Registered participants	1680	5365
Participants completed pre/post-questionnaire	690/143	-/74
Age	M=39 (σ=11)	N/A
Gender	Female: 739 (43.99%) Male: 941 (56.01)%	Female: 621 (11.57%) Male: 4744 (88.42%)
Country	Guatemala (76.60 %) Spain (5.11 %) U.S (3.63 %) Honduras (3.09 %) Mexico (2.20 %) Other (9.04 %).	Guatemala (72.04%) Mexico (6.13%) Spain (5.44%) U.S (4.62%) Argentina (1.73%) Other (10.17%)
Students Participation: a) Did not start the course b) With at least one login c) Delivered the first task d) That finished and pass degree of the course	 728 (43.33%) 952 (56.66%) 363 (21.60%) 143 (8.50%)	 2383 (44.42%) 2982 (55.58%) 356 (6.63%) 185 (3.44%)
Final grades for pass degree students (over 100)	M=88.61 (σ=8.36)	M=81 (σ=18.74)
Forum activities	773 questions/3511 answers	564 questions/2401 answers
	273 people active in forums	183 people active in forums
Peer-assessment	5 learning activities for peer-assessment	6 assignments for peer-assessment
Video resources	46 Videos	97 Videos

Table 3. MOOCs implementation

The MOOC courses placed an emphasis on 'learning-by-doing' tasks by hands-on activities with real tools and cloud services to prepare their skills and knowledge for real life scenarios. For the 'Introduction to e-Learning', videos were used to provide an overview of the cloud-based tools that were new to students. A student commented that *'the video-tutorials are very helpful to learn how to use the tools'* while another indicated that *'the videos are very monotonous, [it] needed more written documentation'*.

As for the 'iPhone Development' MOOC, the videos were primarily technical in nature (see Figure 2). A student provided the following feedback regarding the videos, *'the videos were difficult to see, I would liked to use youtube and that were a downloadable version of the video.'* With peer-assessment for the 'iPhone Development' MOOC, a student found *'the evaluation of the activities was very subjective, depended on the commitment of the student [to be] assessed'*.

The purpose of cloud-based tools in the 'Introduction to e-Learning' was for the learning activities to align with the instructional objectives. This included conceptual demonstration, structured knowledge representation and completion of assignments. The additional benefit for students included how to learn to use a set of free tools that could be applied for their own online courses. The learning activities grades for the activities were: 1) M= 83.63, σ =15.89; 2) M= 97.25, σ= 9.56; 3) M= 88.79, σ =15.57; 4) M= 81.99, σ =18.27; 5) M= 92.62, σ =17.03. This demonstrated that students were not only able to use the tools, but they were also capable of meeting the instructional objectives. Some students clearly agreed with the selection of tools based on the following comments, *'I liked it because they are easy to use and free apps'* and *'The tools used are very interactive, easy to learn and use'* but had some concerns such as *'Not all tools are free, and many includes a lot of ads'*. With the questions about cloud-based tools, in a 5 point Likert scale from totally disagree to totally agree, the students indicated that with the MOOCs *'It was fun to doing the learning activities'* with the results being M=4.37 σ =0.99, and for the statement on *'I liked the idea of doing these learning activities to represent knowledge acquisition'* resulting in a M=4.67 σ =0.74.

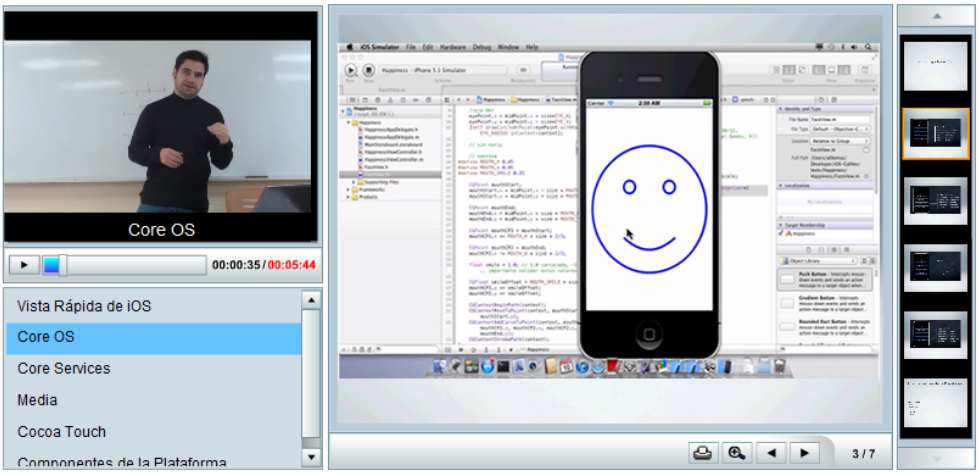

Figure 2. A MOOC class video of 'iPhone development'

As for the gamification experience with massive collaborative forums, the accumulation of badges gave a sense of competence, encouraging inputs; fostering interaction, and creating knowledge through social collaboration. For the 'Introduction to e-Learning' MOOC, the top 10 most active students had an average participation of M=24.7 for new questions and M=109.3 for answers, with a total of 31.95% for the overall questions and 31.13% for answers. For the 'iPhone Development' MOOC, the top 10 students had an average of M=9.9 for asking new questions, an average of M=52.8 for providing answers, making a total of 17.55% for questions and 21.99% for answers.

From the above, there seemed to be a high level of motivation although the number of questions and answers from the 'iPhone Development' students were notably fewer that the 'Introduction to e-Learning' group of students. The participation in the 'iPhone Development' MOOC was lower than in the 'Introduction to e-Learning' MOOC; however it is worth noting that the interaction in in 'iPhone Development' was more active.

After reviewing and analyzing the collaboration messages for the 'iPhone Development' MOOC, it was clear that the highly technical topics required more interactions to get the help and support required for students. As the level of attrition that occurred in the course was very high, the

students who were left were usually motivated and were keen to do well in the course. This positive attitude provided the students with a sense of 'community of practice' who appreciated and committed to work with one another.

There were also problems with learning in the MOOC, in particular where comments about the same items were repeated and discussed over many times. This is especially problematic where a student commented that, *'the use of the forum was confusing, there were many posts and was difficult to follow'*. This demonstrated a low level of individual capability to interact effectively in these massive forums. This is also an area of research focus on remix and filtering of feedback. Following interviews with some students, it was clear that students were overwhelmed with a large amount of postings, comments and questions. Moderating a large number of entries may also prove to be quite difficult for the tutors.

Focusing on the assessment aspects, there was a reasonable level of participation (M= 2.82 for 'Introduction to e-Learning' and M=2.96 for 'iPhone Development') on the number of times student performed peer assessments per assignment. An example of positive motivation related to peer assessment can be reported by a student who completed 17 peer-assessments for one assignment (for 'iPhone Development). It was also interesting to note that 49.65% of the completed 'Introduction to e-Learning' MOOC students reported that they already had some type of formal peer assessment experience. Using a 5 point Likert scale, from totally disagree to totally agree, the response for "For the peer assessment, did you find the system easy to use?" returned M=3.97 σ =1.06 for the statement. Some of the positive comments from participants about their peer assessment included, *'It is gratifying, also helps learn'* and *'It is very rewarding because it allows itself to assess the performance of a peer'*. On the negative side, participants emphasized that *'I am not convinced at all, is okay a review with a score by peers but the real score must come from the tutor'*, and *'The rubric is subjective, too few criteria for real objectivity'*.

5. Summary and Future Work

The MOOCs experiences presented in this work demonstrated two successful courses with a high enrolment rate, and also a high drop-out rate. We have identified that students were initially interested in the learning opportunity as the two innovative thematic courses for the region were also available online at no cost. While the free nature of the courses attracted a big number of enrolled students, however a majority of these students showed a lack of commitment.

The two MOOCs also identified areas for improvement especially with peer assessment processes and better management of online collaboration for dealing with scalability of large groups. Higher retention in MOOCs is another evolving research question. The cloud-based tools have shown great scalability in particular with the new and innovative features. However, interoperability, orchestration and analytics of the tools remain another research area for this educational setting.

Final Remark

The experiences highlighted above motivated Galileo University to create an institutional initiative called 'Telescope' (http://telescopio.galileo.edu) with the aim of sharing knowledge in the Spanish speaking region and to reach out to a largely unreached populations across several countries. As part of the corporate social responsibility, it is the aim of Galileo University to increase participation in science, technology, engineering and mathematics (STEM) by delivering additional MOOCs in the areas of physics, mathematics, software development and e-education. The Telescope initiative is expected to deliver around 10 MOOCs in 2013.

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