ABSTRACT
Massive Open Online Courses (MOOCs) are a recent but hugely popular phenomenon in the online learning world. Collaborative Learning is an old idea that is becoming part of many educational settings. This paper presents a new proposal named CSCM (Computer Supported Collaborative MOOCs), including collaboration aspects into MOOCs. Moreover, an extensive analysis of MOOCs platforms and learning theories is presented.

Categories and Subject Descriptors
D.2.11 [Software Architectures]: Domain-specific architectures and Patterns.

General Terms
Design, Human Factors, Theory.

Keywords
MOOCs, CSCL, uLearning, Gamification, TLA

1. INTRODUCTION
Massive Open Online Courses (MOOCs) are a recent but hugely popular phenomenon in the online learning world. They are hailed by many as a solution for the developing world’s lack of access to education because MOOCs can provide learning opportunities to a massive number of learners from anywhere in the world as long as they can access the course through Internet [1]. They can be seen as an extension of existing online learning approaches, but they also offer an opportunity to think afresh about new models of open online education.

This initiative has produced a great impact, considering it as the one of the biggest technological advances in 2012 [2]. Many works [3] mention the importance of MOOCs and associate their success to different factors, like accessibility, flexibility or becoming a worldwide phenomenon. However, there is a wide variance in the considered features and the quality of current MOOCs. For instance, Shelley Kinash [4] has proposed several features that commonly differentiate MOOCs from other mechanism of online education, shown in Table 1.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<tr>
<td>Stand-alone subjects</td>
<td>MOOCs are often untethered, or at least on a long lead, from universities. MOOCs are usually stand-alone subjects in which anyone from anywhere can enroll.</td>
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<tr>
<td>Social network component</td>
<td>A social network is an important component of MOOCs. The design of many MOOCs resembles Facebook in that students can friend, like and post to one another.</td>
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<tr>
<td>Real-time (synchronous) and anytime (asynchronous) learning activities</td>
<td>MOOCs often balance real-time (synchronous) and anytime (asynchronous) learning activities. For example, there will be times where the professor and students are online at the same time chatting through voice or text. Other activities are designed to allow the student to go online anytime it suits their personal schedule.</td>
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<tr>
<td>Self-pacing learning</td>
<td>There are often enough materials and exercises made available to the students from the time they enter the MOOC that they are able to self-pace their learning. They are usually not tied to the traditional university semesters. Enrolment and completion is often staggered or completely unscheduled. Taking as much or as little time as they need, students earn their certificates/credit when they have completed enough modules or earn enough badges to qualify for completion.</td>
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<tr>
<td>Timed release design</td>
<td>While sufficient materials are provided for self-pacing, MOOCs often also use a timed release design. Educators avoid overwhelming students with excessive content by pre-setting release dates so that the curriculum is revealed over time.</td>
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Adaptive learning Many MOOCs apply the concept of adaptive learning. The difficulty and challenge of content and exercises adjusts to the student’s level. For example, if a pattern is emerging in that a student is repeatedly erring on certain content areas or fundamental skills; the system will automatically provide remedial instruction and test building block concepts.

Latest technology-enabled design feature Adaptive learning is a technology-enabled design feature. Many MOOCs take advantage of the latest technologies that enable or enhance learning.

eAssessment – peer eAssessment Rather than requesting that students’ mail-in assignments, most MOOCs are designed to use eAssessment. Students complete their assessment activities online and/or submit online, and some are computer-scored.

Multimedia and Game-based learning Much of the content of MOOCs is multimedia. MOOCs are often rich in video and some use game-based learning. For example, Udacity has teamed up with Google, NVIDIA, Microsoft, Autodesk, Cadence and Wolfram to develop new courses, including HTML5 game development and mobile applications development.

Segmented content in short units Content is usually segmented into short units. For example, there are series of five- to 10-minute instructional videos interspersed with learning activities and assessment.

Nevertheless, recently a study [5] of a million users of MOOCs, released by the University of Pennsylvania Graduate School of Education found that, on average, only about half of those who registered for a course ever viewed a lecture, and only about 4 percent completed the courses. The same chronicle cites the sentence - It’s like, “The MOOC is dead, long live the MOOC” - by Jonathan Rees, a Colorado State University-Pueblo professor who has expressed fears that the online courses would displace professors and be an excuse for cuts in funding.

Similarly, surveys conducted by researchers at Duke University show that fun and enjoyment were selected as important reasons for enrolling in a MOOC (95%) [6]. However, at the end, most students reported that they have a general interest in the topic (87%). Further research will be needed in order to understand learner motivations at the outset, and also what maintains learner motivation during a MOOC course.

“At the beginning everybody talked about MOOCs being entirely online, but now we’re seeing lots of things that fall in the middle, and even I see the appeal of that.” So, the big question is what happens with MOOCs? What are the real problems? How can be re-organized in order to accomplish the big deal what they were designed? These kinds of questions have been the starting point to analyze how collaborative elements could be integrated into MOOCs in order to obtain a better goal. The interfaces through which MOOCs are delivered do not currently enable students to log in and interact in a synchronous manner, collaborating or visualizing their progress. The main problem with these MOOCs is their inability to permit students to collaborate through a student-centered interface.

Collaborative Learning is an old idea that is becoming part of many educational settings. According to proponents of collaborative learning, the fact that students are actively exchanging, debating and negotiating ideas within their peers increases students’ interest in learning. And even more relevant, by engaging in discussion and taking responsibility for their learning, students are encouraged to become critical thinkers [7].

Many researchers have reported that students working in small groups tend to learn more of what is being taught. Moreover, they retain the information longer and also appear more satisfied with their classes [8]. In that way our proposal named CSMC (Computer Supported Collaborative MOOCs) tries to include collaboration aspects into MOOCs. Computer-supported collaborative learning (CSCL) is an emerging branch of the learning sciences concerned with studying how people can learn together with the help of computers. This simple statement conceals considerable complexity. The interplay of learning with technology turns out to be quite intricate. The inclusion of collaboration, computer mediation and distance education has problematized the very notion of learning and called into question prevailing assumptions about how to study it [20].

Next section describes the related work and it is followed by a section where our proposed model is described. The paper ends with the conclusions and future work.

2. RELATED WORK

Different ideologies have driven MOOCs in two distinct pedagogical directions: the connectivist MOOCs (cMOOC) which are based on a connectivism theory of learning with networks developed informally; and content-based MOOCs (xMOOCs), which follow a more behaviorist approach. In many ways, this is the same learning process versus learning content debate that educationalists have had for many decades and failed to resolve. cMOOCs emphasize connected, collaborative learning and the courses are built around a group of like-minded ‘individuals’ who are relatively free from institutional constraints. cMOOCs provide a platform to explore new pedagogies beyond traditional classroom settings and, as such, tend to exist on the radical fringe of HE. On the other hand, the instructional model (xMOOCs) is essentially an extension of the pedagogical models practiced within the institutions themselves, which is arguably dominated by the “drill and grill” instructional methods with video presentations, short quizzes and testing [9].

xMOOCs have been criticized for adopting a knowledge transmission model; in essence, they are considered to be technology-enriched traditional Teacher-Centred instruction [10]. Such systems offer an individualized experience in that they allow students to take alternative routes through material and offer automated feedback. However, they do not provide a social learning experience or one of being dealt with personally. Coursera leaves the design of the courses up to the individual
institutions within broad guidelines. However, it is likely that few institutions have enough staff with significant working knowledge of online pedagogy involved in the development of these courses.

By contrast, cMOOCs provide great opportunities for non-traditional forms of teaching approaches and learner-centred pedagogy where students learn from one another. Online communities 'crowd-source' answers to problems, creating networks that distribute learning in ways that seldom occur in traditional classrooms in universities. For example, institutions, like MIT and Edinburgh University are using MOOCs as an experimental venture to participate in emerging pedagogical models, exploiting peer support and using peer assessment techniques.

Some of the most popular platforms are:

- edX (https://www.edX.org/)
- Coursera (https://www.coursera.org/)
- Udacity (https://www.udacity.com/)
- Udemy (https://www.udemy.com/)
- P2Pu (https://p2pu.org/en/)
- Khan Academy (https://www.khanacademy.org/)
- Coursebuilder (https://code.google.com/p/coursebuilder/wiki/ListOfCourses)
- SlideWiki (http://slidewiki.org)
- UniMooc (http://iei.ua.es/mooc-emprendimiento/)
- RedUnX (http://www.colmenia.org/)

We know our students must be prepared to solve problems in a cross/trans/multidisciplinary world. Our courses should benefit from and model this reality. In that way there are some initiatives trying to include collaborative aspects into MOOCs. In that way and considering the problem mentioned in the previous section, a group of teachers developed a model of open online course to challenge the MOOC model. They're calling it the distributed open collaborative course (DOCC).

Instead of setting up a course with full lesson plans, lectures, and assignments like a MOOC, the prototype DOCC provides instructors with a videotaped discussion on a theme and encourages participants to share the assignments and other course materials amongst themselves. In other words, the basic pieces are given with the DOCC, but each is heavily customized by the instructor to match conditions in his or her classroom. This seems like a model that could be more attractive to faculty. It gives them a "primary source" and a theme, but encourages them to build a course around them that they think will be the best for their students [11].

NovoEd is a MOOC provider created by a professor at Stanford University. The platform, originally named Venture Lab, was launched by Management Science and Engineering Professor, Amin Saberi and PhD Student, Farnaz Ronaghi. This new platform intends to encourage more collaborative work in small groups, which sets it apart from current MOOC platforms [12].

The main problem with these initiatives is they do not guarantee a real collaboration. Just putting a group of people around a task does not imply people collaborate; it is necessary to structure activities convey people need to participate and collaborate [13]. So, it is important to consider what elements are necessary to be included with the goal to provide mechanisms how to collaborate and communicate effectively in an online environment Collaborative learning and communication is needed and an essential dimension within MOOCs due it allows students to learn needed skills, including how to collaborate and communicate effectively in an online environment, and, it creates a framework for constructing and/or sharing knowledge in a given subject area that may lead to deeper and more meaning learning [14]. MOOCS could be spaces which can decenter the role of the teacher, leading to collaborative interactions among students, allowing them with more power, responsibility and accountability for their learning. The model we propose includes these kinds of elements.

3. PROPOSED MODEL

The main goal of our proposal is the integration among collaborative and ubiquitous aspects, including the next 7 main elements, also shown in Fig. 1:

- Teachers
- Collaborative Environment
- Study Resources (contents, collaborative activities)
- Learning Objects Repository
- Technological Platform (Learning Management Systems, Learning Virtual Environments)
- Access Services
- Students

![Figure 1. Computer Supported Collaborative MOOCs (CSCM) Model](image-url)

Fig. 1 depicts the proposed model. The pedagogical part includes a conceptual model based on the user profile, including constructivist aspects in order to promote an active participation of the students in the teaching-learning process, and so try to evoke skills like collaboration, communication and work group.
In the proposed model, Teachers (I) will be the people in charge of the generation and construction of contents and activities (III) using a collaborative environment (II). This implies the building of these contents will be done in a collaborative manner; while the traditional model there is a teacher who organizes learning experiences, who are supposed to acquire and (slightly) adapt an elaborated set of educational methods and content, in our proposal this content building is done through the collaboration of peers working on a boundary object.

While the traditional model is linear, our Model has a spiral structure where cycles of exploration, learning and creation of new knowledge are iterated on higher levels. In the framework of contents building teachers can iterate and participate with school practice, colleagues and researchers/trainers who may alter shared knowledge objects profoundly if educational practice requires different approaches. As a mechanism supporting contents building a framework including a guide and computational software is developed. This framework tries to guide the teachers into the development for collaborative Learning activities; defining which task is necessary to do in order to foster a real collaboration among participants. The contents will be designed incorporating gamification techniques [15], which typically involve applying game design thinking to non-game applications to make them more fun and engaging [16].

As some authors [17] have mentioned, students’ motivation is a compulsory aspect on the MOOCs; noting that the great part of students who register for MOOC courses never finish them, why do this happen? Maybe, the answer is too simple, and MOOCs need to be more interactive and engaging learning sites. So, gamification of MOOCs could be an important issue to consider. If students engage in meaningful play, perform roles, complete task and even score points, a friendly sense of competition can be added to these MOOCs.

In the activities (III), the model includes a mechanism where collaborative learning activities are designed in a way students (VII) work in a collaborative way to reach to solve a task. While the traditional MOOCs the evaluation phase is done as a traditional manner (individual evaluation), our proposal includes collaborative evaluation techniques. In order to include contents and activities (III) it is mandatory define and adapt learning objects repositories and metadata to describe and represent these new “Learning objects” defined in a collaborative manner. (IV).

In the technological platform (V) the model includes a knowledge management multiplatform incorporating mobile Learning, multimedia and videogames components supporting services of e-t-Training, e-Performance, e-learning and t-learning (VI). In that way our model will be multiplatform giving the option to use different kind of devices, allowing participants access information in a ubiquitous way. This information will be displayed in a way could be easily accessed, retrieved, usable.

In (V) and (VI) we will use TLA (Training and Learning Architecture) [18].TLA is the name of the next generation of SCORM [19] proposed by ADL taking as starting point the work of done in the Tin Can project. TLA is a holistic solution for the LO interoperability which comprises: Experience Tracking, for tracking any learning experience; Content Brokering, for describing, discovering and delivering content; Learner Profiles, for user profiling; and Competency Networks, for objectives and competencies definition. Each component is envisioned to be a collection of one or more standardized Web service definitions and associated open source software that implements the Web services.

![Figure 2. The components of the Training and Learning Architecture (TLA)](image)

Finally, it is necessary to define an evaluation strategy in order to measure the learning level acquired during the collaborative activity. Understanding and analyzing the collaborative learning process requires a fine-grained sequential analysis of the group interaction in the context of learning goals Dillenbourg et al. claim that during many years, theories of collaborative learning have been focused on how individuals work in group, and recently, they have focused on the group by itself, trying to establish when and under what circumstances collaborative learning is more effective than individual learning [8]. In this context, some independent variables have been identified and widely studied: the size and composition of the group, the nature and the objectives of the task, the media and communication channels, the interaction between peers, the reward system and sex differences, among others [18]. Recent research, however, is giving emphasis to the study of collaboration processes and their support [4,5].

4. CONCLUSIONS AND FURTHER WORK

In this paper a new proposal named CSCM (Computer Supported Collaborative MOOCs) including collaborative and ubiquitous elements: such as: (I) Teachers, (II) Collaborative Environment, (III) Study Resources (contents, collaborative activities), (IV) Learning Objects Repository, (V) Technological Platform (Learning Management Systems, Learning Virtual Environments), (VI) Access Services and (VII) Students. Moreover, a pedagogical conceptual model based on the user profile is presented to promote, through collaboration, communication and work group, an active participation of the students in the teaching-learning process. Also, our proposal includes collaboration aspects for the contents, activities and evaluation. Other important aspect including in the CSCM proposal are gamification techniques, to improve the students’ motivation.

CSCM Technological platform supports services of e-t-Training, e-Performance, e-learning, m-learning and t-learning, and it is based on a holistic solution for LO interoperability: TLA.
(Training and Learning Architecture), the next generation of SCORM.

Nowadays, we are working in the validation of CSMC proposal design and in the definition of an evaluation strategy in order to measure the learning level acquired during the collaborative activity.

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6. REFERENCES