

iMOOC Platform: Adaptive MOOCs

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Abstract. Massive Open Online Courses or MOOCs presents low completion rates, they are massive thus the participants' profile is too much heterogeneous regarding origin, capacitation, motivation and learning aims. The number of studies that propose using adaptive techniques to resolve the problems above is increasing. This work presents the logistic, methodological and technological models of an adaptivity-based framework. This framework includes the basic elements of adaptive learning using a learning management system as core technology and expanding the adaptive possibilities in the logistics of the courses. The proposed model is implemented in an adaptive platform so called iMOOC that currently has a campus composed by four adaptive MOOCs. Also, a study about the participants' perception of usefulness and their needs for the adaptive processes is presented.

Keywords: Adaptive learning · Massive open online course · Online learning · Learning management system

1 Introduction

MOOC (Massive Open Online Course) means the last social advance in open education. Millions of users around the world make this type of courses offered by teachers of the most prestigious universities. The number of MOOCs continues growing and also the people who join them. Along with this growth, debates and studies have arisen including social issues (change of the university model), economic issues (new revenue for universities), technological issues (MOOC specific online platforms) and methodological issues (new pedagogical models).

Along with the reviews about the history and the specific characteristics of MOOCs (mass use, heterogeneity and multi-profiles/preferences/learning objectives) [1–4] there are future recommendations to improve the low completion rates [5] and the learning outcomes, including the application of adaptive learning techniques among their strategies [6–8]. Daniel et al. say [9] “A possible, but still undeveloped, solution that will probably be available in the near future is to implement adaptive learning techniques to

make MOOC courses more personalized”, also point some of adaptivity “Agents analyzing the learner’s profile could customize a course as follows: adjusting course content according to the participants’ pre-requisites or educational background; changing course content according to the participant’s location or country of origin, for example language, units of measure, currency symbol, seasons, etc.; and showing relevant case studies or further readings according to the country or region of origin/interest”, and about the required collaboration among the involved agents “There is a need to develop sophisticated adaptive learning mechanisms that will require the establishment of MOOC working partnerships between educators, instructional designers, and programmers”.

In this sense, the hypermedia systems, which were initially developed several years ago [10–12], jointly with other technologies that are starting to be used in the MOOC deployment in order to follow the users’ behavior in this kind of courses, such as semantic web [13] and learning analytics [14, 15]. This way recommendations to the participants may be done [16] or detecting possible dropouts, for example through the participation in the for a [17].

There exist several frameworks that allow the inclusion of adaptive techniques in MOOCs. Sonwalkar [19] proposes, using web services and a computer architecture, an Adaptive Learning Systems (ALS) that adapts itself to five learning styles throughout diagnostic assessments about the participants’ preferences and goals. Onah & Sinclair [19] use recommendation systems “The framework supports users in creating their own paths, allowing them to make informed choices about appropriate resources based on their expression of current objectives and preferences”. This framework focuses on capturing the users’ knowledge using concept-based quizzes. Teixeira [20] adds to his MOOC pedagogical model, so called iMOOC, the content adaptation taking into account the participants’ prior knowledge and the device they use to access the course.

In this paper an adaptive framework is proposed. It has been tested in the intelligent MOOC (i-MOOC) platform [21–24]. Most of MOOCs are xMOOC type, that means they are based on similar models of the traditional Learning Management Systems (LMS). This kind of MOOCs forces students to adapt themselves both learning strategy and resources. Also, some of these MOOCs incorporate cooperative learning tools, usually Web 2.0 tools and social networks. i-MOOC platform improves this classical model combining the best elements of xMOOCs and cMOOCs types with adaptive capabilities in the same online system [25–28].

This paper covers three of the four aspects mentioned above: logistic, methodology and technology (apart from the economics models MOOCs). A specific experience with the proposed framework has been developed, including characteristics of the related frameworks cited, but adding more capabilities regarding the logistic part and simplifying the technology used.

The main goals of this paper are:

- Describing a logistic, methodological and technological proposal based on a platform that allows for adaptive MOOCs.
- Identifying the adaptive processes that can be associated to a MOOC.
- Measuring the perception of the participants in a MOOC about the adaptive characteristics thereof.

The rest of paper is organized as follow. Section 2 presents the proposed model to integrate adaptive MOOCs (aMOOC). Section 3 introduces the experience done. Section 4 presents the results, including the participants' characteristics and their perception about the adaptive activities that a MOOC should incorporate. Finally, the conclusion section closes the paper with the discussion of the experience and the obtained results.

2 An Adaptive Model for MOOCs

The proposed model is based on the authors' framework [28] that has been tested with a real case its effectiveness to reduce the MOOC dropout ratio [5] and to improve the users' satisfaction. This framework is based on a learning ecosystem [23, 29–32] composed by a Learning Management System (LMS) plus several own services for adaptivity and learning analytics and web 2.0 tools for knowledge management and gamification [33].

This work is focused on the applied adaptive methodology and the support learning ecosystem. In the following subsections the adaptive characteristics of the proposed model regarding logistic, methodology and technology are presented.

2.1 Logistic Model

The i-MOOC platform [21] is used. It has been developed throughout a collaboration agreement between Tech University of Madrid and University of Zaragoza in 2013. In 2015 the University of Salamanca joined to this agreement.

Figure 1 shows the logistic model that is proposed in this work. The platform may be composed by “n” virtual campuses, and each virtual campus includes by a set of aMOOCs.

The adaptive characteristics are:

- Against a classic MOOC, with fixed starting and ending dates and specific week timetable (all is oriented to users adapt themselves to the MOOC), this proposal has a wide period of learning that supports different schedules and plans. During this period the enrolment process is open and every participant decides, from an individual point view, the number of aMOOCs that wants to do, also the intensity and the working schedule.
- Virtual campus definition, each one composed by aMOOCs sharing a common topic or knowledge field. Each specific aMOOC is independent from the others, but it can be joined with other aMOOCs in order to create a greater pedagogical unit and optimize common resources. The interconnection is based on sharing resources, activities and itineraries (learning paths).
- The training from other aMOOCs is recognized. Common parts to other made aMOOCs are identified, this way the shared part is validated. For example, if in the “A” aMOOC a student develops an activity to acquire a specific skill, this student will not to do the activities related to the same skill in the same virtual campus.

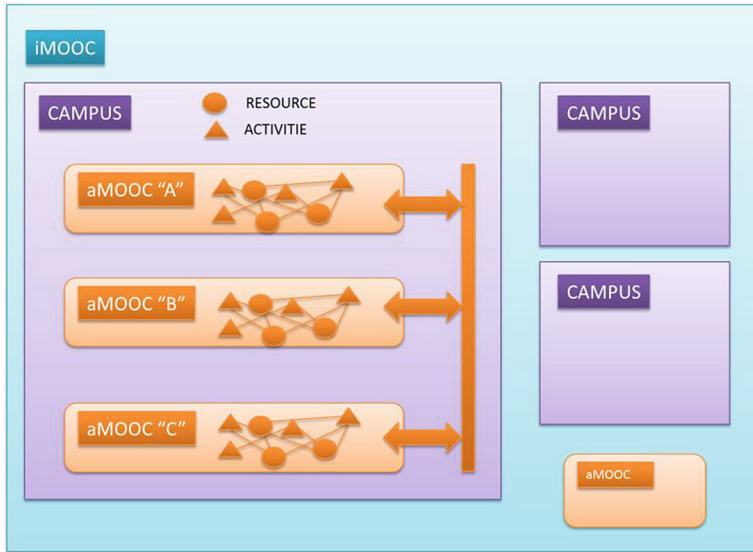


Fig. 1. Logistic model

2.2 Methodological Model

The experience gathered by the authors in previous works about adaptive learning in online environments [34–36] is used. The research conducted previously has led to discover basic needs deficiencies that teachers find in their day to day and require contributions by teachers adapted to each student. In previous experiences the following “adaptive pills” merged to satisfy different needs of adaptivity [37]:

- P₁. Self-assessment training.
- P₂. Adapted advance to the student’s learning speed.
- P₃. Adaptation of learning to different profiles/skills/interests.
- P₄. Contributing and sharing resources among a set of users with a common interest/profile.
- P₅. Adapted learning to the acquired knowledge (the results of the activities to be carried on).
- P₆. Monitoring student’s progress.

The combination of these “adaptive pills” are included in the aMOOCs, allowing to create different learning pathways and other actions that personalize learning.

2.3 Technological Model

For this experience no technological development is needed, because of Moodle [38] LMS is used. Moodle has more personalization capabilities than other platforms such as edX regarding educative tools, analysis and SCORM compliance. Also, Moodle is friendly enough for both instructional designers and students, due to it eliminates some barriers for creating MOOCs in some specialized platforms. On the other hand, Moodle

fulfill the accessibility standards, has mobile access and the allowed resources may be youtube videos and accessible formats (html, pdf, etc.), which permit the users' access from a huge number of devices. The platform has been tested with a very large number of students [39].

The large and active developer Moodle community ensures improved versions (continually updated) including increasingly useful tools. Also external plugins complement the basic installation. All this makes it possible to carry out the methodological requirements, putting technology at the service of the methodology. Some tools provided by Moodle are described below, which provide solutions, respectively, to the needs of adaptivity (adaptive pills P_i) listed above:

- S_1 (P_1) Quizzes with feedback and hints.
- S_2 (P_2) Activity completion and Restrict access options.
- S_3 (P_3) Groups and groupings. Group Choice plugin.
- S_4 (P_4) Forums (grouping mode).
- S_5 (P_5) Activity completion and Restrict access options. Lesson.
- S_6 (P_6) Table of Activity completion.

3 Research Context

The proposed framework has been implemented in the i-MOOC platform [21] through the "Educational innovation MOOC campus" composed by four aMOOCs. The first edition of this campus was opened during four months (from November 23rd, 2015 to February 28th, 2016). The available aMOOCs in this first edition were:

- aMOOC Practical fundamentals of educational innovation (15 h) [40].
- aMOOC Flip Teaching (20 h) [41].
- aMOOC Learning communities (15 h) [42].
- aMOOC Teamwork competence development (30 h) [43].

The used LMS, Moodle 2.8, includes, as elements for adaptivity facilitators, access restrictions, finalization conditions, groups and groupings, as well as several plugins to choose the group and to generate certificates, for example. These tools have been used to make visible the resources done by the students in previous activities (several resources at the same time or in sequence), to share the works done by the participants with their peers with the same profile (same interest, same educational level), to offer different resources depending on the participants' preferences or previous knowledge, to offer different learning paths depending on participants' profile (for example, in the aMOOC of teamwork competence the chosen profiles are teacher, student and researcher) and to follow the participant progress.

The evaluation has been made using quizzes and Q&A fora in Moodle with automatic feedback and faculty feedback. According to the framework proposed in [28], fora have been used to promote discussion between participants and with the faculty, also throughout the fora participants may upload new resources. Besides, Google+ "Innovación Educativa Aplicada" social net has been used to share resources and information.

The results of an initial survey to detect participants' profiles and their preferences with respect to certain adaptive actions to be implemented in a MOOC are presented in the following section.

4 Results of Implementation

At the date of 19.02.2016 the Educational Innovation MOOC Campus had 870 enrolled people (the campus closes at the date of 28.02.2016); 519 of them had fulfilled the initial survey about the participants' characteristics and their perception about the possible adaptativity options in future aMOOCs.

Regarding the countries of origin, slightly more than half of the participants are Spanish; the rest are distributed in 27 Spanish-speaking countries (official language of the course). The top ten countries are: Spain (53.86 %), Mexico (10.62 %), Argentina (6.18 %), Peru (5.41 %), Colombia (5.02 %), Venezuela (4.25 %), Ecuador (3.67 %), Brazil (1.74 %), Dominican Republic (1.35 %) and Bolivia (1.16 %).

With respect to gender, 53.95 % are women. Tables 1, 2 and 3 show the obtained data about participants' professional profile, educational innovation previous experience and motivation for enrolling in the MOOC Campus.

Table 1. Professional profile

Self-employed	5.59
K12 teacher	10.02
Secondary teacher (13–18 years)	24.08
Vocational education teacher	10.79
University teacher	22.54
Employee (non teacher)	5.97
Student (non university)	0
University student (education area)	6.55
University student (non education area)	1.93
Other	12.52

Table 2. Educational innovation previous experience

I have not previous experience	21.00
I only have seen information in Internet	30.25
I have applied or apply educational innovation	38.34
I have occupied or occupy a position related to educational innovation	10.40

The questions about participants' preferences regarding adaptivity characteristics that they will like to find in the aMOOCs, using a Likert scale 1–4, (1- Completely disagree; 2- Somewhat agree; 3- Sufficient agree; and 4- Strongly agree) are gathered in Table 4.

Table 3. Motivation for enrolling in the MOOC Campus

Expanding my education in general	53.37
Knowing what the educational innovation is, but for now I will not apply	12.72
Starting to apply educational innovation	35.65
Having a new vision of educational innovation	44.12
Researching in educational innovation	46.63
Knowing how the course is organized and/or accessing to the materials	19.27

Table 4. Perception about adaptivity aspects

	1	2	3	4
F ₁ - Proposing of different activities depending on my choice or the results of my evaluation	0.58	4.43	47.98	47.01
F ₂ - Accessing the contents/activities following my learning speed of work, without a specific timetable to do that	0.58	5.78	27.55	66.09
F ₃ - Choosing between different difficulty levels in the contents/activities to reach different learning objectives	0.39	5.59	41.62	52.41
F ₄ - Organizing interest groups by the same area or the same experience level to discuss in specific fora	0.77	13.68	43.93	41.62
F ₅ - Choosing different evaluation methods (self-evaluation, peer review, etc.)	0.96	7.90	45.47	45.66
F ₆ - Organizing peer evaluation also by interest groups/same area/same level of experience	2.31	10.02	47.98	39.69

5 Discussion

The proposed framework includes the adaptive elements that Sonwalkar [18] establishes the ALS should have, including adaptive logistic in the way to set up the MOOC campuses with the aMOOCs and simplified technology to develop the adaptive learning in each aMOOC, which mean a significant advance in comparison with the above mentioned proposals [18–20]. The proposed model has been implemented in the “Educational Innovation MOOC Campus”.

It has been confirmed the heterogeneity of the participants in this experience based on variables: country of residence (27 different), gender (just over half of women), professional profile (teachers, students, freelancers and other professions), previous experience in educational innovation and motivation for the course [28].

Campus participants have given a high valorization to the adaptive processes, with a value greater that 86 % (including 3- Sufficient agree; and 4- Strongly agree answers). The perception of usefulness of the logistic proposal in the adaptivity has been confirmed, with a special focus on the bigger period to make the course and the methodology of each aMOOC, where the navigation adaptation of the contents according their own learning speed received a 93.64 % of valorization. Regard to learning processes

embedded in aMOOCs, 94.03 % indicates that they would like to choose between different levels of difficulty and different learning objectives. It also indicates that it is advantageous to use the adaptivity so that they can form homogeneous groups for the development of the same activity or to discuss between them (85.55 %). However, there is a 2.31 % that is not agree that peer review is conducted by homogeneous groups. We should discern whether this rejection is not specifically directed to the activity of peer review that does not please itself to all participants. All this supports the general recommendations applying adaptability in MOOCs [6–9].

6 Conclusions

As a general conclusion, it has been shown that the logistic, methodological and technological model offers new options to the previous frameworks; it may be implemented in a particular product and the campus users of this experience accept adaptivity on eLearning platforms, in MOOCs and in cooperative activities.

Future work is devoted to process the final data about participation in the campus, as well as the final satisfaction surveys that validate the model. These actions will make possible improvements such as:

- Creating new learning pathways within each aMOOC, which fit the profiles of the participants and the course subject (because of they are related).
- Improving the automatic feedback to perform activities.
- Sending recommendations for other aMOOCs depending on the results of certain activities.
- Generating different certificates for different purposes within the same aMOOC and campus certificates.

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