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An adaptive hybrid MOOC model: Disrupting the MOOC concept in higher education

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Abstract In the 18th century, the educational model underwent a disruptive change driven by the transition from an agricultural to an industrial society. In the 21st century, the change from the industrial society to a knowledge society has been consolidated, but it has not involved a disruption in the learning context. Some elements, many based on technologies, can be considered disruptive, but they have not had sufficient effect to produce a change in the model that has predominated for 300 years. In 2008, teachers began to offer training outside the walls of the university, with a totally disruptive and chaotic model compared to the traditional one; this was supported by open, informal, cooperative, connectivist, autonomous and self-guided training. Massive open online courses (MOOCs) began with cMOOCs, and most universities join the initiative, but they abandoned this disruption, ultimately offering the same courses they always had with free access for anyone, resulting in the second generation of MOOCs (xMOOCs). These MOOCs responded to a new social demand, but their characteristics and context make a formative disruption – which has not yet emerged – necessary. This paper analyses the elements of the two generations of MOOCs and proposes a new model that does not require sophisticated technological solutions. It also presents a case study that integrates the social advantages of cMOOCs, the organisational benefits of xMOOCs and the personalisation of the learning, which is essential due to the heterogeneity of the participants. The results and the participant viewpoints emerging from the case study confirm the feasibility of the model, the improvement of the results of current MOOCs and the need – demanded by the participants – to consider diversity, all of which should be accomplished in a disruptive way.

Keywords. Massive open online course, informal learning, non-formal learning, personalized learning, adaptive system.

1. INTRODUCTION

In 2008, George Siemens and Stephen Downes (University of Manitoba, Canada) conducted an online course titled 'Connectivism and Connective Knowledge' (CCK08), in which 2300 students were enrolled. This was the origin of massive open online courses (MOOCs) (Downes, 2008; Siemens, 2012). The original MOOCs were totally disruptive, not only because of the number of enrolled students but also due to the pedagogical approach employed. The characteristics of these courses, which are totally opposed to those that dominated (and still dominate) in the university context of online courses, are as follows:

- Autonomous informal learning regulated by the participant;
- Distributed knowledge and learning from the process of exploration and analysis of knowledge and its connections; and
- Participants generate, share, interpret and combine knowledge. These actions are part of the same learning.

In 2011, the term MOOC had great social influence, and the media reflected the success of this type of course. At the same time, the number of courses grew, as well as the funding allocated to the creation of courses and platforms (with the participation of universities) specialized in the management, support and offering of MOOCs. The crucial factor in the great impact of MOOCs was the number of enrolled learners, for some courses representing hundreds of thousands of people. This contributed to increasing the popularity and influence of the courses, which in turn increased the number of students enrolled.

At the same time, the rise of MOOCs has come with a heavy price, namely the loss of the disruptive factor. What, in origin, was a totally disruptive change in the context of online courses of university training was reduced to a name (MOOC) and the characteristic of massification that it involves. Currently, most MOOCs are not disruptive: Their methodological structure is virtually identical to the usual courses of the university (face-to-face and distance), the course organization is content-oriented (students adapt to the content selected by the faculty) and technology platforms are a (reduced) version of the learning management systems (LMSs) used in universities (García-Peñalvo and Seoane-Pardo, 2015; Gros and García-Peñalvo, 2016).

The first MOOCs, which were actually disruptive, are called cMOOCs (or first-generation MOOC) and current MOOCs are called xMOOCs (or second-generation MOOCs). Although numerous types of MOOC have emerged in the literature, some of which have included the limits of absurdity (renaming classic non-open or non-massive online courses simply because videos were used), these are the two types of MOOCs that have shaped the history of these courses (Clark, 2013)

The university community, which is mainly institutional and social, consider the second generation of MOOCs a success; thus, the number of universities offering them is increasing. These xMOOCs have come to be perceived as an indicator of universities' educational technology and even as one of the disruptive factors that will change

universities' economic, organizational and consolidation models. This view contrasts with that of many detractors, mainly university instructors, who see MOOCs as a short-term marketing action that will be discarded when the MOOCs cease to be successful. These critics maintain that from a pedagogical point of view, MOOCs are a failure and even as they are conceived, they continue because people to ask for certificates of all types for their participation, even if university academic recognition is not obtained. In this respect, MOOCs are like the two sides of a coin, with one face representing arguments for their success, and the other providing evidence to the contrary. Evidently, the defenders see one face of the coin, while the detractors see the other.

The defenders' arguments are mainly as follows:

- *Strategic impact for universities*. Enhanced brand image, dissemination of the training offer, projection of identity signals;
- *Economic impact.* Additional income from issued accreditations (García-Peñalvo et al., 2017).
- *Institutional support.* Measures aimed at motivating teachers to promote the creation of MOOCs; and
- *Social impact.* Strong acceptance of this initiative by society.

The detractors' main arguments are based on the following:

- *Academic impact.* Little or no impact on formal university education;
- *High dropout rate.* The completion rate of between 5% and 10% is considered a failure; and
- *Low validity of accreditation.* It is difficult to ensure that the person to whom the accreditation is given is the person who has performed the tests.

Based on the arguments of the defenders, it is predicted that the MOOCs will remove the less competitive universities in the higher education or force them to engage in internal restructuring along with alliance policies. The number of MOOCs in universities is growing continuously; this is taken as an indicator of the good health enjoyed by MOOCs, and it is one of the main factors highlighted by those who support this initiative.

Detractors, in contract, predict the disappearance of MOOCs once they no longer attract media and social interest due to their ineffectiveness. The number of subscribers per MOOC is decreasing. In addition, MOOCs are evolving and losing their identity, and small private online courses (SPOCs), which are paid courses accepting a small number of users, are emerging. Moreover, corporate online open courses (COOC) have addressed the heterogeneity of MOOCs by focusing on the homogeneity of corporations. These elements are taken as indicators that MOOCs will inevitably disappear (Pilli and Admiraal, 2016).

Regardless of the views of advocates and detractors, cMOOCs – which are truly disruptive MOOCs – are clearly difficult to manage, organise and have students, while it is hard to grant certification for them (based on informal learning). However, it is also

clear that the current MOOCs are not disruptive, since they are no more than an extension of the current model of online courses in the university to a new context; thus, they miss the opportunity for change and formative evolution.

This work intends to introduce the realization of a new model of MOOCs that creates a balance between cMOOCs and xMOOCs, incorporating the disruptive elements of the former and the ease of management of the latter. A new model must be designed to adapt to the new context that has emerged from the MOOC initiative (mass courses), but this must also be able to deal with the social, technological and learning changes occurring outside the university.

The technology used in the development of MOOCs must be changed; it currently has the peculiarity of supporting large volumes of access data but using almost identical processes (although more limited) to those involved in LMS technology (designed for academic training). Therefore, the technology is based on non-formal training and the organization of the content is similar to that of a formal training course (academic training). Finally, the methodology and organization are currently identical to the organization of formal training of the content, and thus, they must also be changed.

It is necessary to design specific technological frameworks for the MOOC context to take advantage of the massification, diversity, and multiculturalism they present; generate new pedagogical approaches; and use the new forms of learning derived from Web 2.0. Likewise, it should be clarified that progress in MOOCs can be applied in formal university academic training and improved in the process of changing the educational model.

There have already been attempts to develop MOOCs that integrate the disruptive elements of cMOOCs with the advantages of xMOOCs; these include hybrid MOOCs (hMOOC) (Fidalgo-Blanco et al., 2016; Downes, 2016a). These courses combine xMOOC platforms with social networks, content-centric learning methodologies (xMOOCs) with activity-centric methodologies (cMOOCs) and participants as mere knowledge recipients (xMOOC) with participants as generators of knowledge (cMOOC).

Previous studies have shown that those enrolled in MOOCs have different academic objectives, different approaches to the application of MOOC contents, different professional profiles, a broad age range and extremely different educational levels. Consequently, in addition to massification, any new MOOC model must consider heterogeneity, diversity and multiculturalism. The xMOOCs do not address these characteristics, since they have been designed for a concrete, homogeneous profile. In other words, they are designed for students with a homogeneous profile that must be adapted to the organization and contents of the course.

The adaptation of learning to the characteristics of the participants is called *personalised learning*, and it is described as a difficult challenge in internment reports (Johnson et al., 2016). This means that it is a challenge where the scope is understood but difficult to achieve. Adaptive systems ((Brusilovsky, 1996; Berlanga and García-Peñalvo, 2008) or

the adaptive functionalities of some LMSs help to adapt learning in any online training, but they are especially necessary for the large, heterogeneous, diverse group of participants enrolled in MOOCs to ensure that their different needs are met (Sein-Echaluce et al., 2011; Esteban-Escaño et al., 2017).

The main assumption in this work is that adaptability is the only dimension that can unite the opposing paths followed by first- and second-generation MOOCs; it also adopts the viewpoint that it is necessary to consider the widespread growth, heterogeneity, diversity and multiculturality of participants. In that sense, this work incorporates adaptive functionalities into the technological model and personalization of the learning into the pedagogical model conforming to hMOOCs.

In the platform called intelligent-MOOC (iMOOC), a hMOOC is implemented that incorporates personalized learning, to obtain the adaptive hybrid MOOC (ahMOOC) model proposed in this work. The specific objectives of this work are as follows:

- To design a disruptive MOOC framework;
- To develop and apply an adaptive MOOC based on the framework; and
- To analyze students' perception of this type of MOOC.

In the following sections, the ahMOOC model is presented and compared with the other types of MOOCs A case study is also present, where the results support the effectiveness of the proposed model. The work ends with a discussion and conclusions.

2. THE ahMOOC MODEL

Any online academic training course is composed of resources and activities, which are usually designed based on the objectives to be achieved in the course. The approach to managing, organising and applying these resources and activities defines the different MOOC models. In this section, three MOOC models are analysed – cMOOC, xMOOC and hMOOC – and a new disruptive model is proposed as an extension of the hMOOC model.

The components necessary to start up any online course, especially a MOOC, are as follows:

- *Space for organising resources and activities;*
- *The design, scope and management of resources;*
- *The design, scope and management of activities;*
- *The pedagogical methodology; and*
- *Course sustainability.*

These characteristics are analysed for each of the models mentioned.

2.1 The cMOOC Model: The Origin

The birth of the MOOC (the CCK08 course) was based on the application of the ideas of connectivism and constructivism (Siemens and Fonseca, 2004)), and it encompassed a totally disruptive approach to online training. The aspects of cMOOCs that should be considered are as follows:

- *Space for organising resources and activities*. A single platform is not used as a fundamental support of the course; rather, several web 2.0 tools (both teachers and participants) are used for proposing activities and sharing resources. According to Downes, the Internet is the website itself (Downes, 2016b), and the structure of the network is the structure of the course (Downes, 2016c);
- *The design, scope and management of resources.* There are no fundamental resources prepared by teachers; rather, they are generated in the network. Depending on the proposed activities, some resources or others are recommended, searched, identified and applied. Participants generate most of the resources, and this is done in the course website;
- *The design, scope and management of activities.* The activities are associated with the users and can be completely different in their outcomes, since each user creates them based on his/her needs;
- *The pedagogical methodology.* This is based on connectivism and informal training. It focusses on the activities of participants, and evaluation (as well as learning) is based on the resources created by the participants; and
- *Course sustainability.* The course is a spiral, where the resources generated by the participants become Internet resources; thus, it can be used in a continuous and autonomous way by the participants.

Figure 1 shows the structural model of a cMOOC, where each participant (P) generates resources (R) that are shared with the rest. This structure is typical of the environment known as Web 2.0; it is fully adapted to the new form of networked learning and represents a disruptive opportunity for the university learning model. However, it is a model that has not been integrated for several reasons: Teachers do not have experience in informal training, and it is difficult to determine in advance the specific objectives of the course – and thus, to evaluate its achievement. In addition, the courses do not have a planned design, and this can cause abandonment due to ‘disorientation’, in contrast to the ‘order’ of formal training.

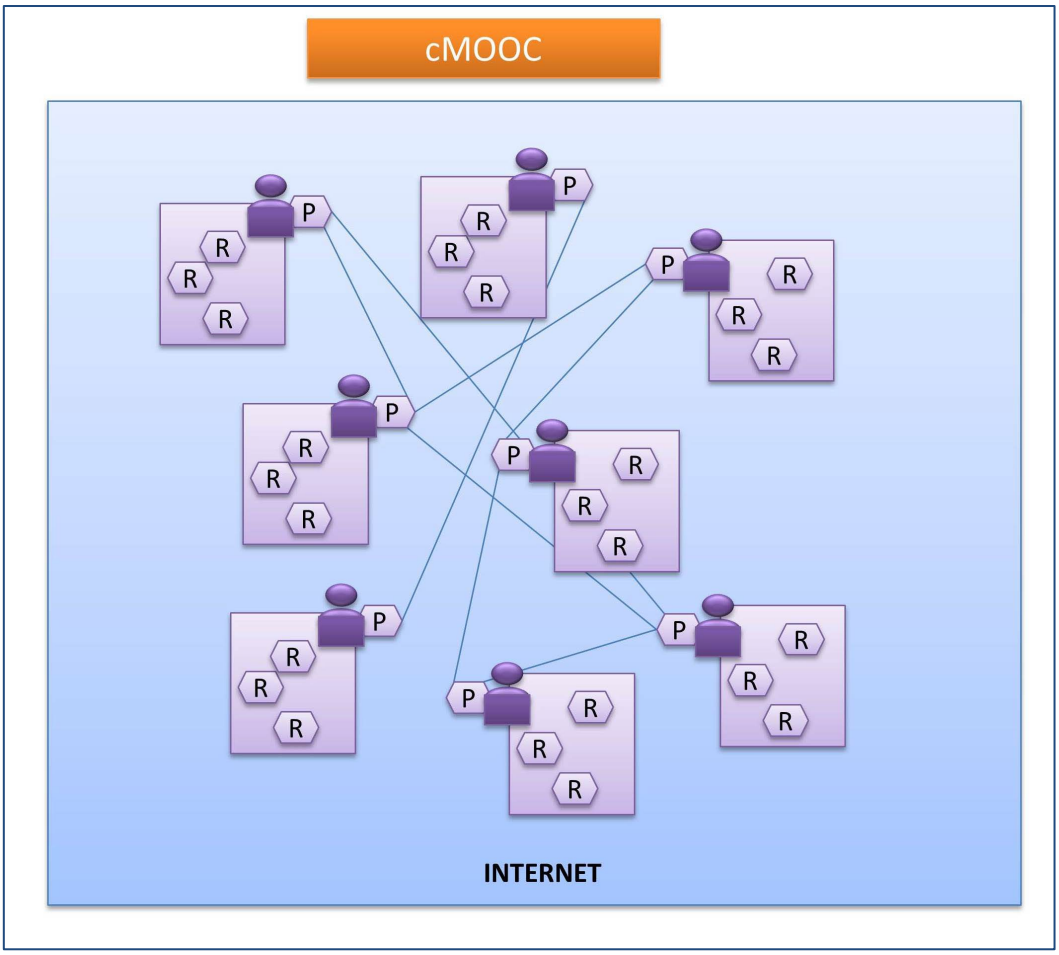

Figure 1. Structural cMOOC model

2.2 The xMOOC model. The Most Used

The xMOOC model shares characteristics with the cMOOC model in terms of its vision and scope, but the two models are extremely different in terms of the approach, organization and management of resources and activities. This type of course includes non-formal training (Fidalgo-Blanco et al. 2016), but its structural model is like that of formal academic training, where the training design is constructed by considering participants with a specific profile. Figure 2 shows the structural model of the xMOOC. Points to bear in mind are as follows:

- *Space for organising resources and activities.* In this case, there is a specific platform (website), where resources and activities are organised with a sequential structure of modules and sections; an example of this is MiriadaX (2017), a specific platform for MOOCs.
- *The design, scope and management of resources and activities.* Before starting, the teacher generates the resources and activities based on a participant's entry profile and specific, predetermined objectives. These resources are organised on the platform;

- *The pedagogical methodology*. The methodology is based on behaviourism (Ardila, 2013) and formal training. It is content focused, and assessment (certification) is based on completing activities in all modules; and
- *Course sustainability*. The course has pre-set start and end dates. In the successive editions of the course, the same implementation is carried out (with minimal changes in resources and activities).

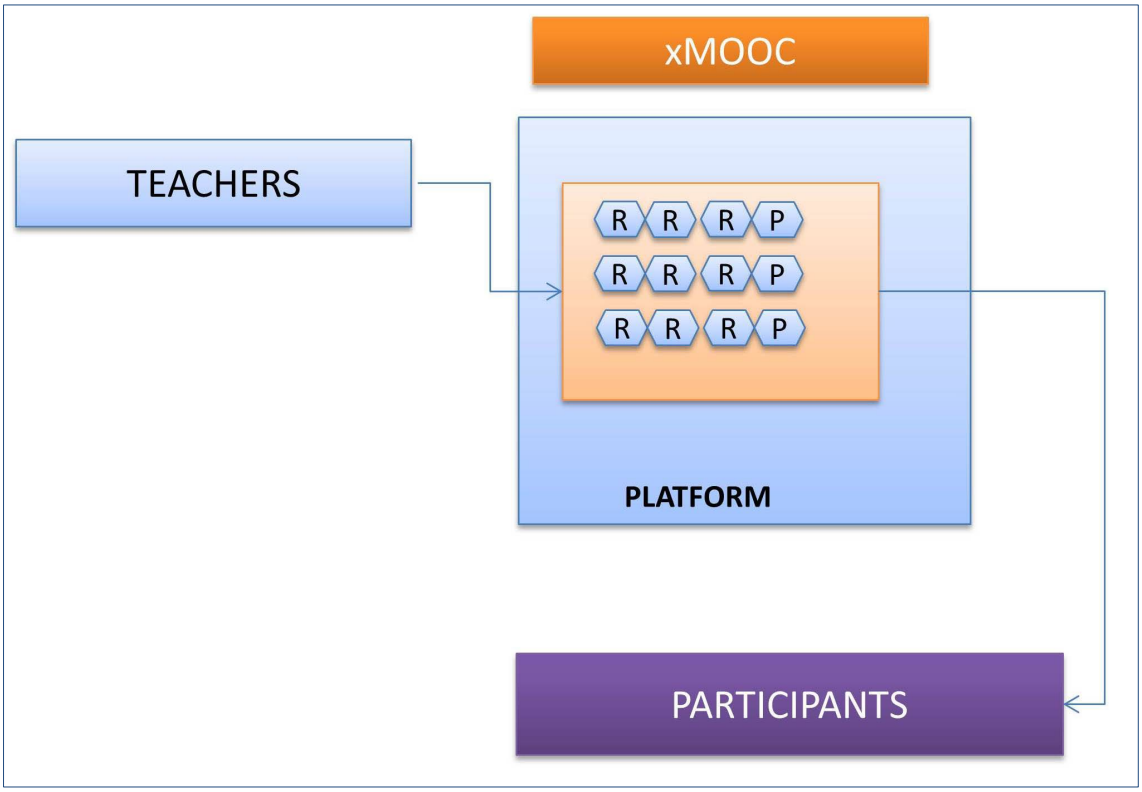

Figure 2. Structural xMOOC model

In the xMOOC, teachers create and organize resources and activities in a structured way in the platform, where participants access the contents. This similarity to traditional academic learning can be an advantage for participants in an online course, as they know its structure, and it is associated with clear planning and specific objectives. However, this structure does not fit the diversity of participants in a MOOC, and thus, it provides no solution or renewal for its new features. With this model, universities offer the same course as always for different situations, and they are wasting an opportunity for renovation and the disruption. Finally, xMOOC present a high dropout rate, since they do not adapt to the expectations of the participants.

2.3.The hMOOC Model. How To Take Advantage of xMOOC and cMOOC

The hMOOC model (Fidalgo-Blanco et al., 2016) uses an xMOOC with a social network, as shown in Figure 3, with the following important differences:

- *Space for organising resources and activities.* The MOOC has a specific e-learning platform for formal training and a social network for informal training;

- *The design, scope and management of resources*. Initially, the teachers prepare a set of resources organised in modules and sections for the website. The resources generated by the participants in the social network can be used on the website;
- *The design, scope and management of activities.* The activities are designed to be carried out on the website and in the social network. Social network activities can be evaluated on the website and vice versa;
- *The pedagogical methodology.* Pedagogy is based on behaviourism and constructivism, formal training (on the website), informal training (in the social network), content orientation (website) and orientation to the activity (social network); and
- *Course sustainability.* The course is a spiral of learning. Each edition can have a formal certification, but informal learning is continuous, and new users can be incorporated into each edition of the course.

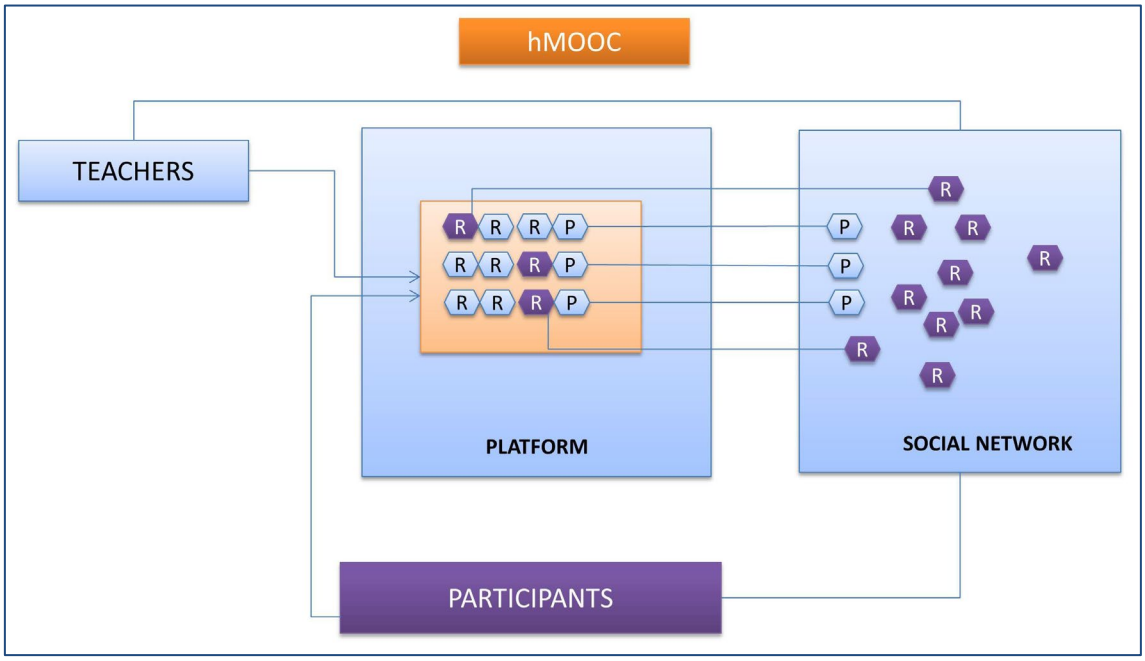

Figure 3. Structural hMOOC model

This model presents an initial structure of contents and activities that contributes to the participant's self-regulation in learning, thereby reducing the attrition caused by disorientation (Littlejohn et al., 2016). However, at the same time, it incorporates elements that bring the structured course closer to the social network, where the new training service is directed. hMOOCs integrate non-formal learning with informal learning, allowing autonomous learning during and after the course. The participants generate resources, sharing and integrating them with other existing ones; this helps them to develop in the social network. In contrast, previous studies on hMOOCs (Fidalgo-Blanco et al., 2016) have shown that the rate of completion is higher for this model and it is widely accepted by participants.

2.4 ahMOOC Model. New Model

There are two important elements that must be considered for a MOOC to provide an effective and disruptive learning model: First, it must adapt to the emerging social demands (the university must adapt to the new situation and not vice versa). Second, it must take into account the heterogeneous characteristics of the participants.

The first element is developed in the hMOOC model. This means that the university is using the tools, methods, resources and activities of the informal, autonomous and cooperative learning taking place on the Internet.

The second element is the main innovation introduced in this work. We propose the ahMOOC model, which includes the characteristics of hMOOCs and favors personalized learning by adapting the activities, contents, examples and even evaluation to the profile of each participant. It should be recalled that the number of MOOC participants is extremely high, and their profiles are heterogeneous (in terms of age, demographic profile, academic background, professional activity, knowledge, learning style, preferences, objectives, etc.).

While the previous models (cMOOC, xMOOC and hMOOC) were designed for a specific student profile, this contradicts one of the features that have contributed most to MOOC success – anyone can enroll in a MOOC, regardless of his/her profession, academic level or age. The ahMOOC model considers this diversity of students and tries to satisfy the learning of the maximum number of students with diverse profiles. The model incorporates adaptive systems that facilitate the customization of the training process, which implies a disruption in the MOOC model. However, we should consider the aspects necessary for its creation, as follows:

- *Space for organizing resources and activities.* The ahMOOC has a website and a learning community composed of social networks, blogs, forums and so on. The main difference from hMOOCs is that the website contains adaptive tools that give access to certain resources and activities depending on the profile of each participant;
- *The design, scope and management of resources.* The initial resources have been gathered by the faculty in relation to the theme of the course, and they include access to resources available on the internet. Participants also generate different types of resources according to their profiles and interests, and these are included as didactic resources within the website for sharing and evaluation (in contrast to cMOOCs);
- *The design, scope and management of activities.* The activities are tailored to the specific needs of each participant, and they are associated with the resources selected by the participant;
- *The pedagogical methodology.* This is based on behaviorism and connectivism, formal and informal training and personalized training; and
- *Course sustainability.* The ahMOOC is part of a set of courses of this type, which can be conducted over a long period of time (several months). Within that period,

each ahMOOC can be offered without fixed dates. The learning community remains permanently active throughout different editions.

The main difference between ahMOOCs and the previous models is based on the selection, organization and sequencing of resources. Figure 4 shows how, in the same platform, the participant can choose between four alternatives (sub-topics of the course s1 ... s4), each focused on certain contents and giving the access to specific certifications. Likewise, during the course, there is also adaptability based on characteristics of user profiles (such as whether the user has a teacher profile and the educational level at which he/she teaches).

The main resources of the course are organized through a dynamic knowledge map that is accessible to all participants and continuously updated. Thus, any participant in the MOOC will always have updated resources, even if he/she did not participate in another edition of the course.

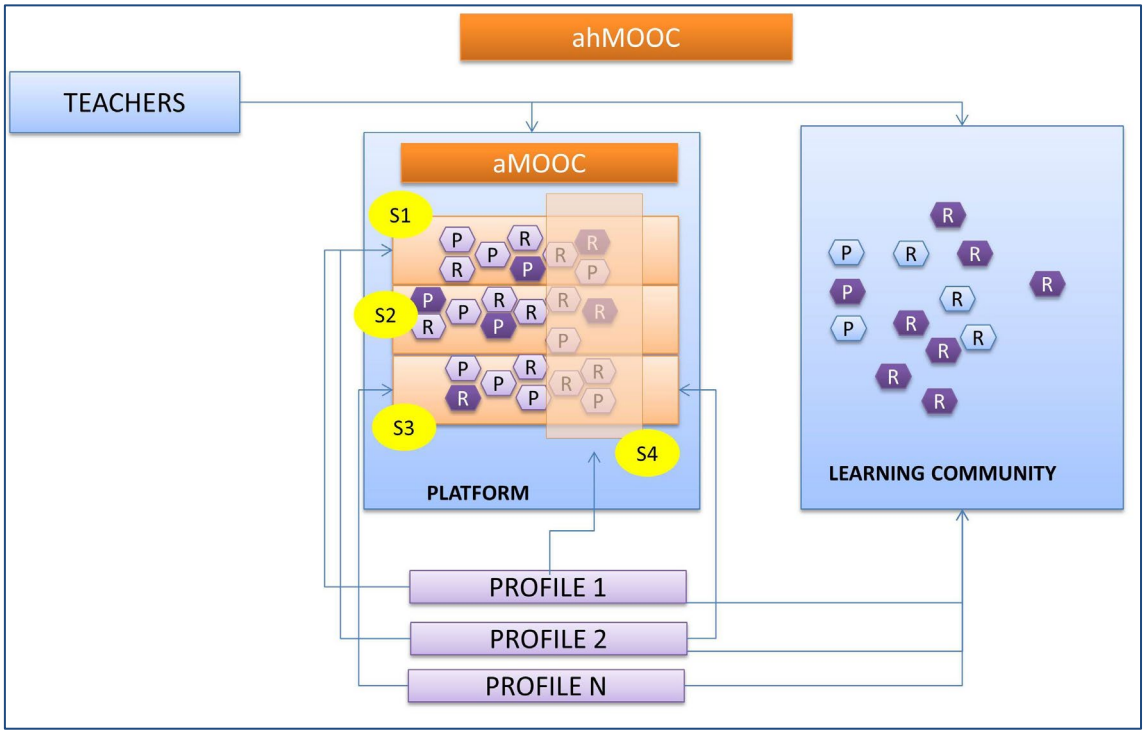

Figure 4. Structural ahMOOC model

To conclude the section and to help in the comparing the four models mentioned, Table 1 contains their main characteristics.

Table 1. Characteristics of cMOOCs, xMOOCs, hMOOCs and ahMOOCs

Model / Characteristic	*cMOOC*	*xMOOC*	*hMOOC*	*ahMOOC*
Website	Users' websites integrated into the website	LMS-type platform	LMS-type platform and social network	Adaptive platform and learning community

Learning resources	Generated by the participants	Generated by the teachers	Generated by the participants and the teachers	Generated by the participants and the teachers
Learning activities	On the web; each participant adapts them to his/her needs	On platforms; each participant does the same.	On platform and social network; all participants do the same.	On platform and in community learning; each participant chooses them to his/her needs and the system adapts automatically to the participant.
Pedagogical model	Connectivism / constructivism; activity oriented	Conductivism; content oriented.	Constructivism and conductivism.	Personalized learning and constructivism
Type of learning	Informal	Non-formal	Informal and non -formal	Informal and non-formal
Sustainability	Continuous learning	Limited access to the website for short periods	Limited access to the website and maintenance of a broad social network	Limited access to the website for a long, flexible period; community for lifelong learning; map of evolving contents.

3. CASE STUDY

University MOOCs are academic courses, but from the point of view of their participants, they are totally disruptive: They are massive, there are prerequisites for enrolment and their participant profiles are heterogeneous in terms of age, academic level and employment status. These are independent training units that grant a specific certification without having to integrate with other courses.

If this disruption were not considered, a MOOC simply be an academic university course where there were no preconditions for enrolment; it would be an online subject, designed for a profile, training and concrete objectives. If this were the case, it would not be necessary to offer a MOOC, as it would suffice to add two components – videos and self-evaluation activities – to an OpenCourseWare subject (OCW, 2017).

As mentioned above, personalized learning is the solution to meet the learning needs of any participant in a university course; due to their characteristics of massive subscriptions and heterogeneity, this is especially the case for MOOCs. Likewise, the university must adapt to the new tendencies and needs of society (not the other way around) to address these developments. To achieve this, it is essential to create open courses that include web 2.0 tools, informal and autonomous learning, cooperation and generative learning.

In this paper, a case study is proposed to integrate the adaptation of an hMOOC to participants – that is, the ahMOOC model presented in the previous section. The ahMOOC was first offered in late 2015, and it was accessible for four months.

The platform used was created within a cooperation agreement between the Polytechnic University of Madrid, University of Zaragoza and University of Salamanca iMOOC (Sein-Echaluce et al., 2016). This platform (based on Moodle, 2017) supports adaptive MOOC (aMOOC), offering resources and activities depending on the profile and preferences of each participant. However, it is also a simple platform that does not require specialized knowledge on the part of the course designers (teachers); this contrasts with other proposals, which are generally much more elaborate but only accessible for technological experts (Sonwalkar, 2013).

For the adaptation of the methodological approach to the social context, the hMOOC model was included, which adapts to the social context but retains the advantages of the academic context (ease of follow-up, coordination, well-defined planning, etc.).

The course was offered in Spanish, so most participants were Latin American. The topic of the course was 'Educational Innovation', and it included four thematic itineraries, as follows: theoretical foundations of educational innovation; development of cooperative skills, such as the use of learning communities and teamwork competencies; and active methodologies like Flip Teaching. Each itinerary presented different processes that could be adapted to the user (profile, objectives, interests, etc.) (Leris and Sein-Echaluce, 2011).

The participants could complete some or all itineraries, and they obtained certification for each itinerary they completed. In addition, although the itineraries were independent, the adaptive system could detect whether an activity had already been done previously in another itinerary and provide validation (so there would be no need to do it again).

The evaluation activities were based on the realization of a project customized to the user's needs. As personal projects were involved, the community in which they were shared was private for the course participants. The rest of the resources and reflections of the users were shared with open learning communities. The methods used to evaluate the results of the case study – with a view to validating this works disruptive model – are presented in the following section.

4. CASE STUDY RESULTS

This section describes the results on the heterogeneity of the participants in the ahMOOC; their perceptions concerning the adaptive needs in a MOOC, as stated before initiating the ahMOOC; the results of the completion of the ahMOOC; and the perception on the educational quality of the ahMOOC once it was over.

4.1 Profile of the ahMOOC participants

From the responses to an initial survey at the beginning of the ahMOOC, the heterogeneity of participants' profiles can be shown. The sample size included 523 people, of which 240 (45.89%) were men and 283 (54.11%) were women. Most participants (308; 64.8%) were between 36 and 55 years, with a great variety in the other age ranges. Concerning country of residence, most lived in Europe (264; 253 in Spain) and Latin America (211).

Regarding the level of completed studies, the following rates were determined: Primary Education, 0.76%; Secondary Education, 3.44%; Professional Training, 7.27%; University Degree, 43.59%; Master's/Doctorate, 42.64%; and Other (2.29%). In terms of the participants' professional profiles, the following results were obtained: Self-employed, 5.54%; Teacher of Child/Primary Education (up to 12 years), 9.94%; Secondary/High School Teacher (up to 18 years), 23.90%; Teacher of Vocational training, 10.71%; University Lecturer, 22.75%; Non-teaching Employee, 6.12%; University Student, 6.50%; University Student (NOT Education Area), 1.91%; Other (including unemployed, opposition candidate, retired, etc.), 12.62%.

4.2 Perception of adaptive needs before starting the ahMOOC

The answers to the items below, of the mentioned initial survey, allowed the researchers to show that the construct of adaptability for MOOC, formed by the indicators corresponding to the items, presents a consistent scale. Thus, the six indicators measure characteristics of the same construct and their value, representing the proposed adaptivity concept in the MOOC. (Leris, Sein-Echaluce, Hernández and Bueno, 2017). These indicators of adaptability were used to design the ahMOOC routes, as follows:

Item 1. I prefer to different activities to be suggested depending on my choice or my assessment results.

Item 2. I prefer to access content/activities following my working pace, not a default calendar to access the contents.

Item 3. I prefer to choose between different levels of difficulty in the content/activities depending on the different learning objectives.

Item 4. I prefer the creation of interest groups (same area, same level of experience, etc.) for discussion in specific forums.

Item 5. I prefer to choose between different methods of evaluation (self-evaluation, peer review, etc.).

Item 6. I prefer peer review to be organized by stakeholders in same area/with the same level of experience.

Leris et al. (2016) present a statistical analysis to determined what adaptability indicators, defined by the construct, are preferred by ahMOOC participants (Leris et al., 2017). There are two indicators that participants value more than any other –adaptation to the pace of personal work (item 2) and diversity in the offered levels of difficulty to reach different objectives (item 3); these results show that self-learning strategies are strongly linked to motivation. Items 1, 3 and 5 are grouped by common characteristics around the concept of individual 'choice' for participants. Meanwhile, items 4, 5 and 6 have common characteristics related to cooperation (forums and peer assessment), and they represent the lowest rated items. Both previous works also study the dependency of the participants' perception on adaptability indicators with respect to characteristics in the users' profile

(gender, age, geographical location, educational background, profession, etc.), the performance or completion of other previous MOOCs, their previous experience or knowledge on the topic of the MOOC and their motivation to start the MOOC (Leris et al, 2016, 2017)

4.3 Completion results

A course on educational innovation was offered under the ahMOOC model with a total of 80 hours (if all possible itineraries were completed). The completion percentages were compared to those of the same MOOC under an hMOOC model (performed on the MíriadaX platform) with a total duration of 40 hours.

In the ahMOOC model, the evaluation activities are based on projects adapted to the student profiles, where each participant elaborates a project that is applicable in his/her environment throughout the course. In the hMOOC model, evaluation activities are much simpler; they are based on answering a self-assessment questionnaire and adopting a content curator role (providing useful resources) on educational innovation. Thus, the effort, involvement and knowledge required to successfully complete the MOOC are much greater in the ahMOOC than the hMOOC model.

The average completion rate for MiriadaX courses (the platform on which the hMOOC is offered) was 18% (Oliver, Hernández-Leo and Albó, 2015). If one compares the average rates of the xMOOC of MiriadaX with those of the three hMOOC (also on the MiriadaX platform), a difference of more than 8 percentage points can be observed (Table 2). Regarding the percentage of completion of the same MOOC under the ahMOOC model, the percentage of completion rises to 30% (see Table 2); however, it is also worth noting that the evaluation tests are considerably more difficult in the ahMOOC than in the hMOOC model.

Table 2. Completion Rate of hMOOC and ahMOOC

MOOC Model	*Participants*	*Completed the course*	*Completion rate (%)*
hMOOC Educational Innovation (3 editions, 2014, 2015, 2016)	13 286	3475	26.16
ahMOOC Educational Innovation (1st edition, beta version, 2015–2016)	661	200	30.26

4.4 Evaluation of the educational quality of ahMOOC

A total of 203 people completed a perception survey on the ahMOOC model once it was complete; this survey especially focused on the impact of adaptability. Table 3 includes the survey, which was composed of Likert and open questions. The Likert scale questions were based on the Student Evaluation of Educational Quality (SEEQ) survey, adapted for use in MOOCs (Marsh, 1982), which measures Learning (Q1 to Q4), Enthusiasm (Q5 to

Q8), Contents (Q9, Q10), Organization (Q11 to Q17) and Evaluation (Q18 to Q21). Table 3 also shows the value obtained (in percentage) from the responses for each element of the Likert scale (1 to 4), grouping the values in the first range (1 – don't agree and 2 – slightly agree) and the second range (3 – mostly agree and 4 – totally agree).

Table 3. SEEQ survey adapted to ahMOOC

	Items/percentages	*1*	*2*	*3*	*4*	*Range 1*	*Range 2*
Q1	*I understood and leaned from the contents of the course*	0.49	4.93	26.60	67.98	5.42	94.58
Q2	*In this course, I learned valuable things*	0.49	1.48	27.59	70.44	1.97	98.03
Q3	*My interest in some topics has increased while doing this course*	0.49	3.45	29.06	67.00	3.94	96.06
Q4	*This course was stimulating*	0.99	6.90	33.00	59.11	7.88	92.12
Q5	*The course was active and dynamic*	1.48	9.36	43.84	45.32	10.84	89.16
Q6	*The way contents were presented maintained my attention*	0.00	9.85	33.50	56.65	9.85	90.15
Q7	*Generally speaking, the videos that were included were interesting*	0.49	9.36	31.03	59.11	9.85	90.15
Q8	*I participated often and worked actively*	1.48	12.81	49.26	36.45	14.29	85.71
Q9	*The course materials were well designed*	1.48	5.91	27.09	65.52	7.39	92.61
Q10	*Video explanations were clear and helpful for understanding the topics of the course*	0.99	4.93	23.65	70.44	5.91	94.09
Q11	*The information shared by participants was useful for understanding concepts*	4.93	23.15	40.39	31.53	28.08	71.92
Q12	*The design of a course that adapts to the needs of participants was well executed*	0.00	4.43	30.54	65.02	4.43	95.57
Q13	*The fact that resources were visible depending on my learning pace was useful*	1.48	4.43	24.63	69.46	5.91	94.09
Q14	*My objectives when starting the course were the same as those I ultimately reached*	0.99	6.90	43.84	48.28	7.88	92.12

Q15	*The suggested activities improved the learning of the course contents*	0.99	8.37	30.54	60.10	9.36	90.64
Q16	*The suggested activities produced useful content once the course was over*	1.97	7.39	30.05	60.59	9.36	90.64
Q17	*Resources and shared ideas in the blog or forum provided different points of view from those given by the teachers*	4.43	15.27	44.83	35,47	19.70	80.30
Q18	*The evaluation difficulty was adequate*	0.99	3.94	31.03	41.38	6.37	93.63
Q19	*The evaluation activities helped me to evaluate my progress in the course*	1.97	9.85	27.59	37.93	15.27	84.73
Q20	*The evaluation method was suitable for this type of course*	1.97	8.37	39.41	50.25	10.34	89.66
Q21	*The relationship between the effort invested and the obtained goals was appropriate*	0.49	4.43	36.95	58.13	4.93	95.07

All items presented more than 65% agreement in the second range (Likert values 3 and 4). Of the questions, 4.76% had results between 70 and 80%, 23.81% had results greater than 80 or equal to 90% and 71.43% had results greater than 90%.

Although the survey covered all aspects of the ahMOOC model, some questions were associated with specific educational disruptions. In this sense, it is worth highlighting items Q11 and Q17, which referred to the usefulness of the contents generated by the students (learning and generative knowledge – the student as a content generator); Q12, Q13 and Q14 (adaptation to heterogeneity); and Q15 and Q16 (continuous and cooperative informal learning).

Participants were asked to volunteer at least three words to describe (positively or negatively) the quality of participant adaptation they perceived in ahMOOC. We have indicated 480 words, of which 19 words highlighted negative aspects (4%) and 461 positive aspects (96%). The analysis of synonyms and their frequency are visualised in the 'word cloud' in Figure 5. This emphasises the words *adaptable*, *excellent*, *innovation* and *interesting*.

Figure 5. Word cloud on the adaptivity perception of ahMOOC participants

5. DISCUSSION

This paper proposed a massive online course with heterogeneous participants. The course sought to use the disruptions evident in previous MOOCs, provide training to the greatest number of people and adapt to the different user profiles. Massification and heterogeneity were demonstrated by analyzing students experiences in completing a MOOC; the results of this case study and previous literature confirm these characteristics of MOOCs. The perception of the need to adapt learning (both traditional and in MOOCs) to participants has been defined in many research works (Teixeira et al., 2016). However, this raises the following question: Do the MOOC participants also perceive this need? The results of the initial questionnaire indicate that the participants also demand adaptability. The participants' high initial assessment of the need to adapt the pace of the course to the learning pace of each participant in a generic MOOC coincides with the high assessment of the participants after the ahMOOC was completed.

This paper proposes a massive online course with heterogeneous participants, using disruption of previous MOOCs, and giving training to the greatest number of people, adapting to the different profiles. Massification and heterogeneity are demonstrated by analyzing people who are enrolled in a MOOC and the results of the case study as well as others confirm this circumstance. The perception of the need to adapt learning (both traditional and in MOOC) to the participants has been defined by many research works (Teixeira et al. 2016) but do the MOOC participants themselves also perceive this need? The results of the initial questionnaire indicate that the participants also demand adaptability. The participants' high initial assessment of the need to adapt the pace of the

course to the learning pace of each participant in a generic MOOC coincides with the high assessment of the participants after the ahMOOC is completed.

Another indicator of the success of a course, at least from an academic point of view, is the completion rate. The Spanish xMOOC on the MiriadaX platform (144 MOOCs and 191 608 participants) showed an average completion rate of 18% (Oliver, Hernández-Leo, Albó, 2015). Using the same platform, the hMOOC on educational innovation (three editions) was implemented with an average completion rate of 26%. Thus, hMOOC had a greater impact in terms of completion compared to the other MiriadaX courses, although both employed the same type of evaluation (peer testing and evaluation).

The ahMOOC completion statistic, as found in this case study, was 30%, representing a higher result than in either the hMOOC or xMOOC data (in MiriadaX). However, a new variable must be added that will lend more importance to the result of a 30% completion rate. It is evident that a high difficulty in the continuous assessment system of a training course results in a higher dropout rate. Therefore, the completion rate in ahMOOC is more relevant because its evaluation system is more difficult than that of hMOOC or xMOOC.

Another way to verify the validity of the ahMOOC model is the SEEQ educational quality survey, which has been adapted to MOOCs (Fidalgo-Blanco et al., 2015). The number of participants who mostly or totally agreed with the survey items exceeded 80%, reaching 95.6% for the Learning dimension. For in the hMOOC on Educational Innovation, the average for this same dimension was 90% (Fidalgo-Blanco et al., 2015).

Likewise, the high values reached in the items of where the incorporation of adaptivity was valued (more than 94% of the participants are mostly or totally agreed) endorses the ahMOOC model. Specifically, item Q13 (The fact that resources were visible depending on my learning pace was useful) received the most positive evaluations in both the initial survey (Leris et al, 2016), where it expressed a general preference, and in the final survey, once this indicator of adaptability had been experienced during the ahMOOC process.

The least valued item was Q11 (The information shared by participants was useful for understanding concepts), at 71.92%. This may have been because participants did not habitually to consult the forum and the operation of the forums did not favor the classification of the posts according to their content (users need to collaborate to name them properly). In contrast, in some ahMOOC itineraries, the forums were used as an evaluation system, which may have reduced the interest in sharing and supported the practice of sending the work itself. This aspect should be strengthened and study how to improve this system. Item Q21 (The relationship between the effort invested and the obtained goals was appropriate) was highly valued, although the evaluation required more effort than it would for the average MOOC.

Finally, the words that the participants have freely chosen were almost all (96%) positive. The word *adaptive* stands out, illustrating the participants' awareness of this aspect of the model. However, they also highlighted words related to the quality of the course, such as

excellent, good or *enjoyable*. The disruptive factor was also evident in the word *innovation*.

6. CONCLUSIONS

Although it seems contradictory, disruption must be progressively implanted in education. When the disruption is drastic, it is usually not successful. At least, this is what has happened with MOOCs.

MOOCs continue to be an opportunity to plan, test and validate disruptive approaches to education. In this work, we demonstrated that the social impact of MOOCs and disruptive approaches can be used (recovering some of them from the origin represented by cMOOCs), as well as other novelties, such as adaptability and personalised training.

The indicators used to verify the feasibility, validity and effectiveness of the model have more than exceeded international indicators on the MOOC completion rate (10% worldwide, 18% for MiriadaX). It showed 30% improvement, even with the addition of complex evaluation activities (project development).

The perceptions of the participants also approached 100% in the second range (Likert values 3 and 4) for some items, and more than 80% of responses were always in this range. Therefore, not only was the new model been effective in terms of results, but it has also been perceived in this way by the participants.

The ahMOOC model fills an important gap in left by MOOCs, namely the adaptive dimension as a response to massification and heterogeneity. It has also been shown that this dimension is the most significant factor in moving toward disruption in the formation of MOOCs. On the one hand, ahMOOC adds disruptions to the xMOOC model, recovering those brought in with the cMOOC; on the other hand, it adapts to the specific conditions of the MOOC participants.

In future work, we intend to use participant profiles to study the relationship between the responses given on the need for adaptability of the participants in the initial survey and the responses to the final perception survey. We will also continue experimenting with new ahMOOCs that include different indicators of adaptability to precisely measure which ones are the most effective for personalising learning.

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