What Drives a Successful MOOC? An Empirical Examination of Criteria to Assure Design Quality of MOOCs

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***Abstract*— Massive Open Online Courses (MOOCs) have gained a lot of attention in the last years as a new technology-enhanced learning (TEL) approach in higher education. MOOCs provide more educational opportunities to a massive number of learners to attend free online courses around the globe. Discussions around MOOCs have been focusing on the potential, social, institutional, technological, relevance, and marketing issues and less on the quality design of MOOC environments. Several studies have reported a high drop-out rate in average of 95% of course participants and other pedagogical problems concerning assessment and feedback. Thus, the quality of MOOCs design is worth additional investigation. Although several studies identified a large set of criteria to the successful design of TEL systems in general, not all of them can be used in the MOOC context, due to some unique features of MOOCs. This study is a first step towards identifying specific criteria that need to be considered when designing and implementing MOOCs. The results of this empirical study are based on a large survey targeting learners as well as professors, both with MOOC experience. As a result, we identified and rated 74 indicators classified into our two main dimensions of pedagogical and technological criteria distributed over six categories. From these, the *learning analytics* and *assessment* categories were found to be the key features for effective MOOCs.**

Keywords-MOOC; E-learning Criteria; MOOC Design; Quality.

I. INTRODUCTION

The original concept of Massive Open Online Courses (MOOCs) is to offer free and open access courses for massive number of learners from anywhere all over the world [1]. MOOCs have unique features that can make it an effective technology-enhanced learning (TEL) model in higher education and beyond. While the great potential of this new learning model has been discussed in various publications in the last two years, lately more critical reviews come up e.g. concerning business models and yet unsolved pedagogical challenges, most notably high drop-out rates [4] and assessment and feedback. Many researchers have been discussing the development of MOOCs in terms of concept, potential, social, institutional, technological, relevance, and marketing issues [7]. However, the quality design of MOOC environments has not yet been clearly defined, especially from the technological and pedagogical perspective to engage passive participants to become active learners through learning activities [8].

Thus, the quality of MOOC design should be investigated in more detail. Different literature reviews provide a wide range of criteria addressing the design of effective TEL environments, such as content design, page layout, visual arrangements, use of illustrations, and colors. Nevertheless, not all of them can be used to design a successful MOOC. In this study, we address the challenge of what drives a successful MOOC from a pedagogical and technological perspective.

This paper is organized as follows: Section II is a review of the related work. Section III describes the research methodology and how we collected the research data. In section IV, we present and discuss in detail the results of the study. Finally, Section V gives a summary of the main findings of this study and highlights new opportunities for future work.

II. RELATED WORK

Quality assurance is one of the core issues in the TEL field. Wright [3] provides online course criteria based on the experiences of staff in the Instructional Media and Design department at Grant MacEwan College, classified into 10 categories with 121 specific indicators. The main indicators include accessibility, organization, language, layout, objectives and evaluations.

The learner's perspective is the main focus of a study conducted by Ehlers [9]. The author acknowledges that successful TEL is not only related to high quality content delivered to learners by a TEL provider, but also requires co-operation from learners. This approach shows how students' feedback and experiences can be used to increase the quality of TEL experience.

The studies of Wright [3] and Ehlers [9] focused on quality in TEL systems in general. Not all of the identified criteria can be used in the MOOC context, due to some unique features of MOOCs, such as openness and massiveness.

More recently, Conole [4] presents a specific quality approach, namely the 7Cs learning design framework, which can be used to design pedagogically-sound MOOCs. It contains conceptualise, capture, communicate, collaborate, consider, combine, and Consolidate. This framework,

978-1-4799-4038-7/14 $31.00 © 2014 IEEE
DOI 10.1109/ICALT.2014.23

however, was not backed by a study with MOOC stakeholders.

In this paper, we focus on quality in a MOOC context, based on an empirical study with different MOOC stakeholders. Our study is a first step towards identifying specific criteria to design successful MOOC from both technological and pedagogical perspectives. We reviewed a wide range of criteria that has been identified in MOOC studies, and we took into consideration the challenges of MOOCs, such as drop-down rate, lack of human interaction, assessment issues, and pedagogical approaches [1]. In the two dimensions pedagogy and technology, we identified 74 criteria distributed into 6 categories. We then used these criteria in a survey with learners and professors with MOOC experience. These criteria shall provide support to researchers and instructional designers in improving the quality of MOOCs.

III. METHODOLOGY

This study follows the action research methodology which consists of three phases distinguished by having some identifiable objectives and characteristics, i.e. collecting the initial list of MOOCs criteria, designing the survey, and analyzing the final survey results [6].

A. Criteria Collection

The first phase of this action research study was to analyze TEL design criteria and guidelines. Thereby, we took into consideration the main challenges that have been identified in the MOOC literature [1]. The initial list of criteria we collected included 102 indicators categorized into the 2 dimensions pedagogy and technology and distributed into 7 categories. Then, we pre-validated this list with a small panel of 5 learners and 5 professors. Their feedback resulted in a refinement and restructuring of the initial list of criteria to include 74 indicators distributed into 6 categories, as depicted in Figure I.

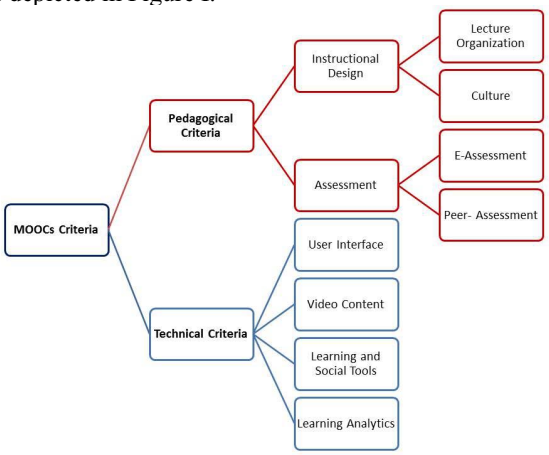

Figure I: Classification of MOOC criteria

B. Survey Design

The next phase of this study was to design the MOOC criteria survey based on the final list which was defined in the first phase. The purpose of this survey was to collect feedback from different MOOC stakeholders concerning the importance of the collected criteria. The survey instrument consisted of 6 sections, a section for each category. A 5-point Likert scale survey was used from (1) not important to (5) very important.

We invited a wide board of MOOC stakeholders to participate in this study. 107 learners who had participated in one or more online courses and 98 professors who have taught at least one MOOC completed this survey.

IV. RESULTS AND DISCUSSION

Our initial intention was to split up the analysis of the survey results based on the learners' and MOOC providers' perspectives to figure out which criteria are more important for each target group. We found, however, after analyzing the results by computing the mean and standard deviation for each criteria that the statistics showed no significant differences between the two groups. Thus, we decided to merge the two groups and analyze the whole set of data to highlight the criteria with the highest importance to both learners and MOOC providers. In the next sections, we present and discuss the criteria that need to be considered when designing and implementing a MOOC environment.

A. Participants

The demographic profile of this survey was distinguished into professors and learners as follows:

- Professors: 98 professors who had taught a MOOC completed this survey. 41% from Europe, 42% from the US and 17% from Asia.
- Learners: 107 learners participated in the survey. A slight majority of these learners were males (56%). 14% of whom were between the ages of 18 and 24 years, 22% are aged 25 to 29, nearly, 17 % are between 30 to 34, 12% are between 35 to 39 and 35% aged over 40 years. About, 36% were studying Bachelor, 40% Master's, 12% PhD, and 12% High school and other levels of studying. All of them had taken one or more online courses, and 92% had prior experience with MOOCs. These learners came from 41 different countries and cultural backgrounds in Europe, US, Australia, Asia, and Africa.

B. Pedagogical Criteria Dimension

29 criteria were identified to measure the instructional design and assessment categories which represented the pedagogical dimension.

a) Instructional Design Category: This category presents a set of learning design principles, focusing on lecture organization and some of the culture issues. The first 9 indicators show how the lecture organization and the course objectives can foster learning in MOOCs. The next 6 indicators were related to the culture issues. Table I summarizes the statistical results in the instructional design category ranked according to the means values.

In the statistical results of the instructional design category, we can clearly observe that the lecture organization

criteria were rated as important with an overall average means of 4.11, in particular the indicators 1, 2, 3 and 4 which emphasize the objectives and course schedule to be defined at the beginning of each MOOC.

TABLE I. DESCRIPTIVE RESULTS FOR THE LECTURE ORGANIZATION CATEGORY (N=205)

NO	Instructional Design Category		
	Lecture Organization Criteria	***M***	***SD***
1	Objectives should be clearly defined at the beginning of each lecture.	4,63	0,69
2	Supporting the collaborative learning among learners.	4,52	0,78
3	MOOCs system should provide coaching and scaffolding at critical times.	4,50	0,68
4	Offer course outline that contains objective, subject list and time schedule.	4,50	0,79
5	Providing opportunities for learners to become more self-organized.	4,31	0,81
6	Write down the video keywords to help learners search for related videos.	4,20	0,92
7	Offer the course progress time line in visualization graphs.	3,91	0,91
8	Each short video lecture should cover at most three objectives.	3,34	1,18
9	Let the learners responsible for obtaining the objectives, have a voice in setting them.	3,13	1,15
Lecture Organization Criteria Average		4,11	0,88
	Culture Criteria		
10	Give learners examples that can be understood by everyone regardless of the cultural background	4,08	0,87
11	Provide at least two different times for learners to participate in the video-conference discussion.	4,06	0,95
12	Using English language for MOOCs to meet the wide range of learners from different countries and cultures.	3,89	1,02
13	Video lecture must consider diversity in cultural values.	3,86	0,98
14	Using the international time [UTC] for deadlines and calendar.	3,80	1,11
15	Be careful when using symbols such as food, animals, and everyday objects.	3,48	1,08
Culture Criteria Average		3,86	1

Moreover, scaffolding, collaboration, and self-organization were identified as important criteria to empower learners in MOOCs. Although, learning theories emphasize the opportunity for learners to select their own objectives and learning strategies, the result of indicator 9 did not appear to be a critical factor in judging MOOCs quality.

Culture criteria have also been identified as important for a MOOC to be accepted from a massive number of participants around the globe.

b) Assessment Category: The ability to evaluate learning outcomes of a vast number of learners in MOOCs is indeed a big challenge [2]. Thus, assessment is an important factor for the success of a MOOC. In order to assure assessment tools to be relevant, accurate, and congruent with the objectives, content, and practical activities in a MOOC environment, 14 indicators were developed and classified into e-assessment and peer-assessment criteria, as presented in table II.

The statistical results the of assessment category indicate that both learners and teachers are aware that assessment is important to assure the quality of the learning outcome.

TABLE II. DESCRIPTIVE RESULTS FOR THE ASSESSMENT CATEGORY (N=205)

NO	Assessment Category		
	E-Assessment Criteria	***M***	***SD***
16	Each quiz should give feedback and/or show the correct answers.	4,57	0,90
17	Providing quiz – test report for learners to know their performance.	4,49	0,91
18	Using different types of questions (e.g. short answers, essay, matching, multiple choice question and true/false question).	4,44	0,79
19	Using of electronic assessment such as (E-test, short quizzes and surveys).	4,28	0,78
20	Define deadlines for each quiz-test.	4,18	1,10
21	Provide integrated assessment within each task.	4,12	1,05
22	Identify the maximum number of marks for a question.	4,06	0,97
23	Allow learners to suggest new questions.	3,93	1,06
24	Create the question database.	3,92	0,81
25	Each assignment should have hints.	3,44	0,95
E-Assessment Criteria Average		4,14	0,93
	Peer-Assessment Criteria		
26	Design guidelines and rubrics with clearly defined tasks for the reviewer.	4,53	0,84
27	Give clear directions and time limits for in-class peer review sessions and set defined deadlines for out-of-class peer review assignments.	4,36	1,06
28	Each student do the peer review should explain his evaluation.	4,32	0,79
29	Design of peer-assessment module as a part of MOOCs assessment strategy.	3,91	0,98
Peer-Assessment Criteria Average		4,28	0,92

E-assessment criteria obtained an overall average of 4.14, with an acceptable standard deviation. Particularly, indicators 16, 17 and 18 obtained a high mean score of 4.57, 4.49 and 4.44, respectively. These indicators stress the importance of feedback to help learners understand the topic of study and improve their learning outcome. Moreover, providing performance reports can improve learner's self-awareness and self-confidence.

The peer-assessment category obtained an overall means average of 4.28 with 0.92 standard deviation. Particularly, indicators 26 and 27 which focus on the assignments deadlines and that each learner should explain his or her evaluation to avoid grading without reading the work or not following a clear grading scheme, which negatively impacts the quality of the given feedback.

In addition, learners and providers provided some comments on this category. They are considering the opportunities to create e-portfolios to collect all test reports, peer-assessment, and learners' achievements in order to support self-reflection.

C. Technological Criteria Dimension

MOOCs are not only providing the opportunity to easily access learning resources but also include several technology features that support different important activities in the learning experience such as interaction, collaboration, evaluation, and self-reflection [1]. The technological criteria that are addressed in the reviewed literature can be classified into four main categories, namely user interface, video content, social tools, and learning analytics.

a) *User Interface*: Does the MOOC layout have impact on the learning experience? To answer this question table III presents 13 indicators that were developed to figure out the interface elements, which are required to achieve effectiveness, efficiency, and user satisfaction in MOOC environments.

TABLE III. DESCRIPTIVE RESULTS FOR THE USER INTERFACE CATEGORY (N=205)

NO	User Interface Category		
	User Interface Criteria	***M***	***SD***
30	Control features for video clip where appropriate, for example, play, repeat, full screen, slowdown, stop and pause.	4,70	0,53
31	Provide a search box function to help learners to find different learning materials.	4,51	0,76
32	Video lecture should be tagged / categorized to enable easier search.	4,45	0,72
33	Student can download the video lecture in their own devices.	4,43	0,89
34	Help systems should be focused on reducing "user errors."	4,31	0,92
35	Provide links to videos encoded for different connection speed as much as possible.	4,30	0,84
36	Framing: arrange objects/graphics to match screen ratio.	4,28	0,77
37	Standard video format be offered as a "HTML5-compatible video".	4,09	0,86
38	Provide related videos.	4,07	0,85
39	Slide- and teacher-view. In this view, the user sees a close-up of the lecturer superimposed on the teaching screen (6480px). Thus, the student sees both the learning material as well as the teacher explaining it	4,00	0,96
40	Student can switch between slide and teacher view to full teacher or slide view.	3,88	1,02
41	Minimum Video resolution (pixels) 320 * 240.	3,84	1,06
42	Videos should be displayed with a thumbnail and their (possibly truncated) title, as well as information about video date and ranking and how many times this view has been watched.	3,64	1,06
User Interface Criteria Average		4,19	0,87

The user interface indicators obtained an overall means of 4.19. Indicator 30 obtained the highest mean score of 4.70. This indicator concentrates on the importance of control features of the lecture video that may influence the interaction and controlling of the lecture content. Moreover, a powerful search function is an important tool in MOOCs to help learners easily find the required course materials. This is a crucial feature due to the open and distributed nature of MOOCs. In sum, the most important interface features are the one that are related to videos. This result is expected since videos are the backbone of MOOCs, which are inherently video-based learning environments.

b) *Video Content*: Table IV presents 14 indicators that were introduced in the literature to capture the learners' attention when they deal with the course content in MOOCs. The video content category obtained an average mean score of 4.13. In general, it is important to assure that the video content is accessible, appropriate, and accurate. Based on the survey results, recommendations for effective video content include good audio/video quality, providing a summary and a transcript of the video lecture, and using small chunks of videos of no more than 20 minutes.

TABLE IV. DESCRIPTIVE RESULTS FOR THE VIDEO CONTENT CATEGORY (N=205)

NO	Video Content Category		
	Video content Criteria	***M***	***SD***
43	Sound should be clear (even experienced presenters are prone to gabble when being recorded).	4,81	0,44
44	The level of detail provided about the subject should meet the level of audience for which the resource has been designed.	4,52	0,68
45	Offer references for facts and information in the video-lecture.	4,39	0,81
46	Provide a summary of the video lecture.	4,31	0,86
47	Use short video clips, No more than 20 minute clips.	4,29	0,95
48	Provide a transcript of the video lecture.	4,24	0,94
49	Synchronization of video and lecture note	4,15	0,94
50	Keep videos small for easier transfer, e.g., to up to 10 M.B.	4,15	0,95
51	Synchronization of video lecture and the transcript of the video.	4,09	1,00
52	A different color can highlight pieces of information that are considered important	4,01	1,00
53	Long sentences, which normally contain conditional clauses, are difficult to understand. So convert every long sentence into two or more short ones.	3,94	1,04
54	Starting videos with surprise information to attract the learners.	3,73	1,03
55	Avoid videos that have rapid cuts or changes of scenery.	3,67	1,07
56	The body of the text occupy from 25 to 40% of the total space of a video screen.	3,46	0,99
Video Content Criteria Average		4.13	0.91

c) *Learning and Social Tools*: Our aim in this category was to investigate the social tools that may influence the learning experience in MOOCs as seen in Table V.

TABLE V. DESCRIPTIVE RESULTS FOR LEARNING AND SOCIAL TOOLS CATEGORY (N=205)

NO	Learning and Social Tools Category		
	Learning and Social Tools Criteria	***M***	***SD***
57	Provide collaborative discussion tools.	4,50	0,69
58	Provide e-mail notification.	4,43	0,84
59	Offer notification tool for the important news and deadlines.	4,41	0,79
60	Using video-conference tools to allow learners from different locations to communicate with the teachers.	4,28	0,84

TABLE V. (CONT.)

NO	*Learning and Social Tools Criteria*	*M*	*SD*
61	Offer a subscribe feature to get videos and discussions updates.	4,14	0,88
62	On-line participants list should be available to help learners to do synchronous discussions.	4,13	0,93
63	Provide video annotation tools.	3,93	0,92
64	Last minute tool that contain the summary of the discussion and highly recommended video annotation by learners.	3,90	0,95
65	Link with the social networks tools such as "Facebook and Twitter".	3,72	1,22
66	Video platform should provide ranking tools "like & dislike".	3,48	1,25
Learning and Social Tools Criteria Average		4,09	0,93

Discussion, notification, and video-conferencing tools were identified as the most important means to achieve collaboration in MOOCs. Other, not very common collaboration tools in MOOCs, such as collaborative video annotation and social networking services were, on the other hand, less important.

d) *Learning Analytics*: In MOOCs it is difficult to provide personal feedback to a massive number of learners. Thus, several MOOC studies recommended to apply learning analytics tools to monitor the learning process, identify difficulties, discover learning patterns, provide feedback, and support learners in reflecting on their own learning experience [5]. Table VI shows the key terms of learning analytics using in MOOCs.

TABLE VI. DESCRIPTIVE RESULTS FOR LEARNING ANALYTICS CATEGORY (N=205)

NO	**Learning Analytics Category**		
	Learning Analytics Criteria	***M***	***SD***
67	Provide recommendations and feedback for learners to improve their performance.	4,59	0,67
68	Provide performance report to learners.	4,52	0,77
69	Provide learners with analytics tools for self-reflection.	4,42	0,82
70	Provide statistics on the course activities.	4,41	0,78
71	Predicting student performance.	4,37	0,85
72	Analysis and visualization of learning data.	4,34	0,79
73	Apply Social Network Analysis techniques to identify/visualize relationships between learners.	3,81	1,12
74	Provide the options for reporting to the teacher.	3,52	1,20
Learning Analytics Criteria Average		4,25	0,87

The learning analytics category achieved a high average means score of 4.25, which indicates the importance of analytics tools to support learning in MOOCs. In particular analytics tools targeting learners were identified as crucial. These include tools for recommendation, feedback, performance reports, awareness, and self-reflection.

V. CONCLUSION AND FUTURE WORK

The purpose of this study was to identify specific criteria to assure the design quality of MOOCs from both learners' and teachers' perspectives. Based on an extensive literature review, we identified 74 criteria for effective MOOC environments classified into the dimensions of pedagogy and technology, distributed into 6 categories, namely instructional design, assessment, user interface, video content, social tools and learning analytics.

The results of this study are based on a large survey including 107 learners as well as 98 professors both with MOOC experience. The statistics results of this survey showed that, learning analytics and assessment have obtained the highest average mean scores of 4.25 and 4.21 respectively, which reflects the importance of learning analytics and assessment as key features in MOOCs.

On the other hand, user interface, video content, social tools, and instructional design obtained average mean scores of 4.19, 4.13, 4.09, and 3.98 respectively. Although there is a wide agreement that usability, content, collaboration, and instructional design play a major role in achieving effective MOOCs, these categories were identified in our study as less important compared to the learning analytics and assessment categories. In fact, the latter two categories are highly challenging tasks in MOOCs and are still less explored than the former ones. Thus, it is crucial to investigate new learning analytics techniques to address the needs of different MOOC stakeholders (e.g. learners, teachers, educational institutions) and to develop feedback and assessment methods, such as badges and peer-assessment that reflect the open and massive nature of MOOCs.

Driven by the results of this study, our future work will focus on learner-centered MOOCs by providing a MOOC environment enhanced with embedded learning analytics components to foster self-reflection, awareness, and self-assessment as well as peer-assessment and gamification modules to support open assessment in MOOCs beyond traditional eTests and quizzes.

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