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Delving into participants' profiles and use of social tools in MOOCs

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Abstract— *This paper presents an in-depth empirical analysis of a nine-week MOOC. This analysis provides novel results regarding participants' profiles and use of built-in and external social tools. The results served to detect seven participants' patterns and conclude that the forum was the social tool preferred to contribute to the MOOC.*

Index Terms— collaborative learning, distance learning, Computer and Information Science Education

1 Introduction

MOOCs (Massive Open Online Courses) have caused a disruption in education systems in just a few months [1], [2]. Following the success of Coursera or edX in the United States, many initiatives at national levels were created across Europe, such as MiríadaX in Spain, FutureLearn in UK, iversity in Germany, or OpenUpEd, which is an umbrella initiative of European MOOCs. On the one hand, MOOCs offer teachers the opportunity to reach a large number of students interested in the subjects taught [3]. On the other hand, MOOCs enable students accessing free education provided by elite universities [4]. Furthermore, MOOCs are the meeting point for communities of people that share common interests [5].

The large number of people that register in MOOCs entails a great heterogeneity [5]. This heterogeneity does not only refer to participants' literacy, background or origin, but also to their performance throughout the MOOC; it is possible to find participants that complete the course with proficiency and also contribute actively to the generation of a community [6], and participants who have no real interest in the course but log in a couple of times just because it is free [7]. Between them, there are many others that are interested in the course but give up because they cannot keep pace and do not find the adequate support and advice [8].

The most engaged participants are expected to act as mentors, assisting their peers and enriching the MOOC with additional contents and discussion [9]. Mentors complement teachers, who cannot give personalized support to the large number of people enrolled in MOOCs [10]. Social tools, such as forums or social networks, are typically employed to connect MOOC participants. These social tools can be included in the platform that centralizes the course (built-in social tools) or can be provided by third-parties (external social tools) [11]. In any of these cases, an appropriate selection of social tools is a key aspect to effectively build connections among MOOC participants, facilitate mentors to support their peers and foster the creation of the MOOC community [12].

This paper delves into participants' profiles and use of social tools in MOOCs with the aim to help MOOC teachers detect different types of participants and make informed choices when selecting social tools. Specifically, this paper presents two contributions: a list of profiles that characterize participants according to their performance throughout the MOOC, and an analysis of the level of activity in built-in and external social tools around the MOOC. Both contributions are particularized for a nine-week MOOC called Digital Education of the Future (DEF), deployed in the platform MiríadaX. The decision to separate the analyses of participants' profiles and use of social tools is determined by the fact that data from the former were obtained from the mandatory part of the MOOC (watching videos and carrying out assignments), while data from the latter were obtained from the complementary support of the MOOC, which was not required to pass the course. These two perspectives provide an in-depth analysis of the course considering both, the participants' characteristics in and around the MOOC and their final outcomes. This paper uses partial data included in the conference paper [11], which covered the first six weeks of DEF, and extends the study to the entire course. This work seeks to provide an insight into the range of people that coexist in MOOCs and their activity in social tools based on empirical data. The results add an overall understanding of MOOC participants and can be used by teachers for designing upcoming courses.

The remainder of this paper proceeds with Section 2 laying the groundwork with a review of the literature related to participants' profiles and use of social tools in MOOCs. Section 3 briefly describes the MOOC DEF. Section 4 proposes a novel characterization of participants recognizing seven different patterns, according to their performance, and analyzes the level of activity in five built-in and external social tools using the data collected from DEF. Section 5 discusses the most relevant findings to support teachers in making informed choices when designing MOOCs. Section 6 draws the conclusions and set some open questions that emerge from this work.

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2 Related Works

Although MOOCs are a recent research field, there is already some literature exploring the diversity of people that coexists in these courses, and the use of social tools as a means for mass communication and collaboration. In addition, research in online learning and in other collaborative settings (especially regarding the analysis of social tools) provides results and ideas that sustain and inspire the contributions of this work.

2.1 Participants' profiles in MOOCs

Most of the research on participants' profiles has been done in xMOOCs, which are MOOCs that replicate the traditional educational model of knowledge transfer from teachers to students. However, there are also studies defining some participants' activity patterns in cMOOCs (connectivist MOOCs) [13], which are MOOCs that rely on user-generated content and in which connections among participants are key for the course to advance.

Regarding xMOOCs, some researchers have classified participants into different profiles according to their behavior during the course. For example, Hill [6] defines five profiles: *no-shows*, those who register in a course but never log in; *observers*, those who log in but do not take assessment tasks; *drop-ins*, those who participate in some activities but do not attempt to complete the entire course; *passive*, those seeing the course as content to consume; and *active*, those participating in all the activities and enriching the course. Similarly, authors in [14] distinguish five groups of people depending on their level of participation in the MOOC forum: *inactive*, those that do not visit the forum at all; *passive*, those that just consume information; *reacting*, those that add further aspects to existing questions; *acting*, those that post questions and lead discussions; and *supervising/supporting*, those that besides leading discussions summarize gained insights.

Regarding cMOOCs, the most relevant work is the one by Milligan et al. [15], who explored patterns of learners' engagement after 17 weeks of a cMOOC. This study classifies people into three patterns: *active*, those that followed the course and also enriched it through active blogs and Twitter accounts; *lurkers*, those that followed the course but did not engage with peers; and *passive*, those that were frustrated or dissatisfied with the course but still persisted until week 17. Both the existing xMOOC and cMOOC classifications of participants match some of the participants' 4C learning behaviors identified in [16]: consume, connect, create and contribute.

There is also research in online learning that provides some understanding about how to classify MOOC participants based on performance. For instance, Fischer [17] proposes a framework to support the exploration of human-centered social computing focused on cultures of participation, distinguishing among *unaware consumers*, *consumers*, *contributors*, *collaborators*, and *meta-designers*. Most people start as *unaware consumers* who, when aware of the possibilities offered by the supporting technology, become aware *consumers*. A fraction of the aware consumers contribute (*contributors*), organize the content acting also as curators (*collaborators*) and, in a small percentage, feel responsible for the content shared and extend the environment (*meta-designers*). Fischer's classification can be adapted to the MOOC context, since MOOCs are a particular type of participatory learning community.

These studies provide a base of empirical data for arranging MOOC participants according to different classification methods. However, more empirical research is needed in order to understand the relationship between participants' performance throughout a MOOC and final scores, defining simple and precise patterns for categorizing participants, as it is done in section 4.1 of this paper.

2.2 Social tools in MOOCs

In the last few months, discussions about the importance of using social tools in MOOCs appeared in both traditional peer-review publications and non-academic dissemination sources (e.g. blogs). Although most authors agree that social tools are the basis for supporting connections among MOOC participants and creating a "sense of community" [5] [18] [19], few studies provide empirical data about real use of social tools in MOOCs at the time. Hill gathers in a recent post most of these studies [20].

For example, authors in [21] report that only 3% of the people enrolled in edX's first MOOC participated in the discussion forum. This work also identifies that, of the total number of people that earned a completion certificate, 52% of them were active contributors in the forum. Duke University also reports that about 7% of people registered in its first MOOC contributed in the forum [22], participants being satisfied with its overall use. Similar conclusions were reached in [23], whose authors analyzed the activity in the discussion forums of 23 Coursera MOOCs. This study also reports that the number of people posting in the forums was never higher than 10% of registered participants, being under 5% in most cases. Finally, the University of Edinburgh reports a bit better numbers with an average of 15% of participants engaged in discussion forums in its first six MOOCs [24].

There are also a few studies that focus on the analysis of Facebook, Google+ or Twitter, which, although external to MOOC platforms, are sometimes useful in MOOCs as an alternative to discussion forums, and as a form of widespread publicity. As an example the report by Duke University [22] points out that over 80 students joined a Facebook study group during its first MOOC. Also, the course "E-Learning and Digital Culture" delivered at the University of Edinburgh had a large amount of social media activity in Facebook, Google+ and Twitter [24]. With respect to the latter social tool, authors in [25] analyzed the use of Twitter in the MOOC "OpenCourse" during two consecutive editions. They found that only 39% of the total tweets were related to the course topics, with 31% tweets about the course organization and 8% about MOOCs, tools and platforms in general. Interestingly, 17% of tweets had no visible connection to the course topics and 4% were just for self-marketing.

Although these works provide some empirical results about the level of activity of MOOC participants in one or two social tools, these results typically refer to built-in social tools. However, in this work, we compare in section 4.2 several built-in and external social tools for providing a more general picture of the discussions emerging around a MOOC and the kind of information shared among participants.

3 Digital Education of the Future

Digital Education of the Future (DEF) was a MOOC on educational technologies deployed in MiríadaX by five Professors from the Universidad Carlos III de Madrid (Spain) between 5th February and 25th April 2013. This MOOC lasted nine weeks with a short break at Easter. The nine weeks were divided into three modules of three weeks each, covering three broad subjects by means of video lectures: a) human computer interaction; b) mobile learning; and c) MOOCs as a disruption in education. There was also a short presentation module to introduce participants in the course topics, the assessment system and the social tools around DEF.

Teachers applied a continuous assessment in DEF during the whole course. Participants needed 50 points out of 100 to pass and there were 13 different summative assessment activities (see Table 1 for details about the weights of the activities and the timeframes to complete them). These activities were either multiple choice tests or peer review (P2P) activities, which were the two kinds of assignments supported by the platform MiríadaX at the time. P2P has been successfully applied for years in many fields including research, and is a recurrent way to assess tasks that cannot be automatically corrected in MOOCs [4]. MiríadaX implemented P2P activities as follows: a) participants got the first half of the score if they submitted the task and reviewed all their peers' work (the system typically assigned them 3-5 documents to review); b) participants got the second half of the score from the grade given by their peers. Teachers provided a detailed rubric to facilitate the review of P2P activities.

Id	Summative assessment activity	Week	Completion dates	Weight
A1	Module 1, end-lesson test 1	1	7 - 15 Feb	5%
A2	Module 1, end-lesson test 2	2	14 - 23 Feb	5%
A3	Module 1, end-lesson test 3	3	21 Feb - 1 Mar	5%
A4	Module 1, P2P activity	3	27 Feb - 10 Mar	10%
A5	Module 2, end-lesson test 1	4	28 Feb - 6 Mar	5%
A6	Module 2, end-lesson test 2	5	7 - 15 Mar	5%
A7	Module 2, end-lesson test 3	6	14 - 22 Mar	5%
A8	Module 2, P2P activity	6	14 - 25 Mar	10%
A9	Module 3, end-lesson test 1	7	2 - 10 Apr	5%
A10	Module 3, end-lesson test 2	8	9 - 17 Apr	5%
A11	Module 3, end-lesson test 3	9	16 - 24 Apr	5%
A12	Module 3, P2P activity	9	16 - 24 Apr	10%
A13	End-course test	9	20 - 25 Apr	25%
Course dates			5 Feb – 25 Apr	100%

Table 1. Distribution of summative assessment activities in DEF.

Regarding social tools, teachers selected five, two MiríadaX built-in and three external. Built-in social tools were Q&A and a forum. External social tools were Facebook, Twitter and MentorMob (see [11] for details about the intended purpose of each social tool in DEF).

The registration process in DEF remained open throughout the course. In total, 5,595 participants were registered after the nine weeks. The origin, literacy, background, status and motivation of the participants were very varied (see [11] for further information). The course was taught in Spanish and around 60% of people came from Spain, but there were also large communities of people from most Latin American countries.

Table 2 summarizes participants' final scores. A total of 456 people (8.15% of the 5,595 registered participants) passed the course, while 5,140 (91.85%) failed it. The maximum score achieved was 94.7 points out of 100, with the mean 9.37 and the standard deviation 20.22. The low mean value is the result of most participants getting zero points (70.49%), which is quite common in MOOCs, since a high percentage of registered people do not really intend to take them [6]. If we exclude participants with zero points, then the mean value increases to 31.75 (SD 25.97).

Result	Score	Num. participants	%
Failing	0 points	3,944	70.49%
	Between 1 and 29 points	914	16.34%
	Between 30 and 49 points	281	5.02%
	Total failing	5,139	91.85%
Passing	Between 50 and 69 points	272	4.86%
	Between 70 and 89 points	172	3.07%
	Between 90 and 100 points	12	0.21%
	Total passing	456	8.15%
Total		5,595	100%

Table 2. Distribution of participants' final scores in DEF.

4 Results and Analysis

This section analyzes the data extracted at the end of DEF. These data are arranged according to participants' performance, in order to detect different profiles, and the actual use of social tools.

4.1 Participants' profiles

In order to simplify and be precise when classifying participants we only take into account participants' performance in the sequence of activities proposed by teachers, which in most MOOCs involves watching videos and solving a exercises (tests and P2P activities in DEF). Thus, the participants' profiles defined here do not take into account the contributions submitted to the social tools, which are addressed in the next subsection. This classification builds on the patterns defined in [6] and [15], but considering that the registration process in DEF remained open throughout the course.

Three broad categories are defined for MOOC participants: *lurkers* (those that register in the course but watch a few resources at most); *participants that do not*

Category	Pattern	%	Number of participants	Passing	Failing
Lurkers	No shows	26.56%	1,486	0 (0%)	1,486 (100%)
	Observers	42.04%	2,352	0 (0%)	2,352 (100%)
Participants that do not complete the course	Drop-ins	13.21%	739	12 (1.6%)	727 (98.4%)
	Latecomers	5.38%	301	119 (39.5%)	182 (60.5%)
	Drop-in latecomers	5.22%	292	2 (0.7%)	290 (99.3%)
Participants that complete the course	Non-engaged	1.57%	88	28 (31.8%)	60 (68.2%)
	Engaged	6.02%	337	295 (87.5%)	42 (12.5%)
Total		100%	5,595	456 (8.15%)	5,139 (91.85%)

Table 3. Classification of the participants registered in DEF, indicating how many of them passed or failed the course.

complete the course (those that just take a part of the course); and *participants that complete the course* (those that take the course from the beginning to the end). Within these three broad categories seven patterns are established particularized for DEF. These patterns are summarized in Table 3:

- *No shows*. These are a type of lurkers that enrol in the course but do not perform any activity (neither watch videos nor solve exercises). No shows formed a large group of 1,486 people (26.56%) in DEF, for whom there were no records beyond clicking on the register button.
- *Observers*. These are another type of lurkers that register in the course, typically watch a few videos, but do not attempt any evaluation activity. There were 2,352 observers (42.04%) in DEF that watched at least one of the videos, despite not trying any summative assessment activity.
- *Drop-ins.* These are a type of participants that do not complete the course. They start the MOOC but never finish it [6]. 739 (13.21%) drop-ins were identified in DEF, checking that they completed the first summative assessment activity (A1), but did not attempt the end-course questionnaire (A13).
- *Latecomers.* These are another type of participants that do not complete the course. However, unlike drop-ins, latecomers join after the course starts. 301 latecomers (5.38%) were identified in DEF, checking that they completed the end-course test (A13), but missed the first summative assessment activity (A1).
- *Drop-in latecomers.* These are the third kind of participants that do not complete the MOOC. They join late and leave before the end of the course. 292 participants (5.22%) were classified as drop-in latecomers in DEF, checking that they missed the first summative assessment activity (A1), performed at least one of the intermediate activities (A2–A12), but left before the end-course test (A13).
- *Non-engaged.* These are a kind of participants that complete the course from the beginning to the end, but without participating in activities that require an important workload. We identified 88 non-engaged participants (1.57%) in DEF, as those that performed the first and last multiple choice tests (A1 and A13) and some other intermediate summative questionnaires (A2-A3, A5-A7, A9-A11), but did not participate in any of the three peer review activities (A4, A8, and A12).
- *Engaged.* These are also participants that follow the course from the beginning to the end, but in this case performing all kinds of activities. 337 engaged participants (6.02%) were identified in DEF, as those that completed both summative questionnaires and peer review activities. However, not all of them carried out the 13 summative assessment activities (only 104 people tried them all).

The larger number of observers with respect to no shows in DEF contradicts Hill's analysis [6] (he detected a higher proportion of no shows in Coursera MOOCs). That can be explained by two reasons. First, the registration process remained open as the course was being delivered, causing that many people decided to watch a few videos just after enrolling (observers). Second, the lack of availability of a stable version of the platform MiríadaX caused that the registration process could be open only fifteen days before the starting date, limiting the number of people that registered and did not click on any of the course materials (no shows). The lack of sufficient time to announce the course motivated that teachers decided to keep the registration in the course open for latecomers and that most of the score could be achieved in the second half of the course (65% of the total score could be obtained in weeks 6-9). Interestingly, we detected that 26.1% of those passing the course were latecomers (119 out of 456) as reported in Table 3, an important pattern that should be taken into account during the instructional design of the MOOC so as to support this profile.

Table 3 details the percentage of participants of each profile that passed the course. Obviously, all the lurkers failed with zero points. Nevertheless, we found a few drop-ins (and drop-in latecomers) that also got zero points in the few summative assessment activities they tried to resolve. Interestingly, the assessment system enabled that some of the people that did not complete the entire course reached 50 points out of 100. This is especially significant in latecomers, with 39.5% of them passing the course. Anecdotally, a negligible number of drop-ins (1.6%) and drop-in latecomers (0.7%) could also pass the course after completing most of the summative assessment activities, but leaving before the end-course test. We also noticed the penalty of not being involved in peer review activities, since only 31.8% of the non-engaged participants were able to pass DEF, even though they followed it from the beginning to the end. Finally, most engaged participants (87.5%) were able to pass following the continuous assessment system designed by the teaching staff (those engaged participants that failed the course typically skipped several intermediate

summative assessment activities).

The decision to let participants join the MOOC once started has the positive effect of latecomers counterbalancing the number of drop-ins. This can be seen in Table 4, which represents the number of participants in DEF that worked in each of the summative assessment activities. After the initial excitement of the start of the course (A1, A2), there was an important drop in the number of people that tried to solve A3; but this drop progressively decreased in the coming weeks thanks to latecomers. It is noteworthy that the number of people trying to solve the multiple choice tests even grew in some weeks, such as between A5 and A6, or between A10 and A11. Peer review activities, which demanded a higher effort to participants were less attractive and typically had a lower number of people working on them. Interestingly, the peer review activity in the second module received more people than the one in the first module. One possible explanation for this fact, as detected by the teaching staff inspecting the social tools, was the initial confusion of many participants with the two-step procedure of submitting their work and later reviewing their peers' tasks.

Summative assessment activity	Number of participants that attempted the activity	%
A1	1,164	20.8%
A2	1,105	19.7%
A3	900	16.1%
A4	497	8.9%
A5	847	15.1%
A6	865	15.5%
A7	799	14.3%
A8	523	9.3%
A9	799	14.3%
A10	748	13.4%
A11	763	13.6%
A12	351	6.3%
A13	727	13%
Total number of participants registered: 5,595 (100%)		

Table 4. Number of participants taking each of the 13 summative assessment activities in DEF.

4.2 Social tools

Participants in DEF contributed to the course using the five social tools selected by the teachers. Table 5 summarizes the number of people that posted messages in each social tool, the total number of contributions received per tool, and the number of posts submitted by the most active user in each social tool. It is interesting to point out that the most active user was different for each of the five social tools. Therefore, having several social alternatives enabled MOOC participants choosing the one (or ones) they felt more comfortable with or were more used to.

Q&A had a moderate impact in DEF with 604 posts from 339 different participants. This social tool was mainly employed to submit queries about the logistical and methodological aspects of the MOOC, such as certification, assessment system, or peer review assignments; and it was also the entry point for complaints about the platform, especially service outages. In total, 332 different questions were created through Q&A (4 of them by the teachers). Teachers tried to answer them all, but quite a few were also answered by DEF participants, who could also vote the most relevant ones. Unlike the other social tools, the contributions in Q&A began to arrive from the first day participants registered on the course, that is, a couple of weeks before the course actually started.

The *forum* was the tool with the highest impact in DEF. In total 2,819 contributions from 800 different participants arranged in 684 different threads were submitted to the forum, which was primarily used for deep discussions about the topics presented in the video lectures. Several participants used the forum very actively, with 50 users posting 10 or more messages in this social tool.

Facebook was the external tool with a higher impact, receiving 664 posts from 341 different participants. Facebook was also used for long discussions, usually started by the teaching staff. Figure 1 shows the number of contributions received in Facebook per day. It can be clearly seen the initial excitement and progressive drop, as well as intermediate peaks which were generally produced in response to teachers' posts in the Facebook wall.

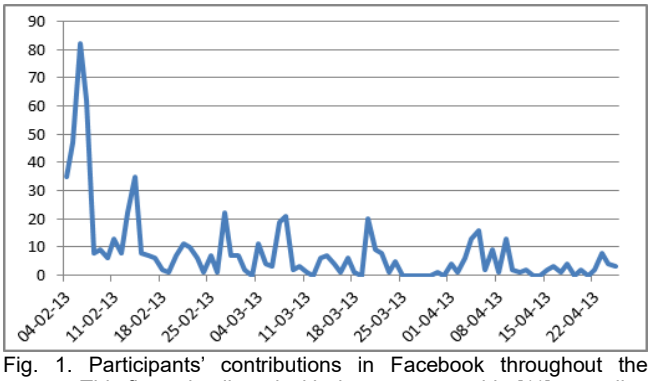

Fig. 1. Participants' contributions in Facebook throughout the course. This figure is aligned with those presented in [11] regarding Facebook and Twitter impact in the first six weeks of DEF.

Twitter had a moderate impact with 659 tweets including the course hashtags from 173 different people. That makes Twitter the social tool with a higher number of posts per user. These posts mainly contained opinions about open questions posed by the teachers, additional resources shared by the MOOC participants, and remarkable quotations extracted from the video lectures.

MentorMob had a very low impact as a social tool to share contents related to the MOOC, and people preferred other means for sharing, such as the forum, Facebook or Twitter. Teachers created four MentorMob lists and included some initial resources, but only 45 contributions from 34 participants were received, which means not only the lowest number of contributions and participants from the five social tools, but also the lowest number of contributions per participant. The impact of MentorMob was so low that the last resource was linked

	Built-in		External		
	Q&A	Forum	Facebook	Twitter	MentorMob
Number of people that posted in this social tool	339	800	341	173	34
Number of posts	604	2,819	664	659	45
Number of posts by the most active user	8	155	17	48	6
Number of posts per user	1.78	3.52	1.95	3.81	1.32
Date of the first / last post (2013)	18-01 / 25-04	04-02 / 25-04	04-02 / 25-04	04-02 / 25-04	05-02 / 09-04

Table 5. Participants' contributions in DEF. Posts from the teaching staff are excluded from these data.

two weeks before the end of the course.

Finally, and regarding the relationship between participants' performance and use of social tools, it is noteworthy that from those who passed the MOOC, 65.4% (298 out of 456) contributed in any of the five social tools. This number is slightly higher than the one reported in [21]. In addition, from those who did not pass the MOOC, only 14.3% (733 out of 5139) contributed in any of the available social tools.

5 Discussion

The classification of participants based on performance was established from the records provided by MiríadaX just after the end of the course. These records indicated whether a participant had taken an activity or not, and the score obtained (in the case of assessment activities). Nevertheless, MiríadaX only kept data from the people registered in the course at that moment. There might be other people that, apart from leaving the course earlier than expected, explicitly deregistered from DEF. These people, for whom there are no records, would be classified as lurkers (either no shows or observers), drop-ins or drop-in latecomers. From the messages posted in built-in social tools (Q&A and forum), we detected 119 people that contributed at some point during the course but later deregistered. All these people would be discarded as lurkers according to Hill's patterns [6] since they actively participated in the social tools; and thus these 119 extra participants would necessarily be drop-ins or drop-in latecomers. From the percentages of each pattern calculated in Table 3, we could estimate another equivalent 441 extra lurkers, and conclude that approximately 560 additional people enrolled in the course but deregistered before its end, which represents an additional 10% in the total number of participants. This additional 10% may be reasonable but probably too optimistic because lurkers tend to forget the course after their first access, which also includes deregistering.

The classification of participants presented in this paper is aligned with the one in [11], but taking into account that in the latter there are only four patterns versus the seven defined here. As the analysis here covers a longer period of time in comparison to [11], the number of lurkers increases and the people that followed DEF from start to finish decreases, as expected. Further, this paper builds the classification of participants looking into the performance of each individual in each summative evaluation activity, while [11] establishes the classification based on the total number of participants that completed each assignment. As such, the classification in [11] would be less accurate due to not taking into account that there might be people that could have missed some activity but carried out the subsequent ones. Furthermore, the classification of participants is not a novel contribution since it builds on outcomes from previous research works [6], [15] in which five of these patterns were already detected: no shows, observers, drop-ins, not-engaged, engaged. However, the particular features of the course enabled the detection of two additional patterns that do not appear in these previous works: latecomers and drop-in latecomers.

With respect to social tools, their potential to connect the different participants in DEF was apparent. From the 5,595 participants, at least 1,031 (18.4%) of them contributed through any of the five social tools available. This numbers are higher than those found in [21][22][23][24] and can be due to the higher number of social tools offered in this MOOC and to DEF teachers actively participating in tools like Facebook or Twitter fostering debate. The aforementioned percentage of contributors in DEF excludes the 119 extra users that also posted in the social tools but explicitly deregistered the course, and possibly some of the hundred usernames on Facebook, Twitter and MentorMob that could not be mapped to the corresponding usernames in MiríadaX. Creating a community of over one thousand participants connected through the social networks around a MOOC, no matter their profiles and interests, maximizes the possibility of finding people with whom to collaborate and share [5].

From the five social tools, participants in DEF preferred built-in tools and especially the forum to discuss and contribute. This conclusion based on empirical data (Table 5) is consistent with participants' perception of their degree of involvement in social tools, as studied through volunteer surveys filled out by DEF participants during the first weeks of the MOOC (see [11] for details). The preference for built-in social tools in DEF is aligned with the findings in [18], in which participants employed more the built-in forum than Facebook for privacy reasons. The fact that DEF participants found in a centralized platform both the learning materials and the social tools can also motivate their preference for built-in tools as a way to contribute to the course.

Of course, this preference for built-in tools was not true for everyone. And it must also be added that the five social tools available in DEF were employed for different purposes. Although a deeper analysis of the actual

content in the messages is required, from first analysis we can see that the forum or Facebook were more suitable for longer discussions about the course topics, unlike Q&A or Twitter. In addition, while teachers selected a specific tool to easily share and arrange related resources (MentorMob), participants decided to employ the forum, Facebook or Twitter to share these additional resources in a more unstructured way. This leads to an interesting result: it is a good idea to offer several social tools in MOOCs, as also suggested by [18], in order to get different outcomes and levels of participation.

However, offering multiple social tools in a MOOC has one major drawback: the information overload for learners and teachers, who must visit several sites to find the most significant contributions. In fact, we received complaints of information diluted in different spaces. Moreover, teachers had problems to detect emergent issues, and noted the repetition of the same discussions in several places. In order to overcome this shortcoming it is convenient to develop intra-tool filtering mechanisms based on the quality of the contributions, and encourage participants to follow best practices when using social tools, such as reading before writing or not opening unnecessary threads. Unified interfaces that allow posting in several social tools at the same time can also alleviate this drawback [26] although they are still not present in most MOOC platforms, as it was the case in MiríadaX.

The most positive aspect of including social tools in MOOCs is the appearance of mentors (or facilitators) giving support to their peers [5]. In DEF, these mentors were participants that voluntarily filled the gap of teacher-students interactions particularly within the forum. Among the more than a thousand people that contributed through the various social tools available in DEF, mentors would be found among the ones that posted more messages in one or several of these tools. The fact that there are voluntary mentors in MOOCs may help creating a stronger community around the MOOC and fostering the discussions in the different open threads.

On the opposite side there can be people with negative intentions that want to take advantage of the open nature of MOOCs for their own benefit. In the case of DEF, we found several participants posting comments off-topic and even spam. We also had people that voluntarily or involuntarily published some answers to assessment activities in the social tools. All in all, it is necessary to include rewards for mentors and enable the community of participants to self-regulate the MOOC throwing out those people that try to undermine the learning process.

6 Conclusions and Future Work

MOOCs are characterized by a large number of people enrolled in them. However, the performance of all these people throughout the MOOC is very heterogeneous, and only a few manage to follow the course from beginning to end. This paper classifies the participants in MOOCs according to seven different patterns depending on the assignments they take. The example of DEF is used to detect that observers are the largest group when MOOCs start their advertising campaign with little time in advance. Also, DEF shows the value of leaving a door open for latecomers, offering alternatives that encourage them not to give up. Properly identifying participants' profiles in MOOCs based on performance can help developing personalized recommending systems or more effective engagement mechanisms that can help reducing the existing high dropout rates.

This paper also analyzes the impact of built-in and external social tools in MOOCs, with the forum revealing as the main source of contributions in the case of DEF. Nevertheless, other social tools such as Facebook, Twitter and Q&A also had a moderate impact in the promotion of discussions and in the sharing of resources related to the MOOC. An important conclusion that stems from this analysis is the need for a trade-off between offering participants a wide range of social tools (so they can use the ones they feel more comfortable with) and the extra burden in order to process the large amount of information generated in the different social tools. Teachers should be aware of this conclusion when designing the MOOC, and also reflect about whether they will be able to promote the conversation (or at least follow it) if opting for multiple social tools, since most social tools need regular interventions to foster debate once past the initial excitement.

The findings of this paper also serve to open new lines of research regarding participants' profiles and use of social tools in MOOCs. One of these research lines concerns the role of voluntary mentors. Questions such as, who these people? what is their motivation? or whether they are really prepared to replace teachers or not, remain open. Besides, it would also be interesting to find out if it is possible to have these mentors in the next editions of the MOOC, as a way to generate a growing community of people that survives beyond the course. Another line of research refers to encouraging everyone, not only mentors, to further contribute in social tools with strategies like gamification approaches, which were not included in MiríadaX at the time of running DEF. Further, there is a need for mechanisms that help self-regulating the community, and fight against those who seek to undermine the learning process within the social tools. Related to this, it is necessary to find ways to filter the huge amount of information generated in the different social tools, separating and promoting the valuable contributions, no matter in which social tool they were posted. Finally, and in order to generalize the results obtained in this study, similar analysis should be made using MOOCs on different areas of knowledge, deployed in different platforms, and that include a varied number of social tools for participants to choose from.

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