International Review of Research in Open and Distributed Learning

Social Networks and the Building of Learning Communities: An Experimental Study of a Social MOOC

Mariana de Lima et Marta Elena Zorrilla

Volume 18, numéro 1, février 2017

Special Issue: Advances in Research on Social Networking in Open and Distributed Learning

URI : https://id.erudit.org/iderudit/1066178ar
DOI : https://doi.org/10.19173/irrodl.v18i1.2630

Aller au sommaire du numéro

Éditeur(s)

Athabasca University Press (AU Press)

ISSN

1492-3831 (numérique)

Découvrir la revue

Citer cet article

de Lima, M. & Zorrilla, M. (2017). Social Networks and the Building of Learning Communities: An Experimental Study of a Social MOOC. *International Review of Research in Open and Distributed Learning*, *18*(1), 40–64. https://doi.org/10.19173/irrodl.v18i1.2630

Résumé de l'article

This study aimed to analyze the student's behaviour in relation to their degree of commitment, participation, and contribution in a MOOC based on a social learning approach. Interaction data was collected on the learning platform and in social networks, both of which were used in the third edition of a social MOOC course. This data was then studied via statistical methods and analysis of social networks. This study assumes that social communities would arise around the course, would remain over time, and that participants would even contribute with new proposals. The findings indicated that social learning communities are built and continue only while the course is open and while the teachers are involved in fostering participation. Although this study is limited, the design criteria of the course, the pedagogical model on which this is supported, and the methods applied for this analysis provide other researchers and educators with clues for better understand the dynamic process of social learning in social MOOCs.

International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 18, Number 1

February – 2017

Social Networks and the Building of Learning Communities: An Experimental Study of a Social MOOC

Mariana de Lima and Marta Zorrilla
Universidad de Cantabria, Spain

Abstract

This study aimed to analyze the student's behaviour in relation to their degree of commitment, participation, and contribution in a MOOC based on a social learning approach. Interaction data was collected on the learning platform and in social networks, both of which were used in the third edition of a social MOOC course. This data was then studied via statistical methods and analysis of social networks. This study assumes that social communities would arise around the course, would remain over time, and that participants would even contribute with new proposals. The findings indicated that social learning communities are built and continue only while the course is open and while the teachers are involved in fostering participation. Although this study is limited, the design criteria of the course, the pedagogical model on which this is supported, and the methods applied for this analysis provide other researchers and educators with clues for better understand the dynamic process of social learning in social MOOCs.

Keywords: Social learning, learning communities, social networks, MOOC, learning analytics, education 3.0

Social Networks and the Building of Learning Communities: An Experimental Study of a Social MOOC

In the last several years, Information and Communications Technology (ICT) has taken a special relevance in education. Beyond being a technological support, the new digital environments are an alternative to the traditional classroom. Online courses have coexisted and supported classroom-based education. However, in the last decade, massive open online courses (MOOCs) have transformed this type of teaching. According to Schuwer *et al.* (2015), the MOOC movement is the latest "big thing" in Open and Distance Learning (ODL) and threatens to significantly transform higher education.

A simple definition, by OpenupEd (2015), says that MOOCs are "courses designed for large numbers of participants, that can be accessed by anyone anywhere as long as they have an internet connection, are also open to everyone without entry qualifications, and offer a full/complete course experience online for free" (p. 1).

Open and distance learning seeks to make education more open to those who need or wish for alternative opportunities to the traditional system (D'Antoni, 2009). As well, "it also draws upon open technologies that facilitate collaborative, flexible learning and the open sharing of teaching practices that empower educators to benefit from the best ideas of their colleagues. It may also grow to include new approaches to assessment, accreditation and collaborative learning" as claimed the Cape Town Open Education Declaration (2007, para. 4).

Brahimi and Sarirete (2015) note that in the traditional learning model, the teacher serves as the repository and transmitter of knowledge. In the MOOC's approach, however, the teaching model is generally inverted and focused on the learner who chooses his or her own "roadmap" by interacting with peers and accessing, in a flexible way, all information and resources (open and free). The learning cycle is an ongoing process that must be designed to improve the quality of knowledge as well as the collaboration among learners (Brahimi & Sarirete, 2015).

MOOCs are likely the leading exponent of the new Education 3.0 model. Education 3.0 is an umbrella term used by educational theorists to describe a variety of ways to integrate technology into learning. Although there is not a consensus definition for this term, most educators agree that Education 3.0 is a connectivist, heutagogical approach[1] to teaching and learning where teachers, learners, networks, connections, media, resources and tools create a unique entity that has the potential to meet individual learners', educators' and even societal needs, being that most resources are free (Gerstein, 2013). Education 3.0 suggests a new pedagogy where educators and learners create, shape, and evolve knowledge together, deepening their skills and understanding as they go (Cape Town Open Education Declaration, 2007).

Internet and technology, in general, and social media, in particular, have changed learning processes by questioning not just where people learn, but also how and why they learn. Education 3.0, and MOOCs as well, propose a relevant change in teachers' and learners' roles. Learners play a key role as creators and connectors of knowledge that are shared with others through social networks. Learners become the authors, drivers and assessors of their experiences and educators become a guide-as-the-side, coach, resource-suggester and cheerleader who encourage learners to create their own learning journey (Gerstein, 2014) and knowledge.

At the same time, social networks have created conditions for the development of new paradigms and methodologies in education (Putnik et al., 2015) such as community-based learning or social learning. Social learning is a key aspect of MOOCs platforms which supports scalable peer-based learning as well as acting as the main channel of interaction between teachers and students (Brinton et al., 2014) and between learners themselves.

Sol, Beers, and Wals (2013) define social learning as "an interactive and dynamic process in a multi-actor setting where knowledge is exchanged and where actors learn by interaction and co-create new knowledge in on-going interaction" (p. 37). On the other hand, Paredes-Labra, Herrán-Gascón, and Velázquez-Vázquez

[1] a holistic approach to developing learner capabilities, with learning as an active and proactive process, and learners serving as the major agent in their own learning, which occurs as a result of personal experiences.

(2012) stated that learning communities (and communities of practices as well), by exchange of ideas, experiences, proposals, and so on, must promote the improvement of professional and academic practices and the development of learners and professionals in a collaborative and integral way. Thus, active participation, socialization of experiences and the approach to common issues of interest are all key aspects to the success of this tool. In addition, Putnik et al. (2015) stated that social networking concerning education issues must be applied in two different dimensions: (1) to organize the educational process as a social network-based process (useful for peer assessment, discussions, and collaborative tasks); and (2) to analyze the students' interactions using techniques from the social network analysis field (SNA).

SNA is an important part of the social networks theory and corresponds to the study of relationships of individuals or groups of individuals. SNA represents both actors and relationships in terms of network theory, depicting them as a graph or network, where each node corresponds to an individual actor within the network, e.g., a person, a group or an organization, and each link symbolizes some form of social interaction between two of those actors, e.g., friendship or kinship. This representation is called sociogram.

SNA draws on various concepts from the graph theory to describe and illustrate the individual and collective structure of a network. The most relevant are the centrality measures (Freeman, 1977) which allow us to identify the most prominent actors: that is, those extensively involved in relationships with other network members.

An advantage that sociograms present is that they are highly meaningful and easily usable since they generally allow users to rank and filter network nodes or links based on the values of network concepts. Even more, sociograms are able to represent different features by designing elements using different shapes and colours, which enable teachers to gain insights in a glimpse (Zhu, Watts, & Chen, 2010).

SNA techniques have been applied to data from very different contexts, which allow researchers to model different types of interactions. In the educational arena, Dawson, Tan, and McWilliam (2011) used centrality measures to monitor the learners' creative capacity; Putnik et al. (2015) studied the correlation between these measures and students' performance; and Rabbany, Elatia, Takaffoli, and Zaïane (2014) applied SNA so as to analyze the structure of the interactions raised between the students in forums.

Social networks and collaborative learning are essential elements of a MOOC, especially for massive courses called "cMOOC." The use of both internal and external social networks in a MOOC is well appreciated by students (Castaño-Garrido, Maiz-Olazabalaga, & Garay-Ruiz, 2015), and their use is also very suitable for developing collaborative learning tasks (Brinton et al., 2014). On the other hand, sociograms and centrality measures are valuable tools for understanding the social network phenomena (Zhu, Watts, & Chen, 2010). Therefore, these tools along with analytical techniques are used to analyze the students' behaviour in relation to their degree of commitment, participation, and contribution in a MOOC supported on a social learning approach.

MOOC's Pedagogical Approaches and ECO Project

To introduce connectivism as an essential element of a learning model is to assume that the learning process is no longer an internal or individualistic activity (Siemens, 2014). ICTs, Internet, and other digital tools are making an impact on the field of education and are forcing the education community to develop new

learning approaches based on interaction, exchange, and collaboration, and focused on learners rather than on content or on teachers as has been done in the past. In this sense, connectivism supposedly has the potential to improve teaching methods and encourage both innovation and new pedagogical practices (Yuan & Powell, 2013).

Siemens (2012) used the terms cMOOC and xMOOC to contrast two different pedagogical approaches of MOOCs. While cMOOCs are rooted in principles of connectivist learning that emphasize creation, creativity, autonomy and social networked learning, xMOOCs are instead based on a transmission model of teaching and learning. In addition, Yuan and Powell (2013) stated that cMOOCs emphasize connected and collaborative learning and provide with a new pedagogy beyond traditional classroom settings unlike xMOOCs which are an extension of online pedagogical models, dominated by the traditional instructional methods with video presentations, short quizzes and testing. From this base, the use of social space for exchange becomes essential for the development of a MOOC based on connectivism and the principles of Education 3.0, where social networking plays an important role (Gerstein, 2014) and in which development of collaborative knowledge is a key aspect (Castaño-Garrido, Maiz-Olazabalaga, & Garay-Ruiz, 2015).

Considering this framework and the recent and significant changes in the field of traditional and online education, the ECO Project was funded to contribute to the increase, improvement, and development of social MOOCs.

ECO project: Pedagogical model. Elearning Communication Open-Data: Massive Mobile, Ubiquitous and Open Learning (ECO Project) is a European consortium formed by 23 public and private institutions and organizations from all over Europe and funded by the European Union through the "Competencies and Innovation Framework Programme" (CIP).

ECO Project is aimed to design, develop, and evaluate different MOOCs for educators and the teaching community in order to provide basic tools for both the development of these types of courses and to promote specialization in different areas. Furthermore, ECO Project aims at creating courses that follow a new pedagogical approach.

The pedagogical model of ECO Project assumes a "traditional" educational design in combination with the power of social media, bringing together didactic content, participation, debate, and dialogue through internal (forum) and external (Facebook and other) social networks. In any case, this pedagogical approach, based on connectivism and the social-constructivist perspective, goes towards the construction of a learning community that could be active even after the course has ended. So, the "s" in ECO sMOOC stands for "social," since it should (ideally) provide a learning experience marked by social interactions and participation among students (Morgado et al., 2014).

According to Wenger (1998), communities of practice are characterized by three essential dimensions that make them different from other kinds of groups or communities: what it is about, how it functions, and what capability it produces. In this sense, "communities of practice develop around things that matter to people. As results, their practices reflect the members' own understanding of what is important . . . even when a community's actions conform an external mandate" (Wenger, 1998, p. 4). Furthermore, and

independent of the nature of the community, its development depends on a diverse and well-distributed internal leadership (Wenger, 1998).

Based on that, in ECO's courses, the use of internal and external social spaces aims to go beyond the simple interaction between people (chat) and delve into the thoughtful exchange of good-practices, thus creating a network of interest, knowledge, and new ideas. In order to reach this goal, and following ECO's pedagogy, some collaborative (non-mandatory) tasks must be regularly proposed using social networks (e.g., forum and Facebook). The main objective here is to generate not only discussion, but also further debate between participants around each topic.

Because these courses can have a wide variety of targets, it is not possible to design a one-solution-fits-all model. It needs to be designed as a framework model within which choices are made and specified in order to make the courses effective. People who participate in this learning event become part of a learning community, which, to some extent, is also a community of interests or a community of practice (Morgado et al., 2014).

In short, the main pedagogical principles of ECO Project model are (a) learner-centeredness, (b) autonomy, (c) interaction (as "s" in sMOOC indicates), (d) flexibility, (e) digital inclusion and (f) ubiquitous learning. Thus, the xMOOC's pedagogical approach is avoided by applying connectivist and social-constructive learning and situated practices.

This new pedagogical framework highlights a new scenario in which social networks have a special importance. Thus, analytical studies addressed to evaluate whether the goals of this learning model are achieved or not must be carried out.

Methodology

This paper adopts a case study approach to investigate our research questions. This method of study is especially useful to test theoretical models by using them in real world situations. While it will not answer a question completely, it will give some clues and allow further conclusions to be drawn on the subject. As Yin (2009) claimed, the case study research is a linear but iterative process, meaning that each step in the process must be reviewed and each decision questioned. This iterative analysis has been performed for this research at the beginning of each edition of the course.

This study will explore the following research questions related to social network-based learning and the building of learning communities:

RQ1. What is the profile of the learners who follow a social MOOC and what is their behaviour?

RQ2. What types of networks emerge?

RQ3. Do social network-based activities enable the creation of learning communities that endure over time?

Data Sources

Our study comprises different data sources. On the one hand, MOOC participants' activity data collected in ECO's platform was read and stored in a MySQL database. This data provides us with information about videos watched entirely, completed peer-review assignments, and number of messages written and replied to by each participant in the forum. On the other hand, activity registered in Facebook was extracted using Facebook Graph API and saved in the same relational database. From Facebook, we recovered all the posts written in response to each topic and its social valuation ("likes"). The account created on Facebook is public and is called "*Innovacion Educativa y Desarrollo Profesional*."

Due to ECO Project's awareness of legal and ethical issues concerning the use of personal data and its commitment to reduce technological barriers for those users with special needs or at risk of exclusion, the platform does not oblige users to fill out any feature except for a name. Therefore, two anonymous surveys were prepared: an initial one, focused on discovering the learner's profile, their background, and their goals in this course; and a satisfaction survey at the end of the course to measure to what extent the course fulfilled its aims.

Analytical Tools

This study employed two analytical techniques: SQL/OLAP and SNA (Social Network Analysis). SQL/OLAP, to manage and aggregate data from different points of view and pivot tables (available in Microsoft Excel) to visualize data and draw meaningful plots. ORA Software (Carley, 2014) was chosen to measure and visualize the social networks, which arose from the participants' interaction in forums and on Facebook. Specifically, centrality measures at an individual level were used to identify the most influential participants in the network.

Research Context: Course Description

The course being analyzed is called "Educational innovation and teacher professional development. Possibilities and limits of ICT." It was taught in Spanish, hosted in OpenMOOC platform (https://ecolearning.eu/), and lasted eight weeks. The course was aimed at preparing students to design, develop, and evaluate contextualized educational innovation projects, which included the use of information and communications technology (ICT).

The course was designed under a social learning approach and seeks to encourage students to work autonomously (i.e., to be able to independently select activities and content that are interesting for them) as well as to stimulate the interaction between participants through peer-review tasks and debates opened in the forum (inside the platform) and social networks (Facebook, Twitter, Google+/Hangouts, in this case). Peer-review activities were compulsory (and required to obtain badges), whereas discussions were optional. Furthermore, at the beginning of each content module the teaching team invited participants to watch a Hangouts meeting in order to present the team, structure, content, activities, and assessments of each unit.

The course has been taught in different periods: the last term of 2014 with 305 students enrolled, spring of 2015 with 709 (404 new enrolments), and the last term of 2015, the target of this study, with 1311 students registered (602 new enrolments). The experience and the analysis of the first and second edition allowed

us to better organize the schedule and focused on the use of one external social network (Facebook) and on the internal platform (forum).

The analysis of available activity data in the third edition allows us to validate or refute our hypothesis: if social MOOCs make the building of learning communities easier, and if those communities endure over time.

Table 1 briefly collects the collaborative tasks and their schedule in the third edition, which took place between 5th October 2015 and 20th December 2015 (weeks 41 to 48 in 2015). The course was extended two weeks for delivery.

Table 1

Schedule of the Third Edition of the Course

Unit - Week	**Social learning activities**
Unit 1 - week 1	Introduce oneself in ECO´s platform forum Discussion regarding unit content in the platform forum Exchange of photos on Facebook to present how ICTs are being located and used in participants' context Initial survey
Unit 2 - week 2	After reviewing basic and supplementary materials (articles and videos), participants should debate unit content via ECO´s platform forum Exchange of experience on Facebook related to the barriers participants found upon introducing ICTs in their particular educative contexts
Unit 3 - week 3	After reviewing basic and supplementary materials (articles and videos), participants should debate unit content via ECO´s platform forum Exchange of information on Facebook related to participants' experience in ICTs training
Unit 4 - weeks 4 and 5	P2P tasks include individual effort, drafting of a report, and collaborative effort via a peer-to-peer assessment task After reviewing basic and supplementary materials (articles and videos), participants should debate unit content via ECO´s platform forum Exchange of experience on Facebook related to students' participation in educative innovation projects
Unit 5 - weeks 6 and 7	P2P tasks include individual effort, drafting of a report, and collaborative effort via a peer-to-peer assessment task After reviewing basic and supplementary materials (articles and videos), participants should debate unit content via ECO´s platform forum Exchange of information on Facebook related to professional educative innovation networks
Unit 6 - week 8	Satisfaction Survey

Findings

RQ1. What is the Profile of the Learners Who Follow a Social MOOC and what is their Behaviour?

Firstly, we analyzed the initial survey using Google Forms (see an excerpt of this survey in Figure 1). We received 253 units out of 602 new enrolments in the third edition (42%). Most learners are women (62%) with an age range of 18 to 30 years old, whose aim is to gain knowledge. Most have a degree in Education or another similar field. They consider themselves very active in the use of social networks (80%). Only 38.3% of learners had previously carried out a MOOC. Participants came mainly from Spain, Venezuela, Mexico, Colombia, Argentina, and Ecuador.

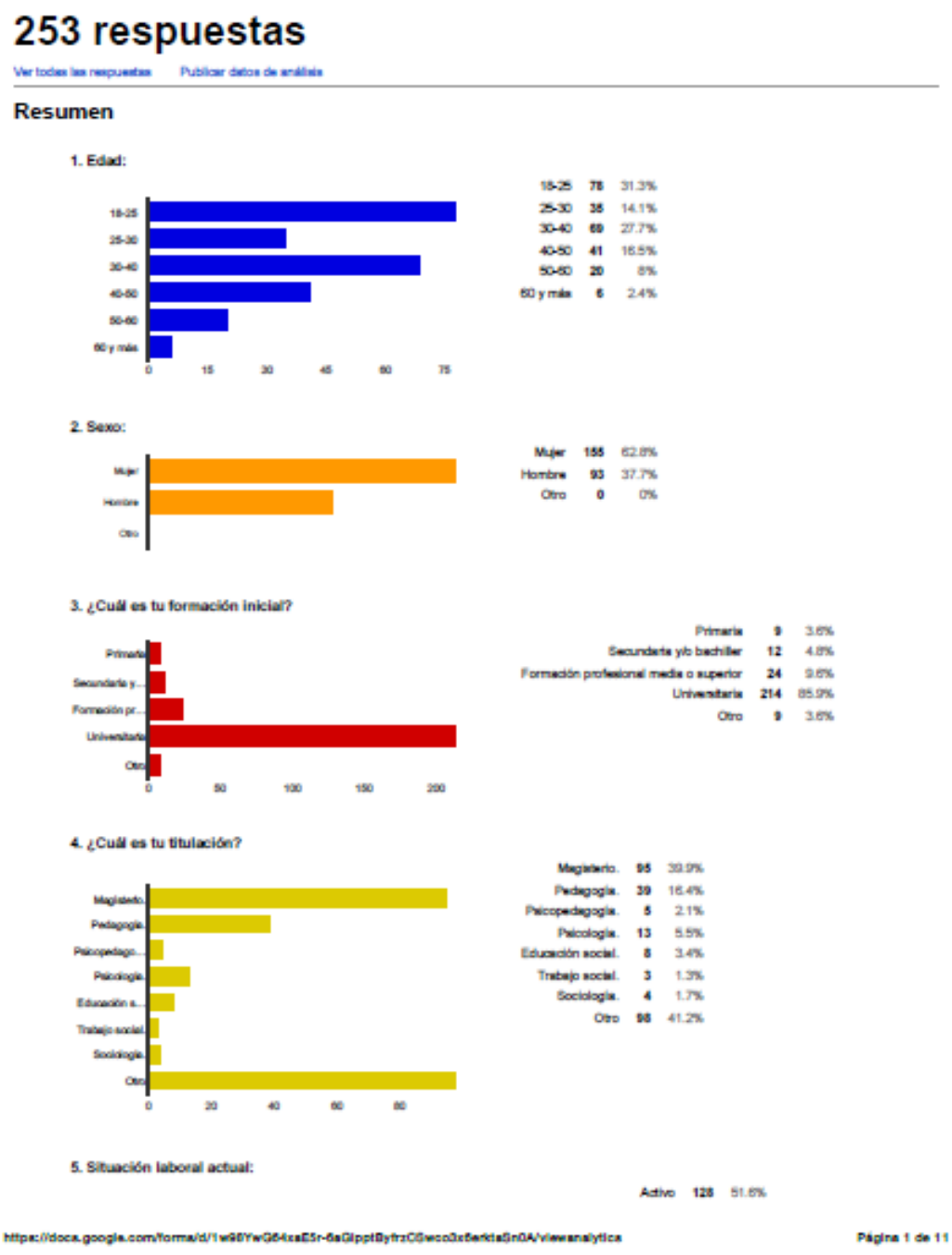

Figure 1. An excerpt of the initial survey. Question 1 asks age, 2 asks what gender, 3 asks "What is your academic level?" and 4 asks, "What is your degree?"

One well-known problem in MOOCs is the high dropout rate in the first few weeks of the course (Brinton *et al.*, 2014; Alario-Hoyos, Perez-Sanagustin, Delgado-Kloos, Parada, & Muñoz-Organero, 2014). Social MOOCs also suffer from this inconvenience but the fact that the course is always open makes new enrolments easier during the course and thereby slightly compensates for the dropout rate. Figure 2 depicts

the number of enrolments and dropouts per week throughout the length of the course. The course started in week 41 and finished in week 48 although the course was finally closed in week 50 of 2015. Here, we have only taken into account those learners who were in the platform at least one day. As can be observed, the course received students each week. The highest dropout rate occurred in the two first weeks (weeks 41 and 42 of the year 2015). Although we do not know the reasons, it is quite likely that the course did not meet the students' expectations. Remarkably weeks 4 and 5 of the course (weeks 44 and 45 of 2015) received a relevant number of enrolments.

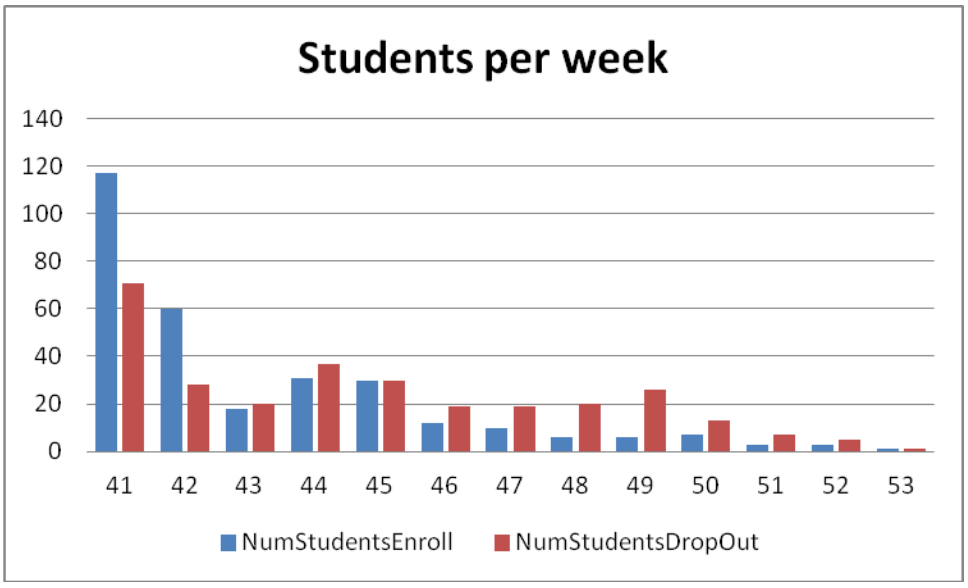

Figure 2. Number of enrolments and dropouts per week of the course.

In general, learners who started the first few weeks are those who followed and participated in the course, although as can be observed in Figure 3, there were also participants who enrolled later and performed the compulsory activities. On the other hand, the fact that these kinds of courses are both free and flexible also influences the degree of commitment, which is generally lower compared to a traditional setting.

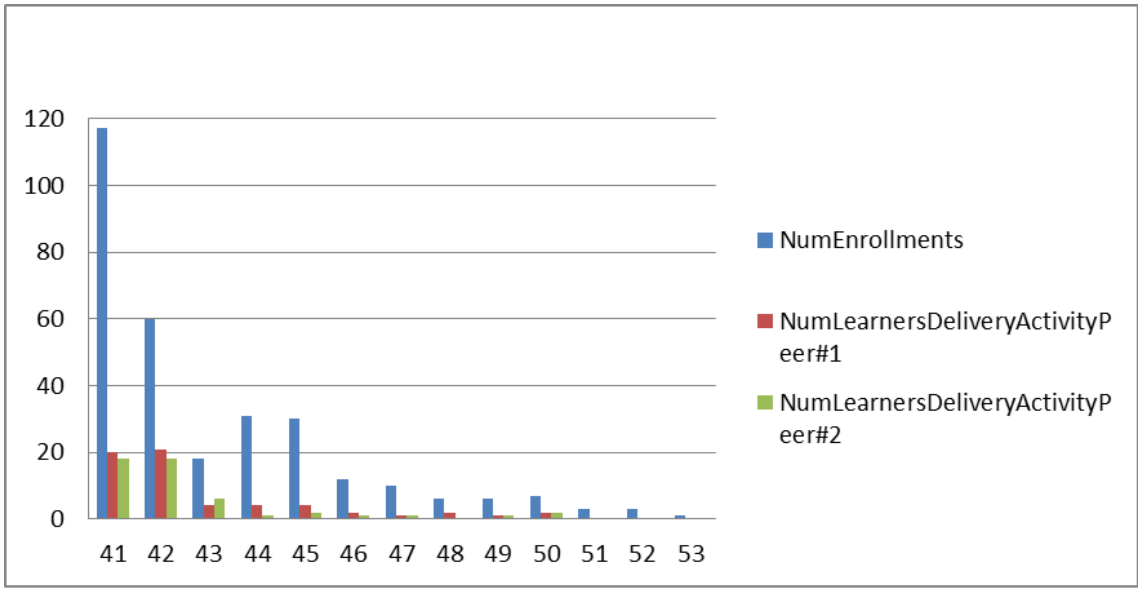

Figure 3. Number of learners who enrolled each week alongside the number of learners who delivered the peer-reviewed activities (compulsory).

As commonly occurs (Putnik et al., 2015), those who participate more achieve a higher mark, as shown in Figure 4. Only 35 learners performed the two compulsory peer-reviewed activities, seven did only one, and 82 students did some activity in the platform such as visualizing videos or participating in the forum. This demonstrates that people who enrol in a social MOOC do not seek to achieve a certificate but to gain knowledge on a topic.

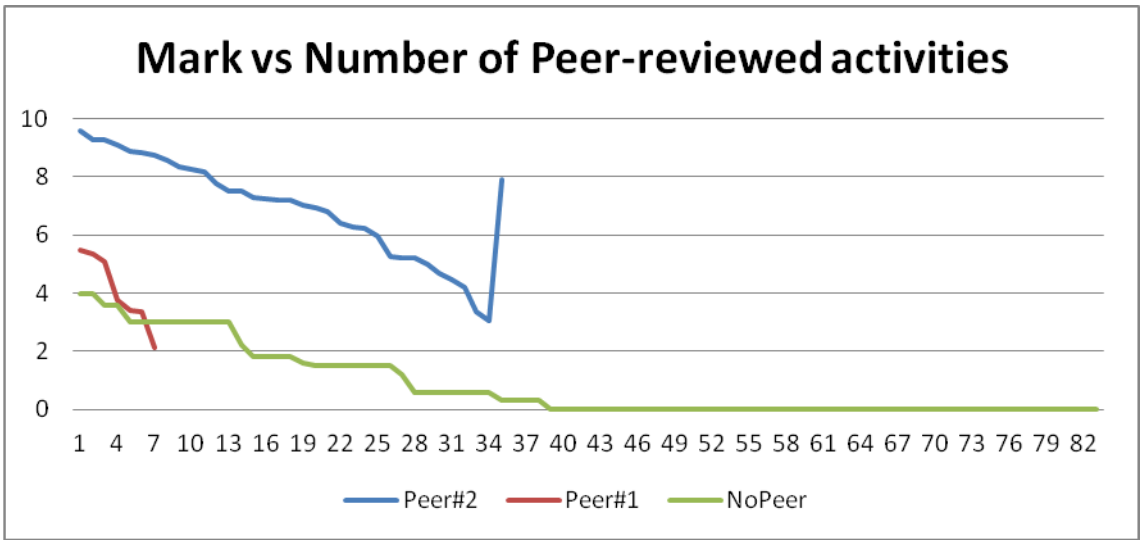

Figure 4. Mark in a 10-likert scale vs. activity performed in the platform.

Regarding the activities performed in the forum and on Facebook, data shows that the highest number of messages were written during the week in which the discussions were opened, though the discussions continued until the end of the course, with the exception of activity number 5 in which most comments appeared two weeks later, most likely due to the delivery of the second peer-reviewed task. Figure 5 displays the number of messages written in each forum activity each week except forum activity 1, which was discarded because it was focused on introductions and not on discussion topic. Figure 6 depicts the number of comments written on the wall. These plots show that both tools were used equally and that the activities were implemented at the same time. Thus, it can be claimed that the tools were not a barrier for the learners.

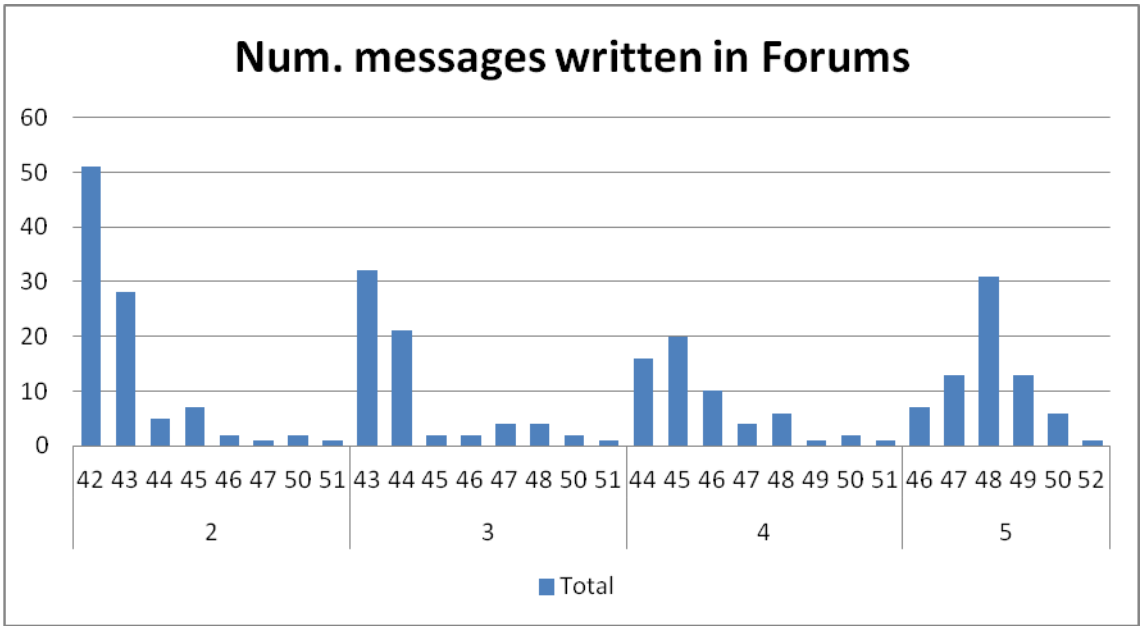

Figure 5. Number of messages written in Forum activities per week since Forum opening.

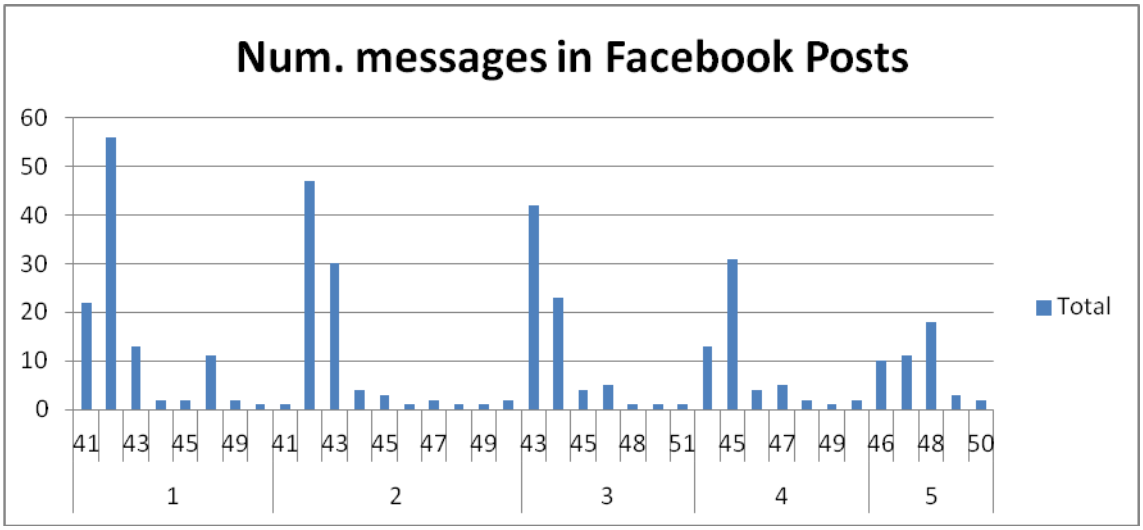

Figure 6. Number of messages written on Facebook activities per week since Forum opening.

Finally, another interesting fact (see Table 2) is that participants contributed mostly on weekdays, considering that the number of messages was remarkably lower on weekends.

Table 2

Total Number of Messages Written on Facebook and in the Forum Per Day of Week throughout the Course

Day of week	Num. msg facebook	Num. msg forum
Wednesday	73	61
Friday	72	57
Tuesday	68	55
Monday	64	44
Thursday	50	35
Sunday	30	23
Saturday	23	21

RQ2. What Types of Networks Emerge?

Although papers such as Alario-Hoyos et al. (2014) demonstrate that learners in cMOOCs prefer forums, this study conversely does not, as shown in Figure 5 and 6. Social MOOCs attract people who like and frequently use social network sites and thus, the activity in this respect is quite balanced. The total number of participants, both learners and teachers, was 104 in the forum and 103 on Facebook, and as can be observed in Table 3, their participation per weeks is quite similar. One limitation of this study is that we could not identify each person on Facebook with his/her account in ECO Platform thus we could not know for certain that they were the same person.. Only those who filled the ECO register form properly and were identified by their full name on Facebook were able to be followed (35 people). These students participated in both platforms but in different activities. Thus, the tool was not a barrier.

Table 3

Number of Messages Written on Facebook and in the Forum Per Week

Week of the year	Num. participants facebook	Num. participants forum
41	18	
42	60	38
43	48	42
44	30	31
45	34	27
46	14	12
47	15	16
48	20	24
49	7	7
50	2	3

Regarding the number of messages, Table 4 reflects that the participation is quite similar. In fact, most learners only wrote one message per discussion task and they generally did not contribute in all of them. Furthermore, it must be taken into account that some participants instead of writing a long text, sometimes sent several short and consecutive messages, which leads to this small difference. The average length of messages is 400 characters, ranging from 44 up to 3110 characters. Thus, these texts are quite extent and discursive, although regrettably they do not reach the metacognition phase which is necessary to construct new knowledge according to Kellogg, Booth, and Oliver (2014). Basically, learners paraphrase the content of a video or text. For instance,

> Por lo general, por lo que comentáis, la falta de disponibilidad de equipo y recursos no es la barrera más importante para la incorporación de la innovación con TIC;. . .
>
> You usually say that the lack of availability of equipment and resources is not the most important barrier for including ICTs in innovation. . .

Table 4

Number of Messages Written on Facebook and in the Forum Per Activity

Post/forum	Num. comments in Facebook	Num. messages in forum
1	109	-
2	92	97
3	77	68
4	58	60
5	44	71
Total	380	296

Sociograms, in Figures 7 and 8, depict the interaction produced in each Facebook and Forum task respectively, and show the participants who wrote comments in each discussion. Red nodes represent learners and teachers and yellow nodes, topics. The links between nodes signify that a comment was written by that participant regarding that topic. There were 27 people who wrote messages in the five posts on Facebook, 9 people in four, 7 in three, 20 in two, and finally 35 in only one post. Regarding the forum, a similar type of network appears. In this case, 28 people contributed in the four forum activities but only once, 14 in three, 15 in two, and 30 in only one forum task. The thickness of the edges in Figure 8 depicts the number of messages sent. This shows that only three people wrote several messages (@jgdq314242, @Elia, and @Carlos.Rodriguez) but, as can be observed, only in one or two activities. It must be highlighted that all of them were teachers.

Tools that build these sociograms allow teachers to filter by different features such as topics or number of messages interchanged, enabling them to discover who is interested in each topic (community of practice) and to what extent.

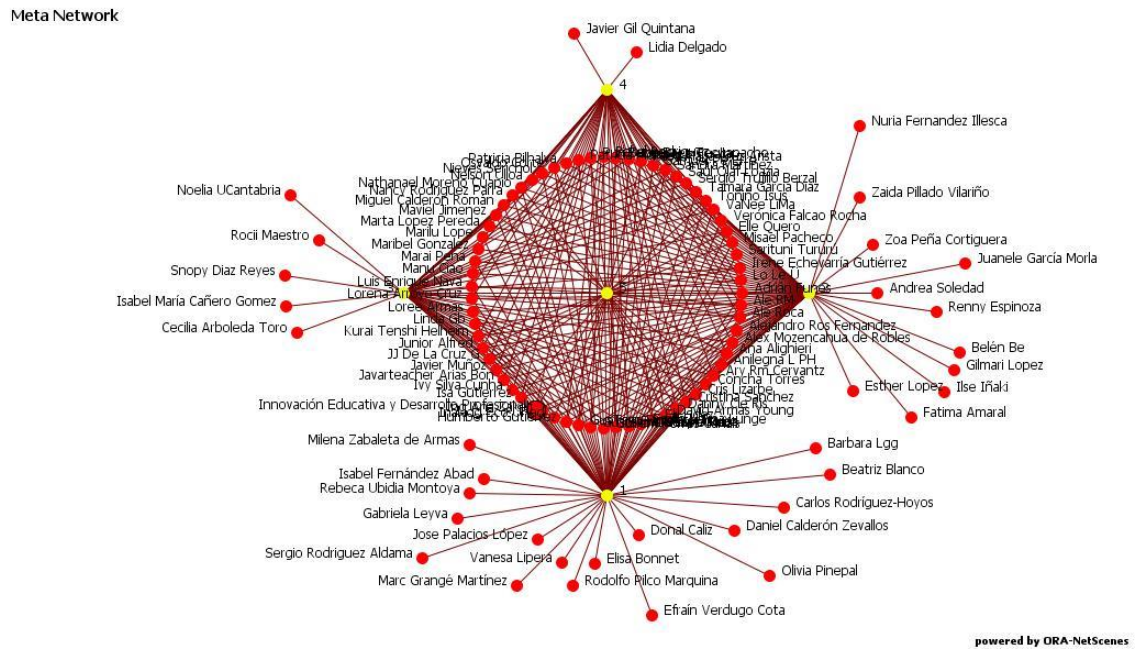

Figure 7. People involved in Facebook activities: yellow spots identify Facebook activities whereas red spots represent participants.

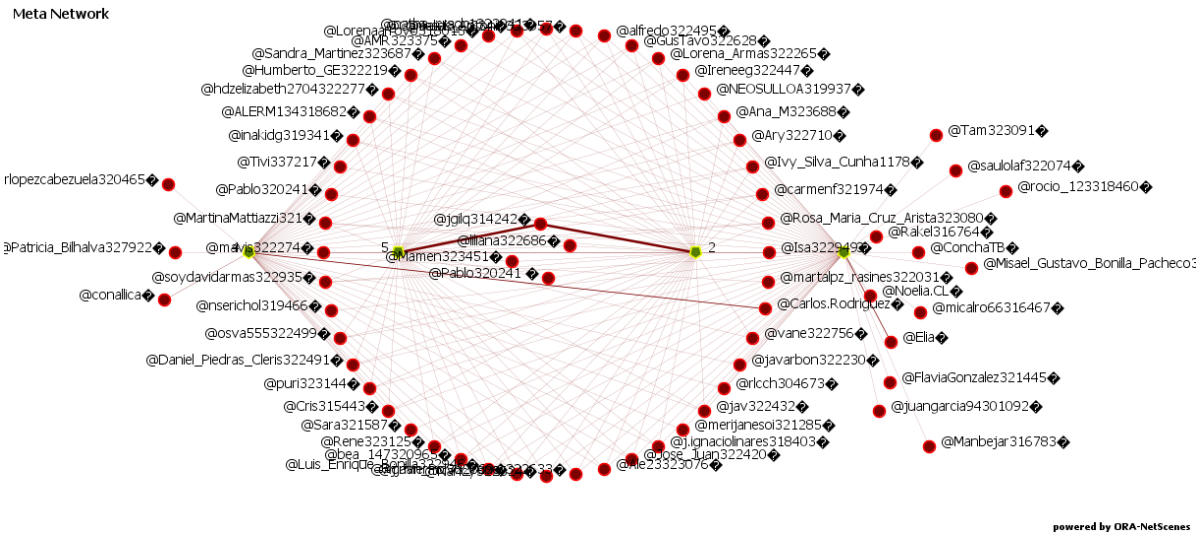

Figure 8. People involved in forum activities: yellow polygons identify Facebook activities whereas red spots represent participants.

If we focus now on the degree and type of interaction, Figures 9 and 10 depict that the social network created is radial, which means that teachers were the ones who encouraged and kept the activity going. *Innovacion Educativa* was the account used by teachers on Facebook. The thickness of the edges in the sociogram

represents the number of messages interchanged. It ranges from 1 to 5. It can be observed that the interchange of messages in the Facebook community was very low, only pointing out the learner Javarteacher Arias Bon who sent several messages to Concha Torres. Furthermore, few participants communicated directly with others: this is the case of David Armas Young, Noelia UCantabria, and Irene Echevarría.

The forum community (Figure 10) seems to have facilitated the communication between more people. That is to say that participants in forums answered comments from other students as well as those directly from teachers, whereas participants on Facebook generally responded only to the main comment. Despite this, the network is also radial. Learners @joselbd, @inakidg319341, @Ireneeg322447, and @javarbon322230 communicated with more participants, as the number of links that emerge from their nodes show.

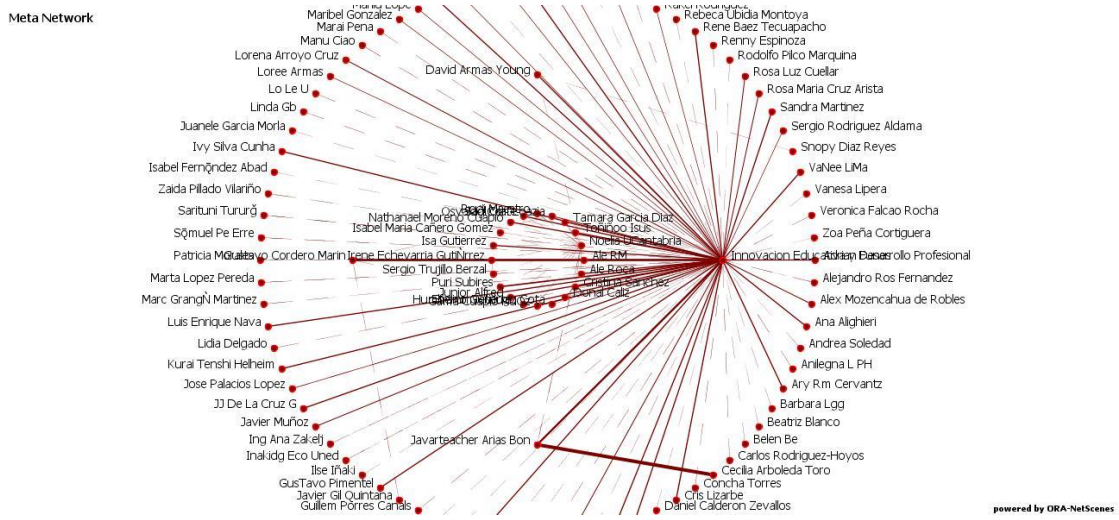

Figure 9. Interaction graph built from the interchange of messages on Facebook. Thickness of edges is proportional to the number of interchanged messages.

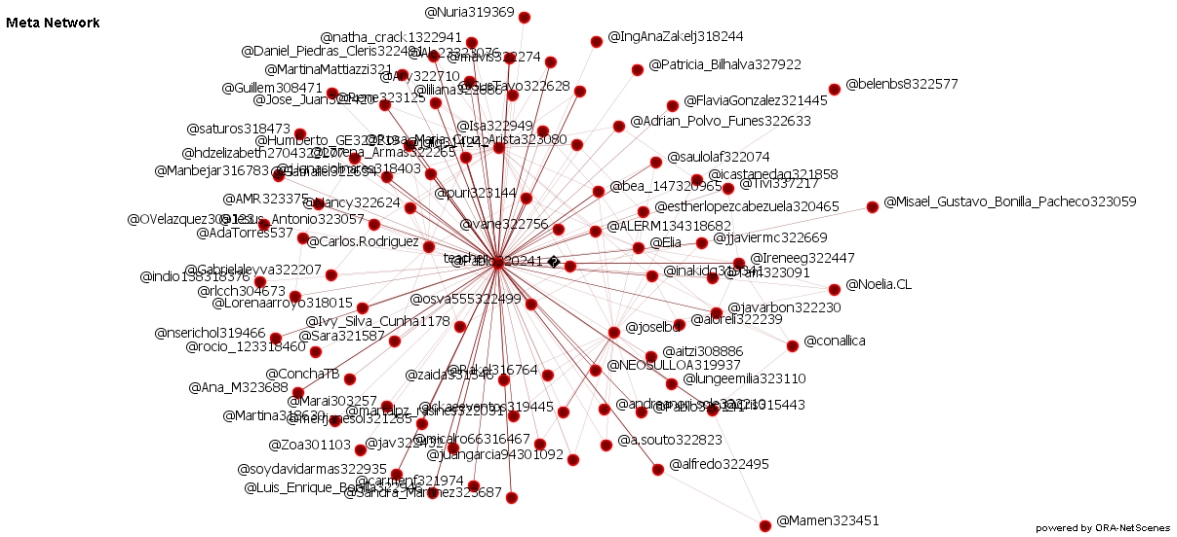

Figure 10. Interaction graph built from the interchange of messages in the forum. Thickness of edges is proportional to the number of interchanged messages. It ranges between 1 and 5.

Because this is more difficult to appreciate graphically, SNA centrality measures were used (Freeman, 1977), allowing us to know which participants contributed the most and which were essential to keeping the network alive. Figures, thus, help to measure, to rank, and to compare the differences in participation.

The *degree* measures the immediate influence: which participants were more active, i.e., those who were more deeply involved in the activity, either asking or responding. If we take into account the direction of the links, the *indegree* reveals those participants that responded the most, because of their reputation or due to the question itself, i.e., it may be an interesting or controversial question. On the other hand, the *outdegree* depicts those participants who respond the most, i.e., those who contribute to the activity by adding new content, proposing new approaches to the discussion, or asking for further explanations. The *betweenness* detects those participants who discuss the most and make others discuss, either by asking questions or answering in such a way that the others are encouraged to intervene, i.e., they act as the vehicle of communication. *Authorities* are those participants with high authority values who seem to have some sort of reputation, because what they ask is usually worthy of a response.

Tables 5 and 6 show the SNA measures of the people whose participation was remarkable (marked in bold) on Facebook and in the Forum respectively. As can be observed, the leadership on Facebook was held by teachers (mainly by *Innovacion Educativa y Desarrollo Profesional* account), since they had the highest values in *indegree*, *outdegree,* and *authority*. It must be also remarked that the learner Javarteacher Arias Bon had facilitated and encouraged participation in the learning community as his *betweenness* and *indegree* show. This leads us to confirm that the Facebook learning network is kept thanks to teachers' involvement.

Table 5

Relevant Participants According to SNA Centrality Measures from User x User Facebook Network

	Authority	Betweenness	In-degree	Out-degree	Role
Innovacion Educativa y Desarrollo Profesional	**0,41085**	**0,39426**	**0,22544**	**0,02285**	Teacher
Noelia UCantabria	0,00533	**0,12644**	0,00305	**0,01523**	Teacher
Gustavo Cordero Marin	**0,00793**	0,02366	0,00228	0,00914	Learner
Javarteacher Arias Bon	0,00458	**0,13624**	**0,01219**	0,00762	Learner
Cristina Sanchez	**0,00799**	0,0099	0,00305	0,00609	Learner
David Armas Young	0,00003	0,00406	0,00152	0,00381	Learner
Efrainn Verdugo Cota	0,00663	0,00752	0,00152	0,00152	Learner
Isabel Maria Cañero Gomez	0,00121	0,01168	0,00152	0,00076	Learner
Donal Caliz	0,00178	0,00228	0,00076	0,00076	Learner
Cecilia Arboleda Toro	0,00237	0	0,00076	0,0099	Learner
Puri Subires	**0,00796**	0	0,00228	0,00457	Learner
Ale Roca	0,00003	0	0,00076	0,00381	Learner

Regarding the forum network (Table 6), it was the teachers who received most of the comments, whereas learners (e.g., @joselbd, @Ireneeg322447, @bea_147320965, and @javarbon322230 with high out-degree) were the ones who answered the most. The teacher, @jgilq314242, played an important role as a link between participants as his *betweenness* indicates, and @jgilq314242 was an active person whose comments deserved an answer.

Table 6

Relevant Participants According to SNA Centrality Measures from User X User Forum Network

	Authority	Betweenness	In-degree	Out-degree	Role
Teacher	**0,39921**	0,00000	**0,44270**	0,000	Teacher
@jgilq314242	0,05628	**0,00555**	0,06517	0,009	Teacher
@Carlos.Rodriguez	0,02285	0,00490	0,02247	0,004	Teacher
@Elia	0,01803	0,00085	0,01798	0,002	Teacher
@Noelia.CL	0,00595	0,00000	0,00674	0,000	Teacher
@inakidg319341	0,00199	0,00082	0,00674	0,011	Learner
@Ireneeg322447	0,00199	0,00039	0,00225	**0,018**	Learner
@bea_147320965	0,00197	0,00060	0,00449	0,016	Learner
@Rosa_Maria_Cruz_Arista323080	0,00156	0,00144	0,00449	0,004	Learner
@jjaviermc322669	0,00075	0,00026	0,00449	0,011	Learner
@javarbon322230	0,00066	0,00109	0,00449	0,016	Learner
@joselbd	0	0	0	**0,049**	Learner

On the other hand, Facebook also provides us with social valuation about learners' contribution by mean of "like counts." Figure 11 highlights participants whose comments were considered as relevant to their peers. This figure also depicts that a reputation system helps to build subnetworks around the people with certain social valuation such as Javarteacher Aries Bon and Cristina Sánchez.

powered by ORA-NetScenes

Figure 11. Interaction graph built from the interchange of messages on Facebook. Node size is proportional to the number of likes that these participants received. This number is shown in Table 7.

Table 7

Facebook Participants with the Highest Number of Likes Received

Participant	Like count	Role
Innovación Educativa y Desarrollo Profesional	31	Teacher
Javarteacher Arias Bon	11	Learner
Cristina Sánchez	10	Learner
Nieves Serichol	7	Learner
Adrián Funes	6	Learner
Isa Gutierrez	6	Learner
Sagl Olaf Loazia	6	Learner

RQ3. Do Social Network Based Activities Enable the Creation of Learning Communities that Endure Over Time?

One of the main goals of ECO Project is to increase the number of well-qualified teachers in Europe and to enable them to create their own online courses and other open educational resources to be distributed through its open learning platform. Thus, its aim is to build a learning community around "educational issues." To achieve this goal, ECO courses are always open and encourage students from one edition to participate in the following ones. From this participation, it is assumed that new groups of people with similar interests will appear and that those groups will provide new courses designed under this pedagogical model.

Although the experience is very short, only one year, our experience has not been very positive. None of our learners from one edition participated in the following ones. Basically, students followed the course as far as they could or were interested. No new course or proposal arose from this group of participants. Thus, the participants of our communities of practice, according to Wenger (2010), only achieved the engagement level and not the alignment level needed to negotiate and plan a new course.

In analyzing the satisfactory survey (46 completed), which tried to assess the degree of conformity of the course to the pedagogical model and degree of satisfaction of the learners, we can say that 89% consider that the course boosts interaction between peers and feel very satisfied with the following issues: (a) support from other students; (b) posts and comments made by other students, (c) projects, jobs, or other resources shared by other participants, and (d) the feedback and comments others made about their work. This drives us to think that the model is suitable for, at least, people with a profile similar to the one described in this paper. Regarding the reason why they enrolled and followed the course, learning new things was the most selected option (77%), along with achieving a certificate (50%).

Discussion

ECO Project, based on social learning, aims (among other issues) at creating a learning community for educators and teaching and encouraging learners to contribute their knowledge, experience, and resources among others. Likewise, ECO Project offers participants the opportunity to become promoters of new courses following this new pedagogical approach. In fewer words, ECO's principles are aimed to promote and boost the change that Education 3.0 suggests.

After the completion of the analysis of the third edition of "Educational innovation and teacher professional development. Possibilities and limits of ICT" course, we found out that participants have not contributed to building the autonomous and sustainable learning community that ECO Project proposes. However, the study's analysis, although limited, allows us to draw several conclusions.

Firstly, the removal of barriers that facilitates the enrolment of people (simply with a mail account) prevents teachers from carrying out an in-depth-analysis of these courses, and thus, the process of continuous instructional improvement is restricted. On the other hand, this simplified registration system used by ECO

Project, and the fact that the course is always open, favour the incorporation of new learners throughout the course, which leads to growing the learning community with other points of view and expertise.

Nevertheless, in our analysis, we found that the students' profiles differ from other MOOCs (Alario-Hoyos et al., 2014) in two aspects: (a) they use the forum and Facebook indistinctly and are thus socially-connected and (b) the degree of participation is quite reduced and teacher-centred. Regrettably, their learning model is still traditional, meaning that they continue bringing their knowledge to those who know more with the aim of being given feedback, as Gerstein (2014) noted, instead of sharing and constructing new knowledge supported by their peers. This cultural issue is still very prominent in Spanish-speaking countries. The leadership of the "teacher" is still alive: on one hand, learners need the recognition or endorsement of teachers and, on the other hand, the teacher feeds this habit by assuming the role of facilitator and cheerleader in order to keep the dialogue ongoing, at least during that time the course is open.

Another reason could be the short duration of the course, which could limit the creation of strong links. The study carried out by Kamalodeen and Jameson-Charles (2016) shows that social ties started to be centred on one participant after eight weeks. They also mention that their learners preferred viewing to contributing, and thus a community and collaborative spirit must still be developed to achieve the goals of Education 3.0.

In addition, we must highlight that most participants (62.1%) had not participated in another MOOC before. This fact leads us to think that learners' lack of experience in courses of this sort (and likely also in communities of practice) has hindered the autonomous and independent interaction among participants. In this sense, we can remark as a limitation of the course the absence of strategies in order to promote a culture around communities of practice: concept, importance, transcendence, advantages, functions, developing, etc. The belief that this community might arise "spontaneously" led the teacher team to take over the leadership of all debates during the course. This fact is contrary to Wenger's (1998) proposal about the need to recognize people/leaders that could legitimize the community as a place for sharing and creating knowledge, working from the inside rather than attempting to manage communities from the outside.

It is interesting to note that the majority of the participants that did not complete mandatory tasks were the ones who participated more actively on social spaces. Even more, some discussions were kept active throughout the course and drove participants to reflect and re-think issues, one of the landmarks in learning. This demonstrates that people who enrol in social MOOCs do not seek to achieve a certificate but to gain knowledge on a topic, as the results of our internal satisfaction survey confirm.

Likewise, we would like to highlight the usefulness of sociograms for analyzing the kind of communities and sub-communities built, whether the activity is centred on the teacher or not. Sociograms also allow teachers to know what topics attracted more attention and, if observed in different snapshots, how the networks evolved. On the other hand, SNA measures enable teachers to identify prominent people in the social communities created. This information could be used for different purposes such as the creation of work teams for the purpose of joining more and less-connected people, or to assign new issues to more active people for their dissemination and discussion. Some SNA metrics such as *betweenness* or authority could also be used as elements of gamification since they reveal the importance of these actors in the network.

We found that social acknowledgment is a relevant aspect of social interactions, especially in social networking websites. For this reason, social networks in general have a Karma System that points out (positively or negatively) users' reputation. Moving to educative aims, a Karma System can be useful to indicate "participants' level and quality of course engagement" as well as to "encourage interactivity and high quality submissions" (Morgado et al., 2014, p.29) from participants, and consequently enable the apparition of learners' communities around influential students. In this sense, we found that Facebook's reputation system helped to build subnetworks around the people with a certain social valuation. But, in any case, those subnetworks have generated an autonomous learning community as ECO Project's objectives deal with. Even more, no learner from previous editions of the course participated in the following ones. Unfortunately, we have not managed to generate a strong learning community either during the course or at its completion: the networks were created around teachers' feedback, learners basically commented once per topic and, after the course ended, people did not return to Facebook or to the forum to participate. As Wenger (2010, p. 182) claims, "the engagement in practice is rarely effective without some degree of alignment with the context" and this must be the main cause of our failure. Most learners were interested in learning but were not motivated enough to become drivers of a new MOOC course or to build a learning community on their own.

Acknowledgements

We thank Taner Engin for his collaboration in the development of the software modules used to extract data from social network services. The research leading to these results has received funding from the European Community's CIP: CIP-ICT-PSP-2013-7-621127 Programme under grant agreement No. 21127 and from the Spanish Government under grant TIN2014-56158-C4-2-P (M2C2).

References

Alario-Hoyos, C., Perez-Sanagustin, M., Delgado-Kloos, C., Parada H. A.G., & Muñoz-Organero, M. (2014). Delving into participants' profiles and use of social tools in MOOCs. *IEEE Transactions on Learning Technologies, 7*(3), 260–266. Doi: http://dx.doi.org/10.1109/tlt.2014.2311807

Brahimi, T., & Sarirete, A. (2015). Learning outside the classroom through MOOCs. *Computers in Human Behavior, 51*(B), 604–609. Doi: http://dx.doi.org/10.1016/j.chb.2015.03.013

Brinton, C. G., Chiang, M., Jain, S., Lam, H., Liu, Z., & Wong, F. M. F. (2014). Learning about social learning in MOOCs: From statistical analysis to generative model. *IEEE Transactions on Learning Technologies, 7*(4), 346–359. Doi: http://dx.doi.org/10.1109/tlt.2014.2337900

Carley, K. M. (2014). ORA: A toolkit for dynamic network analysis and visualization. In R. Alhajj & J. Rokne (Eds.), *Encyclopedia of social network analysis and mining* (pp. 1219-1228). Springer New York. doi: http://dx.doi.org/10.1007%2F978-1-4614-6170-8_309

Castaño-Garrido, C. M., Maiz-Olazabalaga, I., & Garay-Ruiz, U. (2015). Redes sociales y aprendizaje cooperativo en un MOOC [Social networks and cooperative learning in MOOC]. *Revista Complutense de Educación, 26*(1), 119-139.

Cape Town Open Education Declaration (2007). Unlocking the promise of open educational resources. Retrieved from http://www.capetowndeclaration.org/read-the-declaration

D'Antoni, S. (2009). Open educational resources: Reviewing initiatives and issues. *Open Learning: The Journal of Open and Distance Learning, 24*(1), 3-10. Doi: http://dx.doi.org/10.1080/02680510802625443

Dawson, S., Tan, J. P. L., & McWilliam, E. (2011). Measuring creative potential: Using social network analysis to monitor a learners' creative capacity. *Australasian Journal of Educational Technology, 27*(6), 924–942

Freeman, L. C. (1977). A set of measures of centrality based on betweenness. *Sociometry, 40*(1), 35-41. http://dx.doi.org/10.2307/3033543

Gerstein, J. (2013). Education 3.0 and the pedagogy (andragogy, heutagogy) of mobile learning. [Web log post]. Retrieved from https://usergeneratededucation.wordpress.com/2013/05/13/education-3-0-and-the-pedagogy-andragogy-heutagogy-of-mobile-learning/

Gerstein, G. (2014). Moving from education 1.0 through education 2.0 towards education 3.0. In L.M. Blaschke, C. Kenyon, & S. Hase (Eds.), *Experiences in self-determined learning* (pp. 83-99). Create Space Independent Publishing Platform.

Kamalodeen, V.J., & Jameson-Charles, M. (2016). A mixed methods research approach to exploring teacher participation in an online social networking website. *International Journal of Qualitative Methods 15*(1), 1-14. http://dx.doi.org/10.1177/1609406915624578

Kellogg, S., Booth, S., & Oliver, K. (2014). A social network perspective on peer supported learning in MOOCs for educators. *International Review of Research in Open and Distance Learning, 15*(5), 263-289.

Morgado, L., Mota, J., Quintas-Mendes, A., Fano, S., Fueyo, A., Tomasini, A., . . . Brouns, F. (2014). ECO D2.2: Instructional design and scenarios for MOOCs –version 1. Retrieved from http://project.ecolearning.eu/wp-content/uploads/2015/08/ECO_D2.2_Instructional_design_and_scenarios_v1.0.pdf

OpenupEd. (2015). Definition massive open online courses. Heerlen: EADTU. Retrieved from http://www.openuped.eu/images/docs/Definition_Massive_Open_Online_Courses.pdf

Paredes-Labra, J., Herrán-Gascón, A., & Velázquez-Vázquez, D. (2012). Generando una comunidad de práctica en una red social. Análisis de caso [Generating a community of practice in a social network. Case analysis]. *Revista Complutense de Educación, 23*(1), 75-88.

Putnik, G., Costa, E., Alves, C., Castro, H., Varela, L., & Shahl, V. (2015). Analysing the correlation between social network analysis measures and performance of students in social network-based engineering education. *International Journal of Technology and Design Education*, 1-25. Doi: http://dx.doi.org/10.1007/s10798-015-9318-z

Rabbany, R., Elatia, S., Takaffoli, M., & Zaïane, 0. (2014). Collaborative learning of students in online discussion forums: A social network analysis perspective. In A. Peña Ayala (Eds.) *Educational data mining, studies in computational intelligence 524* (pp. 441–466). Doi: http://dx.doi.org/10.1007%2F978-3-319-02738-8_16

Schuwer, R., Jaurena, I. G., Aydin, C. H., Costello, E., Dalsgaard, C., Brown, M., . . . Teixeira, A. (2015). Opportunities and threats of the MOOC movement for higher education: The European perspective. *The International Review of Research in Open and Distributed Learning, 16*(6), 20-38.

Siemens, G. (2012). MOOCs are really a platform. [Web log post]. Retrieved from http://www.elearnspace.org/blog/2012/07/25/moocs-are-really-a-platform/

Siemens, G. (2014). Connectivism: A learning theory for the digital age. Retrieved from http://er.dut.ac.za/handle/123456789/69

Sol, J., Beers, P. J., & Wals, A. E.J. (2013). Social learning in regional innovation networks: Trust, commitment and reframing as emergent properties of interaction. *Journal of Cleaner Production, 49*, 35–43. Doi: http://dx.doi.org/10.1016/j.jclepro.2012.07.041

Yin, R. K. (2009). *Case study research: Design and methods* (4th Ed.). Thousand Oaks, CA: Sage.

Yuan, L., & Powell, S. (2013). MOOCs and open education: Implications for higher education. *Cetis White Paper*. Retrieved from http://publications.cetis.ac.uk/2013/667

Wenger, E. (1998). Communities of practice: Learning as a social system. [Web log post]. Retrieved from https://thesystemsthinker.com/communities-of-practice-learning-as-a-social-system/

Wenger, E. (2010). Communities of practice and social learning systems: The career of a concept. In C. Blackmore (Eds.). *Social learning systems and communities of practice* (pp. 179-198). http://dx.doi.org/10.1007/978-1-84996-133-2_11

Zhu, B., Watts, S., & Chen, H. (2010). Visualizing social network concepts. *Decision Support Systems 49*(2), 151-161. Doi: http://dx.doi.org/10.1016/j.dss.2010.02.001