# Evolution of the Conversation and Knowledge Acquisition in Social Networks Related to a MOOC Course

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**Abstract.** This paper presents a real case of tracking conversations and participation in social networks like Twitter and Google+ from students enrolled in a MOOC course. This real case presented is related to a MOOC course developed between January 12 and February 8, 2015, in the iMOOC platform, created as result of the collaboration by Technical University of Madrid, University of Za-ragoza and University of Salamanca. The course had more than 400 students and more than 700 interactions (publications, replies, likes, reshares, etc.) retrieved from the social both social networks (about 200 interactions in Twitter and 500 in Google+). This tracking process of students' conversations and students' participation in the social networks allows the MOOC managers and teachers to understand the students' knowledge sharing and knowledge acquisition within the social networks, allowing them to unlock the possibility of use this knowledge in order to enhance the MOOC contents and results, or even close the loop between the students' participation in a MOOC course and the parallel students´ usage of social networks to learn, by the combination of both tools using adaptive layers (and other layers like the cooperation or gamification like in the iMOOC platform) in the eLearning platforms, that could lead the students to achieve better results in the Learning process.

**Keywords:** MOOCs · iMOOC · Conversation · Knowledge acquisition · Social networks · Informal learning · Twitter · Google+

## 1 Introduction

The informal conversations through social networks are one of the most successful ways to get extra knowledge and enhance the Learning experience in many online courses [1–4]. Many authors have pointed that the conversations and interactions in the social networks could reveal some real characteristics and results of different Learning


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activities, offline activities, etc. [5]. For example, it is possible to highlight the theory of Connectivism [6, 7], where the Learning process is enhanced by the connections between students and teachers and online resources [8], refers to the elements of social networks that encourage such relationships or interactions, so these will offer an ideal space for creating Learning communities. According to Siemens [6] from ICTs the importance of individual knows what an shift to what an individual knows how to find out.

According to the literature [3, 9–12], it is possible to identify three types of Learning:

- Formal Learning: "Learning that occurs in an organized and structured environment (in an education or training institution or on-the-job) and is explicitly designated as Learning (in terms of objectives, time or resources). It typically leads to validation and certification".
- Non-formal Learning: "Learning which is embedded in planned activities not explicitly as Learning. Non-formal Learning outcomes may be validated and lead to certification".
- Informal Learning: "Learning resulting from daily activities related to work, family or leisure. It is not organized or structured in terms of objectives, time or Learning support".

In the case of a MOOC, the informal Learning emerges from connections between students in a spontaneous way against non-formal, than even being also a kind of informal Learning is a pedagogical focus directed by the course team, as it would be the case where specific tags in social networks (*hashtags* [13] in Twitter [14] or Google+) are proposed by teachers to start a discussion or conversation out of the MOOC [15, 16]. These kinds of Learning out of the MOOC (informal and non-formal) can influence the results and achievements of the students within the MOOC [17], also it can allow to MOOC teachers, from the study of the conversations of the students, to discover their shortcomings, their major problems faced in the course or even what or how to find solutions to community faced such problems. On the other side it could be a used to reuse in future editions and improve the Learning platform (using the gained knowledge about those subjects that are more interesting for students, those that enhance the informal Learning around the MOOC course, etc.).

The main goal of this research work, based on previous considerations and other that will be discussed below, is to discover the knowledge acquisition and to track the conversations related to the MOOC content courses in environments non-designed for Learning like the social networks [18] to allow MOOC teachers and managers to improve the Learning process in this kind of platforms in future editions of the MOOC courses.

The manuscript is divided into the following sections: Sect. 1 (Introduction) introduces the problem and main concepts that will be used and discussed in the manuscript. Section 2 (Materials and Methods) presents the resources used to perform the analysis, which are basically the MOOC course, and the social networks where students and course teachers had performed the conversations and where the informal Learning take place. Section 3 (Results) describes the analysis results, presenting also the data retrieved within the analysis and showing the main trends in conversations, the

most used tags for discussions, main users that participated, etc. Section 4 (Discussion) discusses the data presented in the previous section include also considerations regarding also the Learning community features and issues. Finally, the Sect. 5 (Conclusions) presents several conclusions about the research work and potential work for the future.

## 2 Materials and Methods

### 2.1 Materials

**iMOOC and the Course "Social Networking and Learning".** The intelligent platform MOOC (iMOOC) is the outcome of an agreement of collaboration in 2013 among the Technical University of Madrid, the University of Zaragoza and the University of Salamanca. It is based on the eLearning platform Moodle 2.6.5. Its principal distinguishing features are the adaptability and the promotion of cooperative informal Learning. One of the main features is the use of Cooperative MOOC model proposed by Fidalgo et al. [19] part of a xMOOC (eLearning platforms) combining connectivist characteristics typical of cMOOCs based on Learning communities. In this model, which integrates three layers, we have added a fourth one with gamification elements [20] involving the others. These layers represent the eLearning platform and social networking (technological layer), the instructional design of the course (training layer), the results and generated content from cooperation between students and teachers (cooperative layer). Eventually associated elements are added to the three layers to improve motivation (gamification layer).

Within a single course we find a set of educational itineraries based on three variables: the general user's profile, preferences and choices of the users or students and progress in the Learning process within the course. To configure these features we have used Moodle platform features such as conditional or groups, supported by external plugins to create groupings, obtain statistics or offer certificates automatically. On the other hand the promotion of informal Learning through collaboration has been implemented using tools offered by the platform such as profiles, forums, workshops and external tools like social networks.

The MOOC course "Social Networking and Learning" [21] is an adapted version of the course "Application of social networking to education: virtual communities" version given on the platform Miriada X. The course duration was 1 month, starting on January 12 and ending on February 8, 2015. Regarding the participation, 793 students were enrolled for the course, more than 400 started it, and 183 students finally accomplish the goal. This course aims to teach students to create virtual Learning communities using social networks. Over four modules an overview of the social web, exploring two of the most extended social networks such as Facebook and Twitter is given. In the last module other social networks are studied, without going into too much detail, highlighting those characteristics that define them and can serve for educational purposes. The course takes advantage of features of the platform like is adaptability [22, 23], offering students the possibility of choosing various educational itineraries based on the topics covered in the course. The student can choose from 5

itineraries: Full course for teachers (offers two additional lessons from implementation of Twitter and Facebook to teaching), complete course for non-teachers, Twitter (only one module on the network), Facebook (only one module this network) and special itinerary. The special itinerary was addressed to students who had participated in the course in a previous edition, featuring a new module focused on Learning communities with a more practical approach. This itinerary allowed access to the rest of the course.

**Hahstags and Social Networks.** Regarding the social part with a non-formal Learning approach, where the connections between the members and the content is generated, it was decided to use a Learning community for the course. To develop the community the course managers chose the Google+ and its "Communities" tool, where members could publish using classification categories proposed by the course team. Thereby they could interact, ask questions or discussions and share resources (links, application examples and exercises or activities raised in the course). This community consists of more than 5000 members having students from previous editions of the course and professionals interested in the subject.

To encourage community use throughout the course, different exercises have been proposed to the enrolled students that must be resolved publishing the solutions in this community or in their Twitter accounts, using specific *hashtags* included in the statement of each exercise. Although the discussion of the solution in the social media helped to generate more interaction among students [24]. Both debates as the exercises were associated with a specific category ("discussions" and "activities and exercises"). These relations will also be enhanced off the platform by community discussions or videoconferences a group of students can submit projects related to course topics after voted in the community for the other fellow. These are broadcast live video from YouTube by Google Hangout tool and using *hashtags* students pose their questions to the speakers, both Twitter and from the community in Google+.

As a result of use of *hashtags* within the course, one can distinguish among several types depending on its origin and its use over time:

- Course *Hashtags,* proposed by the teaching staff, would be framed within what is non-formal Learning. There are two types, generic for the entire course or specific for a module, which students could use in their related publications, even in specific activities or exercises for the course.
- *Hashtags* different to those proposed in the course depending on the needs and according to the students' publication. This use would be more associated with informal Learning.
- *Hashtags* used synchronously by participants at specific times of the course, for example *#RSEHangout* for hangouts sessions.
- *Hashtags* proposed in the course and used asynchronously, as the need arises them.

The goal of using these kinds of tags and resources seeks to improve dropout rates due to the heterogeneity of students in the course. Within the MOOC course ecosystem it is also possible to distinguish the three types of Learning explained previously, with the theoretical part in the iMOOC platform corresponding to formal Learning, community Google+ created by teachers or *hashtags* proposed by them corresponds to the non-formal Learning and those conversations initiated by students parallel to the course so

through social networks or community contributions in periods the course is not taught as informal Learning in the course.

### 2.2 Methods

To get insight about the usage of social networks and use of conversations and interactions in order to gain knowledge around the MOOC topics, it is necessary to develop a strategy to retrieve, save and use the information that users share on social networks. In this strategy, the authors have developed some crawlers and automatized systems that search in Twitter the usage of some previously-defined *hashtags* related to the MOOC course, determining the amount of users who use it, identifying, if it is possible, the users who are already enrolled in the MOOC course and the users that are only participating in the informal conversation (and without participating in the MOOC), and even those *hashtags* created *ad hoc* by the students to start new conversations or tag the publications with other extra search. In the case of Google+ the researchers did not develop any crawler due the API restrictions of the social network, but they used third-party tools like AllmyPlus (http://www.allmyplus.com/) that allow them to retrieve social interaction related to each *hashtag*.

The analysis in the first stage was not intended to dig inside the real conversations (was not intended to make text mining or other text analysis techniques), but it intend to reveal the use of some *hashtags*, the interaction among users, etc. that will serve as basis for later analysis that could reveal the URLs that users share, the identification of leaders and influencers in the conversations, determining coincidences between the students or users of the social network, their usage rates of some resources, etc. in order to get a full insight about the MOOC community that could be used to improve it for later editions of courses. This full insight will reveal some aspects like the students' interaction and conversations, and what kind of informal or non-formal Learning happens in detail in these social networks (which are not specialized in academic content but intended for general purpose).

Once the analysts have retrieved and saved the information, it is needed to define how can be possible to extract true knowledge from the raw data, and how the system could reveal and show this knowledge to the analyst, MOOC managers, etc. In this first approach of the analysis, the representation is performed mainly by through tables and structured data, also some basic graphs were implemented to help the analysts to understand the information presented.

## 3 Results

The application of the previously described information tracking strategy in the social networks led the authors to discover some relevant information. This information help to understand the scope of the social interactions between MOOC course users, and MOOC course contents. As previously stated, the course teachers proposed several *hashtags* to help the conversation tagging and tracing its evolution, or simply to tag the common conversations about the MOOC contents (*hashtags* related to non-formal Learning). These *hashtags* were the following: *#DebatesRSE, #ActividadesRSE,*

*#DudasRSE, #AvisosRSE, #EjerciciosRSE, #modulo1RSE, #modulo2RSE, #modulo3RSE, #modulo4RSE, #RSEMOOC, #RSEHangout, #RSEEjemplosRRSS, #RSEMalasPracticas, #RSEmiKlout, #UsosTwitterEnseñanza, #RSEMoodleTwitter*.

The analysis of these *hashtags* revealed the following amount of interactions (publications, replies and comments to the publications, retweets and reshares of publications, and favorites or +1 in Google+ ) and its distribution over both social networks (Table 1, Fig. 1)

**Table 1.** Total interactions in Twitter and Google+ with teachers' proposed *hashtags*

| Total interactions | Twitter | Google+ | Total |
|---|---|---|---|
| Publications | 108 | 119 | 227 |
| Replies/Comments | 17 | 76 | 93 |
| Retweets/Reshares | 42 | 17 | 59 |
| Favorite /+1 | 45 | 315 | 360 |
| Total | 212 | 527 | 739 |

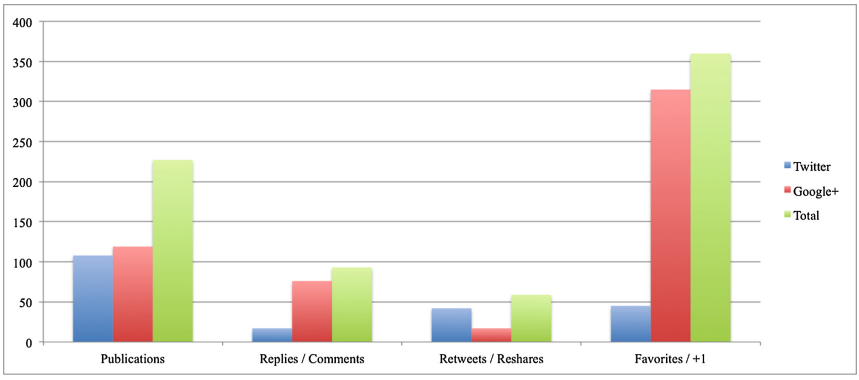


**Fig. 1.** Total interactions versus interactions in each social network related to the MOOC course

Among these global data per social network, it is possible to filter the information depending the type of interaction and each *hashtag* so it is possible to know the real interactions with the contents related to the MOOC course (through its tagging by *hashtags*). Following are presented the data of the most used *hashtags* proposed by teachers (Table 2, Fig. 2).

Also, the teachers proposed some debates (non-formal Learning) in the social networks (mainly in Google+ ) to discuss some concepts near to the MOOC contents. In the case of this course, the teachers used one debate started in the previous course, obtaining in this edition 28 comments and 5 +1's on Google+ .

Regarding the informal Learning component of the social networks usage, the analysis revealed some interesting data about the trends in informal conversations and learners' knowledge sharing preferences. These data, as the previously explanation

**Table 2.** Official *hashtags* interactions in each social network (*hashtags* most used)

| Interactions/ Hashtag | #RSEMOOC | #RSEHangout | #RSEEjemplosRRSS | #RSEMalasPracticas | #RSEmiKlout | #RSEMoodleTwitter | Total interactions per type |
|---|---|---|---|---|---|---|---|
| Twitter Tweets | 9 | 19 | 4 | 5 | 8 | 59 | 104 |
| Google+ Publications | 16 | 4 | 35 | 27 | 20 | 0 | 102 |
| Twitter Replies | 2 | 4 | 1 | 0 | 1 | 9 | 17 |
| Google+ Comments | 33 | 15 | 9 | 2 | 8 | 0 | 67 |
| Twitter Retweets | 5 | 16 | 0 | 1 | 5 | 9 | 36 |
| Google+ Reshares | 3 | 2 | 6 | 5 | 1 | 0 | 17 |
| Twitter Favorites | 5 | 15 | 0 | 2 | 6 | 11 | 39 |
| Google+ + 1's | 57 | 25 | 84 | 47 | 51 | 0 | 264 |
| Total Hashtag Interactions | 130 | 100 | 139 | 89 | 100 | 88 | |

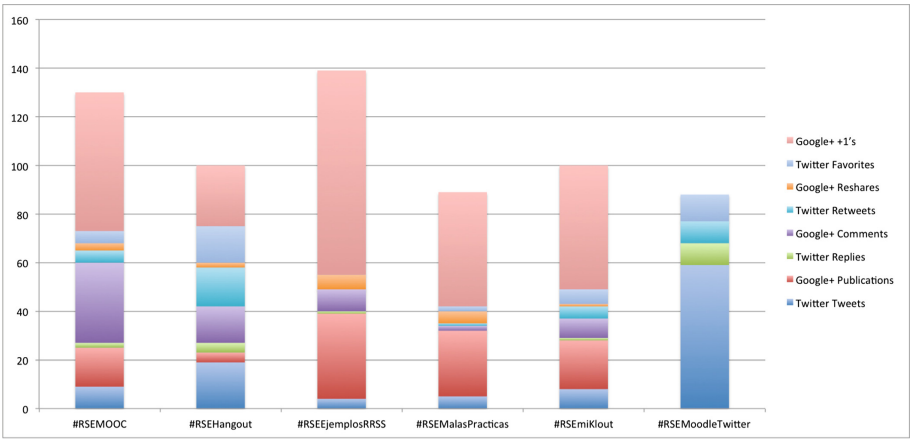


**Fig. 2.** Distribution of interactions in each proposed *official hashtag* in the social networks

about the teachers' proposed *hashtags*, can be showed filtered by social networks interactions with *hashtags* and debates started (by the students in this case). As example, in the case of *hashtags* used by students, not proposed by the teaching staff, it is possible to find, in Google+ 169 publications started by students. In these publications, the *tags* most used (and most interacted) by them are the following (Table 3, Fig. 3): *#facebookeducacionrse*, *#twitter*, *#educación* (education in Spanish language), *#facebook*, *#aprendizaje* (Learning in Spanish), *#infografía* (infographics in Spanish), *#aula* (classroom in Spanish).

**Table 3.** Unofficial *hashtags* most used by the students within the MOOC course (related to informal Learning) in Google+

| | #facebookeducacionarse | #twitter | #educación | #facebook | #aprendizaje | #infografía | #aula |
|---|---|---|---|---|---|---|---|
| Number of publications | 26 | 12 | 10 | 9 | 7 | 6 | 4 |
| Comments | 7 | 18 | 14 | 7 | 4 | 13 | 0 |
| Reshares | 5 | 21 | 20 | 6 | 8 | 7 | 0 |
| +1's | 61 | 94 | 65 | 54 | 55 | 35 | 4 |
| Total Interactions /Hastags | 99 | 145 | 109 | 76 | 74 | 61 | 8 |

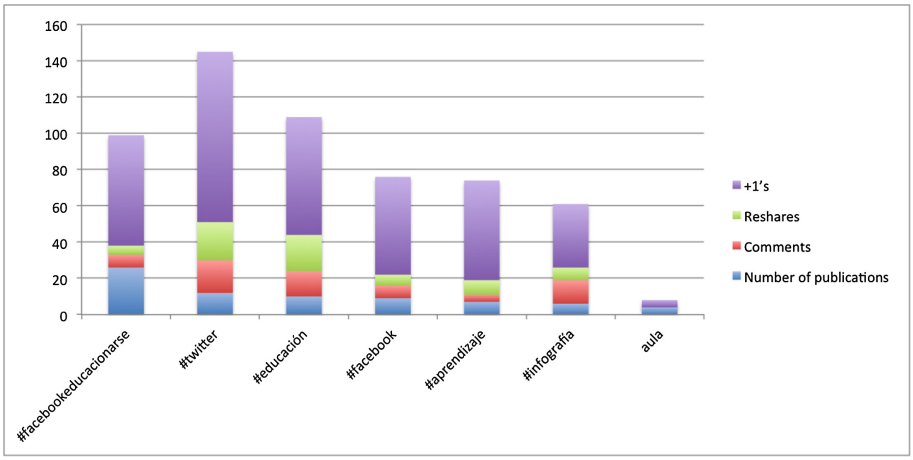


**Fig. 3.** Distribution of interaction with unofficial most used *hashtags* proposed by students in Google+

Also, about *unofficial* and *informal* debates started by the students, the analysis raised 10 different discussions with 14 publications and 45 +1's also on Google+ community.

## 4 Discussion

Regarding the results, the authors want to discuss two main questions about the utility of the study and its application. These questions are: Is it possible to identify the *trending topics* (subjects that interested more to the MOOC and social networks audience) in this Learning community through this analysis approach? Is it useful to know these data to improve the MOOC or the Learning community?

From the authors' point of view, the answer to both questions is yes:

- Yes, it is possible to identify in the social networks the trending concepts and contents most discussed and probably more interesting for the students in both

ways, through *official hashtags* and through *unofficial hashtags*. Regarding the data, it is possible to identify what are the most used tags, what contents reflect more users' interactions, etc., so it is possible to assert that retrieving information about the interaction with the tags, the teachers and MOOC managers could identify what subjects and concepts are more interesting for the users and apply this knowledge to improve the experience within the MOOC and its results. Also, it should be remarked that if this analysis approach is enriched, for example with basic text mining techniques, the teachers and managers could filter the interactions and comments using extra information that learners use, like URL, news posted, content feeds, etc., and this can open new advanced possibilities even helping the personalization and adaptation to users that iMOOC approach performs.

- Yes, the data is useful to improve the MOOC and enhance the Learning community. The retrieved knowledge can be used, as stated just before, to "close the loop" with the adaptativity, cooperation or gamification features present in the iMOOC platform, or even closing the loop in other way, using both kind of tools (MOOC and social networks) to establish tools collaboration approaches to use them within the same Learning processes. For example, knowing the main interests for a user (based on the comments and interactions inside and outside the MOOC platform), the iMOOC could present contents or resources depending on the user's interests detected within the social networks, or even MOOC could recommend some debates and conversations in the social networks, etc. based on the users' interaction inside the MOOC course.

There are another two issues that authors would remark regarding the conversations tracking; one is the limitation retrieving data from the social networks, and the other main issue is related to the previous students' skills using social networks and the errors and mistakes they can make using the systems, the *hashtags*, etc.

In the case of the limitations retrieving information, there are many problems with Twitter and Google+.

- In the case of Twitter, the API only allows to search tweets in a 7-day window before the moment of the search, so it difficult too much to perform the analysis post-course. Instead of this search methods, the Twitter's API allows to *live stream* the tweets under some *hashtags*, but it requires that the analysts know previously all the possible *hashtags* that would be used, or another techniques that make possible to include new *hashtags* within the live tweet stream.
- In the case of Google+, Google APIs limits the access to retrieve data, so if analysts want to retrieve the interactions and data about the activity on Google+ without restrictions, they should perform manual analysis tasks, use web scrapping techniques, or utilize third-party tools like those used in this research work (http://www.allmyplus.com/ for example).

Other relevant issue regarded in the analysis, is the importance of the students' previous skills using these kinds of systems like the social networks. During the analysis, the researchers have observed many errors using tags in publications, error commenting other activities performed purely in the social networks, etc. These skills and the performed mistakes are relevant in the analysis because they could introduce noise and

errors in the results. Thus, the researchers would develop strategies in the future to avoid this kind of noise and possible errors during the analysis phase.

## 5 Conclusions

This paper explains the authors' way to track the conversations in social networks related to a MOOC course and how they make basic analysis in order to review the knowledge sharing and knowledge acquisition through these social networks. The paper also reveals how this kind of data retrieval and basic analysis empowers the MOOC managers and teachers to understand and track the conversations in social networks like Twitter and Google+ around MOOC concepts and subjects, so they can measure the Learning process in these social networks regarding three kinds of Learning, formal, informal and non-formal Learning. The data presented in this paper can serve as a basic example of this usage, and the authors present some other applications and future work to enhance and improve this analysis to make it more powerful.

Regarding the results of this preliminary study about the students' conversations in social networks and its reflection on their knowledge acquisition and Learning, the authors agree that it is possible to enhance the retrieval and analytics process, achieving a clear process with great outcomes regarding the detection of interests, desires and concepts and subjects that the students want to discuss with others.

The improvement of this process, would allow achieve the combination of both Learning tools, the MOOC platform or eLearning platform that the students use to learn in a formal or non-formal ways, and the social networks that the students use to learn in non-formal or informal ways. This combination could produce a loop process where the MOOC and social networks can feedback themselves, detecting students' behaviors, desires and interest, to use them later by the integration with adaptive Learning platforms, like the iMOOC platform or many others, improving by this way the Learning processes through the use of personalization layers that use interests detected and the insights retrieved from users' interaction in social networks, to present personalized contents to the students that could encourage them to improve their Learning, to obtain better outcomes from this process, and better performance in the Learning experience.

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