Twitter as a Tool for Teaching and Communicating Microbiology: The #microMOOCSEM Initiative [†]

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INTRODUCTION

Social networks are already being exploited for searching, storing, and sharing knowledge, demonstrating that they are an efficient vehicle for social learning. Consequently, they could be implemented as a competent tool for formal learning. Twitter is among the 10 most popular online social networks, integrating a community of over 500 million users around the world. Twitter has already been used in several educational programs and evaluated as a positive teaching experience with an outstanding potential in academic and educational environments (1–6). However, there are scarce examples available in the literature about its use in science teaching and communication. In this work, we present and analyze the application of Twitter to create an online space for communication and learning of basic microbiology. With this aim, a team of professionals in the field has imparted, to our knowledge, the first worldwide open access microbiology course via

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Twitter. Here we assess the results of our experience of using this social network as a tool for teaching, promoting, and communicating scientific knowledge to a wide audience.

PROCEDURE

A total of 30 professionals were involved, all members of the Spanish Society for Microbiology (SEM, *Sociedad Española de Microbiología*), affiliated with 25 different universities or research centers located in different cities in Spain, France, the USA, and the UK. The layout of the course was elaborated and agreed on by discussion via e-mail with the Massive Online Open Course (MOOC)'s coordinator, who delivered some basic instructions to the rest of the virtual faculty members in order to ensure homogeneous material (see Appendix 1 for a course syllabus). Briefly, each participant prepared a lecture consisting of a series of 30 to 50 sentences (tweets), each one a maximum of 140 characters, often including links to diverse curated on-line free access or contents specifically generated for the course, web pages, news, and especially images or videos. Each tweet was to be written in Spanish, using simple and concise language, meant to communicate science to a general audience outside the academic environment. It was advised that humorous tweets be included periodically to emotionally involve and motivate the reader (see Appendix 2 for examples of representative tweets). Most of the lecturers spent more than three hours preparing the class. The hashtag #microMOOCSEM was created for this course: "micro" acknowledges both the subject under focus, microbiology, and the fact that it is conceived for the small 140-character format; "MOOC" for Massive Online Open Course; and SEM for the Society. Thus, each tweet included the #microMOOCSEM hashtag. The course took place over 10 weeks (April 5 to June 8, 2016), with classes scheduled every Tuesday, Wednesday, and Thursday at 22:00 h (GMT +1) so that they could be followed at convenient times in Spanish-speaking countries in the American continent. Tweets were sent from the @SEMicrobiologia Twitter account and programmed to be posted at a frequency of one tweet per minute using the application *TweetDeck* (https://tweetdeck.twitter.com/). Students were encouraged to follow the course through their mobile devices or computers, either live at the scheduled time or later, searching the hashtag #microMOOCSEM. The same hashtag could be used by the students to interact with the lecturers. Three weeks before the start of the course, an intense promotion campaign was run through social networks, universities, and scientific institutions, as well as the press and radio, in diverse locations around Spain. Contacts were also made with some Latin-American Microbiology Societies. After each lesson was posted, tweets were compiled and stored online using the open tool Storify (https://storify.com/SEMicrobiologia), so that they could be consulted any time after the class was over. Once the course was completed, data were analyzed using the open software Twitter analytics (https://analytics.twitter.com/).

RESULTS AND CONCLUSION

Comprehensively, the course consisted of 28 lessons plus a "Graduation Party" (Appendix 3), involving 1,225 tweets, 702 images, 265 hyperlinks to web pages, and 136 videos related to microbiology. Considering the total number of tweets and their release frequency, the total length of the course was approximately 20 hours. Certain classes became a Twitter *trending topic* in Spain. Figure 1 shows the number of Twitter daily impressions along course development. Some classes reached over 260,000 impressions and 3,700 retweets. However, data trend reaches a plateau in the number of impressions from the fifth week on, suggesting that longer courses may result in a decrease in followers. We could not detect a direct relationship between the number of impressions for a particular class and the day of the week, the social interest of the topic, or the number of images or videos included. Appendix 4 compares the monthly activity of the @SEMicrobiologia Twitter account before starting the MOOC to that in April, the month that marked a peak of activity. Before the start of the course, the number of followers for the @SEMicrobiologia Twitter account was 2,176, and the last day of the course it rose to 7,240 (Appendix 5).

The course has been followed worldwide: 62% of the followers were located in Spain, 29% were from Mexico, Venezuela, Argentina, Colombia, Peru, Ecuador, and Chile (from the most represented to the least), 2% in the USA and the UK, and the remaining 7% in other countries. Regarding gender, 61% of followers were female. The most represented followers were college and high school students, high school and higher education teachers, as well as healthcare and science professionals, journalists, and scientific communicators.

To assess the acquisition of knowledge by the followers, we included three or four quiz questions (Appendix 1) at the end of each class, reaching a total of 78 questions that were answered by an average of 309 followers per day. Figure 2 ranks the questions according to the percentage of correct answers obtained.

At the end of the course, a satisfaction survey was completed by the lecturers: all of them confirmed that this experience has been useful to improve their teaching skills and, at the same time, to learn new concepts related to microbiology in topics different from their own; they would recommend this course to their students and colleagues for technology-enhanced teaching and learning, and they would like to participate again in a similar course via Twitter.

The #microMOOCSEM experience demonstrates that, when properly used, Twitter is an excellent means for collaborative teaching and active learning, as well as for establishing professional networks and communicating science to society. With this first online Microbiology course via Twitter, we have proved that science lectures can be taught by this means to a wide interested audience in a highly interactive way, with immediate feedback, and
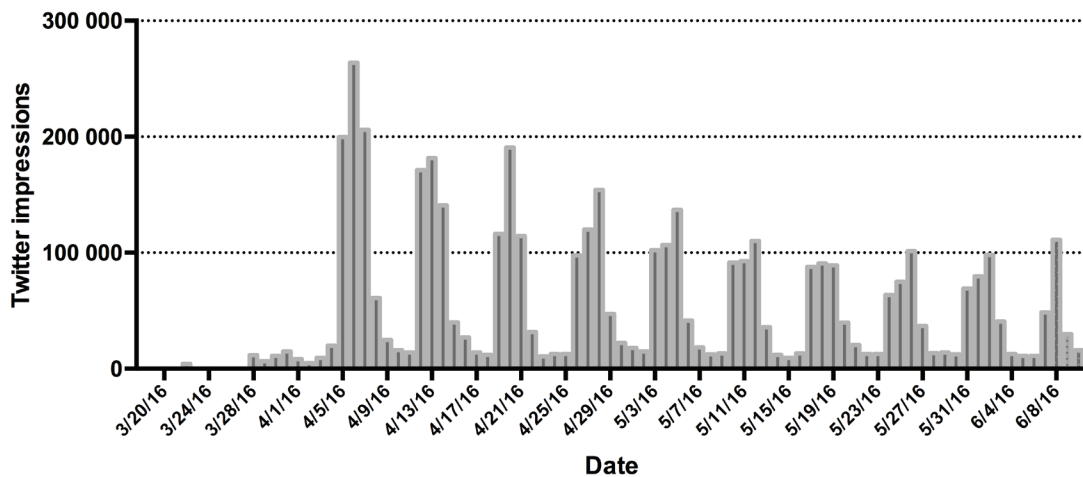
FIGURE 1. Number of Twitter daily impressions during the time that the course was active. Impressions refer to the number of times that users visualized a particular tweet with the hashtag #microMOOCSEM. Peaks coincide with broadcasting days. During the time that the course was active, the Twitter account of the SEM received a total of 4,420,172 impressions and over 175,000 visits. SEM = Spanish Society for Microbiology.

- 90-100 %
- 80-89 %
- 70-79 %
- 60-69 %
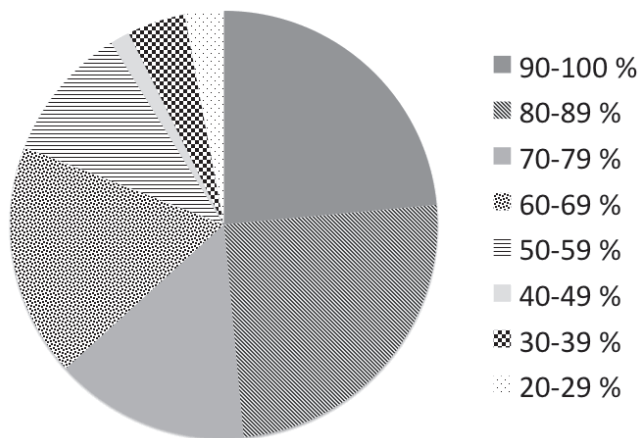- 50-59 %
- 40-49 %
- 30-39 %
- 20-29 %

FIGURE 2. Number of questions correctly answered. Data from 68 questions are included. The results show the percentage of followers (virtual students) who answered correctly. More than 90% of virtual students correctly answered 16 questions, and more than 50% correctly answered 62 questions. None of the questions had a 100% failure score.

with the convenience of access from home or any place in which a mobile device has access to internet data.

SUPPLEMENTAL MATERIALS

Appendix 1: Table 1. Twitter course syllabus
Appendix 2: Figure 3. Image captures of representative tweets posted during #microMOOCSEM course
Appendix 3: Table 2. Structure of #microMOOCSEM lessons

Appendix 4: Table 3. Activity of the Twitter account @SEMicrobiologia before and after the course
Appendix 5: Figure 4. Evolution of the number of followers of the @SEMicrobiologia Twitter account

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