

The impact of the MOOC movement on social networks. A computational and statistical study on Twitter

La repercusión del movimiento MOOC en las redes sociales. Un estudio computacional y estadístico en Twitter

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Abstract:

This article analyses the impact of the MOOC movement on the Twitter social network. To do so the lexical-semantic impact of 55,511 tweets by ten of the world's leading platforms offering MOOC courses was analysed using a tf-idf calculation to represent documents in natural language processing. The Twitter profiles, patterns of use, and geolocation of tweets by continent were also analysed using computational and statistical techniques. The results show that there is no correlation between use of Twitter accounts by MOOC platforms and their number of followers. The tweets by participants are mainly grouped into two semantic blocks: alert/excited and calm/relaxed and tweet traffic is often concentrated in the United States and Europe; South America's percentage is moderate while Africa, Asia and Oceania have little impact. The most frequently occurring words in the tweets are: «learning», «skills», «course», «free» and «online».

Keywords: MOOC, Twitter, social networks, platforms, tweets, impact.

Resumen:

Este artículo analiza el impacto del movimiento MOOC en la plataforma Twitter y, para ello, se procesan 55511 tuits según su repercusión léxico-semántica mediante el cálculo de tf-idf para la representación de documentos en Procesamiento de Lenguaje Natural en diez de las principales plataformas mundiales que ofrecen cursos MOOC. Asimismo, se analiza el perfil en Twitter, los patrones de uso y la geolocalización de los tuits por continentes mediante técnicas computacionales y estadísticas. Los resultados muestran que el empleo de las cuentas de Twitter por parte de las plataformas no guarda correlación con el número de seguidores de las mismas. Los tuits de los participantes suelen agruparse en dos bloques semánticos: alerta/

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animado vs calmado/relajado y el tráfico de tuits se suele concentrar en Estados Unidos y Europa; el porcentaje en Suramérica es moderado, mientras que en África, Asia y Oceanía es muy poco representativo. Las palabras

más recurrentes en los tuits son: «learning», «skills», «course», «free» y «online».

Descriptor: MOOC, Twitter, redes sociales, plataformas, tuits, impacto.

1. Introduction

MOOC platforms use the available social media to disseminate their activity and they participate in social networks as do universities (Cataldi and Cabero, 2010; Chamberlin and Lehmann, 2011; Túñez and García, 2012; Castaño, Maiz, and Garay, 2015; Raposo, Martínez, and Sarmiento, 2015), to maintain an up-to-date profile, promote their courses and their platform and interact with users, thus obtaining fast and direct feedback. This helps improve their corporate image (Kierkegaard, 2010), optimise their service strategies, and develop their academic and professional activities.

Most research on the influence of Twitter on users has been in terms of social mobilisation (Bacallao, 2014; Rodríguez-Polo, 2013) or political participation (Baek, 2015; Kruikemeier, 2014). Other researchers have studied the participation of citizens in charitable or community activities (Boulianne, 2009; Gil-de-Zúñiga, Jung and Valenzuela, 2012). Studies have also been carried out on the impact of Twitter on education, through statistical analysis of activity on this social network by educational institutions such as universities (Guzmán Duque, et al 2013) or in rela-

tion to its application in academic contexts for improving skills (Vázquez-Cano, 2012).

To date, there has been no research analysing the impact of the MOOC movement on Twitter or the activity by the main platforms on this social network with regards to dissemination, providing information on their courses and marketing their courses. Consequently, the objective of this research project is to analyse the Twitter profile of ten of the most important platforms in the provision and promotion of MOOC courses using a statistical and computational focus that makes it possible to understand how and for what purpose these platforms use their Twitter accounts.

2. Twitter, microblogging and MOOCs

The current virtual communication ecosystem (social networks, blogs, digital video platforms, microblogging, gamification, etc.) helps on-line educational provision to go viral, and the strategies used are more typical of business marketing processes, from models that focus on relationships (the client first philosophy), creation of social branding, segmentation and personalisation of messages, and

brand evangelisation through to influencing and virality, and the implementation of experiential marketing that creates customer engagement (Castelló, 2010a). MOOC course platforms have started copying these business strategies in their efforts to attract students (clients) to their «free» courses and nurture loyalty in a type of student that might subsequently lead to them needing to pay for extra services apart from education (certificates, recognition of credits, more personalised treatment, etc.).

The use of Twitter as a social microblogging network for disseminating MOOC courses is a global trend among platforms and developers. MOOCs are disseminated all over the world using social networks, principally Facebook and Twitter. It is also important to note that these platforms are not only used for dissemination, but also for supporting the delivery of units during the courses and after their end (van Treeck and Ebner, 2013: 414). The business and educational strategy that MOOCs espouse, based on open and free learning, is particularly important on social networks, and especially in the short messages with hyperlinks to other content and topics (hashtags) that comprise tweets. In fact, this trend is moving towards a symbiotic integration of the two models (Microblogging & MOOCs), and between April and June 2016 the first scientific MOOC course on Twitter took place using the hashtag: #microMOOCSEM.

Consequently, the use of microblogging in higher education and in academic dissemination processes is generally focussed on sharing and notification of a range of news and information (Mateik,

2010; Ruonan, Xiangxiang, and Xin, 2011). More specifically, Twitter facilitates the dissemination of information about conferences, courses, grants, and such like, keeping users up-to-date and encouraging their participation (Curioso and others, 2011; Fields, 2010; Milstein, 2009) in forums, conferences, and seminars (Holotescu and Grosseck, 2010). It is used to invite the educational community to participate in activities of social interest (Atkinson, 2009). It is also used for disseminating promotional campaigns relating to MOOC platforms, attracting students, or disseminating the cultural programming and topics related to the services provided (Curioso and others, 2011; Fields, 2010; Milstein, 2009; Mistry, 2011; Vázquez-Cano, 2013; López Meneses, Vázquez-Cano, and Román, 2015; Aguaded, Vázquez-Cano, and López Meneses, 2016).

Similarly, the use of Twitter by MOOC platforms is moving towards three types of activity: creating brand identity, launching courses, and collecting analytics for segmented marketing studies.

Twitter has also become a communications resource for many MOOC courses that offer thematic hashtags to support students who are studying them. In fact, it has already been noted in academic literature that MOOCs can be understood as virtual environments for social connectivity in a field of study that have an open teaching approach (McAuley and others 2010; Vázquez-Cano, López-Meneses, and Sarasola, 2013; Vázquez-Cano, López Meneses, and Barroso Osuna, 2015; Daniel, Vázquez-Cano, and Gisbert, 2015; Hernández, Romero, and Ramírez,

2015; Aguaded, Vázquez-Cano, and López Meneses, 2016). The use of Twitter in massive open learning processes can be directed towards six principal activities (Treeck and Ebner, 2013): encouraging interaction in mass education through the use of Twitter feeds; conversations outside class through thematic hashtags; exchanging academic content through links posted in thematic hashtags; compiling documentation and information with the help of automated tools for collecting tweets; promoting the organisation of seminars through Twitter; and contacting researchers, lecturers, and students with similar interests.

These uses and the possibility of being able to contact other users in communities and interact with them through the feed and hashtags make Twitter a very useful companion for massive open educational environments. The results of these experiences show that 70% of the hashtags used had a direct relationship with the course and 39% of them referred to specific topics contained in the delivery of the courses (Treeck and Ebner, 2013). Emily Purser, Angela Towndrow, and Ary Aranguiz (2013) have explored the relationship between peer tutoring and options for interacting in MOOCs through on-line learning-support tools, such as the hashtags used in *#edcmooc*. Peter Tiernan (2012) has also examined the role of Twitter in increasing interaction by students in academic conversations. His study concluded that Twitter has great potential for encouraging the development of virtual conversations outside the university once face-to-face classes have ended. He also showed that

it gave students who participated less in face-to-face classes a setting and tool that boosted their participation. These results confirm the ones obtained by Martin Ebner and others (2010) when they analysed the tweets with the hashtag *#edmedia10* after an e-learning seminar, results that show that relevant information is obtained through the contributions by the participants. It is clear that Twitter has a variety of potential uses and that the purpose to which users put it can vary depending on their intentions. Indeed, some contributions, such as those by Crawford (2009), have suggested listing the different forms of participation on Twitter, giving three categories: «background listening» (p. 528), «reciprocal listening» (p. 529), and «corporations 'listening in'» p. (531). Twitter as an object of study and a tool for communication has gone through three stages: the first analysed the banality of messages by examining their content; in a second phase from 2009 researchers regarded it as a powerful social communication tool that was valuable for sociological analysis of social events; and we are currently in a third phase in which Twitter has established itself as a great worldwide sociocultural database, a diachronic fingerprint by which human behaviour and events can be analysed. For example, we can locate hashtags that enable us to evaluate the importance or impact of social events such as Spain's 15M anti-austerity movement or the Arab Spring and evaluate the sociocommunicative behaviour of a society when faced with an event of social importance. This sociohistorical component was also underlined by the fact that the USA's Li-

brary of Congress is archiving the tweets posted in the United States to preserve their content and offer them as information to the American people.

Consequently, Twitter has become a social communication and representation tool of undoubted worldwide importance for the academic world and research. However, we cannot neglect fundamental concepts that shape the social reality of microblogging such as how ephemeral its influence is (Back, Lury, and Zimmer, 2013; Elmer 2013; Vázquez-Cano, Fombona, and Bernal, 2016) and the difficulty of comprehension and interpretation for those individuals who are not part of the social network. The structural dynamic of Twitter enables researchers in the field of educational communication to obtain relevant data using big data analytics techniques relating to the activity of microblogging in synchronic and diachronic analyses of activity in the social network (Rogers, 2013, p. 363; Marres and Weltevrede 2013).

Applying big data analytics techniques to the MOOC movement enables us to analyse the influence and patterns of use on-line, providing us with valuable information about how leading platforms go about providing information, interacting and marketing, and how these education communication strategies might affect the dissemination and penetration of the MOOC movement in society and the academic world.

3. Methodology

To perform this research we decided to analyse 10 Twitter accounts of MOOC

platforms that are seen as reference points in the open education movement and that have a Twitter account to provide information about and disseminate their activity. These are the following ten platforms: edX (@edXOnline), Coursera (@coursera), Udacity (@udacity), Udemy (@udemy), Khan Academy (@khanacademy), Canvas network (@canvasnet), Future learn (@FutureLearn), Open2study (@Open2Study), Miriada (@miriadax), and MIT OpenCourseware (@MITOCW). A total of 55,511 tweets were analysed from the period between 1 January 2015 and 31 December 2015.

The method for achieving the two core objectives of the research was organised into three phases:

Phase one: using the Twitonomy tool to determine the most important variables of the profiles of the MOOC course platforms in accordance with Key Performance Indicators (KPI); this makes it possible to perform a comprehensive analysis of each Twitter account. This first phase was complemented by analysis of the sentiment of the tweets. This analysis was performed using the Meaning Cloud API that makes it possible to establish the polarity of the terms extracted from the tweets. All of the tweets were then geo-located to ascertain which continents had the largest traffic in tweets about MOOCs according to the tweet traffic of the ten platforms analysed.

Phase two: analysing the thematic and content characteristics of the tweets posted by the ten platforms analysed by using a tf-idf calculation and applying the inverse document frequency technique.

To do this we used the Bag of Words tool that is one of the most widely-used methods for representing documents in natural language processing (Baeza-Yates and Ribeiro-Neto, 1999). This method models the documents using a histogram of relevant terms. In other words, it represents each document by the frequency of appearance or number of times that the words with a higher weighting appear, without taking into account the order in which they appear. A matrix of «m» documents and «n» terms is produced to represent them where each document represents a row in the matrix and each column corresponds to a term, giving an m-n. matrix where each row in the matrix represents a document and the frequencies of the terms that appear in it.

Phase three: performing an inferential statistical analysis of the most significant

tweets according to possible correlations between the number of followers variable and the other variables that comprise the profile of a Twitter account. To do so we will export the principal numerical data of the Twitter accounts to the SPSS programme.

4. Results

Firstly, we present the results of the analysis of the Twitter profiles of the 10 platforms analysed according to the total number of tweets posted during 2015, the number of followers, the accounts the platforms follow, the number of tweets retweeted, mentions of followers (@), and the links and hashtags used in each tweet. To show this, Table 1 is arranged in descending order from the most followers to the fewest.

TABLE 1. Twitter profiles of MOOC platforms.

Platforms	Tweets	Followers	Following	Retweets	@	Links	#
Khan Academy @khanacademy Opened account Oct. 2008	14.991.990,55	495.062	139	48 24%	74 0.37%	141 0.71%	45 0.23%
Coursera @coursera Opened account Aug. 2011	21.911.820,50	310.771	313	23 13%	65 0.36%	136 0.75%	33 0.18%
edX @edxOnline Opened account Apr. 2012	584.228.127,70	189.697	147	530 19%	2123 0.75%	1933 0.69%	1600 0.57%
MIT OpenCourseWare @MITOCW Opened account Jan. 2009	796.313.073,58	155.939	536	880 67.3%	624 0.48%	886 0.68%	188 0.14%

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Platforms	Tweets	Followers	Following	Retweets	@	Links	#
Udacity @udacity Opened account Jun. 2011	319.918.575,09	124.744	790	340 18%	835 0.45%	1053 0.57%	603 0.32%
Udemy @udemy Opened account Aug. 2009	1.054.026.417,24	97.503	7.764	158 6%	1926 0.73%	2237 0.85%	400 0.15%
FutureLearn @FutureLearn Opened account Dec. 2012	1.075.724.446,70	50.894	1.298	448 18%	1450 0.59%	1130 0.46%	1191 0.49%
Miríada X @miriadax Opened account Nov. 2012	958.729.908,19	45.799	271	708 24%	3120 1.04%	375 0.13%	331 0.11%
Open2Study @Open2Study Opened account Feb. 2013	28.634.491,23	9.855	380	35 8%	242 0.54%	218 0.49%	304 0.68%
Canvas Network @canvasnet Opened account Oct. 2012	10.702.580,71	9.559	330	44 17%	130 0.25%	189 0.73%	189 0.73%

Source: prepared by the authors.

As can be seen, the platform with the most followers is Khan Academy ($n = 495,062$), which started its activity on Twitter in 2008. However, it has posted a relatively low number of tweets since creating its profile ($n = 1,499$) with an average of 0.55 tweets a day. The platform that has posted the most tweets since its creation is FutureLearn ($n = 10,757$) with an average of 6.70 tweets a day. Likewise, Udemy is the platform that follows the most accounts of third parties or institutions ($n = 7,764$). The platform that has retweeted the most tweets is MIT OpenCourseWare ($n = 880$). On the other hand, the platform that most often men-

tions other users is the Spanish platform Miríada X ($n = 3,120$). The platform that inserts the most links in its tweets is Udemy ($n = 2,237$) and the one that uses the most hashtags is edX ($n = 1,600$). The data for Coursera are significant; this is the most important platform in the world of MOOCs but on average only posts half a tweet a day, something that does not prevent it from being the platform with the second largest number of followers ($n = 310,771$). The two platforms with the least activity are Open2Study and Canvas Network.

After analysing the account profiles, we then defined the pattern of use by

each platform to establish the days of the week on which it is most used and the in-

terfaces from which the tweets are posted (Figure 1).

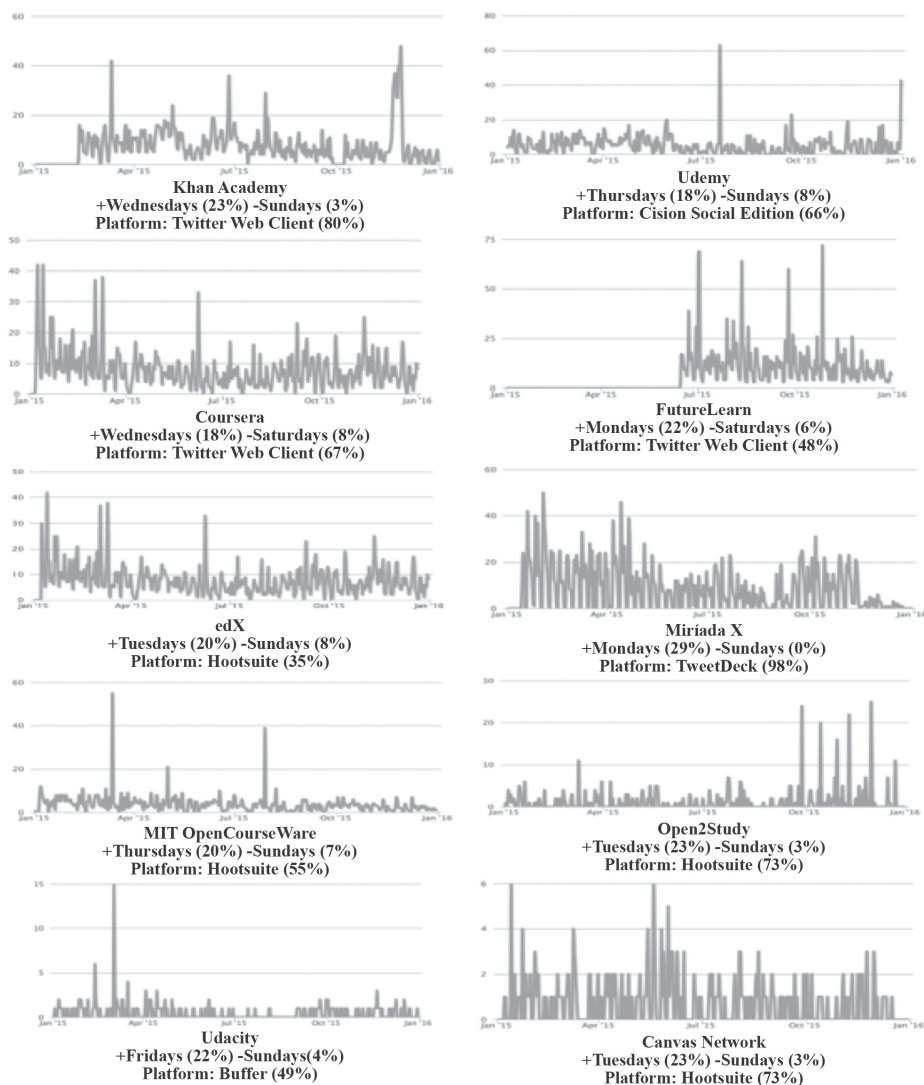


FIGURE 1. Patterns of posting tweets.

We can see that the large Coursera and Khan Academy platforms are generally most active on Wednesdays, followed by MIT OpenCourseWare and Udemy whose most intensive activity is on Thurs-

days. All of the platforms show a reduction in their Twitter activity during week-ends. The client platform from which they post their tweets varies depending on the MOOC platform; Coursera, FutureLearn,

Khan Academy, and Open2Study use the Twitter web client platform. The second most used platform is Hootsuite (Canvas Network, MIT OpenCourseWare and edX).

We performed a general sentiment analysis for the ten platforms analysed using the meaning cloud application and

the sentiment viz on-line application (https://www.csc.ncsu.edu/faculty/healey/tweet_viz/tweet_app/).

The analysis of the sentiment pattern for the ten platforms shows a positive sentiment with a majority of blocks of tweets among the alert/excited v. calm/relaxed semantic blocks (Figure 2).

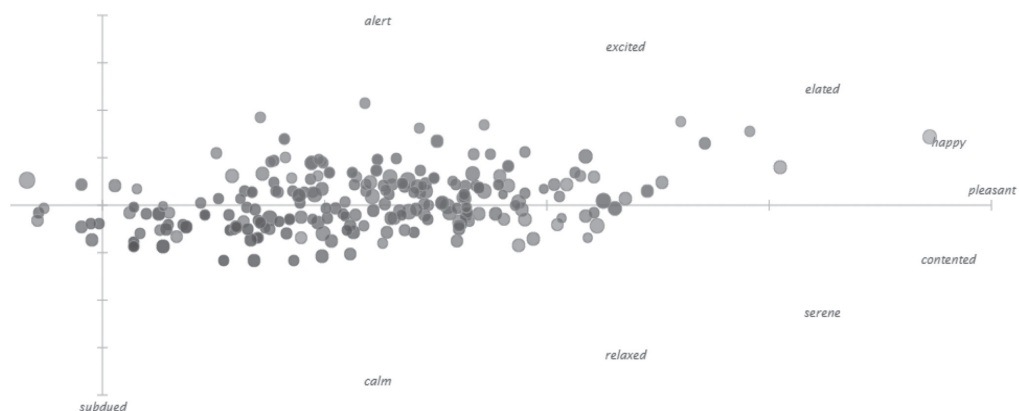


FIGURE 2. Sentiment analysis for the tweets posted.

The geolocation of the tweets from each platform also allows us to observe in which areas of the planet they are most

frequent (Figure 3). To do this, we geolocated the traffic in tweets from each platform using a KPI of the Twitonomy tool.

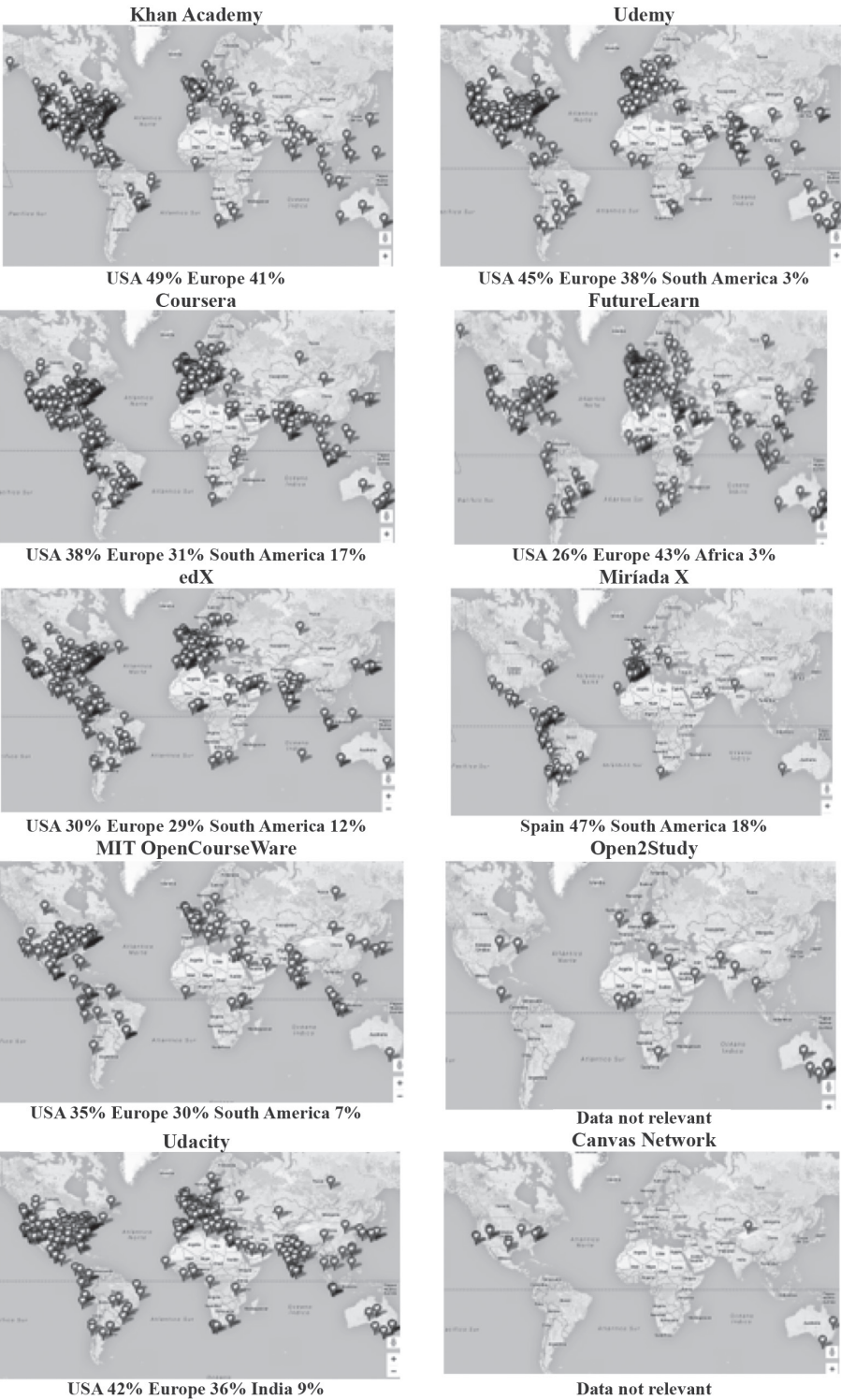


FIGURE 3. Geolocation of the percentage of tweets by the MOOC platforms.

As shown by Figure 2, traffic in tweets from the platforms is mainly concentrated in the USA and Europe; for the principal platforms these areas represent around 40%. Likewise, the platforms with the greatest presence in South America are Coursera, eDX, MIT OpenCourseWare, and the Spanish platform Miríada X. Africa, Asia and Oceania have limited participation.

We then analysed the weighting of the most relevant terms from the accounts according to the number of appearances of each term in each of the tweets from the platforms. This measurement means that the importance of each term is disproportionate and so it is often represented using a logarithmic scale.

$$Wt, = \{1 + \log tft, , tft,d > 0 \\ 0, tft, \leq 0 \quad (1)$$

In long documents the frequencies of the tf terms can easily be higher than in much shorter documents, thus distorting the real importance of the words. For this reason the frequency of the term is usually normalised according to the total number of documents N. Although the frequencies of the terms are normalised and scaled, the importance of each word increases in proportion with the number of times that it appears in a document and so an effort is made to compensate for this effect by taking into account the frequency with which the word appears in the total number of documents, thus making this technique highly suitable for processing tweets. The procedure involves giving greater importance to terms that appear in fewer documents, ahead of

those that appear in virtually all of them, given that the latter terms have little or no representativity when representing the whole. This factor is known as «term frequency-inverse document frequency». Consequently, for the tf-idf calculation we have applied the inverse document frequency. This is obtained by dividing the total number of documents by the number of documents that contain the term and applying the logarithm:

$$idf_t = \log N / df_t \quad (2)$$

where N is the total number of documents and df_t is the frequency of documents that contain the term t. Finally, the calculation of the tf-idf weighting gives a combination of both factors: $W_{t,d} = tft_{t,d} \cdot idf_t$. The calculation of the idf is shown from which the tf-idf weightings of the key words for each platform are calculated (Table 2).

A total of 55,511 tweets were processed and, as can be seen in Table 2 from the results obtained, the words with the highest weightings and, therefore, the ones with the highest representativity are: «learning» (0.602 / fq = 260), «skills» (0.592 / fq = 251), «course», (0.498 / fq = 201), «free» (0.401 / fq = 167), and «online» (0.382 / fq = 110).

Finally, we analysed whether there is a significant correlation between the «number of followers» variable for each of the Twitter accounts of the ten platforms and the other variables that describe the profile: number of tweets retweeted, profiles that the platforms follow, links, and hashtags. In Table 3 we show the descriptive statistics for these variables.

TABLE 2. tf-idf weightings.

Platforms/Words					
Khan Academy (1490 tweets)	<i>learning</i> (0.611) [μ : 6.28, σ : 1.83], a = [μ : 5.12, σ : 2.46 $f q$ = 260]	<i>Growth</i> (0.601) [μ : 6.11, σ : 1.74], a = [μ : 4.99, σ : 2.40 $f q$ = 202]	<i>School</i> (0.411) [μ : 3.71, σ : 1.10], a = [μ : 3.32, σ : 1.86 $f q$ = 114]	<i>Students</i> (0.301) [μ : 3.11, σ : 0.71], a = [μ : 2.81, σ : 1.22 $f q$ = 84]	<i>Videos</i> (0.296) [μ : 2.99, σ : 0.50], a = [μ : 1.95, σ : 1.01 $f q$ = 72]
Coursera (2188 tweets)	<i>Skills</i> (0.601) [μ : 6.04, σ : 1.65], a = [μ : 4.99, σ : 2.25 $f q$ = 199]	<i>Course</i> (0.585) [μ : 4.99, σ : 1.33], a = [μ : 4.22, σ : 2.01 $f q$ = 166]	<i>Free</i> (0.299) [μ : 3.25, σ : 1.01], a = [μ : 3.02, σ : 1.01 $f q$ = 110]	<i>Learning</i> (0.201) [μ : 2.45, σ : 0.60], a = [μ : 2.11, σ : 1.22 $f q$ = 80]	<i>Taking</i> (0.171) [μ : 1.98, σ : 0.55], a = [μ : 1.80, σ : 1.10 $f q$ = 69]
edX (5842 tweets)	<i>Mooc</i> (0.598) [μ : 5.00, σ : 1.63], a = [μ : 4.82, σ : 2.10 $f q$ = 202]	<i>Course</i> (0.560) [μ : 4.78, σ : 1.50], a = [μ : 4.10, σ : 1.98 $f q$ = 184]	<i>Learning</i> (0.399) [μ : 3.71, σ : 1.09], a = [μ : 3.51, σ : 1.75 $f q$ = 101]	<i>Skills</i> (0.320) [μ : 3.40, σ : 0.79], a = [μ : 2.60, σ : 1.20 $f q$ = 81]	<i>World</i> (0.298) [μ : 2.49, σ : 0.60], a = [μ : 2.10, σ : 1.01 $f q$ = 71]
MIT OpenCourseWare (7963 tweets)	<i>Experience</i> (0.602) [μ : 6.01, σ : 1.75], a = [μ : 5.00, σ : 2.30 $f q$ = 255]	<i>Digital</i> (0.600) [μ : 6.00, σ : 1.60], a = [μ : 4.90, σ : 2.20 $f q$ = 240]	<i>Mitocw</i> (0.401) [μ : 3.50, σ : 1.00], a = [μ : 3.30, σ : 1.80 $f q$ = 101]	<i>Videos</i> (0.300) [μ : 3.30, σ : 0.60], a = [μ : 2.75, σ : 1.20 $f q$ = 81]	<i>Data</i> (0.295) [μ : 3.10, σ : 0.55], a = [μ : 2.10, σ : 1.01 $f q$ = 64]
Udacity (3199 tweets)	<i>Sebastianthrun</i> (0.580) [μ : 6.28, σ : 1.83], a = [μ : 5.12, σ : 2.46 $f q$ = 254]	<i>Education</i> (0.560) [μ : 6.20, σ : 1.83], a = [μ : 5.12, σ : 2.46 $f q$ = 222]	<i>Learning</i> (0.411) [μ : 3.51, σ : 1.10], a = [μ : 3.32, σ : 1.86 $f q$ = 115]	<i>Check</i> (0.300) [μ : 3.20, σ : 0.063], a = [μ : 2.81, σ : 1.22 $f q$ = 85]	<i>Exciting</i> (0.300) [μ : 3.18, σ : 0.60], a = [μ : 2.71, σ : 1.22 $f q$ = 83]

Platforms/Words					
Udemy (10540 tweets)	Course (0.602) [μ : 6.25, σ : 1.80], a = [μ : 5.15, σ : 2.45 $f q$ = 267]	Learning (0.601) [μ : 6.20, σ : 1.76], a = [μ : 5.10, σ : 2.40 $f q$ = 232]	Skills (0.410) [μ : 3.70, σ : 1.15], a = [μ : 3.30, σ : 1.80 $f q$ = 103]	Free (0.300) [μ : 3.45, σ : 0.75], a = [μ : 2.80, σ : 1.25 $f q$ = 80]	Check (0.300) [μ : 3.40, σ : 0.70], a = [μ : 2.75, σ : 1.20 $f q$ = 81]
FutureLearn (10757 tweets)	Learn (0.603) [μ : 6.38, σ : 5.83], a = [μ : 5.53, σ : 3.46 $f q$ = 360]	Course (0.598) [μ : 6.38, σ : 5.83], a = [μ : 5.53, σ : 3.46 $f q$ = 360]	Free (0.400) [μ : 3.75, σ : 5.50], a = [μ : 3.33, σ : 5.86 $f q$ = 554]	Social (0.305) [μ : 3.45, σ : 0.75], a = [μ : 3.85, σ : 5.33 $f q$ = 84]	Online (0.305) [μ : 3.45, σ : 0.75], a = [μ : 3.85, σ : 5.33 $f q$ = 84]
Miriada X (9587 tweets)	Curso (0.601) [μ : 5.98, σ : 4.83], a = [μ : 5.50, σ : 2.78 $f q$ = 360]	Mooc (0.555) [μ : 5.30, σ : 4.80], a = [μ : 4.90, σ : 2.45 $f q$ = 360]	Inscribite (0.411) [μ : 3.75, σ : 3.51], a = [μ : 3.33, σ : 1.96 $f q$ = 554]	Nuevo (0.302) [μ : 3.45, σ : 2.75], a = [μ : 3.15, σ : 1.33 $f q$ = 84]	Empieza (0.300) [μ : 3.40, σ : 1.71], a = [μ : 2.80, σ : 1.30 $f q$ = 84]
Open2Study (2863 tweets)	Open2study (0.601) [μ : 6.38, σ : 5.50], a = [μ : 5.53, σ : 3.46 $f q$ = 120]	Course (0.569) [μ : 6.30, σ : 5.53], a = [μ : 5.50, σ : 3.46 $f q$ = 101]	Online (0.422) [μ : 3.75, σ : 3.50], a = [μ : 3.30, σ : 2.86 $f q$ = 554]	Clases (0.285) [μ : 3.45, σ : 2.75], a = [μ : 3.00, σ : 2.33 $f q$ = 55]	Free (0.205) [μ : 3.45, σ : 1.75], a = [μ : 1.99, σ : 1.00 $f q$ = 62]
Canvas Network (1070 tweets)	Canvasnet (0.600) [μ : 4.38, σ : 4.83], a = [μ : 4.50, σ : 3.46 $f q$ = 111]	Free (0.595) [μ : 3.30, σ : 3.99], a = [μ : 3.50, σ : 3.46 $f q$ = 99]	Courses (0.421) [μ : 3.00, σ : 5.50], a = [μ : 3.30, σ : 2.86 $f q$ = 85]	Mooc (0.295) [μ : 2.12, σ : 0.75], a = [μ : 2.80, σ : 2.33 $f q$ = 76]	Experience (0.235) [μ : 1.45, σ : 0.60], a = [μ : 2.05, σ : 2.11 $f q$ = 34]

TABLE 3. Statistical description of the variables defining the Twitter profiles.

	Mean	Standard deviation
Followers	148982.30	152735.723
Tweets	5551.10	3869.097
Following	1196.80	2333.767
Tweets ret.	321.40	311.064
@	1058.90	1054.755
Links	829.80	766.517
#	488.40	515.633

We then performed a Pearson correlation to establish potential relationships between the different variables and the number of followers of the different plat-

forms. In this way, we can define whether or not the presence or alteration of these elements with regards to the formal structure of the tweet is significant (Table 4).

TABLE 4. Correlation between defining variables of Twitter profiles.

		Followers	Tweets	Following	Retweets	@	Links	#
Pearson correlation	Followers	1.000	-.385	-.176	-.225	-.351	-.181	-.236
	Tweets	-.385	1.000	.516	.636	.767	.611	.394
	Following	-.176	.516	1.000	-.151	.292	.671	-.009
	Retweets	-.225	.636	-.151	1.000	.588	.301	.348
	@	-.351	.767	.292	.588	1.000	.545	.507
	Links	-.181	.611	.671	.301	.545	1.000	.652
	#	-.236	.394	-.009	.348	.507	.652	1.000
Sig. (unilateral)	Followers	.	.136	.313	.266	.160	.308	.256
	Tweets	.136	.	.063	.024	.005	.030	.130
	Following	.313	.063	.	.339	.206	.017	.490
	Retweets	.266	.024	.339	.	.037	.199	.163
	@	.160	.005	.206	.037	.	.052	.068
	Links	.308	.030	.017	.199	.052	.	.021
	#	.256	.130	.490	.163	.068	.021	.

Source: prepared by the authors.

We can see that there is no significance between any of the coded variables and the number of followers that the platform has on Twitter. Therefore, we

can infer that the communication, information and marketing strategies that the MOOC platforms might follow on Twitter do not have a direct relationship with the number of followers it has on that social network.

5. Conclusions

The aim of this research project was to analyse the Twitter profiles of ten of the most important platforms in the provision and promotion of MOOC courses, using a statistical and computational focus that would allow us to understand how and for what purposes these platforms use their Twitter accounts. The descriptive analysis of the ten platforms analysed enables us to confirm that the platform with the most followers is Khan Academy ($n = 495,062$) even though its level of activity is relatively low with a total of 1,499 tweets posted, an average of 0.55 tweets a day. The platform that has posted the most tweets since its creation is FutureLearn ($n = 10,757$) with an average of 6.70 tweets a day. Likewise, Udemy is the platform that follows the most third persons or institutions ($n = 7,764$). The platform whose tweets have been retweeted the most is MIT OpenCourseWare ($n = 880$). On the other hand, the platform that mentions other users the most is the Spanish Miriada X platform ($n = 3,120$). The platform that puts the most links in its tweets is Udemy ($n = 2,237$). The one that uses the most hashtags is edX ($n = 1,600$). Coursera is noteworthy because, despite being the most important platform in the world of MOOCs, it only posts an average of half a tweet a day, something that does not prevent it from

being the platform with the second most followers ($n = 310,771$). The two platforms with the lowest activity levels are Open2Study and Canvas Network.

The major Coursera and Khan Academy platforms are generally most active on Wednesdays and primarily post their tweets from two platforms: Twitter Web Client and Hootsuite. On the other hand, analysis of the sentiment pattern shows positive sentiment with a majority of blocks of tweets in the alert/excited v. calm/relaxed semantic blocks. With regards to the geolocation of the tweets, the platforms generally have the greatest presence in the USA and Europe. For the principal platforms the percentage is around 40%. Likewise, the platforms that have the greatest impact in South America are Coursera, eDX, MIT OpenCourseWare, and the Spanish platform Miriada X. Africa, Asia and Oceania have limited participation.

Regarding the lexical-semantic description of all of the tweets posted in the ten platforms, using the tf-idf calculation and the «inverse document frequency» technique the results show that five terms are prevalent: «learning» ($0.602 / fq = 260$), «skills» ($0.592 / fq = 251$), «course» ($0.498 / fq = 201$), «free» ($0.401 / fq = 167$), and «online» ($0,382 / fq = 110$). Finally, the correlational analysis to verify whether there is a significant relationship between any variable of use of the platform and the number of followers shows that there is no significance between any of the coded variables and the number of followers of that platform on Twitter. Consequently, we can infer that communication, information, and marketing strategies that

the MOOC platforms implement through Twitter do not have a direct relationship with the number of followers that they have on this social network.

Finally, the semantic description of the words used most by the platforms enables us to show that the use of Twitter centres on commercial promotion of courses and dissemination of information at the start of them.

Identifying communicative patterns on Twitter by the principal MOOC platforms at a global level enables us to visualise how a global social network with a high level of penetration is used to disseminate education on a massive scale. Likewise, the analysis of these patterns can be used in subsequent research to carry out comparative studies on how this social network is used in other sectors, educational institutions, universities, etc.

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