

Article

Twitter Social Network in University Teaching. Digital Innovation Strategy for Social Responsibility

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Abstract: The incorporation of social networks in university teaching enables new communication channels and opens new channels for training meetings, which also provides a different dynamic to day-to-day teaching, promoting communication initiatives under social responsibility. This article presents an experience of digital innovation through the use of social networks, Twitter in particular. The overall objective of this innovation is to allow communication, to provide information and reflection as a learning tool, where the main reason for the existence of this community is the exchange and intercommunication of lessons related to the different subjects and to enable professional development. It is developed through eminently active pedagogical methods, considering the theory called connectivism. The results obtained corroborate the starting hypothesis that this teaching team had from the beginning, that a methodology enriched with the use of Twitter, a tool that allows complementing the content of the subjects and interacting with them without limitations of space and time, would increase and improve the process of teaching–learning.

Keywords: university teaching; innovation; social networks; ICT; Twitter

1. Introduction

At the university level, the incorporation of information and communication technology (ICT) in teaching, has entailed a rapid reception in recent years, both to address theoretical issues in the implementation of educational innovations and for their evaluation. There are many experiences that can be known about the innovations [1–6], although there is still a long way to go for their consolidation in the pedagogical praxis of higher education institutions. As described by [7], it is not just about incorporating technological tools and training teachers, but there are internal and external factors that do or do not benefit the incorporation of ICT as fundamental support for teaching; for example, attitudes, perceptions and interests of teachers towards ICT [8,9].

However, an increase of university students' participation in social networks can be appreciated; figures given by the Interactive Advertising Bureau (IAB Spain) [10] in its annual report of social networks indicate how the penetration of social networks in Spanish society continues to increase. The report found that 85% of internet users aged 16–65 use social networks, which represents more than 25.5 million users in our country.

In this sense, as [11] considers, this recent use of social networks among university students promotes the possibility that teachers use these tools to achieve the premises marked in the European Higher Education Area (EHEA), since “social media, in general, and social networks, in particular, provide several ways to meet the challenges of higher education, both from a technical and pedagogical point of view” [12] (p. 133), training citizens who must deal with challenging social and global problems in the 21st century.

In addition to the aforementioned, it must be considered that social networks should be used for teaching, in order to understand that educational institutions should be as close as possible to the reality that students experience and not be left out of all the social changes that are taking place, especially, as [13] points out, when using social networks properly in the classroom we can establish new communication channels and open new channels for training meetings that also provide a different dynamics from day to day teaching. In addition, the growing home education movement and its social significance makes use of these technologies [14].

At the same time, the new socio-environmental situation and educational innovations, as [15] points out, require the development of skills for sustainability in university graduates during their training programs to promote their possible transfer in the different contexts of their subsequent professional activities.

Education is considered to be a necessary key for social transformation towards sustainable development [16]. Within the new conceptualizations presented by [17], whose proposed navigation approach aims to allow educational actors to be oriented and, consequently, navigate and learn by making connections in our more-than-human world.

In the face of the needs presented by this type of teaching, a methodological change will be necessary and, thus, the theory called connectivism must be taken into account [18]; connectivism directs us towards eminently active learning methods that respond to the current challenges of teaching in the digital age. Reference [19] defines the theory of connectivism as “a proposal of educational innovation that responds to the current way of generating new knowledge and that students learn with the full range of tools that technology and hyperconnectivity put at their disposal. It is a commitment of current teachers to engage with the knowledge of these new learning alternatives to be at the forefront and offer their students innovative and relevant teaching” (p. 1).

Understanding that this new methodological proposal is necessary undoubtedly implies giving a new meaning to the roles of teachers, students, e-moderation [20], as well as classrooms, spaces, and considering different ways of conceiving ICT. For this purpose, according to [21], they should not be used to do the same that has been done without them or to present the information, but to do different things and to create new communicative scenery. The TPACK model (technology, pedagogy and content knowledge) presents an interesting way so teachers can integrate technology, pedagogy and disciplinary knowledge into their teaching function [22].

In this sense, considering that there are numerous advantages and possibilities that social networks can bring to education [23–25], work done with microblogging networks as support elements for university teaching practice is presented here, in which Twitter is considered as a considerably useful means for the development of academic and professional skills promoted in the process of European convergence.

Twitter is a very basic communication platform due to its microblogging nature. Microblogging is a form of communication belonging to a post delivery system (currently Twitter allows 280 characters), whose information stands out for simplicity and immediacy, being therefore a fast and direct way of reaching users. In this sense, the usefulness of the network in educational fields is wide, to which its ease of publication is attached (from mobile, computer or devices with instant messaging software).

According to [26], the use of Twitter in higher education contributes to increasing the degree of commitment in educational activities, both of students and teachers and is a good instrument to promote informal learning.

Because all the aforementioned, we can say that within the university educational world, Twitter facilitates immediate feedback, allows information to be shared and enables reflection on certain concepts, in order to justify the current concept of reflective and critical interactivity, especially for its validity in the field of educommunication [27].

2. Research Design

2.1. Objectives

The general objective of this article is to analyse the use of a microblogging social network application (Twitter) as a complementary resource to face-to-face classes in different university subjects; such an application allows communication and facilitates the exchange of information, as well as reflection. Used as a learning tool, where the main reason for the existence of this community is the reciprocity and intercommunication of teachings related to the different subjects, to allow professional development.

The specific objectives that are intended to be achieved with this project are the following:

- SO1 To increase and enrich the interaction between university students, teachers and society, through microblogging services, and more specifically through Twitter.
- SO2 To promote the degree of involvement of students with the subjects, promoting an active methodology.
- SO3 To deepen exploration into the contents worked on in the face-to-face classes; activities that propitiate their reflection.

In order to analyse the development of these specific objectives, the interactions that have taken place between students and teachers have been taken as variables of analysis based on the number of reactions to, comments on, likes and retweets of the messages on the social network. The quality (texts, images, videos) and quantity of these messages have also been taken into account.

2.2. Context Features and Sample

A teaching experience is presented here that is part of a Teaching Innovation Project approved by the General Directorate of Training and Innovation of our university.

The methodological process followed happened during the 2017–2018 academic year in the development of the following educational subjects:

“Didactics in Social Education”. Course: first of the double degree in Social Work and Social Education. First semester.

“Evaluation, quality and educational innovation for social cohesion”. Course: fourth of the degree in Social Education and fifth of the double degree in Social Work and Social Education. First semester.

“Educational intervention for the social integration of people at risk of exclusion”. Course: second of the degree in Social Education. First semester.

“Management and organization of Social Education centres and institutions”. Course: fourth of the degree in Social Education. Second semester.

“New Technologies and Information Management”. Course: first of the degree in Social Work (L1). Second semester.

The total number of subjects involved are five, one of them in two lines. The number of groups has been six, corresponding to different courses of the degree in Social Education, Social Work and double degree in Social Work and Social Education. The subjects correspond to the first and second semesters of the course.

A total of 330 students enrolled in the six subjects; since the activity was absolutely voluntary, initially 181 people were interested. We took data at the beginning of the innovation project from both female and male students who had previously used Twitter *f* (159), some who had never used it *f* (22) (last columns), *f* (18) male students and *f* (163) female students. From this group, 87.85% of them were Twitter users *f* (159), of which 9.4% were male students *f* (17) and 78.45% female students *f* (142) and some had no prior Twitter experience *f* (22) of which, there was one *f* (1) male student and *f* (21) female students.

In relation to the initial information of the students, data are presented in the following Table 1.

Table 1. Initial sample. Source: own development.

Subjects	Course/Degree	Enrolled Students		Participants			
				Twitter Users		Not Twitter Users	
		M	W	M	W	M	W
1. Didactics in Social Education (DSE)	First of double degree in SE & SW	5	55	3	39	0	9
2. Evaluation, quality and educational innovation for social cohesion (EVAL)	Fourth of degree in SE	7	43	1	13	0	1
3. Evaluation, quality and educational innovation for social cohesion (EVAL)	Fifth of double degree in SE & SW	3	48	1	15	0	2
4. Educational intervention for the social integration of people at risk of exclusion (INT)	Second of degree in SE	10	49	7	27	0	3
5. Management and organization of Social Education centres and institutions (DIOR)	Fourth of degree in SE	6	42	1	12	0	1
6. New Technologies and Information Management (NNTT)	First of degree in SW (L1)	8	54	4	36	1	5
TOTAL		39	291	17	142	1	21
		330		159		22	

The average age of the participants at the beginning of the innovation project was 20 years. All older students were Twitter users, however, many of the younger students did not have an account or did not use this social network.

Finally, the total number of students who participated and used the social network Twitter throughout the development of the different subjects are those shown in the following Table 2.

Table 2. Twitter participants in the development of the subjects. Source: own development.

Subjects	Total Participants	%
1. Didactics in Social Education (DSE)	35	58.3%
2. Evaluation, quality and educational innovation for social cohesion (EVAL)	23	22.8%
3. Educational intervention for the social integration of people at risk of exclusion (INT)	9	15.25%
4. Management and organization of Social Education centres and institutions (DIOR)	11	22.9%
5. New Technologies and Information Management (NNTT)	30	48.38%
Total	108	32.7%

2.3. Methodology

The innovation methodology that is carried out revolves around digital innovation through the use of social networks, Twitter in particular, throughout different subjects in different degrees, so it is a multidisciplinary and voluntary proposal for students.

The methodology was based on active learning processes, understood as stated by [28] (p. 2), “the realization of different activities by students accompanied by reflection on the actions they are carrying out”, in which both students and teachers participated significantly in social networks in each of the subjects, and where additional knowledge was built by the person who learns, through action, and in which autonomous and reflective learning was encouraged.

On another note, currently one of the paradigms of teaching innovation in teaching in general and in university education specifically, involves the incorporation of ICT as a tool for its development. This incorporation is considered to imply innumerable benefits for the teaching and learning processes that affect both teachers and students, producing a change in the traditional methodology. Therefore, that is why the theory of connectivism must be considered [18,29].

For all the above, in this innovation project it is considered that using microblogging networks as support elements for the teaching practice adds value; that is why it is appreciated that Twitter could be a considerably useful means for the development of skills academics and professionals promoted in the process of European convergence.

The actions carried out were the following:

At the beginning of the subject: (1) exhibition of the project to be developed in the different groups, (2) initial questionnaire on its use and uses of Twitter, (3) provide students with information to start working with Twitter and (4) promote students, individually, and create a Twitter profile at the beginning of the course.

In the development of the subject: (5) invite students to have a “professional Twitter” profile and (6) share links to documents, news, videos, photographs, etc. on the topics that were being dealt with in the different subjects; thus debates/discussions are encouraged.

Participation was encouraged by displaying information or images/photographs of the different class activities, as well as comments, surveys, discussions, etc.

In order that the tweets could be followed from any timeline without the need for everyone involved to need to follow each other and, above all, to avoid interference, we decided to use a different hashtag for each line of comments. A common label is used for all subjects: #innovUPO and a different one according to the subject.

The hashtags of the different subjects are the following:

1. “Didactics in Social Education” #innovUPO #didactica
2. “Evaluation, quality and educational innovation for social cohesion” #innovUPO #evalcal
3. “Educational intervention for the social integration of people at risk of exclusion” #innovUPO #intervencion
4. “Management and organization of Social Education centres and institutions” #innovUPO #diror
5. “New Technologies and Information Management” #innovUPO #TICL1

At the end of the subject: (7) fill out a satisfaction questionnaire with the methodology developed at the end of the subject and (8) analyse the results.

In the initial questionnaire on the use of Twitter the following answers, which have served to guide from a more qualitative point of view, the implementation and monitoring of the whole experience, must be highlighted.

Regarding qualitative data, the negative answers to the question: Do you have a Twitter account? are motivated by the following questions:

Because they did not find the social network attractive, interested or felt the need for its use. With a frequency of f (11).

“I haven’t needed the account at any time and it didn’t get my attention.”

Because of the use of other social networks. With a frequency of f (10).

“I had one a long time ago, but I stopped using it because I started using Facebook and Instagram.”

Because of the need to maintain personal privacy. Frequency of f (1).

“Because I don’t like that dependence that social networks entail and the exposure of your personal life that is done in such a detailed way.”

Because it is not considered a useful tool for training and professional level. With a frequency of f (1).

“I don’t think it’s professional to combine with the subject.”

However, the positive answers to the question: Do you have a Twitter account? are based on the following uses:

To be informed of the news. With a frequency of f (92).

"I think Twitter is a good social network because from it I am informed of the events that occur worldwide."

"I use it to keep me informed of the latest news, since I don't use television and social networks are good resources."

To communicate. To publicize their opinions, thoughts, moods, lived situations, etc. share photos, music, ... With a frequency of f (32).

"It seems like a good place to expose your ideas."

"I use it to share videos or news that interest me, as well as to express how I feel or tell things that have happened to me."

To maintain contact with your acquaintances, friends, colleagues, ... (personal use). With a frequency of f (28).

"To watch news, videos, and various interactions of my friends."

"I've had it for years, I started using it to maintain contact with friends from other countries that I met in an exchange."

For academic or work purposes. With a frequency of f (18).

"I have two accounts, one personal for my hobbies, and another professional, for work and vocational issues."

"For news and work topics".

In order to meet people. With a frequency of f (5).

"To interact with people."

The methodological approach of this research is quantitative. This study is a descriptive non-experimental cross-sectional methodological design, since in the social research practice it is difficult to achieve control of all internal and external factors that can invalidate information [30]. Thus, existing situations, not intentionally provoked, are studied here [31].

Within this phase related with the PK analysis, the published descriptions on Twitter were extracted and supervised. A manual data extraction was performed. The sample made use of the different hashtags in the different lectures throughout the course when students were writing their tweets; these are the key words that allowed us to code and therefore study the use that students made of Twitter as a strategy for information gathering. We also used basic techniques for text pre-processing (tokenization and normalization).

After the codification and systematization of the data, the information was analysed and interpreted in blocks of subjects. In each of them—from an eminently quantitative point of view—the following issues are studied: the number of participants, the number of days on which it has been published on Twitter, the number of tweets with these tags, the type of posts, classified by: (1) text tweets, (2) tweets with linked information, (3) tweets that provide images and photographs, (4) tweets that present videos, (5) retweets and (6) others. And finally, the interaction with the published tweets, computing the Ward index for getting the associations.

Ward's method [32] is a hierarchical cluster analysis whereby clusters must be constructed in such a way that, when two elements are merged, the resulting loss of information is minimal. It quantifies the amount of information as the sum of the squared distances of each element from the centroid of the cluster to which it belongs (SSE = error sum of squares).

After making a description of the characteristics of the units of analysis by subjects, a joint analysis is carried out in relation to the characteristics that are important in the formulated objectives, deepening from a more qualitative point of view, in the effects that the use of Twitter has generated in the process of teaching and learning of the different subjects in which the experience has been launched.

3. Results Regarding the Use of Twitter

As it was mentioned earlier, a hashtag was assigned for each of the subjects of this project. The analysis of the use made of Twitter will be done through these tags.

The interactions maintained in the different subjects are published on Twitter and all of them can be seen at the links presented in the following Table 3.

Table 3. Links of the interactions maintained in each of the subjects. Source: own development.

Subjects	Hashtags	Links to All Posts
1. Didactics in Social Education (DSE)	#innovUPO #didáctica	https://twitter.com/search?f=tweets&vertical=default&q=%23innovUPO%20%23did%C3%A1ctica&src=savs
2. Evaluation, quality and educational innovation for social cohesion (EVAL)	#innovUPO #evalcal	https://twitter.com/search?f=tweets&vertical=default&q=%23innovUPO%20%20%23evalcal&src=savs
3. Educational intervention for the social integration of people at risk of exclusion (INT)	#innovUPO #intervencion	https://twitter.com/search?f=tweets&vertical=default&q=%23innovUPO%20%20%23intervencion&src=savs
4. Management and organization of Social Education centres and institutions (DIOR)	#innovUPO #diror	https://twitter.com/search?f=tweets&vertical=default&q=%23innovUPO%20%23diror&src=savs
5. New Technologies and Information Management (NNTT)	#innovUPO #TICL1	https://twitter.com/search?f=tweets&vertical=default&q=%23innovUPO%20%23TICL1&src=savs

From the information obtained by the sample that is published in the network at the indicated addresses and after analysing all the data, the analysis of the results broken down by subject is presented below.

3.1. Subject 1: Didactics in Social Education (DSE)

In this subject, with the hashtags indicated, 35 people participated, having different presences and interventions, depending on the number of tweets published (Figure 1).

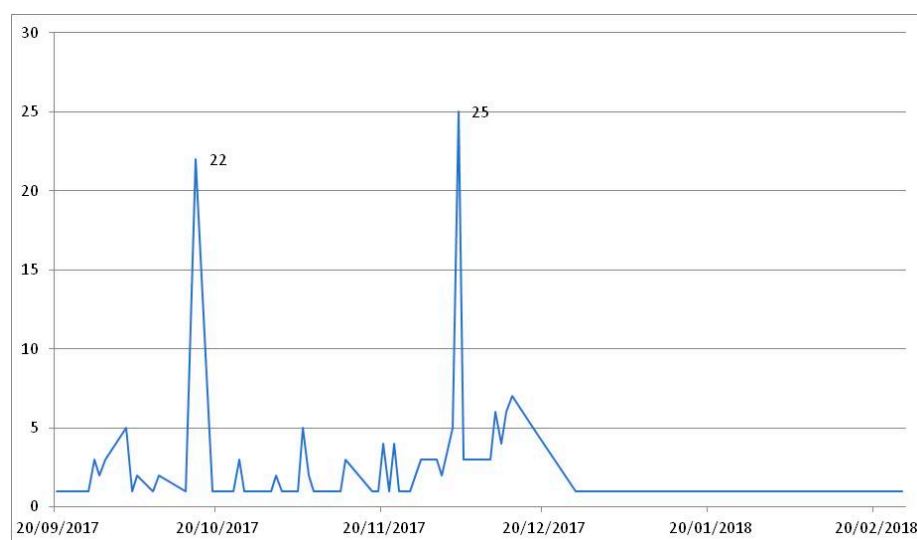


Figure 1. Twitter activity in Didactics in Social Education (DSE). Source: own development.

Throughout the subject there have been 56 days in which it has been published on Twitter. There were differences in the volume of interventions between one day and another; the average participation was 3.04 per day.

The days 6 October 2017 and 4 December 2017 had greater activity, coinciding with classroom activities.

The number of interventions on Twitter with these tags was f (170) and after performing the analysis we appreciate that they show different types of posts, therefore, we have classified them by: (1) text tweets, (2) tweets with linked information, (3) tweets that provide images and photographs, (4) tweets that present videos, (5) retweets and (6) others. On this occasion the data of “others” corresponds to surveys on Twitter.

For this subject the total tweets f (170) are distributed in f (7) text tweets, f (24) link tweets, f (54) image and photo tweets, f (11) video tweets, f (73) retweets and f (1) survey tweet.

The following Figure 2 shows the frequencies and percentages for the subject of Didactics in Social Education.

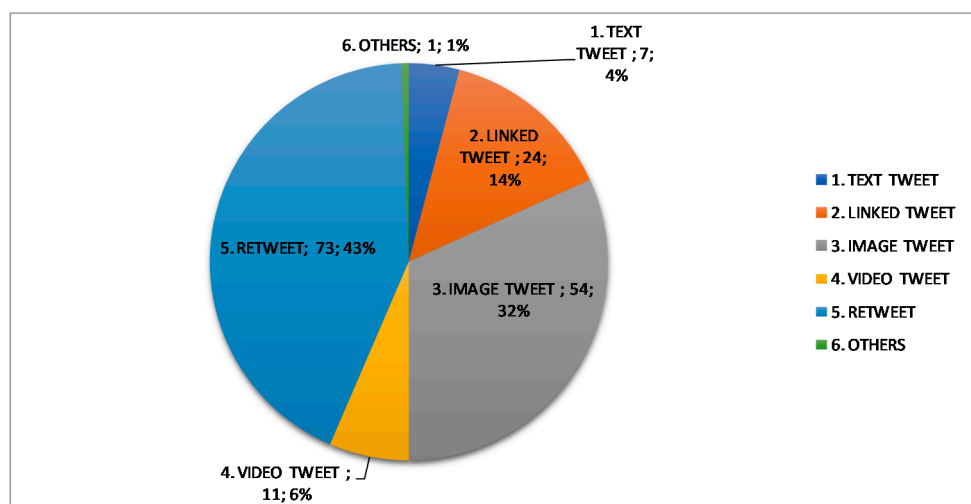


Figure 2. Data of the types of posts used in DSE. Source: own development.

The posts published in this subject, f (170), had different acceptance among the followers. All of them have been involved in interaction, with a total of f (9) responses, f (318) retweets and f (407) likes, highlighting the high distance in the frequency of actions that generate new content (proactive action) f (9) and those which echo already published content (passive action) f (725).

3.2. Subject 2: “Evaluation, Quality and Educational Innovation for Social Cohesion” (EVAL)

This subject that has been taught in the fourth session of the degree in Social Education and fifth of double degree in Social Education and Social Work, when dealing with such content, we have worked with Twitter using the same tags and the information is presented jointly.

There were 23 people participating in the social network in these subjects. The participation percentages vary among them, according to the number of tweets published.

In the period in which the subjects have been developed, there were 86 days in which publications were made. In the Figure 3 shown below, the volume of interventions per day can be seen. Note that 20–21 November 2017, 15 December 2017 and 17–18 December 2017 had a greater number of posts, with an average of 6.06 tweets per day.

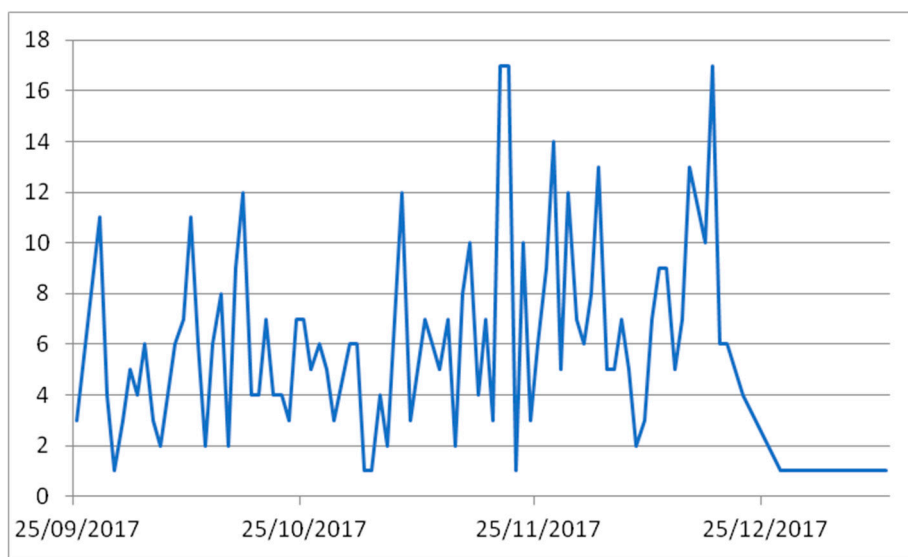


Figure 3. Twitter activity in Evaluation, quality and educational innovation for social cohesion (EVAL). Source: own development.

The total interventions in this subject with these labels were f (521), of which, after the analysis according to their typology, we can note that among them, f (55) were text tweets, f (149) link tweets, f (34) image tweets and f (283) retweets. There are no video tweets. Frequencies and percentages for each type can be seen in the Figure 4 shown below.

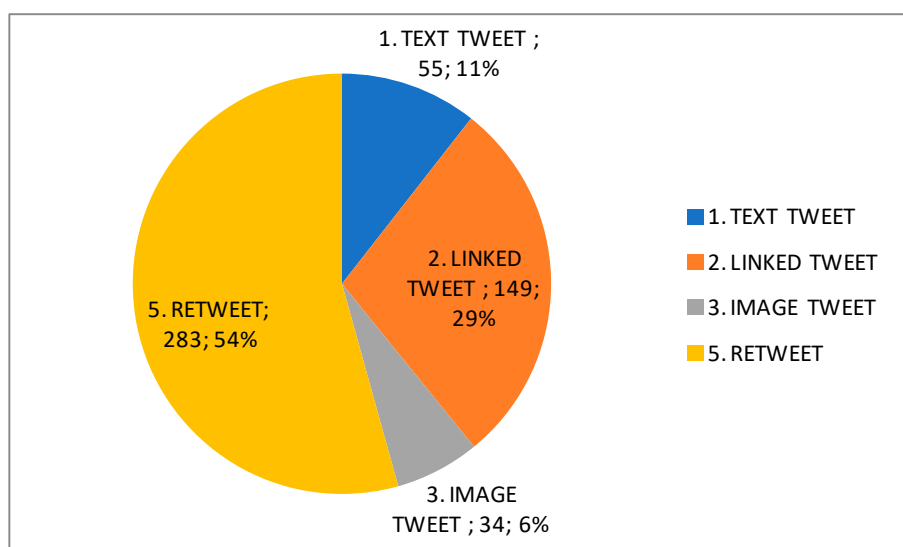


Figure 4. Data of the types of posts used in EVAL. Source: own development.

As has already been said in previous sections, the reception of these posts f (521), by the followers, has been wide with f (30) total responses to them, f (209) retweets and f (900) likes; the retweets and mainly the likes were the most repeated actions.

3.3. Subject 3: “Educational Intervention for the Social Integration of People at Risk of Exclusion” (INT)

9 people participated with the hashtags of this subject, with different interventions.

In this subject there were 35 days in which different entries were published. The volume of interventions per day varies, the average being 2.14. We can highlight the interventions from 12–18 December 2017 in which participation is greater. The following Figure 5 shows their frequency.

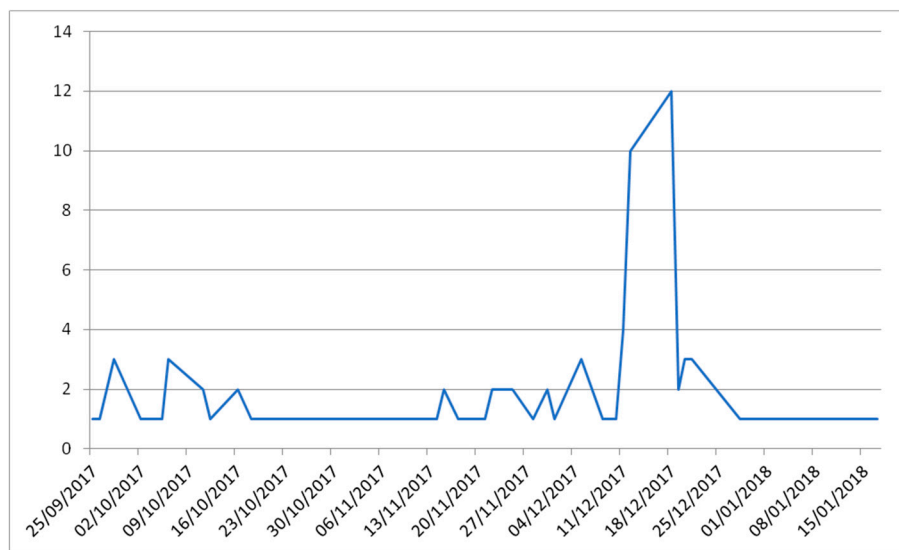


Figure 5. Twitter activity in Educational intervention for the social integration of people at risk of exclusion (INT). Source: own development.

The number of interventions registered with the subject hashtags was $f(75)$ and after analysing them, we show in the following Figure 6 the distribution of the different types of posts used.

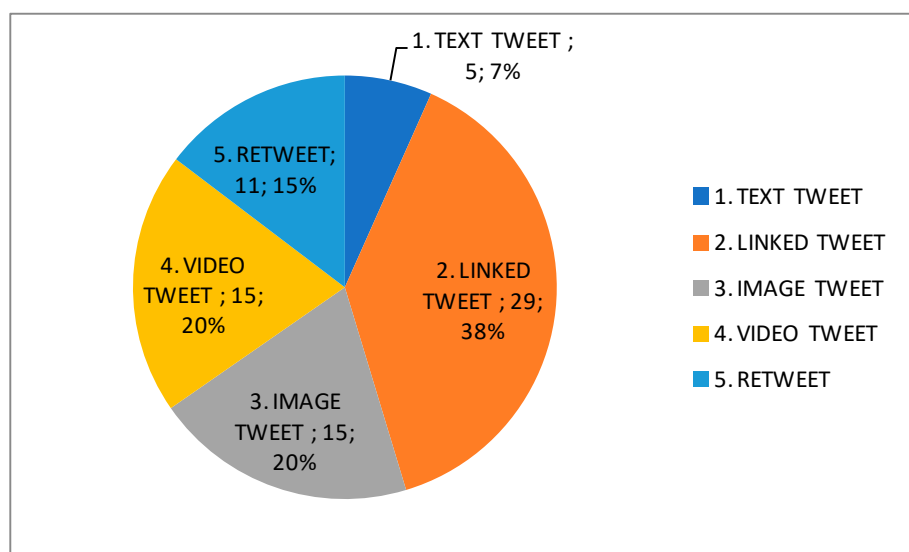


Figure 6. Data of the types of posts used in INT. Source: own development.

The acceptance that these posts had $f(75)$ among the followers has been different, interacting with them through a total of $f(1)$ responses, $f(55)$ retweets and $f(171)$ likes.

3.4. Subject 4: “Management and Organization of Social Education Centres and Institutions” (DIOR)

11 people interacted with the hashtags of this subject.

In relation to this subject, it was published for 86 days, with differences in the number of interactions between one day and another. The average participation was 4,34, which can be seen in the Figure 7 below.

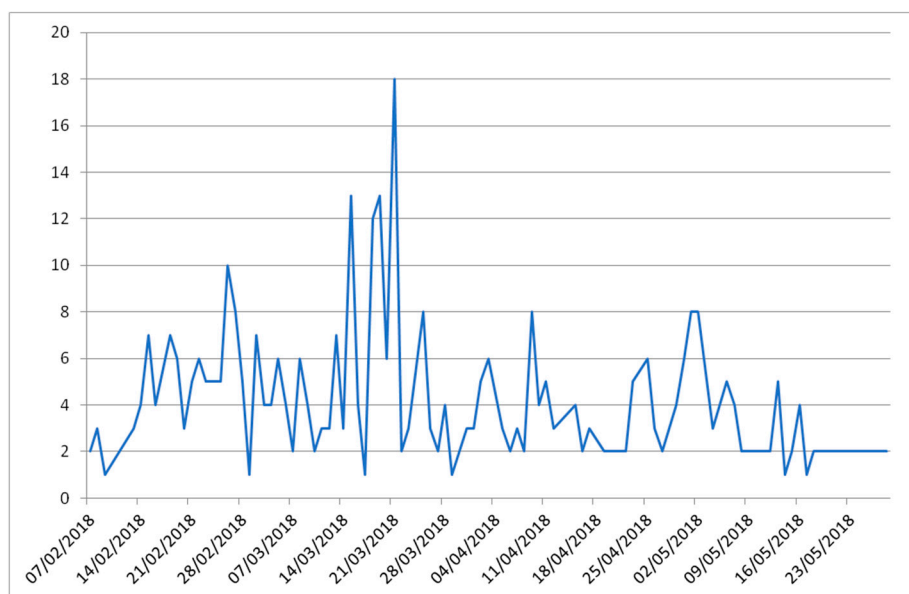


Figure 7. Twitter activity in Management and organization of Social Education centres and institutions (DIOR). Source: own development.

The total number of interventions on Twitter with the tags marked for this subject was $f(373)$ and from the analysis of their typology note that they are distributed among $f(22)$ text tweets, $f(200)$ tweets with linked information, $f(21)$ tweets that provide images and photographs, $f(129)$ retweets and $f(1)$ of others. There are no video tweets.

The following Figure 8 shows the frequencies and percentages of each of the types present in this subject.

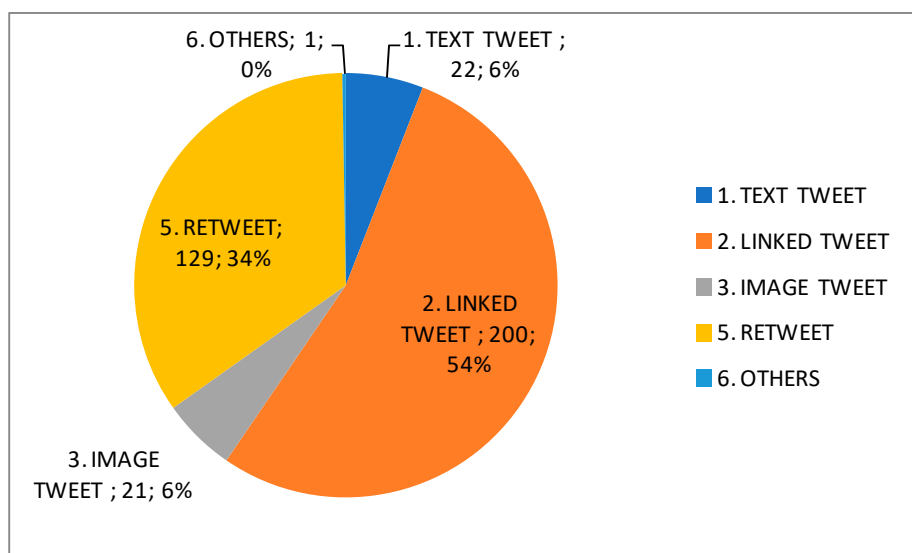


Figure 8. Data of the types of posts used in DIOR. Source: own development.

The acceptance of the posts of this subject $f(373)$ can be seen according to the responses to them, in which it can be seen that they have obtained a total of $f(8)$ response tweets, $f(162)$ retweets to them and $f(621)$ likes in total.

3.5. Subject 5: “New Technologies and Information Management” (NNTT)

This subject has had a participation of 30 different profiles. Some of them are personal and others are group profiles, for example: “Drogadicción” or “EnlaredUPO”.

In this subject there have been 51 days in which tweets have been published. As shown in the following graphic, as can be noted 19–20 February 2018 show a more active participation, the average per day being 3.41, which can be seen from the Figure 9 below.

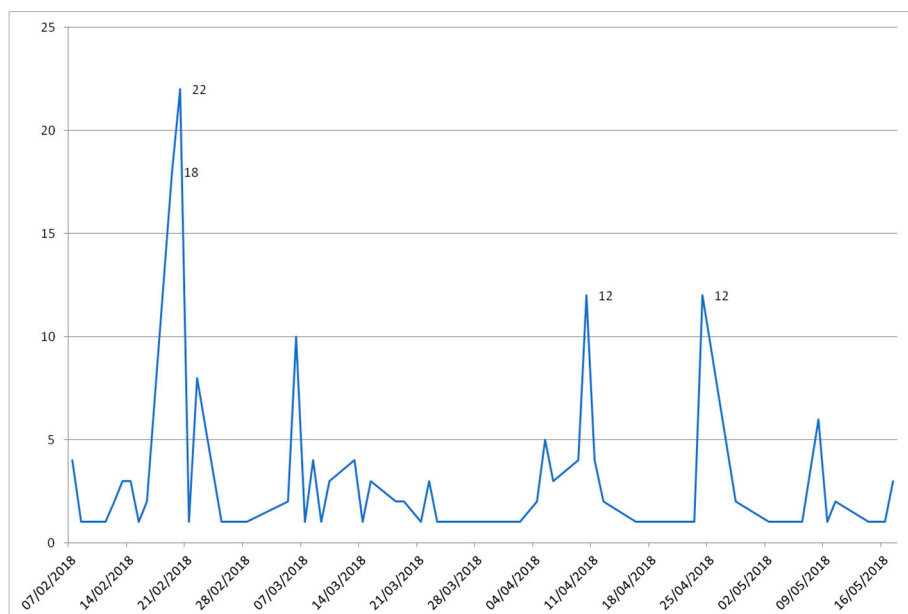


Figure 9. Twitter activity in New Technologies and Information Management (NNTT). Source: own development.

The number of interventions on Twitter with the subject tags was f (174) and the following Figure 10 shows frequencies and percentages in relation to these tweets, classified by type. Note in this subject the tweets with images and photographs. In this instance, the “other” data also corresponds to a Twitter survey, which presents 78 votes and the results to that query.

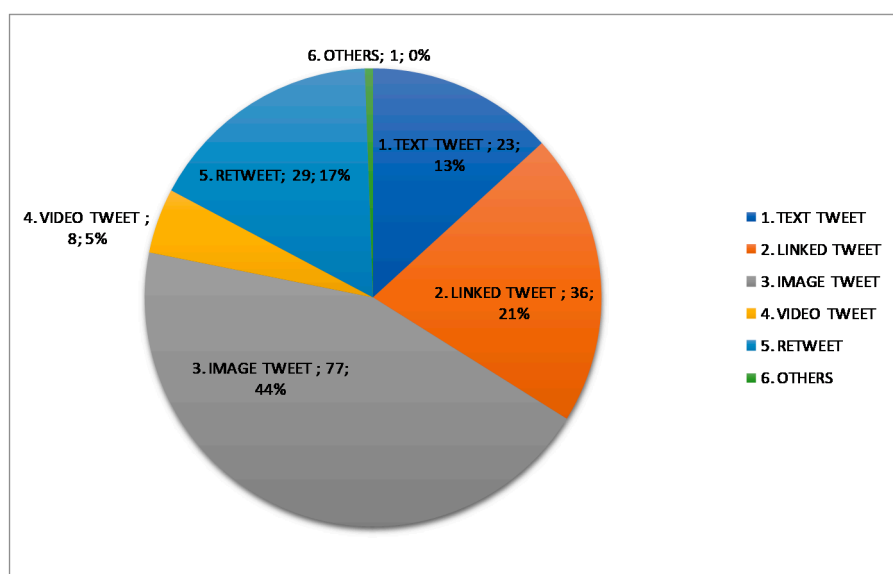


Figure 10. Data of the types of posts used in NNTT. Source: own development.

The acceptance of these posts f (174) among the followers has been f (14) replies, f (256) retweets and f (419) likes.

3.6. Overall Results

Once analysed the data of each one of the subjects, the global data regarding the use of Twitter are the following, as shown in Table 4:

Table 4. Total data of the intervention with Twitter in the subjects. Source: own development.

Subjects	Total Posts	Reactions to the Tweets		
		Answers	Retweets	Likes
1. Didactics in Social Education.	170	9	318	407
2. Evaluation, quality and educational innovation for social cohesion.	521	30	209	900
3. Educational intervention for the social integration of people at risk of exclusion.	75	1	55	171
4. Management and organization of Social Education centres and institutions.	373	8	162	621
5. New Technologies and Information Management	174	14	256	419
TOTAL	1313	62	1000	2518

The statistical calculation that emerges from the data obtained in the total interactions in this project are those shown in the following Table 5.

Table 5. Statistics of the total data in the five subjects. Source: own development.

	POSTS	ANSWERS	RETWEETS	LIKES
Average	262.6	12.4	200	503.6
Variance	32,644.3	118.3	9902.5	74,506.8
SD	180.7	10.9	99.5	273.0
CV	0.7	0.9	0.5	0.5
Median	174	9	209	419
Quartile 1	170	8	162	407
Quartile 2	174	9	209	419
Quartile 3	373	14	256	621
Xmin	75	1	55	171
Xmax	521	30	318	900
Range	446	29	263	729

It can be seen in the data included in the table above, the average number of posts among all subjects was 262.6 tweets, showing a variability of the data with respect to the average that is quite high, considering therefore that the measure of dispersion is very heterogeneous, in which the standard deviation (which tells us how far the values can deviate from the average) marks a dispersion of 180.7 and the relative dispersion of the data (coefficient of variation (C.V.)) is 0.7, which if expressed as a percentage is 70%. When the CV is less than or equal to 80%, it means that the arithmetic mean is representative of the data set, thus the data set is “homogeneous”.

Quartiles are statistical measures of position that have the property of dividing the statistical series into four sets of numbers of equal terms. When the intervals in which the first quartile Q1 is

analysed, it shows that 25% of the data is less or equal to 170; the median or second quartile shows that 50% of the data is less or equal to 174, marking the central tendency; and the third quartile indicates that 75% of the data is less or equal to 375, appreciating this distribution in the posts of the global data.

The range or path between the interval of the maximum value of the data (X_{\max} : 521) and the minimum value (X_{\min} : 75), presents a data dispersion of 446; the data includes an outlier, since the comparison between the maximum and the minimum is wide.

4. Discussion and Conclusions

Based on what is stated in this article, it can be considered that this experience has been very beneficial to lay the foundations in communication outside the traditional and face-to-face classroom, maintaining aspects of the university environment between teachers and students in an extra-academic way (SO1). The quantitative analysis of the data obtained from the study corroborates that a high degree of interaction between teachers and students has been achieved. Broadly, more than 1300 posts with 1000 retweets and more than 2500 likes stand out. This means, in our opinion, there was a high degree of interaction that adds to and complements personal interaction in traditional classes.

The obtained results corroborate the starting hypothesis of this paper that a methodology enriched with the use of Twitter, a tool that allows complementing the content of the subjects and interacting with them without limitations of space and time, would increase and improve the teaching–learning process (SO2). The volume of interactions and shared content presented in the quantitative analysis of the study confirms that the use of Twitter expands the contents of the subject and allows for the enrichment of learning by focusing on some specific topics that, normally due to lack of time, are not addressed in the classroom sessions with traditional methodology, and which are of interest to students. The fact that students themselves share resources and reflections on these topics favours a more active methodology in the teaching and learning processes.

It has allowed the stimulation of active learning, to promote the habit of reflecting on each content through tweets and has facilitated the incorporation of both one's own and other experts' content (SO3). Although the diversity in the use of the tool among students has varied greatly, given that the experience was voluntary and because some subjects may lend themselves more than others to being shared on the social network, it can be confirmed that this methodology substantially extends the interaction of students with the subject.

Work has been done throughout the semesters in capturing and maintaining the interest, motivation and commitment of students to the subject and, based on the data, it can be considered that students have been more involved in the subjects by the fact of having to see, read and interact with teachers and classmates tweets, promoting an active and participatory attitude (SO2). It is also interesting to note that the effects of the use of Twitter have not only expanded the space of interaction between teachers and students outside the classroom environment, furthermore, they have generated a kind of feedback in which the contents addressed in the tweets have also been treated in class with all the students, both with those who participated in the experience and with those who did not. This has established a bidirectional transfer of content between the virtual environment of the social network and the classroom. This has allowed an enrichment and deepening of the curriculum contents of the different subjects. This aligns with the findings from prior literature [33–38].

According to [39] there is a need to take serious and constructive steps to make social media a useful tool in the field of education since this methodological practice has great strengths, mainly due to the fact that it does not entail any costs and due to the possibility of using it through the smartphone, giving the opportunity of proximity and immediacy, its use is easy and accessible. However, it also has some limitations. Students, for the most part, are large consumers of social networks, but the generality does not mean there will be frequent use of Twitter for academic purposes, despite considering it as a tool with great value for information and communication. Likewise, teachers are not always motivated to use it. In this sense, it should also be noted that the results of the study provide more elements for reflection on the use of smartphones and the appropriate use of social networks, when educational

administrations have banned (highlighted in the case of France) or are considering banning the use of these devices in schools (as have some autonomous communities in Spain).

For all these reasons, and considering that the aforementioned digital strategy has great teaching potential, it is convenient to have good training in the didactic use of the social network prior to extending it to the educational community. That is, a pedagogical orientation towards a critical analysis of and acting upon social media information. According to [40] “digital information activation” (Dig-Info-Act).

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