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Professional development of teachers acting as bridges in online social networks

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Spanish K-12 teachers participate in online social networks to share educational resources and also to socialise with other teachers. In these networks, participants connected to several groups can adopt a bridging role. In general, 'bridging teachers' are more participative, engaged and they help to spread information through the network. In this study, we explore how bridging teachers use Twitter and whether this use results in a better outcome in their educational practices. Three kinds of data sources were analysed: teacher interviews, teachers' contributions on their own blogs and webpages, and teachers' Twitter activity. The analysis provided information on the participants' school practices, professional development, use of social networking sites and type of activity on Twitter. The results indicate that teachers acting as bridges use participatory methodologies combined with technology in their classroom and are active users of several social networking sites, although they prefer Twitter for professional matters. Regarding the use of Twitter, we have been able to identify two main patterns of interaction: one targeted at information sharing and the other focused on social relations.

Keywords: online social networks; social networking sites; teachers' professional development; open learning; educational practices; Twitter; K-12

Introduction

A social network can be defined as 'the set of relationships, personal interactions, and connections among participants who have personal reasons to connect' (Wenger, Trayner, and de Laat 2011, p. 9). Networks whose aim is to provide continuous learning for professional purposes have been defined as professional learning networks (Tobin 1998; Trust, Krutka, and Carpenter 2016). Participation in a network can provide access to a wide range of information flows that can be useful for obtaining resources, finding solutions or establishing dialogues with other professionals (Wenger Trayner, and de Laat 2011). Having a central position in active educational networks can benefit teachers, facilitating their access to a greater amount of information. The network structure determines that the flow of information a participant, or node, can access is proportional to the number of connections to other participants in the network.

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The existence of teachers' social networks has been demonstrated to be a key factor in improving student achievement (Moolenaar, Sleegers, and Daly 2012; Yoon *et al*. 2007), as continued and sustained opportunities to discuss school practices with other teachers provides high quality professional development (OECD 2014; Wei, Darling-Hammond, and Adamson 2010). The massive use of the Internet and the participatory culture spread during the last decade (Haythornthwaite 2005, 2009b) have facilitated the creation of new networks, nurtured in online environments through the use of social networking sites (SNS) and other platforms. In the case of teachers, online networks offer them the opportunity to share knowledge and learn together with their peers in other contexts and teaching realities sometimes located far away (Ravenscroft *et al*. 2012). Teachers can access new information, ideas, examples of practice and resources through their participation in online SNSs.

SNSs used in education can promote socioconstructivist learning (Allen 2012; Manca and Ranieri 2017) by modifying the learners' role and providing them with new educational understandings. The interconnected model of professional growth explains how teachers can benefit from the information acquired in online SNSs. This model takes several domains of the teaching situation into account (Clarke and Hollingsworth 2002): (1) the *personal domain*, including teachers' ideas, knowledge and beliefs; (2) the *external domain*, represented by information or resources that teachers acquire while collaborating with other teachers or participating in training activities; (3) the *domain of practice*, related to action research activities developed in the classroom context; and (4) the *domain of consequence*, which includes students' results and other consequences in the classroom climate or organisation. According to the interconnected model, an external source of information, which could be the consequence of participation in an online network or community, can generate change in teachers' knowledge and foster new practices in their teaching. After experimenting in the classroom, teachers can evaluate the applied processes and student outcomes and, based on the results of this evaluation, make changes at a cognitive and behavioural level. In this context of participatory networking, teachers assume responsibility for the information that they exchange and the contributions they make to the educational networks in which they participate, as well as for the information they integrate and the connections they make, deciding by themselves what they need at every moment.

Recent research describes online teachers' networks through the theories on social capital and social network analysis, which reveal how information flows between a group of network members (Ranieri, Manca, and Fini 2012; Schlager *et al*. 2009; Smith Risser 2013; Tseng and Kuo 2014). Bordieu's 'social capital theory' (1986) asserts that:

> the social capital possessed by a person depends on the size of the network of connections they can effectively mobilize and on the volume of the capital (economic, cultural or symbolic) possessed in their own right by each of those to whom they are connected. (p. 21)

Then, teachers' social capital can increase when they connect to a larger number of colleagues who are highly skilled. According to Bordieu (1986), participants in a group have to make an effort to sustain the relations that ensure the continuity of the social formation through social exchanges. These social exchanges are identified as mutual recognition and recognition of the membership and also define the limits

of the group. Members control new entries by defining occasions, places or practices to gather with other people who have similar interests. In this sense, maintaining and increasing social capital through exchanges requires continuous efforts of sociability, recognition and social competence, and this can result in the transformation of one's own cultural capital (knowledge, principles and values).

The study of a network structure using social network analysis enables researchers to detect weak and strong ties between participants and determine which of them assume bridging roles (Granovetter 1983, 1973). According to Granovetter (1983, 1973), weak ties between participants encourage the appearance of bridging roles, which happen when participants are present in several groups of discussion with a low-intensity presence. People acting as bridges are crucial in disseminating information across the networks; they are generally highly involved community members who use the Internet for social purposes and attend many events (Kavanaugh *et al.* 2005). A study conducted by Schlager *et al.* (2009) demonstrated that teachers belonging to several groups posted more content and participated more in the synchronous and asynchronous conversations than teachers belonging to one group. This study considered 'bridges' (also called 'brokers' or 'boundary spanners') as those teachers participating in more than one group within a network. This same approach is applied in the present study, in which we define as bridges those teachers who participate in more than one community or network.

SNSs are web-based services that have common traits such as the creation of a user profile, a public database of connections between users and functions to operate with user-created content (Ellison and Boyd 2013). Teachers' use of generic SNSs for professional purposes has been studied, in the case of Twitter (Macià & Garcia 2017; Carpenter and Krutka 2014, 2015; Davis 2015; Forte, Humphreys, and Park 2012; Smith Risser 2013; Wesely 2013), Facebook (Lundin, Lantz-Andersson, and Hillman 2017; Ranieri, Manca, and Fini 2012; Rutherford 2010) and Ning (Coutinho and Lisbôa 2013). There are also several reviews on the topic of teachers' communities and networks for professional development (Macià & García 2016; Manca and Ranieri 2017). Among the aforementioned SNSs, Twitter is of special interest for this research because many teachers participate in this network and use it to share experiences and reflect on practice, to pose or ask questions, to share teaching materials and resources, to hold generic discussions and to provide emotional support (Davis 2015; Smith Risser 2013; Wesely 2013). In general, people tend to use Twitter to write posts about themselves, whereas educators tend to use it to share information (Forte, Humphreys, and Park 2012). For this reason, Twitter frequently plays the role of an aggregator of content or resources present in other social networks or virtual sites (Wesely 2013), as teachers tweet the link to such content and it can be recovered through the use of a hashtag (the method used on Twitter to categorise tweets into topics). Teachers also use Facebook, especially the 'groups' functionality, which is a closed environment that facilitates interchange around generic or specific topics (Ranieri, Manca, and Fini 2012). The use of both networks may have an impact on teachers' professional growth by fostering their digital competence and helping to change their practice and educational perspectives (Manca and Ranieri 2017).

In a previous study, (Macià & Garcia 2017) analysed the interactions among the members of nine teacher communities, which had a common domain related to education and frequent activity on Twitter and also on other online platforms such as blogs or websites. The study of members' relations on Twitter revealed that all teachers acting as bridges were experienced users of Twitter, as their average number of

followers, followed people and tweets was higher in all cases than the average of people participating in only one community or the average of the sample. These teachers also had higher degrees of centrality in indirect relations and in conversational networks, which means that they had more relations and conversations than other members in the same community. The fact of belonging to more than one community expanded the number of relations and conversations that they established, providing them with access to the majority of the information flow in the network. These findings confirm the results of previous research that demonstrated the prominent role of bridging people in sustaining higher rates of communication (Schlager *et al.* 2009), community involvement and social engagement (Kavanaugh *et al.* 2005). According to Kavanaugh *et al.* (2005), communities with members acting as bridges, as well as strong ties within groups, can better collaborate and their production is more effective. Presumably, teachers participating in several groups or communities have more learning and professional development opportunities, but it would also be desirable for these teachers to have close relationships with their colleagues in order to collaborate and improve collective action in their schools.

The present study

The purpose of this study was to qualitatively explore how bridging teachers (teachers with a bridge role in networks) interact in online networks and communities and whether their online participation has any influence on their school teaching practices.

Three research questions guided the study:

RQ1: What are the common characteristics of teachers acting as bridges in online educational networks?
RQ2: How do bridging teachers participate in the characterised educational networks and what is their evolution over time?
RQ3: What kind of activities do bridging teachers use Twitter for? Which of these activities are related to their educational practice or their professional development?

In order to answer these questions we conducted a case study (Yin 2009) that took into account three qualitative data sources: data about teachers' informed practice through interviews; data published by teachers in their Twitter profiles, taken as the main data sources; and information published in teachers' school or professional blogs or websites as a complementary data source.

Participants

The participants in this study were selected though a purposive sampling technique (Kemper, Stringfield, and Teddile 2003), consisting of identifying cases as representative of teachers with a bridging role in the networks they participate in. Specifically, the invited sample consisted of 10 active teachers belonging to more than four online educational communities (the communities were selected in a previous study by Macià & Garcia 2017). For teachers to be invited to participate in this study, they had to be currently in service and active members of Twitter with an accessible public profile. They also were required to have participated in at least four communities in

Table 1. Profile of the interviewed teachers.

Teacher identification	Grade level	Years of experience	Hours of class per week	Specific tasks in the school
Teacher 1	Pre-kindergarten	30 years	25 h	Web management
Teacher 2	Pre-kindergarten	30 years	25 h	Responsible for Technology
Teacher 2	Primary education	24 years	10 h	School administration, web management
Teacher 4	Primary education	17 years	25 h	Responsible for Technology
Teacher 5	Primary education	19 years	25 h	None
Teacher 6	Secondary education	23 years	20 h	None
Teacher 7	Secondary education	29 years	19 h	Responsible for the library

the former study carried out by the (Macià & Garcia 2017) and to have a blog or website where they wrote about their educational practices.

The seven accepted participants were highly experienced teachers working in diverse levels from preschool to secondary, mainly in urban schools, and teaching from 10 to 25 h per week, as shown in Table 1.

Data collection and analysis

Three main types of data related to the selected teachers were used: (1) semi-structured interviews; (2) teachers' publications on personal and school blogs and websites; and (3) data obtained from their Twitter profiles and tweets. The first phase of data collection consisted of semi-structured interviews with the participants. Interviews were chosen because they were the most suitable instrument for gathering the information required and their flexibility left space for participants to introduce new ideas and concepts (Galleta 2013). Interviews were conducted individually with the participants, audio-recorded and transcribed verbatim. The participant teachers' narratives provided information about their experiences, stances and perspectives on their professional use of SNSs (Bruner 1991; Clandin 2006). In the second phase of the research, the data obtained in the interviews was contrasted with information from the teachers' public Twitter profiles and tweets, as well as with information extracted from their personal or course blogs, web pages and digital portfolios. The data obtained through these three sources was then triangulated (Barbour 2001). This made it possible to better interpret the data and allowed us to gain a wider understanding of teachers' participation in SNSs and its potential impact on their teaching practice.

Each interview was constructed around the three research questions specified at the beginning of this section. Some interview questions were selected and classified from the Teaching and Learning International Survey (TALIS) survey (OECD 2014). This initial list was complemented with other questions based on the relevant themes identified in a previous review conducted by (Macià & García 2016) on informal online communities and networks as a source of teacher professional development. Two external academic experts in the field validated the quality of the interview questions, their relevance and correspondence to the research questions. Improvements were also suggested to some questions. A categorical-content approach of narrative inquiry methodology was used to analyse the interview transcripts and some blog posts (Lieblich, Tuval-Mashiach, and Zilber 1998). This method consists in extracting, classifying and gathering narrative sections into categories. The narratives provided

were coded thematically and analysed within the framework of the research questions, considering the social capital theory (Bordieu 1986; Putnam and Borko 2000) and the interconnected model of professional growth as the theoretical reference (Clarke and Hollingsworth 2002). The aim of the analysis was to identify emerging categories from the experiences of the interviewed teachers in relation to their use of SNSs and their presence in their daily teaching practice. This process resulted in four main categories reported in the following section: (1) teachers' educational practices in school, (2) professional development activities undertaken, (3) kind of SNS used and (4) evolution in the use of SNS, gains and barriers.

A qualitative analysis of the tweets sent by these teachers completed the picture, describing how the participants used Twitter and to what extent it showed any relationship with their educational practice. We considered the tweets and retweets of the last academic year, from September 2016 until June 2017, of the seven participants. A total of 11 866 tweets from the participants were analysed and classified using the themes reported by Veletsianos (2012), which are described in Table 2. Veletsianos

Table 2. Description of the identified themes (adapted from Veletsianos 2012).

Theme	Theme description	Example
Information, resources and media sharing	Sharing information, resources or media related to education and other topics.	*More than 70 great places to curate great content #ContentCuration [URL] via [Twitter user].*
Living a social life	Informing about current activities, interests, likes and dislikes, sharing jokes and experiences.	*I have read the book [title of the book] [URL].*
Live event participation	Sharing content, opinion, social facts or resources about a live event, which can take place face to face or virtually.	*Incredible work done in the "Video seminar" in [hashtag of the event] [URL of a video]*
Courtesy	Thanking, congratulating and greeting.	*[Name of a Twitter user] Thanks for sharing this work.*
Sharing classroom activities and information	Sharing classroom activities or projects and seeking opportunities for the students to interact with others.	*Poetry and movement workshop [URL of the classroom blog] [picture of the activity]*
Debate and opinion	Sharing opinions about education and politics.	*(Educative) innovation should demonstrate its effectiveness in socially deprived schools, not in classrooms where everything works.*
Digital and professional identity	Exhibiting professional achievements and sharing self-made resources.	*I have added more resources into my blog [title of the blog post] [URL of the blog]*
Presence across multiple online social networks	Alerting followers about participation in other social networking sites.	*[hashtags] Instagram post from [user] [Instagram URL]*
Connecting and networking	Connecting to other people or recommending other people.	*I recommend following [name of a Twitter user].*
Requesting assistance and offering suggestions	Asking or answering questions or providing help.	*Does anybody from my TL [tweetline] know if there is any problem with [name of the application]?*

analysed scholars' participation on Twitter and classified their activity into seven themes, which proved to be useful to guide the first codification of our database. Two researchers analysed the dataset independently and achieved 82.6% intercoder reliability. In the event of disagreement, codes were discussed until a consensus was reached. The process of analysing our dataset revealed three new themes in addition to those previously described by Veletsianos (2012). These three new themes, considered relevant to be added, were courtesy, participation in a live event, and debate and opinion. This analysis provided information about the teachers' profiles (number of relations and frequency of use) and information about the type of activities developed in this SNS.

Results

The presentation of the results is organised firstly into the four main themes that emerged from the interview analysis: (1) teachers' educational practices in school, (2) professional development activities undertaken, (3) kind of SNS used and (4) evolution in the use of SNS, gains and barriers. Results from the interviews have been complemented with information taken from a review of the teachers' blogs and websites. There is also a section about the teachers' Twitter profiles and the activities carried out in this SNS.

Teachers' practices in schools and their professional evolution

The interview transcripts provided information on the teachers' educational practices that was complemented with a review of the teachers' blogs and websites. In four of the cases the authors of the analysed blogs were the teachers themselves. They described the activities carried out in the classroom and provided evidence such as photos or examples of student work. In the other three cases, the students were the ones who reported on the blogs about the projects they participated in during class. Both the interviews and the blogs and websites analysed showed in general a wide range of methodologies and activities used, which were also related to the age of the students. That is to say, the type of methodologies and activities applied generally depended on the internal regulation of the students, especially in the case of the older ones. In the case of younger students (3–5 years old) teachers emphasised activities related to experimentation, development of habits and autonomy, knowledge of the environment and activities related to oral narrative. In the case of primary and secondary school students (6–18 years old) activities were related to creativity and product creation (music, videos), inquiry-based learning and collaborative work. Many of these activities were reported on the class blog or on the school website.

As informed in the interviews and observed in the blogs and websites, the seven teachers used the project-based learning methodology (Larmer, Mergendoller, and Boss 2015) to develop students' competences. Some of these projects involved collaboration with other schools. Six teachers often used technology in their classrooms in activities such as publication on blogs, the creation of digital products (digital posters, videos, podcasts, quizzes, etc.) and participation in social media, thus empowering the students with digital competences.

Teachers explained how the lack of digital devices could be a barrier to developing participatory methodologies; for this reason, the 'bring your own device' culture had been applied in the case of three teachers, who admitted using their own devices to

develop school projects. A primary school teacher mentioned the difficulties encountered, especially at first, of gaining parents' trust regarding the use of digital devices in the classroom and problems finding safe web pages to be used by their students, which had resulted in teacher-led searches on the Internet.

Teachers also used digital technologies to sustain communication with their students' families through SNSs (Facebook and ClassDojo) or to maintain a classroom blog. The philosophy behind this use of technology sought to open a window into the class so that families could obtain information about daily or weekly developed activities and share educational resources. A teacher who administered the school Facebook page commented on the importance of using this SNS as families visited it more often than the school website. On this Facebook page this teacher shared information about school activities and also resources for the parents to support school activity at home.

A primary school teacher recognised that for her the blog had represented an open door not only to the families but also to the digital educative community:

> The blog opened me up to my educative community and also to the educative community in the networks, which nourish my practice. I found ideas in other blogs, then I started to share my work, I met the people on the network, and then they invited me to collaborate in projects. (Interview, Teacher 2).

Other interviewed teachers described an evolution in their practice related to the use of SNSs and recognised having grown with the amount of activities and methodologies shared on the net. Teachers identified a turning point in their practice after participating in a face-to-face conference where they could meet other teachers using diverse methodologies and with whom they could keep in touch and collaborate. The need to find other teachers to interact with is related to the perception of feeling isolated in schools.

Teachers' professional development activities

Six out of the seven teachers in this study had undertaken some kind of formal professional development activity during the last academic year. In this study we defined formal professional development as those activities organised by an institution, which may be the public education administration, the school, university or some other organisation. Teachers mostly attended courses and conferences (see Table 3). According to the OECD TALIS survey (2014) 71% of European teachers attend courses and

Table 3. Formal professional development activities undertaken by participant teachers during the last academic year.

Formal professional development activities	Number of teachers
Courses or workshops	5
Conferences	5
Group work with other teachers	4
Training other teachers	4
Seminars	2
Independent learning	2
Mentoring novice teachers	1

44% attend conferences or seminars. Four teachers had also trained other teachers in digital technology uses in the classroom and in specific methodologies, which shows their high level of competence in these fields. Self-training is also an option among teachers with strong digital competence.

Teachers' use of SNSs and other communication technologies

As shown in Table 4, all the interviewed teachers positively rated the use of SNSs for educational purposes, especially Twitter. Teachers preferred Twitter over all the other SNSs because it allowed them to be in touch with other teachers or professionals from the educational field; they described their acquaintances on this SNS as their 'virtual colleagues'. The reason for preferring Twitter to stay in touch with other teachers and maintain professional interchanges could be its open and participatory nature, as teachers stated. A complementary reason for preferring Twitter is the chance to access an abundant and rapid flow of information formed by short sentences, which can be easily searched and revised and in this way updated quickly.

Although Twitter was the preferred SNS for professional purposes, teachers used other SNSs such as Facebook or Instagram. These SNSs were used for more concrete activities such as belonging to specific teacher groups, communicating with families or with students.

Two teachers said that the use of messaging apps (WhatsApp and Telegram) was a great resource for maintaining informal working groups with other teachers or students in order to interchange information about the course (homework, pending deadlines, etc.).

Facebook was identified as a highly suitable SNS for personal purposes such as keeping in touch with families. Three teachers stated that they were barely active on Facebook.

Evolution, gains and barriers in the use of SNSs

Most of the participants in this study started using SNSs by creating an account on Facebook, but many of them recognised that there were some aspects that they did

Table 4. Social networking sites or messaging apps (highlighted in grey) used by the interviewed teachers.

Social networking site or messaging app	Professional use (number of teachers)	Personal use (number of teachers)
Twitter	7	2
Facebook	4	6
Instagram	4	3
LinkedIn	2	0
Pinterest	2	0
ClassDojo	1	0
Edmodo	1	0
Google+	1	0
WhatsApp	2	1
Telegram	2	1

not like such as the privacy policy, its use in class or the system of searches. Later on, teachers started using Twitter for diverse reasons: out of curiosity, due to a training course or after seeing that the administration had an official account. They agreed that starting with Twitter can be difficult until one learns how to follow the appropriate people ('I found it arid until I could connect to people similar to me', interview, Teacher 6), despite the fact that in the initial configuration Twitter can help users find interesting people according to their indicated preferences:

> Twitter, at the beginning, helps you to define your profile. Then I contacted teachers from all the regions of Spain, I started to interact and I was quickly captivated. I saw that I could connect, visit others' work and find people who helped me or gave me new ideas, people who give you feedback (Interview, Teacher 5).

Teachers personally know some of the other teachers who participate in the networks and sometimes meet them face to face, which can in fact improve trust (Matzat 2013):

> I know many people I interact with, but it is impossible to know everybody I follow or I talk to. I have met these people in meetings or conferences. There is a group of teachers from every part of Spain with whom I have collaborated several times and we try to meet once a year face to face and we often meet through Hangout. (Interview, Teacher 7)

Teachers stressed the convenience of participating in SNSs, especially on Twitter as a means to improve their daily practice through collaboration between teachers by sharing ideas, resources or participating in projects:

> I nurture my blog with new ideas and experiences but I also learn from others. It is a return trip, which enriches the planning of my activities. It is easy to find other teachers in Twitter and collaborate with them. With a tweet you can have the information you need or even initiate a project. With one tweet doors and windows to new ideas open, professional ties narrow and efforts are multiplied. You can travel from a tweet to another in search of ideas, resources or methodologies. (Interview, Teacher 7)

Participation in SNSs can also provide social relations, emotional support and nurture self-confidence:

> The network gave me resources and self-confidence. If I were alone I would have more doubts. When in doubt I send a message to my virtual teacher team and I always have an answer, someone who helps or explains to you, or is sympathetic. You feel less alone, especially when your relationship with your colleagues is not fluid or there are disagreements. (Interview, Teacher 4)

> Twitter gave me fantastic social relations. Through Twitter I met people who I now know personally and with whom I share interests, the way we see education, and this helps me not to feel like a weirdo. Sometimes I feel a bit utopic and in Twitter I find people who think like me. I share my materials because

> I believe that in this profession you have to be altruistic; you will never become rich as a teacher. You have to live with a positive attitude: I help you, you help me and everybody can benefit. (Interview, Teacher 5)

Social relations established through Twitter are important not only for enriching daily practice but can also contribute to profoundly changing the concept of education:

> Starting to share in networks for me was a 'before and after'. It was a complete change. I have evolved as teacher and I have a relationship with students which I never imagined. It has been much more than the knowledge, new tools or meeting people; it has generated a change in the way I work. After the project [*a project about student talents*] I started to take into account students' emotions. I learned to respect students. (Interview, Teacher 6)

Although the teachers pointed out many benefits of participating on Twitter, two teachers raised concerns about the negative aspects of SNSs. A secondary school teacher described a conflict about a copyright issue. This same teacher and a primary teacher experienced problems with others participating in the network, who became brand ambassadors or were attracting attention for certain products.

Teachers' profiles and activities on Twitter

As shown in Table 5, participants in the research were experienced, active users of Twitter. As of July 2017, the participating teachers had been using Twitter for between 5 and 8 years and had sent on average 3 to 16 tweets per day, had posted between 8800 and 31 800 tweets, followed between 879 and 11 000 people and had between 1968 and 9985 followers

An analysis of the participation on Twitter of the seven selected teachers shown in Table 6 reveals that their main activity was the publication of information, resources and media sharing, followed by activities related to living a social life and live events. If we compare general patterns of Twitter use we can identify two different profiles: those whose main activity was sharing information and others who focused more on social relations, thus related to living their social life, participating in live events and being polite to their Twitter contacts. The proportion of activity linked to each of the themes is described in detail in Table 6 (see the description of each theme in Table 2).

The highest percentage (42.7%) of activity occurring on Twitter involved the category *information, resources and media sharing*. The content is mainly related to educational topics but can also be linked to other topics of interest for the teachers,

Table 5.   Twitter profile of the interviewed teachers.

Twitter profile	Average	Standard deviation
Years of Twitter use	6.68	0.93
Tweets per day	8.01	5.03
Total number of tweets	18 187.57	8825.12
Following	3409.28	3464.19
Followers	4691.86	2729.41

Table 6.   Percentage of Twitter activity, according to the identified themes.

Activity	Average	T1	T2	T3	T4	T5	T6	T7
Information, resources and media sharing	42.7%	22.2%	36.7%	28.3%	28.8%	58.4%	63.2%	61.1%
Living a social life	17.8%	12.2%	18.8%	25.4%	20.8%	23.0%	13.1%	11.0%
Live event participation	14.7%	18.0%	23.2%	11.2%	34.6%	1.6%	9.5%	5.0%
Courtesy	6.8%	20.4%	9.7%	5.8%	2.8%	1.7%	2.2%	4.8%
Sharing classroom activities and information	6.4%	12.4%	1.2%	17.8%	2.3%	1.8%	1.7%	7.8%
Debate and opinion	4.6%	1.3%	0.1%	7.9%	4.1%	8.1%	6.9%	4.1%
Digital and professional identity	3.9%	9.5%	5.9%	3.1%	1.6%	2.9%	2.2%	2.5%
Presence across multiple online social networks	1.3%	2.1%	3.6%	0.0%	0.6%	1.5%	0.0%	1.5%
Connecting and networking	0.9%	1.3%	0.6%	0.3%	1.9%	0.5%	0.1%	1.6%
Requesting assistance and offering suggestions	0.8%	0.5%	0.1%	0.3%	2.4%	0.5%	1.1%	0.6%

such as arts, ecology, literature and so on, depending on their professional and personal interests. Teachers add hashtags to this information to facilitate searches and sometimes add a Twitter username to make this person aware of the content or to recognise this person as the source of the content. The teacher who shares the most information adds these items in 63.2% of the analysed tweets while the teacher who shares the least information adds these in 22.2% of them.

Activity connected with the category *living a social life* consisting of sharing personal interests, jokes about education and other topics, chatting with other people or referring to social or personal facts was present in all of the analysed Twitter profiles and represents 25.4% of the tweets in every case.

Another common practice found in the teachers' tweet lines was *live event participation*, commenting on conferences, seminars, symposiums and so on. In these situations, in tweets about conference content, participants shared their opinions and also tweeted about social life at the event. Generally they used a hashtag to identify the event and to gather all the information related to it.

Courtesy was initially considered as part of the category *living a social life*; however, the authors noticed that activities such as recognition of others' work, thanking and greeting had a specific sense and importance to some of the teachers. This activity represents an average of 6.8% and is more frequent than sharing professional work, classroom activities or requesting assistance.

Teachers affirmed that they valued the opportunity to learn from other teachers' practices on Twitter, however the category *sharing classroom activities and information* only represented 6.4% of the analysed tweets, and it was unequally distributed among the cases in a range from 1.2% to 17.8%.

The least developed activities were *debate and opinion*, which represented an average of 4.6% of the themes in the analysed tweets; *digital and professional identity*, used in 3.9% of the cases; *presence across multiple networks*, in 1.3% of the tweets; *connecting and networking*, in 0.9% of the cases; and *requesting assistance and offering suggestions*, found in 0.8% of the tweets.

Discussion

In this section, we discuss the main results within the framework of the literature and in relation to the three stated research questions.

RQ1: What are the common characteristics of teachers acting as bridges in online educational networks?

The teachers who participated in this study could be defined as bridges because they participated in more than one cluster in networks. In this sense, they were in a privileged position to receive and disseminate information (Granovetter 1983). According to our findings and in line with the literature, these teachers were highly experienced professionals in the education field, used active educational methodologies (i.e. project-based learning) and promoted the use of technology in their classrooms. They sought the development of soft skills, such as critical thinking, problem-solving, written and oral expression and learning from failure, among their students (Larmer, Mergendoller, and Boss 2015), which has been demonstrated to particularly benefit low achiever students (Han, Capraro, and Capraro 2015).

Participants used diverse tools (SNSs, blogs, web pages, etc.) to expand the boundaries of their classrooms, opening them up to the students' families, the school, town or city and also the teaching community in the SNS. This concurs with literature showing that teachers who act as bridges are generally involved with their community and have a civic sense (Kavanaugh *et al.* 2005). Participants actively searched for opportunities to contact other teachers and looked for examples of inspiring educational practices. These teachers considered that the possibility of collaborating with other teachers in their schools was limited. For this reason they started collaborating in SNSs and also attending educational events where they could meet other teachers with similar interests, thus increasing their social capital growth opportunities. Their interest in meeting other teachers was not directly related to their professional development, which they could achieve by other means (such as courses), but rather to being aware of the flow of information available in the network, participating in open debates and also establishing social and emotional boundaries with colleagues. The interconnected model of professional growth is useful to explain these teachers' activity in SNSs. On Twitter and other SNSs, the participating teachers obtained information that they could use in their classroom practices and, afterwards, they evaluated the students' outcomes. When teachers apply this technique, they can improve their educational practices and gain professional development (Clarke and Hollingsworth 2002). Acquiring new knowledge and professional skills as a result of participating in online social networks was described as highly rewarding by these teachers, who deeply valued the opportunity to interact online with their peers.

The participants of the study had a high level of teaching competence, as they formally trained other teachers in the use of digital tools for educational purposes or specific learning methodologies. They were also advanced users of technology and some of them were in charge of the digital equipment or website management in their schools. These teachers recognised the influence of the other teachers they had met on SNS in the process of improving their teaching competence, either inspiring them or supporting them emotionally, especially in the case of feeling professional loneliness or isolation (Wesely 2013). The cultural capital of these teachers increased through connections and exchanges made and sustained mainly on Twitter and other SNSs.

RQ2: How do bridging teachers participate in the characterised educational networks and what is their evolution over time?

The teachers interviewed were all active members on SNS and preferred Twitter for dealing with educational issues. Twitter is a generic SNS that has been adopted by educators for multiple professional purposes such as communicating with others, increasing the visibility of classroom activities and sharing information, resources and materials (Carpenter and Krutka 2014, 2015; Davis 2015; Veletsianos 2012; Wesely 2013). The asynchronous nature of online SNSs, the knowledge sharing and the immediacy of responses make Twitter and other SNS a suitable space for enhancing teacher professional development. Twitter was also praised for filtering valuable content for teachers, for facilitating searches on educational topics (Carpenter and Krutka 2015) and also for enabling serendipitous learning thanks to its condition of being a network (Wenger Trayner, and de Laat 2011). The participants in the study justified that they used Twitter because of the rapid flow of information, the ease of use of the platform, its open and participative nature and finally the high number of Twitter users who belong to the educational world. Indeed, involvement in online SNS helps teachers enlarge their professional community, share resources and reflect on teaching practices (Carpenter and Krutka 2014, 2015; Wesely 2013).

Some teachers explained that they had been prompted to use Twitter by the isolation they felt in their schools because they were the only ones using a certain methodology or practice, indicating that with this social media they could find emotional support and a network of colleagues. On Twitter, teachers searched for other colleagues who were like-minded, described as generous, forward-thinking, energetic, positive or optimistic by Carpenter and Krutka (2015). Teachers valued the opportunity to learn from other experienced and innovative educators, gain new ideas and also work together on educational projects. Sharing their own experiences provided teachers with an opportunity to think about what they did in their daily routine and create new understandings, as a result of the contributions or the questions posed by other teachers and also the effect that writing about their experience had on their own reflection (Cranefield and Yoong 2009; Davis 2015). The respondent teachers had adopted a pattern of voluntary and self-regulated professional development, which can be described using Knowles' 'theory of andragogy' (1977). Knowles (1977) characterises adult learning as self-directed, based on experience, established while adopting diverse roles, induced from real-life problems and intrinsically motivated.

Sharing the practices they have developed also reinforces teachers' self-confidence and self-esteem. Some teachers also described a change in their stances and professional identity after becoming involved in SNS communities (Kimmons and Veletsianos 2014; Musanti and Pence 2010; Wesely 2013).

Participants in the study used other networks, such as Instagram and Facebook, for specific purposes, such as being in touch with their families or the students. Although there are experiences of teacher communities sustained in Facebook (Ranieri, Manca, and Fini 2012; Rutherford 2013; Steinbrecher *et al.* 2012), we found that this SNS was professionally used by only four of the seven teachers interviewed, to contact certain people or participate in specific groups. However, most of these teachers recognised that they started using SNS with Facebook and later discovered Twitter. This evolution could be due to the different dates that each SNS was created, since Facebook is older (founded in 2004) than Twitter (founded in 2006). Several studies have found that

teachers start participating in networks and communities in silent mode, an activity known as 'peripheral participation' or 'lurking' (Macià & García 2016; Seo 2012; Zuidema 2012). None of the participant teachers recognised having adopted this pattern of participation, but none complained either about teachers who watch but do not contribute, which could be a sign of their concept of the open nature of SNSs.

Participant teachers also used instant messaging applications such as WhatsApp or Telegram to keep in touch with other teachers or to sustain active discussion groups. The use of these tools is very much related to mobile phones. These tools offer the same immediacy as Twitter in a closed and more controlled environment, where people can only join by invitation. The use of these instant messaging tools, and particularly their use in combination with other SNSs, has barely been studied for educational and training purposes but could be effective for maintaining informal communities of teachers (Bouhnik and Deshen 2014; Cansoy 2017).

Relationships in SNSs are sometimes nurtured in face-to-face meetings, which take place occasionally and are also frequently reported on Twitter. In fact, the use of SNSs blurs the limits between the online and offline worlds. Blending online and offline relations can increase participation, sociability and trust among professionals, improving the strength of the communities (Matzat 2010, 2013).

In spite of all the benefits described by teachers around the use of SNS, there are also some barriers that can dissuade teachers from participating in specific conversations or groups. The interviewed teachers described rivalry, the use of networks for advertising, a lack of a sharing attitude and concerns about copyright, problems that have already been reported in the literature (Conole and Culver 2010; Davis 2015; Duncan-Howell 2010; Zuidema 2012).

RQ3: What kind of activities do bridging teachers use Twitter for? Which of these activities are related to their educational practice or their professional development?

Collaboration between unknown members of a network or community can adopt two patterns, lightweight peer production or heavyweight peer production (Haythornthwaite 2009a). Lightweight peer production consists in minimal contributions to a more general project. These contributions are well-defined and quick to provide, avoiding the need for participants to make a long-term commitment to a project or to establish relations with other members; however, it does involve interdependence between members and a commitment to sustaining the product and the community. In the case of Twitter, participation can be characterised as lightweight as it only requires the publication of a 140-character tweet from time to time; however, teachers refer to Twitter as a community with which they feel engaged due to its open and participatory nature.

The activities conducted openly in this SNS are mainly sharing information and socialising. In fact, we can consider that these two types of activities determine two different patterns of participation: (1) teachers who mainly use Twitter to share information, news, resources or media and who dedicate around two-thirds of their activity to this endeavour, and (2) teachers who mainly use Twitter for social purposes such as living a social life, live event participation and courtesy, with this social activity accounting for around 50% of their total activity. These two patterns, consisting of sharing information or being social, could be related to teachers' interests and also to their personal and professional identity. Carpenter and Krutka (2014), in a study with 755 educators, found that the 96% of them used Twitter to share and acquire

resources, 86% to collaborate with other teachers, 76% for networking and 73% for chatting. These results are consistent with the two main patterns of Twitter use identified in this study.

The content of the shared tweets demonstrates that teachers blend their personal and professional identities on Twitter (Veletsianos 2012), manifesting a great variety of facets in their lives. The teachers in our study recognised the great impact of social network use on their professional identity and also on changes in their educational stances. However, the most prominent activity among participants in this study was sharing impersonal information, consisting normally of a hyperlink to other media such as newspapers, reviews, specialised blogs or resources banks, thus enhancing their professional identity. Teachers shared a lot of information related to their profession, which could have helped to build their professional identity (Lundin, Lantz-Andersson, and Hillman 2017), even though information about their own curricula or promotion of own materials or written literature was tweeted only in 3.9% of the cases.

Even though teachers declared that the use of SNS had had an important impact on their classroom practice we found that only 6.4% shared classroom activities or materials, 4.6% debated or gave their opinion and 0.8% of teachers requested help or answered questions on Twitter. Although it was not directly evident in this study, these activities could have a special value for the teachers and encourage them to participate more often. On the other hand, Twitter makes it possible to establish latent ties with many teachers, which could be activated after reading a specific tweet (i.e. a tweet asking for help) and in this way ensure the continuity of an initiated relationship through private messaging, which is not traceable, or through other means. Thus, the results could indicate that teachers prefer using Twitter to search for others' practices rather than to share their own practices or to talk with others about the posted information or resources. Questions and answers may be posted in other channels that we cannot access, such as Twitter private messages, or other messaging tools such as Telegram or WhatsApp. These results are consistent with those of the study by Seo and Han (2013), in which only 1% of the community under study uploaded the materials that were used by the rest of the teachers, showing that peripheral participation is an extended practice in online environments.

Conclusions

This explorative study into teachers who act as bridges reveals that they are active in SNSs and that they take advantage of this participation by introducing new practices into their classrooms and also by collaborating with other teachers to develop school practices. These teachers are highly motivated, enjoy their work and are eager to improve professionally, which could have triggered their participation in SNSs. Thus, it is not clear whether their participation in SNSs directly causes the improvement in their teaching practices or whether SNSs are just another tool used by teachers who are already interested. This question remains open and it is key to understanding the role that online networks and communities can play in teachers' professional development. Our results show that there is certain interdependence between actively participating in an SNS and being involved in several communities. The results also highlight the relevance of lightweight peer production and peripheral participation in productive online social networks, which materialises in this bridging role that certain participants assume.

This study has some limitations such as the reduced number of teachers interviewed and the nature of the information gathered, which was mainly self-reported. We attempted to overcome this limitation by using information extracted from blogs, websites and Twitter, which helped us to achieve a deeper understanding of the interviews carried out. It is also important to note that the data obtained is constrained by a particular time and situation as the habit of using SNSs can change in a short period (Carpenter and Krutka 2015).

Further research could relate teachers' use of SNSs with their personality traits or professional conditions. A larger sample and a deeper study of teachers' circumstances and other involved factors could shed light on the variables that support participation in informal online communities and networks. Moreover, a longitudinal study relating teachers' roles and activities when participating in SNS with their actual teaching practices could help to gain more understanding about the interrelation and reciprocal influences between both realities. Another issue to be further analysed would be whether it is possible to attract teachers to this means of participatory professional development, especially those who are not interested in technology educational uses.

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