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Twitter and Teaching: to Tweet or not to Tweet?

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Abstract. As increasingly more new skills are necessary for graduates entering the workplace or seeking employment, business leaders, politicians and educators suggest that if students are to succeed in today's world, they will require 21st century skills. However, there is no single agreed-upon set of skills. We argue that social media skills are becoming ever more important for employment and society should class them as important 21st-century skills from maintaining well-rounded social media profiles to more advanced data science and analytic skills. At the same time, such a demand affects the teaching process since teachers have to acquire new knowledge about the available tools. Twitter as a microblogging platform is definitely one of the tools that is a part of 21st-century social skills. Thus, by integrating it into the teaching process, Twitter can generate new experiences for both sides, the students and the teachers. In this paper, we conduct a descriptive review of the recent literature that covers Twitter use in teaching. We reviewed results from the top 100 retrieved research results in Web of Science on Twitter and teaching in the domains of social science, science technology, and arts and humanities. We analysed the results quantitatively in terms of content, methods, and methodologies and qualitatively as the description of results found in selected papers that meet certain criteria. This paper also discusses different research departure points for use in further research of the topic.

Key words: *Twitter, teaching, social media, learning, collaboration*

1. Introduction

There is no single set of 21st-century skills although the hundreds of suggestions include life skills such as agility, flexibility, and adaptability; workforce skills such as collaboration, leadership, initiative, and responsibility; applied skills such as accessing and analysing information, effective communication, and determining alternative solutions to problems; personal skills such as curiosity, imagination, critical thinking, and problem solving; interpersonal skills such as cooperation and teamwork; non-cognitive skills such as managing feelings [1]. The National Science Teachers Association [2] believes the 21st-century skillset includes “core subject knowledge, learning and innovation skills, information, media and technology skills, life and career skills, adaptability, complex communication and social skills, non-routine problem solving, self-management/self-development and systems thinking”.

Effective use of social media or, more broadly speaking, sensible use of Web communication technologies is also an important 21st-century skill. Since it is important to use both social media accounts such as LinkedIn, Twitter, or public Facebook to generate interest and further a career, it is equally important that users screen their social media

profiles, enable privacy settings, and ensure that if or when employers search for a prospective employee there is nothing about the candidate that casts them in a negative light to a hiring committee. However, social media, especially Twitter when used correctly, has tremendous benefits within the field of education and more widely, especially within the field of teaching.

The overall research aim of this paper, therefore, is to develop a better understanding of how Twitter is used within teaching. The objectives of the study are to:

- Explore methods of researching the extent to which the teaching world uses Twitter
- Develop a better understanding of current research examining Twitter and teaching
- Develop a better understanding of the theoretical frameworks used in research articles related to Twitter and teaching
- Examine the availability of research articles examining Twitter within teaching.

The primary findings of this paper will interest teachers across higher education by exploring the possibilities of using Twitter in their lectures, researchers interested in teaching and pedagogy methods, and to universities and faculty management. The next section presents the methodology.

2. Methodology

For the purpose of this research, we searched using keywords Twitter + Teaching in the Web of Science database in the domains of social science, science technology, and arts and humanities. We retrieved the first 100 for analysis and selected them according to the publication date, newest to oldest. We also collected a list of the articles and searched for availability of the papers on Google Scholar and other sources (such as the University of Sheffield's Primo Central index). For this particular analysis, we were limited to the papers that were freely and legally available to the researchers conducting research. The researchers could use only the papers that were available via university subscriptions, but a large number of papers were accessible and freely available. We conducted an analysis using a framework that is reported elsewhere [3]. This is a descriptive literature review, descriptive because it focuses on the methodology, methods, findings, and interpretation of each reviewed paper (as opposed to integrative reviews that attempt to find common ideas and concepts from the reviewed material). We divided the presentation of the results in two parts; the first is quantitative in nature (showing distributions of availability, methods and methodologies), and the second is qualitative (presenting results of findings from the studies we analysed).

3. Results

3.1 Quantitative results

The table below displays the distribution of papers grouped by category:

Table 1—Distribution of papers

Groups of papers	Number of Papers
Not available	32
Twitter + student teachers	22
Social media in learning, including Twitter	22
Not relevant	8
Scientific conference	3
e-learning	2
ICT education	1

Teachers engagement on Twitter	1
Sina Weibo (Chinese microblogging service)	1
Scientific journals	1
Scientific research impact	1
Student data mining	1
Technology Acceptance Model used	1
Twitter used in research (mobile app)	1
Total	97

There are 97 papers (out of 100 initially retrieved) we analysed further, because we found that some of them were not scientific papers, for example, theses, data sets, and repeated papers. Table 2 below displays the papers that cover only Twitter in teaching.

Table 2—Twitter used solely within teaching research

Methodology	Count	Methods
Quantitative	10	Online questionnaire, questionnaire, survey, Twitter data, online questionnaire, Twitter -based network of interactions, survey
Qualitative	9	Literature review, tweets analysis, content analysis, Twitter data, literature review, exercise presentation, case study on Twitter data, Twitter data content analysis
Mixed	3	Case study + survey, virtual ethnography + quantitative analysis of the tweets produced, action research

3.2 Qualitative descriptive analysis

In this section, we present findings from the 22 papers in which the use of Twitter within the teaching process was the main focus of the study. Our results, outlined below, are presented in order of retrieval, i.e., articles published more recently are reported on first.

Knight & Kaye [4] set out to understand how students use social network sites (SNS) with a primary focus on Twitter. The article explored how it facilitates the academic-student relationship and disparity between them. One of the main issues raised is the problem that SNS come and go, and teachers have to adapt to the dynamics. This study shows that Twitter is mostly used for information seeking and sharing, to follow famous people and to network with friends. It was also found that there are different uses between teachers and undergraduates. Teachers mostly use it for information sharing and students for information seeking. In terms of academic use, students use Twitter to contact specific tutors to ask specific questions and ask course-specific questions. The first five of the students' perception of usefulness was that Twitter provides details on practical issues, posts course-related updates, reminds them about upcoming assignments, posts questions related to courses, and provides specific assignment reports. For the faculty staff members, the most perceived usefulness is to advertise university activities, share research ideas and publications, advertise department activities, ask course-related questions, and post related updates.

Purdam [5] analysed how people use Twitter in the task-based learning (TBL) process. The results of the paper point to the importance of critical data skills in the age of big data, how Twitter data are a new form of data and how it is possible to implement Twitter within a TBL learning framework. The challenge is to develop tasks for students before the course starts.

Gonzalez and Gadbury-Amyot [6] in their paper pointed out that students viewed the use of Twitter positively and found it helpful with their courses. They also reported they were open to using Twitter in the future, that its use increased student engagement in the course and they found Twitter an excellent resource for question and answer sessions. The challenge of using Twitter related to the teachers' social media skills; however, it could increase the interaction between students and instructor, facilitate prompt feedback from the instructor, and encourage active learning, which are all considered best practices for teaching and learning.

In another paper [7] students showed great interest in Twitter, in particular when they improved, advanced and gained familiarity with the tool. In the final phase, they became aware of the development of their competence acquisition. Implementation of using Twitter in teaching was not a problem for teachers since it promotes a pleasant and motivating learning environment. The first phase was rich and conducive to students, who easily shared the new content generated between them. Some tweets turned students to resources available on the Internet. Such actions point to student interest in a wide integration of materials into their learning. Problems related to setting up an online community around hashtags. So, guidance provided by teachers played a useful role in increasing interaction within a group with the aim of developing a class learning community.

In another study the authors [8] indicated that Twitter represents an educational resource, which is truly multi-disciplinary and breaks down boundaries between professional groups. It could be useful in conferences, and there is an opportunity to reach out to trainees and others seeking continuing professional development and to provide both reliable resources and somewhere to foster debate and discourse on topical themes.

Another paper identified [9] four key success factors for faculty who wish to incorporate Twitter in their pedagogical toolset: 1. Strong initial faculty presence on Twitter. 2. Justification for technology and Twitter in the classroom. 3. Mandatory Twitter participation. 4. Rewards for active professional tweeting versus social tweeting or reactive retweets.

Within another paper, the authors [10] provided tips and suggestions on uses of Twitter in sports-related teachings. They are:

- Use Twitter within the classroom
- Use Twitter to communicate outside of the classroom
- Retweet
- Reply and retweet favourite student responses
- Use Twitter to connect with organizations and businesses
- Use Twitter to connect with coaches, athletes, and sports media
- Assign students to follow Twitter during a live athletic event
- Have students search for examples of class discussion topics outside the classroom
- Interact with alumni
- Archive tweets to create a class story
- Incorporate grades or offer extra credit in order to increase Twitter participation.

In one study [11], the authors elaborated and proposed reasons why teachers should tweet while in the classroom. Twitter promotes active participation, allows more reserved students to participate in class discussions, engages learning, and helps students who are introverted. It is engaging and interactive; it is more engaging than posting comments on a

forum; it is less formal. It encourages students to speak up when class size is large and can make the class much more interesting. It is a good tool to communicate and share ideas. It allows soft-spoken students to share their thoughts. Professors can even read the tweets after class and address the questions raised.

Class participation is not limited by time, and Twitter provides a new platform for students to interact and share knowledge with each other. It could be useful as another avenue to participate in class; it is innovative and an interesting learning method, and tweeting provides more opportunities for students to share anytime during the class and encourages students to discuss actively. It supports knowledge exchange between classmates. Live feeds also make participation dynamic and simultaneous and enhance classroom interaction virtually. Students can post ideas or supplementary materials (links, pictures, articles, videos, etc.), and students like unconventional ways of learning. Twitter speaks the language of the young students and adds variety and interest for students, and students can compete for the sake of the grade. It adds quality to the discussion, rejuvenates the idea of class participation, where class participation is no longer just about receiving marks, but about interacting with other students, thereby breaking the barrier of groupthink.

One study [12] showed that online media tools can integrate into daily educational practices and augment learning and collaboration. One of the problems is that students want to keep their social media identities personal rather than integrate them into their professional lives. Its novel use of social media, however, is a useful educational tool, allowing ease of access to a repository of presentations. Students using the Twitter feed found it easily and accessible and useful and felt its use should continue.

In another study [13], the authors proposed a model for how to develop lectures using Twitter, how to focus on engagement strategies, lectures, extensions, and assessment.

In one more broadly positive study, the authors [14] proposed Twitter as a tool for evaluating classes. It gives the possibility of expressing views freely and taking part in the process of improving teaching the subject. It is a powerful and effective tool thanks to its spontaneity and immediacy. It should be complementary with final deeper and more rigorous assessment, its formative and continuing value allows teachers to approach the perspective of students, their views and interests, enabling faculty to act, change, and improve the course at any time during the process. Using Twitter motivates the student and creates a sense of belonging and effective integration into the subject; students are active in the process and identified with the results. Twitter is a positive and beneficial experience, a popular and novel means that is usually well-received by students. Part of the success depends on perceiving clearly the goal of using the tool. To achieve this, it is necessary to democratize the classroom; the student should have equal status and freedom with the teacher, and teachers should promote an evaluation for improvement and learning that overcomes the sanctioning and hierarchical model that still prevails in the university classroom.

In another study [15], the top ten nodes with the highest in-degree were primarily hashtags, suggesting that people were connecting around thematic markers of common interest, referring to them and making them popular. Another study of the same datasets [16] confirms that the learners were more focused on the topics of interest than on those suggested by course facilitators, and that those topics emerged in the course and groups of people who adopted them maintained them.

According to the authors [17] of one particular study, Twitter allows one to connect, engage, learn, and educate oneself and others in real time on a global scale. This paper had an interesting list of potential pitfalls of Twitter. Here are selective pitfalls that apply to a wider audience since this paper dealt with medical education. Twitter is susceptible to misinformation, and to combat lack of trust, it is important to follow reputable individuals to

overcome this pitfall. Students should only retweet links and information that are from reliable sources. Another aspect is sharing research results over Twitter since it is easy to lose meaning in the 140 characters. It is also important to recognize that online behaviour becomes a part of a user’s permanent Internet identity. Whatever is written on Twitter stays on Twitter and Google indexes it so we have to take care about what we tweet. Another aspect is an employer’s policy for tweeting, and before engaging in tweeting, consult the employer and policies. This study’s authors pointed to Twitter Chat as a highly valuable tool that bonds and connects individuals on a specific topic. Twitter Chat is a discussion that takes place in real time at a pre-arranged time on a pre-arranged subject. Twitter allows one to connect, engage, learn, and educate oneself and others in real time on a global scale.

This research [18] shows the more class participants are familiar with Twitter, sessions run more efficiently and effectively. Students and teachers can discuss questions outside the lecture time and can integrate discussion in after-class sessions. Sometimes questions are for specialists in the domain that can broaden the number of participants in the class. Also, research shows that student–tutor relationships have benefited, and students perceived tutors as more approachable both in person and online. However, using Twitter could increase demand of the tutor’s time outside the class.

Below, we present a figure from a research paper [19] based on the results of research conducted on using Twitter within the classroom:

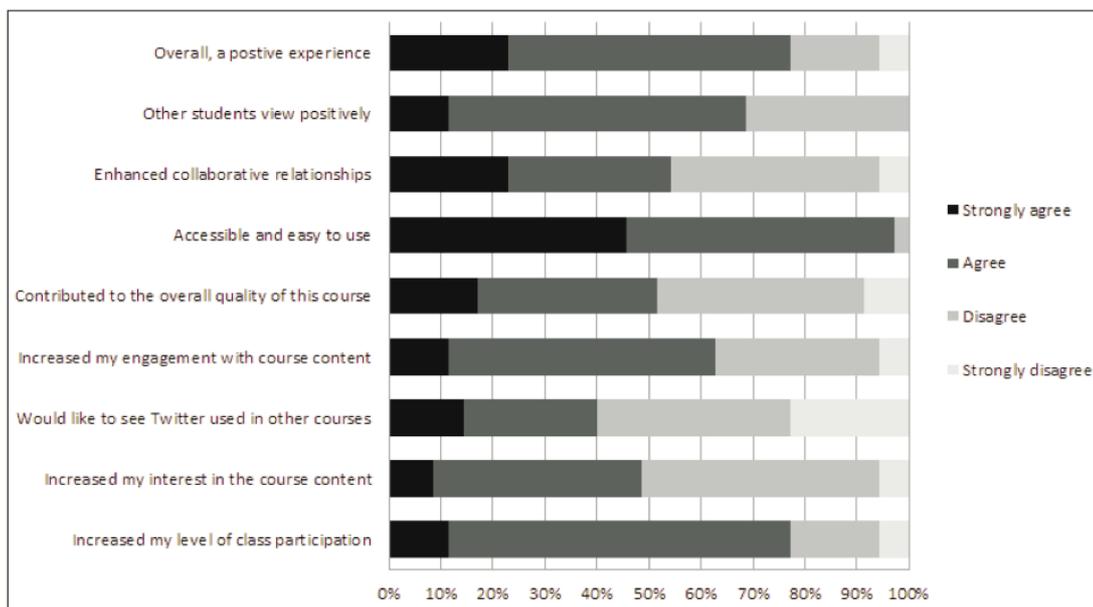


Figure 1—Student perception of Twitter use (from [19])

The results of one particular research article [20] brings the following findings: the amount of Twitter usage was associated with increased student engagement, including organizing social lives and sharing information; course-related tweeting showed no evidence of a relationship to interpersonal relations between students and their tutors. Additionally, Twitter usage also did not relate to class attendance. This research points out that using Twitter for teaching does not in itself improve the relationship between a tutor and learners. The authors suggest that the medium might best be exploited to increase connections between students themselves, students and their tutors, and students and educational resources. Also, they call for careful consideration about whether tweets should become educational or personal since they could have different effects.

Another article [21] analysed Twitter as mandatory backchannel. A backchannel is defined as an electronic discussion that occurs simultaneously in real time during a lecture or conference where students may post questions, comments, or respond to other posts. The authors point out that for a backchannel to succeed, students have to have the devices in the classroom (mobile, PC, laptops, tablets), and at the start of the course, an instructor should evaluate their skills. For successful incorporation of Twitter as a backchannel, it is important that the faculty member commits to implementing it in the education and learning process. Also, to make Twitter as backchannel work, lecture designs should support Twitter interaction in the class (to allow for periodic consistent backchannel check-in, which is also supported by best pedagogical practices). The overall experience of the authors is positive towards using Twitter in education processes.

In one research article [22], the authors argue that Twitter could serve as a scaffold for developing reading comprehension and writing skills required for reading and composing various genres of scientific text. In the disciplines that have large quantities of complex materials to learn from, Twitter could provide entry to the domain. Also, because of its participatory and multimodal text nature that is constantly updated, Twitter can serve as a more engaging text for adolescents than traditional science textbooks.

One particular study [23] points out that by using Twitter, teachers could interact with a much wider audience. This provides numerous opportunities for outreach of various kinds.

They are presented in Table 3, below.

Table 3—Different ways to use Twitter in teaching (from [23])

Blog writing	Spread awareness about the subject and domain and reach an audience that is much wider than your class and reach new potential readers.
Interaction with students	Usually, dedicated Twitter users from the faculty will use Twitter to interact with students. To overcome oversharing, it is possible to use multiple accounts, one for tweets that students will see, and one for private posts.
Creating public awareness	Promote external events relevant to classes
Addressing social issues/being a citizen-scientist	Through Twitter, students could interact and find out about relevant topics more in-depth and from different perspectives, such as work-life balance, the demands of tenure, and bias against women/minorities)

Another paper [24] raised interesting concerns related to publishing research results on Twitter. It is possible for someone to “steal” an idea or research since these results are important to an academic career. There are two possible answers: First, the concept of plagiarism is not new, and chances of it happening increase as researchers publish more material, and second, publishing research results on the Internet can actually reserve the rights because it has the time and date stamped when published. So actually, it secures output from plagiarism or at least gives the opportunity to pursue the plagiarists. The paper’s research showed 72 percent of respondents in the survey thought Twitter helped learning, but used during the lecture, it had a tendency to distract and intrude. But it could be useful between lectures (as pointed out already in some of the research presented above). Also, scientists who teach can use Twitter to interact with their professional colleagues, so they have a more up-to-date and wider network that will enhance the quality of their lectures.

Another research article [25] points out that Twitter makes following course notifications easier and relevant information more informally received. It could strengthen communication with the other students since they can receive education whenever they want. Also, it strengthens communication between student and teacher. The students' willingness to learn increases and courses became more interesting. Students have the opportunity to benefit from knowledge of other people by using the hashtag (#) about subjects they do not understand.

Also as one of the benefits is that students can keep up-to-date and can comment on the current issues. By integrating Twitter with Dropbox, a cloud storage site, it becomes easier to reach course materials and develop joint projects. Sharing course materials in this environment enriches and provides great convenience on sharing homework and projects. It creates positive effects on students' opinions, but it also contributes to students' social and cultural development, and it provides a platform for collaborative studies. Students observed in this research expressed that it helped improve their ability to make comments about course content, and it helped reach educational materials through Dropbox, We Video, an SaaS video editing program, and ThingLink, an image sharing site, mobile applications that show that integrating Twitter with other platforms could boost teaching productivity.

In Table 4 below, we present two main streams of proposed strategies of using Twitter in working with students and as a research tool proposed by the authors in [26]. One stream of strategies is dealing with student engagement and another with how research uses it.

Table 4—Strategies for using Twitter in work with students and as a research tool (from [26])

Strategies for engaging students	Twitter as a research tool
Establish a course profile and use hashtags and, by doing so, keep tweets organized.	Use #hashtag search to find about phenomena.
Collate classroom views and provide instant feedback	Use advanced search functions provided by Twitter and find specific phrases and words, names of people, locations, and hashtags
Create a bulletin board and update students with relevant information (assignment deadlines, seminar topics, and further reading)	Save searches and visit them later in the research process
Reinforce learning activities by using Twitter to set course-related tasks	The discover function on Twitter uses connections to display shared stories and provides updates on new content
Promote knowledge sharing and understanding by getting students to tweet about what they learn while the course is continuing	Add relevant tweets to favourites that are accessible at a later date. Also, looking into favourites of other people can provide a rich source of information.
Get students to share books, journals, and online materials	
Share links to websites	
Foster peer support mechanisms and extend classroom discussion. By doing so, break down barriers between students and develop a sense of	

belonging to community of the class	
Provide a recap at the end of each class to reinforce key learning points	
Establish flexible office hours and use Twitter to provide quick responses and clarifications on student concerns	
Engage with professional communities and find interesting figures to follow	
Map trends and get students to map views and find out what people are discussing	

In this section, the authors presented findings from a qualitative analysis of a collection of papers. The aim was to describe findings from different research projects objectively and follow suggestions that descriptive literature reviews focus on describing individual studies/papers as proposed in [27]

4. Discussion

In the studies presented above, social media and learning theories prevail as departure points in the research. In our view, there is a lack of variety in the theoretical background within the identified studies that could limit research findings. We would like to discuss different theoretical departure points that could be employed in the research of how Twitter is used in teaching. To start with, we would like to point to the framework proposed by Spiranec and Banek [28], which covers different approaches in information literacy as shown in Table 5.

It is possible to define information literacy as the ability to recognize information needs and identify, evaluate, and use information effectively as stated by [29]. The description includes information technology experience, information sources experience, information process experience, information control experience, knowledge construction experience, knowledge extension experience, wisdom experience [29]. All of them are applicable in the findings. Different approaches presented in Table 5 can help us establish a better understanding of potential avenues of research.

Table 5—Different approaches in information literacy education (Source: [28])

Source approach	The focus is on information sources and bibliographical tools and takes the information system and not the user as its point of departure.
Behavioural approach	The main teaching interests are still bibliographical tools and information sources, but they also provide a generalized structure for information seeking, which users can apply in various situations, practices, and contexts.
Process approach	It covers different aspects of information seeking from the user perspective, focusing on how users experience information seeking and create meaning.

Communication approach	This approach largely consists of an awareness of the importance of understanding the socio-cultural conditions for the production, mediation, and consumption of information and emphasizes the social and communicative aspects of information processes, which are context-sensitive
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In the same paper, Spiranec and Banek proposed as a concept Information Literacy 2.0 that has the following features. The accent in teaching is in interpretations and a negotiation, in terms of content focus, on recognizing information contexts, addressing authority, reliability, and accuracy issues. Characteristics are that solutions are nonexclusive solutions and multiple information paths exist. Perception of the information system is on the personal level, and it is subjective. Information spaces are of unorganized structures, and users are creators of the content and need education to do so.

Methodologically, Information Literacy 2.0 is integrated; it is happening in e-learning and a hybrid environment with a strong focus on Web 2.0 services. We prove that most of the features proposed under the framework of Information Literacy 2.0 are presented in the research findings. So, we would like to propose Information Literacy 2.0 as one of the theoretical departures that are useful to find out more about using Twitter in teaching.

Another departure point we could see in the theory of information behaviour could be defined through these often-used four terms: information behaviour, information-seeking behaviour, information-searching behaviour and information-use behaviour. The definition based on Wilson [30] is in Table 6.

Table 6—Four Terms Used in information behaviour research (source [30])

Information behaviour	Totality of human behaviour in relation to sources and channels of information, including both active and passive information-seeking, and information use
Information-seeking behaviour	Purposely seeking for information as a consequence of a need to satisfy some goal. In the course of seeking, the individual may interact with manual information systems or with computer-based systems
Information-searching behaviour	Behaviour the searcher employs in interacting with information systems of all kinds. It consists of all the interactions with the system, whether at the level of human computer interaction or at the intellectual level, which will also involve mental acts, such as judging the relevance of data or information retrieved.
Information-use behaviour	Consists of the physical and mental acts involved in incorporating the information found in the person's existing knowledge base. It may involve, therefore, physical acts such as marking sections in a text to note their importance or significance, as well as mental acts that involve, for example, comparison of new information with existing knowledge.

Other than information behaviour, we could explore possibilities of approaching phenomena from the perspective of information systems research. Lee and colleagues proposed going back to basics, going back to a socio-technical systems paradigm. They point out that an information system consists of social, technological, and informational components, which are not separate but interrelated [31]. As a useful framework for information systems analysis, we would like to propose the DeLone and McLean model of IS success [32] that proposes information, system, and service quality as variables that influence intention to use and user satisfaction with IS. They are correlated, and they will influence net benefit of the IS success. Those variables provide very powerful and an often-used framework for IS analysis.

We would like to also mention an activity theory used in human computer interaction research [33]. The main phenomenon of the research is activity. And, as we see in the above research, finding most of them report on the activities conducted in the class and between classes. As Kuutti [33] put it, “An activity is a form of doing directed to an object, and activities are distinguished from each other according to their objects. Transforming the object into an outcome motivates the existence of an activity”. “Tools” mediate the relationship between subject and object; “rules” mediate the relationship between subject and community, the “division of labour” mediates the relationship between object and community. Those six variables (subject, object, tool, rules, division of labour, and community) enable rich analysis of Twitter usage in the classroom and between.

5. Conclusion

In this paper, we have provided an overview of research that focused on examining Twitter use in the classroom. The descriptive nature of this paper will provide a valuable resource for those considering using Twitter in the classroom. We found that the main obstacle is that usage of Twitter within teaching is left to the individual teachers and their interest in developing their own skills in social media and using it to improve their teaching process. At the same time, social media skills are important for the students’ professional development. Obligatory top-down implementation of Twitter use in the classroom from the universities’ governance bodies sounds extremely difficult to achieve. However, students need to acquire such knowledge whilst they are studying. In the end, it is the teacher’s responsibility whether to use Twitter in the classroom. However, the extra efforts teachers put in are not usually recognized by the educational system they operate in. As Albert Einstein once put it, “It is the supreme art of the teacher to awaken joy in creative expression and knowledge”.

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