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Applying a modified technology acceptance model to qualitatively analyse the factors affecting microblogging integration

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Abstract: The purpose of this research is to examine factors affecting students' perception and engagement of microblogging integration using a qualitative approach. We employed a qualitative case study design to explore potential factors affecting microblogging integration in a hybrid course. Using the technology acceptance model (TAM) model as an umbrella framework, we examined through in-depth interviews with 18 participants the impact of microblogging integration into instruction that affected students' reported use and perceptions of their microblogging-supported learning experiences. We found that individual differences, system characteristics, social influence and facilitating conditions all have impact on student participation and engagement in microblogging integration to varying degrees. We identified more granular factors within each of the four dimensions. Additionally, we proposed a Twitter user taxonomy based on perceived usefulness and usage behaviour and

discussed its broad implications in higher education learning environments. Finally, we identified several pedagogical implications pertaining to strategies of microblogging integration under the context of a hybrid course and offered pertinent recommendations for future research.

Keywords: computer-mediated communication; social media; technology acceptance model; TAM; microblogging; Twitter.

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Teresa Franklin has a passion for teaching and learning through the integration of technology into curriculum and instruction that spans thirty-eight years and includes both online and face-to-face teaching in teacher preparation. Research interests include: program evaluation, evaluation of online/e-learning environments, technology integration and development and mobile technologies. He has significant journal publications and textbooks including *Teaching Science for All Children* (5th ed.), *The Mobile School: Digital Communities Created by Mobile Learners* and *The Changing Roles of Faculty and Students* when Mobile Devices Enter the Higher Education Classroom.

Helen Crompton is an Assistant Professor of the Instructional Technology at Old Dominion University Virginia. She draws from 23 years in education, with 16 years as a full time K-10 classroom teacher and she has a PhD in Educational Technology and Mathematics Education from the University of North Carolina at the Chapel Hill. He works as a consultant for two United Nations Agencies (United Nations, Educational, Scientific and Cultural Organization: UNESCO and International Telecommunication Union: ITU) to research, author and edit publications summarising research on mobile learning. He is also a faculty member for the International Society for Technology in Education (ISTE), teaching the ISTE Standards academy, consulting and recently designing ISTE's self-paced Mobile Learning Academy and Verizon's Mobile Learning Academy.

1 Introduction

Microblogging has become an increasingly popular phenomenon since the first launch of Twitter in 2006. Twitter is a popular microblogging platform with 310 million active users, defined as people who logged in once a month at a minimum (Twitter, 2016). Given such popularity, educators and practitioners have attempted to employ microblogging tools in a wide range of educational settings and contexts. Social media tools such as Twitter have made “hybrid learning spaces that travel across physical and cyber space” possible through students’ attendance and participation in online environments [Greenhow et al., (2009), p.247]. In recent years, Twitter has received a considerable amount of attention in the education literature (Gao et al., 2012; Shabgahi et al., 2013; Ricoy and Feliz, 2016; Tang and Hew, 2017).

Despite the considerable attention and popularity, researchers argued that many unanswered questions exist and more studies are needed in the Twitter-related literature (Gao et al., 2012; Kassens-Noor, 2012; Tang and Hew, 2017). Tang and Hew (2017) in a systematic review study particularly noted that little is known about how learners’ individual differences such as behavioural and performance patterns influence their learning experience with Twitter. Therefore, the purpose of this research is to examine factors affecting students’ perception and engagement of microblogging integration using a qualitative approach. In this study, the researchers used the technology acceptance model (TAM) quantitative conceptual framework, as well as empirical findings from prior studies as a foundation to qualitatively analyse those factors. The researchers qualitatively interpreted the underlying constructs in the TAM model by verifying the factors mentioned in the quantitatively derived models and in previous studies and assessing their influence in the participation and engagement process of microblogging integration in a hybrid course setting.

2 Literature review

2.1 Research on microblogging integration in education

Empirical evidence show that microblogging tools can have educational values (Dunlap and Lowenthal, 2009; Gao et al., 2012; Luo, 2015; Luo et al., 2017; Krutka et al., 2017; Selwyn and Stirling, 2016). Microblogging tools have been employed to facilitate classroom learning activities and to support a more digital, flexible and open mode of learning beyond the classroom, especially in higher education settings (Gao et al., 2012). Researchers have investigated Twitter use in both formal and informal learning (Ebner et al., 2010; Elavsky et al., 2011; Kassens-Noor, 2012). Studies have shown that resources can be shared instantly among participating learners by utilising microblogging; instructors may also exchange ideas and insights with them in an orderly, timely fashion (Click and Petit, 2010; Hansen, 2011; Thames, 2009). Wright (2010) conducted a study more specifically at teacher education students and how Twitter supports in the development of self-reflective practices. During this study, students tweeted about relationships, pedagogy, curriculum, planning, emotions and reflections. Wright reported that students valued the regular contact with a Twitter-enabled community, feeling less isolated.

Educators have adopted Twitter as a digital backchannel to allow just-in-time feedback, comment and questions that take place alongside the main channel of instruction or information (Cronin, 2011; Kimmons and Veletsianos, 2016; Li and Greenhow, 2015; Ross et al., 2011). Specifically, Cronin (2010) summarised several advantages of using backchannel communication to achieve academic purposes, including students taking notes, offering examples, pointing out errors, raising objections, as well as instructors answering questions while reducing whispered private conversations, debriefing and reviewing materials along with students after class. Cronin's (2011) study also suggested that the Twitter-supported backchannel was able to provide real time feedback that is not otherwise achievable in upper level graduate courses.

Many studies reported positive results of Twitter integration to enhance active engagement, interaction and achievement. Kassens-Noor (2012) noted a positive effect on student engagement, which promoted active learning. Her study specifically addressed how Twitter provided instant feedback when used as a knowledge transmitter to inform learners beyond their individual social networks. Twitter's affordances supported students in becoming active learners and augmented the way students apply, create and retain knowledge. Studies also showed that Twitter could facilitate learner-content interaction (Luo and Franklin, 2015; Domizi, 2013; Munoz et al., 2014), learner-learner interaction (Dunlap and Lowenthal, 2009; Hsu and Ching, 2012; Perifanou, 2009), learner-instructor interaction (Prestridge, 2014; McArthur and Bostedo-Conway, 2012). Additionally, a few studies reported an improvement in academic achievement such as course grades (Junco et al., 2011; Kim et al., 2015; Van Vooren and Bess, 2013). Junco et al. (2011) concluded that the grades of the experimental group that used Twitter were significantly higher, as a result of the Twitter-supported activities that entailed working on collaborative service learning projects, providing emotional support for one another, thus building a vibrant learning community among students. Research also reported challenges and concerns in using Twitter for teaching and learning. For example, educational researchers often found that without instructor mandate, only a limited number of learners actively participated in the act of microblogging and the rest remained inactive (Antenos-Conforti, 2009; Cohen and Duchan, 2012; Kop, 2011). This echoes data in the general public that many Twitter users remain consumers not producers of tweets (Koh, 2014). The lack of voluntary use of Twitter may have been caused by unfamiliarity of the tool (Lin et al., 2013; Welch and Bonnan-White, 2012). Studies also found that some participants perceived the use of Twitter as a distraction in the classroom (Andrade et al., 2012; Rinaldo et al., 2011). Instructors who wish to integrate Twitter are also likely to have an increased workload due to the responsibility of maintaining the interaction occurred on Twitter (Luo and Gao, 2012; Ebner et al., 2010).

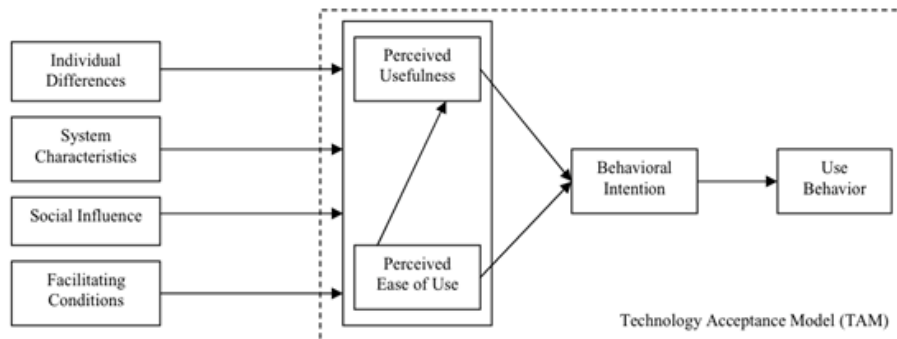
2.2 Research on technology acceptance and adoption models

To understand an individual's acceptance of information technology, researchers have developed a wide array of models and proposed varying theoretical constructs. For example, in diffusions of innovation research Rogers (2003) identified five perceived characteristics of a technology innovation, such as relative advantage, compatibility, complexity, trialability and observability. His earlier work also postulated a five-category classification of adopters representing a wide spectrum of usage, including innovators, early adopters, early majority, late majority and laggards (Rogers, 1962). The TAM

model was considered the most commonly used and most cited theoretical framework for the investigation of the adoption of emerging technology (Davis et al., 1989; Venkatesh and Davis, 2000; Venkatesh and Morris, 2000). The two key constructs in the TAM research are perceived usefulness (PU) and perceived ease of use (PEU), as first posited by Davis (1985). PEU is “the degree to which the...user expects the target system to be free of effort,” while PU is referred to as the users’ “subjective probability that using a specific application system will increase his or her job performance within an organisational context” [Davis et al., (1989), p.985]. The original TAM model has undergone multiple stages of modifications with new constructs being included based on their precursors (Venkatesh and Davis, 2000; Venkatesh and Bala, 2008).

In hopes of synthesising prior research on TAM, Venkatesh and Bala (2008) combined the above variables in the original TAM and its derivatives and proposed a more conclusive means of classification that epitomises the cumulative body of research from the voluminous body of TAM research (see Figure 1). This method of classification consists of four underlying theoretical constructs of PU and PEU: individual differences, system characteristics, social influence and facilitating conditions. The individual differences category refers to variables about individuals’ personality and/or demographics (e.g., gender, age and individual characteristics). System characteristics are external factors concerning the technology itself, which are the salient features of a system that may affect individuals’ development of their preference concerning how useful and easy the system is for the users. Social influence variables refer to the various social processes and conditions that may make a difference to individuals’ perceptions of adopting the technology. Lastly, facilitating conditions concerns the external support that aims to facilitate the use of a type of technology.

Figure 1 Four conditions in TAM 3



Source: Venkatesh and Bala (2008)

2.3 Applications of existing framework and models

The variables listed in Figure 1 were identified as salient determinants in explaining individual’s adoption of information technology by later studies (Compeau and Higgins, 1995; Venkatesh and Davis, 2000; Venkatesh, 2000; Webster and Martocchio, 1992). With the increased use of social technologies over the past 10 years, research suggests that TAM and its variants have been viewed as a valid and parsimonious theory that

predicts users' acceptance of these innovative social technologies (Van Raaij and Schepers, 2008). Researchers also continued to expand TAM theories and models across a variety of disciplines. For example, a new model focused on acceptance with peer support was postulated by Sykes et al. (2009), which was developed to investigate social networks in organisations, adding further understandings to information system use. Curtis et al. (2010) employed UTAUT to examine the adoption process of social media across non-profit organisations in the USA. Verhoeven et al. (2010) also adopted UTAUT to research computer use frequency in secondary school and universities.

2.4 Conceptual framework in the current study

To capture all the factors and investigate these from a more comprehensive perspective, this study uses the four underlying constructs in Venkatesh and Bala's (2008) research. These guide the investigation of potential factors that affect students' perception of microblogging integration, rather than each individual quantitative variable in the previous TAM models. Specifically, individual differences, in the case of Twitter integration, can refer to students' prior use and perceptions of Twitter, in addition to their demographical characteristics, such as age and gender. Research has shown that these prior uses or habits of using Twitter positively affect behavioural intention to Twitter use (Agrifoglio et al., 2010; Barnes and Böhringer, 2011). System characteristics represent the specific features of the microblogging platform that help students develop their favourable/unfavourable perception of a technology system, such as the 140-character limit (Ebner et al., 2010; Wright, 2010). Social influence concerns the social and cultural presumptions of Twitter use that affect individuals when formulating their perceptions and influence their actual use (Ito et al., 2010). The facilitating conditions in the case of microblogging particularly refer to instructional support in and out of the classroom, which is considered to play a critical role in ensuring the success of microblogging-based learning (Holotescu and Grosseck, 2009; Luo, 2015, 2016; Rinaldo et al., 2011). Rather than using these constructs as predictive or explanatory variables to conduct quantitative analysis, which is a typical approach of using the TAM model (Venkatesh and Bala, 2008), this study only uses the four underlying constructs as a conceptual framework to lead questions asked in the interview protocol so as to understand students' perceptions of Twitter integration in this study. In this study, the researchers used these four underlying constructs as a framework to answer the overarching research question – what factors potentially affect students' reported use and perceptions when microblogging is integrated into instruction?

3 Methods

This study employed a qualitative case study design that encompasses an intensive and in-depth analysis of a single case. The approach provides a comprehensive understanding of the critical facets of any new and contemporary phenomenon in its naturalistic setting, allowing an all-encompassing understanding of meanings embedded in their context (Miles and Huberman, 1994; Punch, 2005; Yin, 2008).

3.1 Participants

Participants selected for this study were undergraduates enrolled in a required technology-centered course in a teacher education program at a large Midwestern university in the USA. Participants' ages ranged from 19 to 22, from sophomores to seniors. This sample was purposefully selected as this group of students was among the most active users of social media according to literature. All the participants were college students born in the 1990s, who are considered Millennial that are relatively technology-savvy and closely connected to the online world (Florida et al., 2003).

3.2 Learning context

The microblogging-supported learning activities took place in a single college-level hybrid course designed for pre-service teachers. The course was offered at a Midwestern university as a required course for all education majors on various levels. The major purpose of this course was to familiarise students with technology applications commonly found in educational settings, which justified the use of Twitter as an instance of social media technology. It was a hybrid format class as the class met three times face-to-face throughout a 15-week semester and the remaining coursework was completed online. Microblogging activities incorporated in this course were primarily three-fold:

- a exploring educational Twitter hashtags
- b discussing course-related topics
- c participating in synchronous live chats.

Specifically, in each of the 4-week periods, students were guided to search Twitter hashtags in the Twitter search bar and asked to post three tweets about what they found, to use Twitter to discuss content materials in the course and answer question prompts and join a one-hour live chat concurrently with a massive group of other educators online. Twitter was also used during lectures in face-to-face sessions to enhance participation. In addition to facilitating and complimenting student learning of content materials, the main purpose of these activities was to enhance student-student, as well as student-instructor interactivity. The instructor provided consistent guidance and modelling of student participation on the Twitter platform throughout the semester.

3.3 Data collection

In-depth interviewing is a powerful method to gain a deeper understanding of people's thoughts and perceptions (Marshall and Rossman, 1999; Gomm, 2004; Punch, 2005). The primary interviewing endeavour was a summative, semi-structured interview at the end of the course. A set of structured questions was queried in a standardised format at the first section of the interview. The standardised question set was laid out according to the TAM model to explore potential factors. The standardised question set comprised of questions on *individual differences* including demographical information and prior use and prior perception, *social influence* including how their peers used Twitter, *facilitating conditions* including how they perceived the instructional guidance and *system*

characteristics including how they perceived the features and functionalities of Twitter. For example, for social influence the researchers asked participants how their friends used Twitter and if it influenced their use of Twitter. Additional survey and classroom observation were conducted as supplemental data sources to predetermine the orientation of students' Twitter perception but not included in this study. Based on the preliminary results achieved from the surveys and observations, students who were placed in different categories as different perceptions of Twitter integration (positive versus negative perceptions) were asked additional questions that only pertain to their individual characteristics and Twitter usage pattern. Eighteen out of 24 students voluntarily participated in the in-depth interviews on a one-on-one basis format that follows a semi-structured protocol. After gaining their consent, semi-structured interviews were used and the duration of each interview ranged from twelve minutes to 30 minutes.

3.4 Data analysis

All interviews were recorded, transcribed and coded through identification of any recurring phrases or regularities in the data (Miles and Huberman, 1994). As the TAM model was used as a theoretical framework to understand the scope of potential factors influencing student perceptions, the analysis of qualitative interview data followed this approach which also aligned with the interview protocol. The lead researcher first began reading the transcribed interview data using the four TAM a priori codes (Stemler, 2001). The lead researcher coded the entire interview data by using a systematic line-by-line open-coding process as the data were examined to uncover new topics and themes from the initial four codes. Two other researchers then examined the codes and independently reviewed half of the codes each. The three researchers then together reviewed the data and met to discuss inter-rater reliability to determine the homogeneity of the three researcher's findings. Discrepancies were discussed and codes were revised until consensus was achieved. Additional sub codes emerged from the initial a priori code *individual differences* and the further three codes were not partitioned further. The final codes can be seen in Table 1.

The researchers then applied this list of codes to all the interview responses before returning together to discuss the analysis. To code the data the researchers developed a description of each code to more accurately identify the interview data to be labelled with that code. To become a separate code, over 50% of the respondents must have included interview responses connected to this code. These descriptions can be found in Table 2.

Table 1 The four a priori codes with the five sub-codes

| <i>Main codes</i> | <i>Sub-codes</i> |
|-------------------------|--|
| Individual differences | Prior use |
| | Prior perceptions |
| | Mobile ownership |
| | Technology comfort level and familiarity |
| | Personality |
| Social influence | |
| Facilitating conditions | |
| System characteristics | |

Table 2 The sub-codes and the descriptions used to analyse the interviews

| <i>Codes</i> | <i>Description of the codes</i> |
|--|---|
| Prior use | When the participant spoke about using Twitter in the past. |
| Prior perceptions | When the participant spoke about their feelings about using Twitter in the past. |
| Mobile ownership | When the participant spoke about owning a mobile device. |
| Technology comfort level and familiarity | When the participant spoke about his/her abilities in using technology and if they have used those technologies before. |
| Personality | When the participant spoke about aspects of their personal identity in relation to the use of Twitter. |

3.5 Enhancing trustworthiness, validity and credibility of the data

The researchers employed strategies to ensure the quality and rigor of this qualitative research, including member checks (Maxwell, 2009) and research reflexivity (Nastasi and Schensul, 2005). Member checks were conducted with participants to ensure the accuracy of the information collected. Reflexive documents and journals were kept by the researchers prior to and during the process of the data collection, analysis and interpretation stages, which uncovered possible researcher bias and assumptions to increase the credibility and trustworthiness of the study.

4 Results

The question guiding this research was to determine what factors potentially affect students' reported use and perceptions when microblogging is integrated into instruction? From the coding of the data, four main codes and five sub codes emerged from the analysis. The results section is organised by these categories.

4.1 Individual differences

Students described many aspects of individual differences consisting of their demographical information, prior use and perception of Twitter, technological comfort level and mobile ownership. Demographical differences, including age, grade year and gender appeared to not to affect the students' perception and their use of the Twitter integration, as these differences were minimal among this group of students. Further differences are explained in detail below. Personality seemed to be a latent factor that contributed to students' differences in their Twitter perception and adoption, but was not examined in the interviews.

4.1.1 Prior use

Students described their prior use of Twitter, including duration of engagement and frequency of use. Of the total 18 students, four had never used Twitter before the class, six had used it for less than three years and eight had used it about or more than three years. In terms of frequency of use, the frequency of checking tweets ranges from 'at

least once a day' to '25 times a day' or 'hourly'. Most of the students reported that they checked 'a couple times a day'. Similarly, the frequency of posting tweets varies substantially. The most frequent group of students tweeted more than three times a day, while the least frequent students 'do not tweet much in a couple months', even though she checked it a couple times a week. The common combination of duration of engagement and frequency of use among this group of students is 'check it daily' and 'tweet a couple times a week'.

Our results suggested that prior use is closely associated with their perceptions of Twitter integration. Overall, students who were high in both duration of engagement and frequency of use tended to have the most positive opinion about the integration. Frequency of use seemed to be more important than duration of engagement in terms of its effect on student perceptions, because those who did not tweet much for social and personal reasons were even more reluctant to tweet for this class. Among those who had zero prior experience with Twitter, only one had an absolutely positive opinion about the Twitter use in the class. Two felt neutral about it and one disliked it.

4.1.2 Prior perceptions

Students reported their perceptions on Twitter before the class. Over two thirds of students perceived Twitter as a type of social media they often resort to. Six out of 18 students were enthusiastic about Twitter. One student said, "I just love Twitter, no matter what you do with it". Three also commented that they saw the uniqueness of Twitter as compared to Facebook and believed Twitter was taking the place of Facebook and becoming the trendiest type of social media for teens/young adults.

For educational and professional use of Twitter, only one student stated that she had used it for another class. Three students reported that they sometimes used it to search for news and useful information and valued it as a news or information channel. The majority of students used it to 'connect with friends' or 'for fun'.

As with the analysis of students' prior use, the above results indicate that prior perceptions affected students' perception about their Twitter use in this class. In general, those who held a more positive opinion prior to the class, typically placed more value on Twitter's educational and professional use. It is equally interesting that for participants who were skeptical about its professional use and who were only interested in its social and recreational use, started to change their perceptions on Twitter due following the use of Twitter in this class. Noticeably, two students who reported that they disliked Twitter remained negative after their Twitter experience in the class.

4.1.3 Mobile ownership

All students reported that they owned a Smartphone during the study. The majority (14 out of 18) stated that they used their smart phones for this course, including checking and posting tweets. Most students commented that although they made an alternative account for educational purposes, it was easy for them to switch the two accounts back and forth on their phones. Only two students commented that they used their Smartphone predominantly for their personal account, whereas the tweeting activities for the class were completed using their computers. One student reported that he did not use Twitter on his phone because his Smartphone was an older and slower phone. Mobile ownership seems to only slightly affect student perceptions and use, as most of the students carried

Smartphone. However, those with less positive opinions (3 out of 18) did report a relatively inactive engagement with their Smartphone.

4.1.4 Technology comfort level and familiarity

Students described how comfortable they felt when using technology and how familiar they were with technology in general. Five students acknowledged that they have a high technology comfort level. They felt good about using technology and often helped their friends and families with technological difficulties. More than half of the students felt they were 'okay with technology'. They used some common technologies, such as Smartphone, the internet and social media, but did not explore additional technologies out of their comfort zone. A few others reported that they are "not so good at dealing with technology and they typically kept away from it unless they had to use it". In general, technology skill level slightly affected their perception of the Twitter integration. Most of students who perceived the Twitter integration positively had a high technology comfort level and familiarity. However, special cases existed as one student reported himself to be very tech-savvy but he simply was not interested in any type of social media; another student who believed she knew very little about technology loved all kinds of social media and Twitter in particular.

4.1.5 Personality

Personality was not specifically listed in the interview questions. However, when students expressed an extreme dislike or like of Twitter, further probing questions were asked. The data show that some students reported a 'love' of the technology regardless of how they were using it and others reported disliking Twitter after using it professionally. Personality started to emerge as a prominent theme from the interview data. For example, Student [14], had a negative overall opinion on the Twitter integration and conveyed a strong message about his personality. He first considered himself as a person who is 'reserved', reporting that "[I] do not care about what others say or do". Even though most of his friends joined Twitter long time ago, he did not choose to become part of the trend. He reported himself to be "very tech-savvy," but he had no interest in any type of social media. After experiencing the professional and educational use of Twitter, he said he believed that Twitter has the potential to provide useful content, but in every activity, he perceived risks and challenges much more than benefits by stating that "there are many other tools out there that can probably do the same, if not better". In the end, he commented that "Twitter isn't all bad, but I'm still not completely sold on the idea yet".

Another student who held a slightly negative opinion seemed to be rather reserved and unwilling to share. She admitted that she would never want to share anything with people who she does not know: "I just do not like to talk to strangers. I do not see a point doing it. I have many other valuable things to do in life". She also admitted that she valued privacy highly. Even though she had been on Twitter for two years prior to the study, she only followed her friends and always kept her account private. When asked about Twitter integration, she stated that she perceived many advantages of Twitter as she understood the purpose behind people becoming connected through Twitter. However, she still believed that she would not consider using it, simply because "I just do not feel like talking to strangers".

Contrastingly, enthusiastic Twitter proponents tended to be open-minded, expressive, sociable and enjoyed being connected with others. For example, Student [2] considered herself as someone who “loves to talk and share things with others”. She stated that she would typically “go somewhere and tweet about it” and she “loves to make jokes and share it on Twitter so that others can have a good laugh about it”. Student [10], who considered herself a Twitter enthusiast and also expressed enjoyment for sharing ideas with others and connecting with new people on the internet. Both these students proposed that they should have been required to tweet more often so that they could have more frequent interactions with their peers and gain a deeper understanding of one another.

4.2 Social influence

Students’ perceptions and the use of Twitter appear to be affected by their friends and the people around them. All students reported that their friends used Twitter. Fourteen of 18 total students reported that their friends ‘used Twitter a lot’. Four students admitted that they first signed up for a Twitter account because “that’s what my friend did” or “I was dragged into it by my friends”. Only one student believed that s/he was not influenced by the peers. Students also reported that their peers’ use of Twitter was exclusively personal or social. None of the students observed any type of professional use by their friends like they had experienced in this class. Not surprisingly, they expressed concerns of “looking different” or ‘weird’ as compared to how their peers tweet due to the large number of professional tweets they posted in this study. Therefore, all of the students who had an account prior to this class signed for an alternative account.

4.3 Facilitating conditions

Students were asked to describe how they perceived the guidance the instructor provided over the 12-week period. All students reported that they favoured ‘some kind of guidance’. Eight students preferred full guidance, while the rest proposed guidance modes of different types or on different levels. When being asked if they would tweet the same way as they did in this class without instructional guidance, 12 said absolutely no and six said no with hesitation. Students all believed that their instructor’s guidance was useful for them. Those who were unfamiliar with Twitter noted that they preferred very detailed, step-by-step descriptions of what to do and how to do it as the type of desired guidance. Students commented that they enjoyed seeing the instructor’s own tweets on Twitter because ‘it feels like you are there’. Similarly, they reported that they felt more safe and comfortable joining the live chats with the instructor. As one student commented, “you know you have someone to turn to if you are in trouble”. Other students commented that the instructor’s tweets on Twitter provided a good modelling of how they should tweet.

Ten students pointed out clearly that they liked the way in which the instructor guided the tweeting activities as a progressive scaffolding process. They believed the three major tweeting activities (beginning from exploring hashtag to discussing topics and to live chats) flowed naturally from one another. Four students described the exploring Hashtag activity as a “stepping stone into the other activities”. Without a solid understanding of the hashtags, students would not be able to have a good grasp of how to participate in discussion activities, in particular the live chats.

4.4 System characteristics

Students described their perceptions on Twitter's interface and its features. For the technical aspects, participants reported that Twitter is very easy to use and the basic functions are self-explanatory. Only three students commented that it took them time to learn how to use. All students reported that once they understood and knew how to use the foundational features, all the other functions seem to become clear and self-explanatory. All students stated that the threshold to learn and use Twitter as a technology is extraordinarily low.

Many students referred to the use of hashtags and how their understanding of hashtags had transformed over time as they learned more about it from the course. As one student stated, "I first thought hashtags are just some random things you add to a tweet to make it fun, now I know it is far beyond that. It helps you to discover so many useful things and give you a sea of knowledge". Students also frequently referred to the Connect Tab stating that it demonstrates all the possible forms of connections between the user and other people on Twitter. Three students also cautioned that the Trending Board, as shown across all Twitter's pages, could also be a potential distraction if students were not pre-warned about its benefits and risks.

The 140-character limit was a controversial issue for the students. All students acknowledged that they felt some discomfort when they had to rewrite the sentence that they intended to post as it was over the 140-character limit. However, their perception on this character restriction varied significantly across different individuals. Out of 18 total interviewees, ten favoured the 140-character limit, five disliked it and three were neutral. The proponents believed that it forces users 'get to the point' and say 'what they had to say'. Indirectly, they argued, it expands the volume and pace of interaction within a massive number of users online. In contrast, the opponents believed that the 140-character limit discourages elaboration and sacrifices the depth of content. They also connected this with the shortened attention span often connected with today's teenagers.

Discussing the openness of Twitter, students' opinions again varied considerably. Students with higher Twitter experience tended to view the openness of Twitter much more favourably; whereas those with little experience were more concerned with its risks and constraints. For the students with positive opinions, Twitter's openness was mainly translated into being able to reach and connect with a wider range of people from all over of world and acquire a substantial wealth of information. Students also perceived an absolute freedom of speech and expression on Twitter.

In contrast, students with less experience tended to view Twitter's openness as a deficit and were much more reserved to using Twitter as an educational tool because of its openness. They acknowledged that Twitter's openness can be advantageous in some situations, but only if it is used appropriately. Often, they interpreted its openness as negative, especially in regards to issues such as cyber bullying, potential distraction, information bombardment and 'getting out of control'.

5 Discussions and implications

The four dimensions of factors in the TAM model appears to provide an appropriate framework in this study, denoting critical factors that potentially affect students' perception and participation. All four dimensions of the TAM model, individual

differences, social influence, facilitating conditions and system characteristics, were all speculated and through different lenses in that all of them contributed to students' reaction and perception on the twitter integration to varying degrees. More importantly, pedagogical implications of how to make Twitter work better in classroom settings are given a full contemplation with respect to these different dimensions.

5.1 Acquiring Twitteracy

From these findings, the term Twitteracy in this study was a term used to denote a person's capability to use Twitter to achieve educational goals and benefits. This origin of this term may be traced back to Rheingold's (2012) book *Net Smart* in which he discussed Twitter literacy being the condition or quality of being knowledgeable and skilful in the use of Twitter. Despite its ease-of-use and simplicity, such fundamental knowledge and skills of Twitter, are essential to anyone who intends to use it more than a banal communication tool. Greehow and Gleason (2012) provided a broader conceptualisation of Twitteracy, defining it as a new literacy practice that centres on a multimodal, social mediated and technologically afforded practice that aids learners and educators manoeuvre in both informal and formal learning.

It appears that students' Twitteracy level relies largely on their individual differences prior to the Twitter integration, which is perhaps the most important strand of factors that educators need to take into account when considering Twitter integration into the classroom. Results of this study indicate that the acquisition of Twitter literacy takes both cognitive and conceptual understanding of Twitter as well as experiential practices. At the cognitive level, students need to move beyond their previous perception of Twitter to be open and receptive to the idea of educational Twitter. Despite their ingrained thinking of viewing Twitter as a banal and trivial broadcasting tool to report what they are doing, students ought to learn to grasp the educational essence of Twitter by being a mindful person in the Twitter sphere (Rheingold, 2012). They need to learn what to pay attention to in the crowd of information on Twitter and be able to discern what to use and what to disregard. What Twitter can do for a user all depends on how he/she sees and comprehends.

These data show that many of these students still use it exclusively for social and recreational purposes, which corresponds with findings on similar studies involving Twitter (Ebner, 2013; O'Reilly and Milstein, 2011). It would be beneficial for educators to bring the educational concept of Twitter into classrooms and teach students to be literate about its educational use.

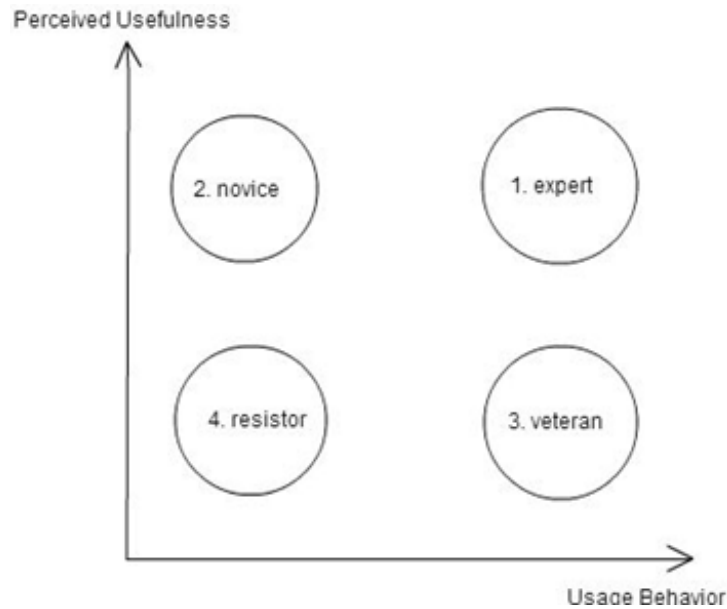
5.2 Acknowledging learners at different levels

In analysing these finer details of student's Twitter usage, themes developed that encompass different levels of Twitteracy. Data analysis shows that the student population had different levels of readiness for the Twitter integration. The differences in their perception and usage pattern prior to the Twitter integration typically lead to distinct degrees of learning experiences. For instructors, it appears from the data that it is pivotal to assess what degree the learner is ready at the moment, both cognitively and technologically, to effectively guide their learning forward from that point.

Our data suggests a taxonomy of Twitter users consisting of four types of students (see Figure 2). This taxonomy could be used by instructors to evaluate students' prior

experience and guide instructors to align the degree to which Twitter could be implemented with students' characteristics including PU and usage behaviour. These students are hierarchically categorised into four types, expert, novice, veteran and resistor, according to the level of easiness for Twitter to be integrated. The characteristics of each type of students are elucidated below.

Figure 2 A taxonomy of twitter users



5.2.1 Expert

Expert students are those prepared for the incorporation of Twitter. These students possess a high level of proficiency with Twitter use and have a positive perception of the educational and professional use of Twitter. Expert students would be typically categorised as early adopters using Roger's (1962) framework; they have used Twitter for more than five years prior to the class Twitter integration. They have developed insights on how Twitter can be used for a variety of purposes and have practiced using the tool. It is critical for the instructor to recognise these students and have them take a leadership role in the implementation of Twitter (Luo, 2015).

5.2.2 Novice

The term novice does not necessarily indicate that these students have not heard of or have never used Twitter, but rather that the use of Twitter for education purposes is a novel and interesting idea. These students have hardly developed any fixed pre-perception of Twitter and they tend to be open and positive to its educational use. They find Twitter integration easy, although they are likely to experience technical

frustrations and feel cognitively challenged. Novices prefer a significant amount of guidance and they prefer the guidance to be explicit, step-by-step and ongoing.

5.2.3 Veteran

The term veterans refer to skilled skeptics who have acquired a plethora of skills and experience using Twitter, but they only used it for communication and recreation use. Twitter veterans who possess a fixed usage pattern of Twitter tend to be skeptical of its educational use. Although these students could also be Twitter early adopters, they utilised Twitter exclusively as a personal social networking tool and are reluctant to deviate to include educational purposes. These skilled skeptics perceive Twitter as a domain where they can be themselves and demonstrate their personal identity; they would not like this domain to be tainted by an instructor's footprints. Therefore, it is the stereotyped perception of Twitter that fundamentally hinders them from being open to the educational Twitter idea. Instructors need to be strategic in trying to alter veterans' preconception by providing authentic modelling and ongoing guidance.

5.2.4 Resistor

Twitter resisters are those who are low on both the PU and usage behaviour axes, who are comparable to Roger's classification of laggards in his adopter categories. They often consider Twitter as useless and a waste-of-time and they typically have not used Twitter. Resisters in this study unanimously reported that most of their friends are using Twitter except themselves. Resisters have already developed a deep-seated negative attitude, which might be associated with unyielding personality traits towards other technologies. In attempts to alter these people's attitude, instructors will have to go to great lengths to change these negative perceptions. Instructors should be cautious about whether to continue Twitter integration if Twitter resisters are found to be the dominant type of learners in the class prior to implementation.

5.3 Providing instructional guidance as facilitating conditions

As social media tools are becoming more prevalent in educational settings, especially in higher education, providing instructional guidance to optimise their use in learning environments have become increasingly pertinent (Davis et al., 2013). Our data reiterate this theme. This study shows that without proper guidance, students may fall into their existing habitual ways of microblogging usage (Lin et al., 2013; Luo and Gao, 2012; Luo, 2016). It is implied that as students' cognitive understanding of Twitter and their technologically comfort level with Twitter increased, instructional guidance tends to be less important. Those who had extensive Twitter experience and carried more positive pre-perceptions perceived the effects of instructional guidance less useful. Some of the expert Twitter users commented that they may have tweeted the same way with or without the instructor's guidance, whereas students in the Twitter novice group placed great emphasis on the provision of instructional guidance. This result again reemphasises the role of instructional guidance for novice learners who have scarce prior knowledge and experience, as is implied in previous studies (Mayer, 2004; Luo, 2015, Luo, 2018).

5.4 Understanding functionalities of Twitter

The hashtag (#) functions as to mark the topic of a tweet and place a single tweet into certain contexts. As researchers indicate, it “presupposes a virtual community of interested listeners who are actively following this keyword or who may use it as a search term” [Zappavigna, (2011), p.791]. The use of a hashtag in a tweet provides a link to an ambient virtual community, contextualises the interaction and makes it searchable to the open world. The use of hashtags helped students in the course expand their professional network to an extensive group of educators that they have never met in their lives. As instructors, it is vital to recognise the power of using hashtag and guide students into exploring them to gain a deeper understanding of Twitter hashtags. These hashtags are often not only searchable keywords, it is the essential passport to enter world-scaled live discussions. Instructors can also create a hashtag for their courses or schools and then allow pertinent stakeholders to explore and participate in real-world dialogues.

The 140-character limit can be a constraint that challenges people’s ability to be concise and also an asset that empowers the use of Twitter, which echoes results from prior research. The limit can be beneficial as it encourages students to write clearly and concisely (Dunlap and Lowenthal, 2009), but it can also cause a distraction and bad grammar (Ebner and Maurer, 2009; Grosseck and Holotescu, 2008). In this study, most students perceived it as a benefit because it restricts what they want to say causing them to summarise and avoid verbose responses. It is worth noting that as students become more Twitter-literate, the 140-character limit is perceived more as an asset than as a challenge. Students learned to be more concise and to-the-point in conveying messages.

6 Conclusions

This qualitative case study is an empirical inquiry into critical factors affecting students’ perception and participation in a college-level hybrid class in the context of teacher education programs. The ultimate goal of this research was to add to the significance and understanding of the possibilities of adequately using microblogging tools such as Twitter in higher education learning environments. Our data show that the TAM model is a suitable umbrella framework for analysing student Twitter use in class. The proposed user taxonomy provides a conceived blueprint of four different types of Twitter users in a class; expert, novice, veteran and resistor. This taxonomy delineates unique characteristics with which these learners possess and suggests some pedagogical implications for instructors before they advance their Twitter implementation plan. This taxonomy serves as a conceptual framework for instructors to better understand the discrepancies in student perception and usage behaviour, thus further helping them develop instructional techniques customised for each type of students. Validation of this taxonomy would be further enhanced through future research and examination.

The researchers also recognised that the study was conducted in a particular context of a hybrid course using qualitative interviewing methods with a limited number of participants. Continuous research on investigating the contributing factors is much needed to determine which particular factor(s) are deemed most important in different learning contexts, especially given that much of factors are sensitive to specific contexts and subjects. A combination of quantitative and qualitative methods may yield more insightful findings; for example, a mixed method study can be conducted to evidence

what potential long-term impact of microblogging integration have on learners in higher education learning environment and what bring forth such impact.

References

- Agrifoglio, R., Black, S. and Metallo, C. (2010) 'Twitter acceptance: the role of intrinsic motivation', in Lomicka, L. and Lord, G. (Eds.): *The Next Generation: Social Networking and Online Collaboration in Foreign Language Learning*, pp.59–90, CALICO, San Marcos, TX.
- Andrade, A., Castro, C. and Ferreira, S. A. (2012) 'Cognitive communication 2.0 in higher education: to tweet or not to tweet?', *Electronic Journal of E-Learning*, Vol. 10, No. 3, pp.293–305.
- Antenos-Conforti, E. (2009) 'Microblogging on Twitter: social networking in intermediate Italian classes', in Lomicka, L. and Lord, G. (Eds.): *The Next Generation: Social Networking and Online Collaboration in Foreign Language Learning*, pp.59–90, CALICO, San Marcos, TX.
- Barnes, S.J. and Böhringer, M. (2011) 'Modeling use continuance behavior in microblogging services: the case of Twitter'. *Journal of Computer Information Systems*, Vol. 51, No. 4 [online] http://iacis.org/jcis/articles/Barnes_Bohringer_2011_51_4.pdf (accessed 23 March 2017).
- Click, A. and Petit, J. (2010) 'Social networking and web 2.0 in information literacy', *International Information and Library Review*, Vol. 42, No. 2, pp.137–142, DOI: 10.1016/j.iilr.2010.04.007.
- Cohen, A. and Duchan, G. (2012) 'The usage characteristics of Twitter in the learning process', Paper Presented at the IJELLO special series of Chais Conference [online] <http://www.ijello.org/Volume8/IJELLOv8p149-163Cohen0808.pdf> (accessed 23 March 2017).
- Compeau, D.R. and Higgins, C.A. (1995) 'Application of social cognitive theory to training for computer skills', *Information Systems Research*, Vol. 6, No. 2 pp.118–143.
- Cronin, J.J. (2011) 'The classroom as a virtual community: an experience with student backchannel discourse', *Business Education Innovation Journal*, Vol. 3, No. 2, pp.56–65.
- Curtis, L., Edwards, C., Fraser, K.L., Gudelsky, S., Holmquist, J., Thornton, K. and Sweetser, K.D. (2010) 'Adoption of social media for public relations by nonprofit organizations', *Public Relations Review*, Vol. 36, No. 1, pp.90–92.
- Davis III, C.H.F., Deil-Amen, R., Rios-Aguilar, C. and González Canché, M.S. (2013) *Social Media and Higher Education: A Literature Review and Research Directions*, Report printed by the University of Arizona and Claremont Graduate University [online] <http://works.bepress.com/hfdavis/2/> (accessed 23 March 2017).
- Davis, F. (1985) *A Technology Acceptance Model for Empirically Testing New End-user Information Systems: Theory and Results*, Unpublished Doctoral dissertation, MIT Sloan School of Management, Cambridge, MA.
- Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989) 'User acceptance of computer technology: a comparison of two theoretical models', *Management Science*, Vol. 35, No. 8, pp.982–1003.
- Domizi, D.P. (2013) 'Microblogging to foster connections and community in a weekly graduate seminar course', *TechTrends*, Vol. 57, No. 1, pp.43–51.
- Dunlap, J.C. and Lowenthal, P.R. (2009) 'Tweeting the night away: using Twitter to enhance social presence', *Journal of Information Systems Education*, Vol. 20, No. 2, pp.129–155.
- Ebner, M. (2013) 'The influence of Twitter on the academic environment', *Social Media and the New Academic Environment: Pedagogical Challenges*, pp.293–307, IGI Global (accessed 23 March 2017).
- Ebner, M. and Maurer, H. (2009) 'Can weblogs and microblogs change traditional scientific writing?', *Future Internet*, Vol. 1, No. 1, DOI: 10.3390/fi1010047.

- Ebner, M., Lienhardt, C., Rohs, M. and Meyer, I. (2010) 'Microblogs in higher education – a chance to facilitate informal and process-oriented learning?', *Computers and Education*, Vol. 55, No. 1, pp.92–100, DOI: 10.1016/j.compedu.2009.12.006.
- Elavsky, C.M., Mislan, C. and Elavsky, S. (2011) 'When talking less is more: exploring outcomes of Twitter usage in the large-lecture hall', *Learning, Media and Technology*, Vol. 36, No. 3, pp.215–233.
- Florida, R., Kaimal, G., Oblinger, D. and Blessing, L. (2003) *How generations X and Y (Millennials) Will Reshape Higher Education*, Society for College and University Planning Virtual Seminar [online] http://www.scup.org/profdev/archive_cds/gen_x-y.html (accessed 23 March 2017).
- Gao, F., Luo, T. and Zhang, K. (2012) 'Tweeting for learning: a critical analysis of research on microblogging in education published in 2008-2011', *British Journal of Educational Technology*, Vol. 43, No. 5, pp.783–801.
- Gomm, R. (2004) *Social Research Methodology: A Critical Introduction*, Palgrave Macmillan, Basingstoke.
- Greenhow, C. and Gleason, B. (2012) 'Twitteracy: Tweeting as a new literacy practice', in *The Educational Forum*, October, Vol. 76, No. 4, pp.464–478, Taylor & Francis Group.
- Greenhow, C., Robelia, B. and Hughes, J.E. (2009) 'Learning, teaching and scholarship in a digital age: Web 2.0 and classroom research: what path should we take now?', *Educational Researcher*, Vol. 38, No. 4, pp.246–259, DOI: 10.3102/0013189x09336671.
- Grossec, G. and Holotescu, C. (2008) 'Can we use Twitter for educational activities', in *4th International Scientific Conference, E-learning and Software for Education*, Bucharest, Romania, April.
- Hansen, D.L. (2011) 'Exploring social media relationships', *On the Horizon*, Vol. 19, No. 1, pp.43–51, DOI: 10.1108/10748121111107726.
- Holotescu, C. and Grossec, G. (2009) 'Using microblogging in education. Case study: Cirip.ro', Paper Presented at the 6th Conference on e-Learning Applications, Cairo, Egypt [online] <http://www.scribd.com/doc/8551345/Using-microblogging-in-education-Case-Study-Ciripro> (accessed 23 March 2017).
- Hsu, Y.-C. and Ching, Y.-H. (2012) 'Mobile microblogging: using Twitter and mobile devices in an online course to promote learning in authentic contexts', *The International Review of Research in Open and Distributed Learning*, Vol. 13, No. 4, pp.211–227.
- Ito, M., Bittanti, M., Horst, A., Horst, H., C.J. Pascoe., Robinson, L., Tripp, L. et al. (2010) *Hanging Out, Messing Around and Geeking Out: Kids Living and Learning with New Media*, MIT Press, Cambridge, MA.
- Junco, R., Heiberger, G. and Loken, E. (2011) 'The effect of Twitter on college student engagement and grades', *Journal of Computer Assisted Learning*, Vol. 27, No. 2, pp.119–132.
- Kassens-Noor, E. (2012) 'Twitter as a teaching practice to enhance active and informal learning in higher education: the case of sustainable tweets', *Active Learning in Higher Education*, Vol. 13, No. 1, pp.9–21.
- Kim, Y., Jeong, S., Ji, Y., Lee, S., Kwon, K.H. and Jeon, J.W. (2015) 'Smartphone response system using Twitter to enable effective interaction and improve engagement in large classrooms', *IEEE Transactions on Education*, Vol. 58, No. 2, pp.98–103 [online] <http://doi.org/10.1109/TE.2014.2329651>.
- Kimmons, R. and Veletsianos, G. (2016) 'Education scholars' evolving uses of twitter as a conference backchannel and social commentary platform', *British Journal of Educational Technology*, Vol. 47, No. 3, pp.445–464.
- Koh, Y. (2014) '44% of Twitter accounts have never sent a tweet', *The Wall Street Journal* [online] <http://blogs.wsj.com/digits/2014/04/11/new-data-quantifies-dearth-of-tweeters-on-twitter/> (accessed 23 March 2017).

- Kop, R. (2011) 'The challenges to Connectivist learning on open online networks: learning experiences during a massive open online course', *The International Review of Research in Open and Distance Learning*, Vol. 12, No. 3, pp.19–38 [online] <http://www.irrodl.org/index.php/irrodl/article/view/882/1689> (accessed 23 March 2017).
- Krutka, D., Nowell, S. and Whitlock, A.M. (2017) 'Towards a social media pedagogy: successes and shortcomings in educative uses of Twitter with teacher candidates', *Journal of Technology and Teacher Education*, Vol. 25, No. 2, pp.215–240.
- Li, J. and Greenhow, C. (2015) 'Scholars and social media: tweeting in the conference backchannel for professional learning', *Educational Media International*, Vol. 52, No. 1, pp.1–14.
- Lin, M.F.G., Hoffman, E.S. and Borengasser, C. (2013) 'Is social media too social for class? A case study of Twitter use', *TechTrends*, Vol. 57, No. 2, pp.39–45.
- Luo, T. (2015) 'Instructional guidance in microblogging-supported learning: insights from a multiple case study', *Journal of Computing in Higher Education*, Vol. 27, No. 3, pp.173–194.
- Luo, T. (2016) 'Enabling microblogging-based peer feedback in face-to-face classrooms', *Innovations in Education and Teaching International*, Vol. 53, No. 2, pp.156–166.
- Luo, T. (2018) 'Delving into the specificity of instructional guidance in social media-supported learning environments', *Journal of Information Technology Education: Innovations in Practice*, Vol. 17, pp.37–54.
- Luo, T. and Franklin, T. (2015) 'Tweeting and blogging: moving towards Education 2.0', *International Journal on E-Learning*, Vol. 14, No. 2, pp.235–258.
- Luo, T. and Gao, F. (2012) 'Enhancing classroom learning experience by providing structures to microblogging-based activities', *Journal of Information Technology Education: Innovations in Practice*, Vol. 11, No. 1, pp.199–211.
- Luo, T., Sickel, J. and Cheng, L. (2017) 'Preservice teachers' participation and perceptions of twitter live chats as personal learning networks', *TechTrends*, Vol. 61, No. 3, pp.226–235.
- Marshall, C. and Rossman, G.B. (1999) *Designing Qualitative Research*, Sage Publications, Thousand Oaks, Calif.
- Maxwell, J. (2009) 'Designing a qualitative study', in Bickman, L. and Rog, D.J. (Eds.): *The Sage Handbook of Applied Social Research Methods*, pp.214–253, Sage Publications, Thousand Oaks, CA.
- Mayer, R.E. (2004) 'Should there be a three-strikes rule against pure discovery learning?', *American Psychologist*, Vol. 59, No. 1, pp.14–19.
- McArthur, J.A. and Bostedo-Conway, K. (2012) 'Exploring the relationship between student-instructor interaction on Twitter and student perceptions of teacher behaviors', *International Journal of Teaching and Learning in Higher Education*, Vol. 24, No. 3, pp.286–292.
- Miles, M.B. and Huberman, A.M. (1994) *Qualitative Data Analysis: An Expanded Sourcebook*, Sage Publications, Thousand Oaks, CA.
- Munoz, L.R., Pellegrini-Lafont, C. and Cramer, E. (2014) 'Using social media in teacher preparation Programs: Twitter as a means to create social presence', *PennGSE Perspectives on Urban Education*, Vol. 11, No. 2 [online] <https://www.urbanedjournal.org/archive/volume-11-issue-2-summer-2014/using-social-media-teacher-preparation-programs-Twitter-means-> (accessed 23 March 2017).
- Nastasi, B.K. and Schensul, S. L. (2005) 'Contributions of qualitative research to the validity of intervention research', *Journal of School Psychology*, Vol. 43, pp.177–195.
- O'Reilly, T. and Milstein, S. (2011) *The Twitter Book*, O'Reilly, Sebastopol, CA.
- Perifanou, M.A. (2009) 'Language micro-gaming: Fun and informal microblogging activities for language learning', in *Best Practices for the Knowledge Society*.
- Prestridge, S. (2014) 'A focus on students' use of Twitter: their interactions with each other, content and interface', *Active Learning in Higher Education*, Vol. 15, No., pp.101–115.

- Punch, K.F. (2005) *Introduction to Social Research: Quantitative and Qualitative Approaches*, Sage Publications, Thousand Oaks, CA.
- Rheingold, H. (2012) *Net Smart: How to Thrive Online*. MIT Press, Cambridge, MA.
- Ricoy, M.C. and Feliz, T. (2016) 'Twitter as a learning community in higher education', *Educational Technology and Society*, Vol. 19, No. 1 pp.237–248.
- Rinaldo, S.B., Tapp, S. and Laverie, D.A. (2011) 'Learning by tweeting: using Twitter as a pedagogical tool', *Journal of Marketing Education*, Vol. 33, No. 2, pp.193–203, DOI: 10.1177/0273475311410852.
- Rogers, E.M. (1962) *Diffusion of Innovations*, 1st ed., Free Press of Glencoe, New York.
- Rogers, E.M. (2003) *Diffusion of Innovations*, 5th ed., Free Press, New York.
- Ross, C., Terras, M., Warwick, C. and Welsh, A. (2011) 'Enabled backchannel: conference Twitter use by digital humanists', *Journal of Documentation*, Vol. 67, No. 2, pp.214–237.
- Selwyn, N. and Stirling, E. (2016) 'Social media and education... now the dust has settled', *Learning, Media and Technology*, Vol. 41, No. 1, pp.1–5.
- Shabgahi, S. L., Shah, N. A. K. and Cox, A. M. (2013) 'A comparative review of research literature on microblogging use and risk in organizational and educational settings', in *International Conference on Online Communities and Social Computing*, Springer Berlin Heidelberg, pp.174–181.
- Stemler, S. (2001) 'An overview of content analysis', *Practical Assessment, Research and Evaluation*, No. 17 [online] <http://PAREonline.net/getvn.asp?v=7&n=17> (accessed 23 March 2017).
- Sykes, T.A., Venkatesh, V. and Gosain, S. (2009) 'Model of acceptance with peer support: a social network perspective to understand employees' system use', *MIS Quarterly*, Vol. 33, No. 2, pp.371–393.
- Tang, Y. and Hew, K.F. (2017) 'Using Twitter for education: beneficial or simply a waste of time?', *Computers and Education*, Vol. 106, pp.97–118.
- Thames, G. (2009) 'Twitter as an educational tool', *Journal of Child and Adolescent Psychiatric Nursing*, Vol. 22, No. 4, pp.235–235, DOI: 10.1111/j.1744-6171.2009.00208.x.
- Twitter (2016) *Twitter Usage/Company Facts*, 6 July [online] <https://about.twitter.com/company> (accessed 23 March 2017).
- Van Raaij, E.M. and Schepers, J.J. (2008) 'The acceptance and use of a virtual learning environment in China', *Computers and Education*, Vol. 50, No. 3, pp.838–852.
- Van Vooren, C. and Bess, C. (2013) 'Teacher tweets improve achievement for eighth grade science students', *Journal of Education, Informatics and Cybernetics*, Vol. 11, No. 1 [online] [http://www.iiisci.org/journal/CV\\$/sci/pdfs/HHB348DV.pdf](http://www.iiisci.org/journal/CV$/sci/pdfs/HHB348DV.pdf) (accessed 23 March 2017).
- Venkatesh, V. (2000) 'Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model', *Information Systems Research*, Vol. 11, No. 4, pp.342–365.
- Venkatesh, V. and Bala, H. (2008) 'Technology acceptance model 3 and a research agenda on interventions', *Decision Sciences*, Vol. 39, No. 2, pp.273–315.
- Venkatesh, V. and Davis, F.D. (2000) 'A theoretical extension of the technology acceptance model: four longitudinal field studies', *Management Science*, Vol. 46, No. 2, pp.186–204.
- Venkatesh, V. and Morris, M.G. (2000) 'Why don't men ever stop to ask for directions?' Gender, social influence and their role in technology acceptance and usage behavior', *MIS Quarterly*, Vol. 24, No. 1, pp.115–139.
- Verhoeven, J.C., Heerwegh, D. and De Wit, K. (2010) 'Information and communication technologies in the life of university freshmen: an analysis of change', *Computers and Education*, Vol. 55, No. 1, pp.53–66.
- Webster, J. and Martocchio, J.J. (1992) 'Microcomputer playfulness: development of a measure with workplace implications', *MIS Quarterly*, Vol. 16, No. 2, pp.201–226.

- Welch, B.K. and Bonnan-White, J. (2012) 'Twittering to increase student engagement in the university classroom', *Knowledge Management & E-Learning: An International Journal*, Vol. 4, No. 3, pp.325–345.
- Wright, N. (2010) 'Twittering in teacher education: reflecting on practicum experiences', *Open Learning: The Journal of Open, Distance and e-Learning*, Vol. 25, No. 3, pp.259–265, DOI: 10.1080/02680513.2010.512102.
- Yin, R.K. (2008) *Case Study Research: Design and Methods*, Sage Publications, Thousand Oaks, CA.
- Zappavigna, M. (2011) 'Ambient affiliation: a linguistic perspective on Twitter', *New Media and Society*, Vol. 13, No. 5, pp.788–806.