Facilitating a Hybrid College-level Course Using Microblogging: A Case Study

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Abstract

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Social media has become an increasingly growing phenomenon that arouses mounting interest as well as heated discussion concerning its varied definitions and practices for academic use. Recently, a common type of social media, microblogging tools such as Twitter, has garnered researchers and educators' mounting attention due to its prevailing usage among the younger generation. This study seeks to both examine student learning in the Twitter-supported learning environments and to understand the potential factors affecting student perceptions and participation.

The researcher incorporated three major Twitter-based instructional activities into a hybrid course, namely, Exploring Hashtags, Discussion Topics, and Live Chats. Twitter was employed as a backchannel to enhance classroom interaction during lectures and student presentations in face-to-face settings. The participants were 24 college-level Teacher Education program students enrolled in a technology course at a large Midwestern University. Major data sources included student posts on Twitter, end-of-the course survey, and in-depth semi-structured interviews.

The findings of the study suggest that Twitter, serving as an instructional technology platform to facilitate student learning, was able to engage student in reflective and meaningful knowledge creation. Student participation was active and relevant, especially in guided environments. Student perception on different activities was overall
positive with slight variations in the Live Chat activity. The four dimensions of factors in the TAM model laid out an appropriate framework, which denoted the critical factors that potentially affect students' perception and participation. Students' prior knowledge and experience with Twitter stands out to be the most prominent factor influencing their perception and participation in these tweeting activities.
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Chapter 1: Introduction

This research concerns the use of microblogging in a hybrid college-level course.

The last decade has witnessed an inconvertible growth in web access and a significant change in the nature of the web. Since 2008, 98% of all U.S. classrooms have had Internet access (National Center for Education Statistics, 2011). In terms of home access, 90% of home computers have connected to broadband Internet according to a national survey done in 2012 (Leichtman Research Group, 2012). Meanwhile, 90% of school-age youngsters (aged 12 to 17) have access to the Internet, which represents the largest and fastest-growing group of Internet users (Lenhart, Arafeh, Smith, & Macgill, 2008). As web access has become more widespread, the nature of the web changed tremendously.

Decades ago, the first generation of the web, referred to as Web 1.0, was mainly concerned with a one-way, top-down information flow in which information was withheld and controlled largely by a small number of content providers (Cormode & Krishnamurthy, 2008). The majority of web users in the web 1.0 age only browsed, read, and obtained information individually through an unidirectional approach, but had nearly no access to edit or create content on the web, nor did they have ample opportunities to connect with other web users. The new Web 2.0 technologies, a term coined in 2004 by Tim O'Reilly, characterize a transition from a predominantly one-way communication-oriented Web 1.0 into a two-way communication model in which users can not only access information from the web, but more importantly, they can create, publish content, and share with others on the web (Greenhow, Robelia, & Hughes, 2009).
These advances in Internet accessibility and the transition in the nature of the web have transformed people's contexts for learning and drawn educators' and researchers' attention on how to best learn *with and through* these emerging technologies. According to results from the Pew Research Center's Internet & American Life Project, 60% of Americans read prolonged content such as books, magazines or newspapers online, 47% of whom were between the ages of 16 and 29 (Zickuhr, Rainie, Purcell, Madden, & Brenner, 2012, p. 15). As these social and interactive media permeate young adults in all walks of life, young learners are constantly engaged in an online inquiry and participation process in which they create their own content and share with others on the web (Lenhart et al., 2011). With these interactive and collaborative activities, researchers posit that this constant and ongoing contact with social media and online communication has evolved into a daily routine and suggests an in-depth exploration of language, social interaction, and various self-directed activity that denotes multifaceted forms of learning (Ito et al., 2010).

In the meantime, throughout the K-12 and higher educational systems, varied forms of online learning have started to pervade both formal and informal learning environments. A majority of secondary schools teachers witnessed students' predominant use of digital search tools and believed that these tools help students find information quickly and easily, and therefore have a positive impact on their students’ research work (Purcell et al., 2012). According to the Sloan Consortium, an institutional and professional leadership organization committed to online learning in higher education, more than 6.1 million college students were taking a minimum of one online course in
Fall semester 2010. This shows an increase of 560,000 students compared to the previous year (Allen & Seaman, 2011). It is also the case that across various majors and grade-levels, 31% of college students have taken at least one course online (Allen & Seaman, 2011). In another Pew Research Center survey, 60% of technology stakeholders concurred that the future of higher education will radically differ from how it is today (Anderson, Boyles, & Rainie, 2012, p. 4). These differences entail new ways of teaching and certification, widespread adoption of teleconferencing and distance learning, and a transition to hybrid formatting of classes that will mix online learning elements with face-to-face meetings.

Among all the Web 2.0 social technologies that carry weight in affording various interconnections, content creation and developing interactivity between online users, microblogging is an emergent tool that holds potential to revitalize the classroom dynamic (Elavsky et al., 2011; Holotescu & Grosseck, 2009; Junco et al., 2013). It is a lightweight online blogging tool that allows a small amount of text-based content (less than 140 characters) to be published on the user’s profile page and shared with the rest of the world (Java et al., 2007). Researchers consistently found that microblogging can help promote conversations both in and outside of the classroom (Ebner, et al., 2010; Junco et al., 2013). In a face-to-face classroom, microblogging is often adopted as a facilitating, virtual backchannel enabled at the backstage of the classroom, to enhance student interaction and engagement simultaneously with the class lecture (Elavsky et al., 2011). Recently, microblogging has been found to be beneficial in facilitating online courses to motivate student learning and to enhance social presence (Hsu & Ching, 2012; Kop,
2011; Pauschenwein & Sfiri, 2010). Educators can incorporate the use of microblogging in different manners to adapt their instruction and facilitate the achievement of different learning objectives.

**Statement of Problem**

As the surge of social technologies and social media has pervaded youth's lives over the years, more and more educators and researchers have acknowledged the communication and interaction between individuals on these youth's everyday communication platforms can in some instances be used as an instructional aide in education (Craig, 2007). Microblogging, as an exemplar of these tools, could be used as an instructional technique in undergraduate education settings aiming to promote the principles of good teaching practices; however, little is understood about this form of instruction.

In the 21st century, higher education is often questioned concerning how well it delivers on its promise of providing meaningful and worthwhile learning experiences that engage learners and fulfill the overall needs of society. Many scholars and educators have seen mounting challenges that higher education is facing today and have accordingly called for revolutionary change (Hacker, 2010). Quoted from Swail (2002), “the rules are changing, and there is an increased pressure on institution of higher education to evolve, adapt, or desist” (p. 16). In fact, in the early ages, Chickering and Gamson (1987) posited *Seven Principles of Good Practices of Undergraduate Education*, many of which are still valid today, although they are often not well practiced or adopted in today's higher education. Those that are considered good practices, such as encouraging frequent
student-faculty contact, providing timely feedback for students, and promoting active learning and cooperation among students, are often found lacking in many undergraduate-level courses (Hacker, 2010).

Additionally, as many scholars have affirmed, the ways in which students learn have dramatically changed with the proliferation of information and communication technologies (Bransford, Brown, & Cocking, 2000). With mounting problems in higher education and changes taking place in the way people choose to learn, these new Web 2.0 technologies are gradually and tentatively being adopted by more and more instructors and institutions (Inoue, 2007; Surry, Stefurak, & Gray, 2011). Many institutions now choose to use live recording technologies to archive professors’ lectures and upload them online for students to review at their own pace (Owston, Lupshenyuk, & Wideman, 2011). Others choose to incorporate various Web 2.0 technologies, such as wikis and blogs, which are adopted to facilitate lecture-based classroom and out-of-class individual learning. Learning management systems (LMS), such as Blackboard and Moodle, are employed to enhance learning in many educational institutions (Unal & Unal, 2010). A hybrid-learning course that uses a blended learning mode, which combines the face-to-face and online components of learning, has become common and many educational institutions have attempted to adopt it on a large scale (Garrison & Vaughan, 2008).

Although the advent of Web 2.0 social technologies has opened up many opportunities for course instruction and delivery, educators often struggle to examine and decide the best type of tool to accommodate specific types of knowledge with learners who display a variety of characteristics. There are still many unknown areas concerning
the use of Web 2.0 social technologies for education (Greenhow et al., 2009). As these researchers noted, "Web 2.0’s affordances of interconnections, content creation and remixing, and interactivity might facilitate an increased research interest in learners’ creative practices, participation, and production—suggesting new ways of thinking about the digital-age competencies we seek to model and facilitate in a range of content areas" (Greenhow et al., 2009, p. 249).

After all, teaching and learning by their nature are affected by an uncountable number of factors that are extremely complex and messy (McDonald, 1991). Research shows that the success of online learning is interrelated with numerous factors, among which social interaction, student participation and engagement, student-teacher interaction, and learners' technological capability all play critical roles in delivering effective online instruction (Conrad & Donaldson, 2011; Haugen, LaBarre, & Melrose, 2001). Understanding how these technologies interact with instructional content, instructional strategies, environmental factors, and characteristics of students and how to optimize student-learning outcomes with these social technologies has become increasingly critical for researchers and educators.

**Purpose of the Study**

Among many technologies that potentially offer benefits when incorporated into educational settings, microblogging seems to hold promise and already contributes to student learning outcomes through multiple means (Elavsky et al., 2011). Due to the boom of Twitter and other microblogging tools, the research on microblogging for use in instruction has started to expand (Kruger-Ross, Waters, & Farwell, 2012). Despite the
enthusiasm for educational microblogging, relevant research studies are rather limited and anecdotal in nature (Gao, Luo, & Zhang, 2012); this is understandable, given that microblogging technologies bloomed only a few years ago. According to the most recent review of research on microblogging in education, most studies that examine learning with microblogging have been conducted in a limited time span (Gao, Luo, & Zhang, 2012). Moreover, findings about microblogging integration in novel learning environments, such as online and hybrid learning environments, are largely unknown. An in-depth and robust research study that details student experiences and perception in a unique hybrid-learning context and is conducted over a longer time span is therefore clearly needed.

This study involves an in-depth examination of students' participation and interaction in the microblogging-supported activities and their perceptions of their experience in a microblogging-supported online class. Through the incorporation of microblogging into a hybrid course, this study seeks to examine the use of this practice as a way of facilitating student learning in both online and face-to-face environments as well as to understand the potential factors affecting student perceptions. The nature of this technology can fundamentally alter the typical communication patterns in the classroom and allow students’ simultaneous participation. How new patterns triggered by microblogging tools disrupt the existing classroom learning paradigm and impact students’ learning outcome is little known in the current literature. This study investigates the variations in student participation and interaction patterns across different types of instructional activities, learning environments, and with different instructional guidance.
modes. After all, the tool in and of itself cannot truly enhance student learning if it is not well integrated with pedagogy (Clark, 1994). Often, it is the interaction between the tool, the instructional methods, and the environmental factors that collectively induces changes in student learning.

**Research Questions**

The primary goal of this study is to explore the possibilities of integrating microblogging into a hybrid course that involves both face-to-face and online content delivery, and how the addition of such integration affects student learning and changes the dynamics in such a class. More specifically, student participation and interaction were measured in order to make inference about student learning. The difference in implementation setting, types of instructional activity, and the degree and types of instructional guidance provided was altered to examine how the changes in these instructional and environmental conditions affect student participation and interaction in microblogging-supported learning. Understanding how effective the pedagogical uses of microblogging in a hybrid course are in different settings (online versus face-to-face environment) and guided modes (guided versus unguided and social versus cognitive guidance) using a comparative study design helps to compare and contrast the impact of those variables and to further determine whether or not variations in its integration manner make a difference to student learning. Students' individual difference in prior use, technological literacy, pre-perceptions of technology integration, and demographic factors were investigated to provide further insights on what additional potential factors may affect students' use of microblogging integration besides the instructional factors. An
examination of those factors can provide a more comprehensive view of the potentials of microblogging integration and guide educators and researchers toward optimized microblogging integration for varying instructional purposes.

The following specific research questions are crafted to guide the research:

1. How did students participate and interact in microblogging-supported learning environments?
   a. How did student participate and interact differently in an online versus a face-to-face environment?
   b. How did student participate and interact differently using a guided versus unguided approach?
   c. How did student participate and interact differently using a social guidance versus cognitive guidance approach?
   d. How did student participate and interact differently across three instructional activities (Exploring Hashtags, Discussing Topics, and Live Chats)?

2. How did students perceive their microblogging-supported learning experience?

3. What factors potentially affect students' perceptions of microblogging integration into instruction?

**Definition of Terms**

To help understand this dissertation, certain terms need to be defined in order to set some boundaries and clarify their particular meanings.

**Backchannel communication** is typically defined as a type of unregulated and unofficial communication that occurs complementarily to the media and interaction that take place...
at the front channel (Cronin, 2011; Kearns, & Frey, 2010). The so-called backchannel is essentially a complimentary channel where learning and interaction extended the traditional physical classroom space. In this study backchannel communication consists of the Twitter-support activities to support lectures and student presentations in the face-to-face meetings, and generally speaking, a venue on Twitter where students and instructor communicate and interact with one another.

**Hybrid course** in this study refers to a regular, college-level class, in which course instruction is predominantly delivered through online means. In this case, it refers to a blended learning model where online learning is primary and face-to-face meetings supplement the online experience. In an online course, course delivery, pedagogy, content, organization, and evaluation could be radically different from a traditional face-to-face class (Orellana, Hudgins, & Simonson, 2009).

**Instructional strategies and methods** are the methods, techniques and strategies that educators use to enhance instruction in their teaching. They are used to teach specific types of knowledge or to reach specific instructional goals. For example, prompting and cueing are scaffolding strategies that provide students implicit guidance in the form of rendering students directive questions (Morrison, Ross, Kemp, & Kalman, 2010).

**Interaction** represents students' active learning in the knowledge construction process from a social constructivism perspective (Berge, 2002; Rourke, Anderson, Garrison, & Archer, 2007). Scholars have categorized different types of interaction, identifying the different stages of knowledge development. (Gao, 2013). In this study, interaction was categorized into six fundamental stages: self-reflection, elaboration/clarification,
alternative/complementary proposal, internalization/appropriation, conflict/disagreement, and support. The categorization of interaction was later used and modified as a coding scheme to code students' tweets. Specification of this coding scheme was further explained and illustrated in Chapter 3.

**Microblogging** is a class of technology that allows users to publish and share brief updates for public view web interfaces and mobile phone applications. Microblogging tools are often seen as an enhancement of blogging tools with add-on social networking features (Ebner, Lienhardt, Rohs, & Meyer, 2010). McFedries (2007) defines it as "a weblog that is restricted to 140 characters per post but is enhanced with social networking facilities" (p. 84); it is a tool that supports immediate communication and fast information exchange among people with similar interest. Well-known microblogging platforms include Twitter, Tumblr, Plurk, Jaiku, Jelly and many more, which all possess the key features of real-time brief message posting and broadcasting. Despite the plurality of existing microblogging platforms, Twitter is the best-known type of microblogging tool being investigated in this case study.

**Participation** in a formal learning context generally refers to the extent to which students participate or involve themselves in class-related activities. Research investigating online learning environments tends to use the quantity of online posting as a parameter of participation (Ebner et al., 2010; Kop, 2011; Wright, 2010). In this particular study it is defined as students' act of posting tweets during the instructional activities. Participation is measured both quantitatively and qualitatively.
Twitter is the first web-based platform that enables microblogging. By far, it is the most popular microblogging platform with over 500 million registered users (Lunden, 2012). In 2012, Twitter became the fastest-growing social platform, attracting a full 5% of online adult users (Smith & Brenner, 2012). Other than possessing all the features that microblogging tools now typically carry, Twitter is also connected to a variety of third-party applications that work in conjunction with it to facilitate displaying and visualizing its data, such as The Archivist, MentionMap, and Visible Tweets (Kilpatrick, 2013).

Table 1 provides a list of Twitter-related terms.

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<tr>
<td>@symbol</td>
<td>Often placed before a Twitter username and/or inserted within a public text message intended to direct a message to an intended user (i.e. @tintinluo)</td>
</tr>
<tr>
<td>Direct Messaging (DM)</td>
<td>To send a private Twitter message to another user. DM is restricted to being sent to the followers of one Twitter user</td>
</tr>
<tr>
<td>Follow</td>
<td>Choosing to opt-in to view another Twitter user’s posts</td>
</tr>
<tr>
<td>Unfollow</td>
<td>Choosing to opt-out to cease viewing another Twitter user’s posts</td>
</tr>
<tr>
<td>Hashtags (#)</td>
<td>Used to categorize tweets on similar topics. Users can insert them into a sentence or place them at the end of a sentence. They can also use them to search and view tweets that include specific hashtag(s)</td>
</tr>
<tr>
<td>Retweet (RT)</td>
<td>Used to republish other Twitter users' posts on your account</td>
</tr>
<tr>
<td>Tweet</td>
<td>As a verb, it means to publish a single microblog post on Twitter; as a noun, it means small bursts of information (140 characters or less) published on Twitter</td>
</tr>
<tr>
<td>Favorite</td>
<td>A feature that allows users to show agreements, positive opinion, or special interest toward particular tweets. It serves the purpose of allowing users' to express emotional responses</td>
</tr>
</tbody>
</table>
Web 2.0 is a generic term referring to a large variety of interactive web-based applications that allow users to create user-generated content and share it with other users on the Internet. Web 2.0 facilitates "participatory, collaborative, and distributed practices within Web 2.0-enabled formal and non-formal spheres of everyday activities" (Greenhow et al., p.247). The classification of Web 2.0 includes social networking tools, such as Facebook and Twitter; media sharing, such as YouTube and Flickr; social bookmarking, such as Delicious and Diggo; and collaborative knowledge creation tools such as wikis. Although the subsets of Web 2.0 tools may not be strictly defined, all those tools embody a user-generated, participatory, interactive, and collaborative content creation enabled by Web 2.0 (Greenhow et al., 2009). In this study, Web 2.0 tools, social technologies, social media, and sometimes social networking tools are used interchangeably despite the fact that those terms may have different semantic focuses when used in alternate contexts.

Limitations

External validity. External validity concerns the question of generalizability, indicating to what population, settings, treatment variables, and measurement variables the results of one study could be generalized (Campbell & Stanley, 1966; Shadish, Cook, & Campbell, 2002). Although this concept is often considered in a quantitative research study, many scholars agree it is of paramount relevance in any research. As a case study, the results and findings of this study tend to be limited to the participants in this case and the context in which this study was conducted (Maxwell, 2009). For example, students with different prior knowledge and experiences of microblogging may react to the idea of
its integration in classrooms differently from those participants in this case study. Findings and extrapolations derived from this group of participants may not be applicable for populations with zero prior knowledge and experiences of microblogging or with populations who had to use Twitter professionally on a daily basis. Although the implications and recommendations from this study can certainly serve and inform readers who are interested in using microblogging for teaching and learning, special caution must be taken, especially when readers attempt to replicate or infer findings from this study to heterogeneous settings.

**Subjectivity of data.** As the primary data, including surveys and interviews attempt to investigate the feelings, beliefs, perceptions, and impressions of human beings, a subjectivity issue cannot be disregarded. The researcher had to analyze the findings based on her own interpretation of empirical data, which unavoidably involves the issue of subjectivity. Since a considerable portion of this study was to investigate the feelings, attitudes, and beliefs that are being self-reported by participants, validity problems may exist because the subjective data may not accurately represent participants’ true feelings. In addition, the validity of the findings could be vulnerable to error due to social desirability bias, which is the propensity of respondents to answer questions in a socially-agreeable and acceptable manner (Crowne & Marlowe, 1960). In other words, participants during the inquiry process may have changed their account and descriptions to appear more socially acceptable. In this study, theoretical constructs in the Technology Adoption Model (the TAM model) serve as a framework to guide the interview questions, mapping out four types of determinants that potentially affect students' perceptions of and
participation in the microblogging integration. Despite of the fact that the TAM model was indeed not directly employed, using those theoretical constructs in the TAM model helps to reduce the subjectivity of qualitative data.

**Researcher bias.** Often times in case studies, a researcher’s own interpretations can impact the way that data is collected and analyzed. This study would not be exempt from researcher bias because it was conducted by a researcher who believes in the value of microblogging, both instructionally and personally. The researcher’s presuppositions and preconceptions could unintentionally affect the results of the study. Although the researcher assumed that there would be no concurrent events that confound the results of this study, chances could not be absolutely eliminated. As the researcher is also the instructor of the class, a potential threat to the study’s validity and reliability is that participants may report and answer questions in a manner that they believe to be favorable to the teacher either consciously or unconsciously.

**Delimitations**

The research questions and participant selection are based upon the goal of the research, to investigate the possibilities of using microblogging as an instructional tool to optimize student learning in a hybrid class. Purely face-to-face or online learning environments, students from a different group, and a hybrid classes where the instructor is opposed to microblogging integration were excluded from this study. Indeed, the case in and of itself has to be distinct and unique to meet the criteria of the case selection and therefore, it would not be indicative of any class that does not carry similar characteristics of this specific case.
Specifically, the research participants were undergraduate students who were young adults enrolled in an online course in a large Midwestern university. As students were participating in this research on a voluntary basis rather than from random sampling, the findings from these participants may not be generalized into other groups of students. The case study is also restricted in the specific context of the online course. As the goals and objectives of course and the demands of technology in each online learning environment vary considerably, students in other online settings or non-online courses may not have the same experiences as the participants of this study and therefore their perceptions may not resemble each other.

Additionally, the instructional activities that involve the use of microblogging are limited in the sense that they had to meet the goals of the curriculum and be within the instructor’s comfort zone to carrying them out in the class. In this study, the instructor used microblogging as a supplemental learning management tool to send out class reminders, announcements, and post links and resources on related instructional topics. More interestingly, microblogging was utilized to support learning of concepts, practical skills and critical thinking in lectures and discussion-based activities. Microblogging was further employed to support multiple collaborative learning activities throughout the entire semester. The implications and insights of this study may limit to the types of instructional activities in which microblogging served as a facilitating role.
Chapter 2: Literature Review

Introduction

To study the integration of microblogging in an online class, it is imperative to understand the literature from both theoretical and empirical perspectives. Microblogs, as a major subset of Web 2.0 technologies, possess both characteristics as a social networking technology and personal learning technology. The integration of such tools facilitates, yet complicates, the traditional classroom-learning environment. In in-classroom learning, teachers may transform their conventional pedagogical practices by using microblogging to enhance the delivery of their instruction; outside of a classroom setting, students can use microblogging to contribute to informal learning. An understanding of the tool, the hybrid course learning environment, the pedagogy used in classroom learning, and how microblogging contributes to in-class and after-classroom learning are all essential elements of this study.

The literature review section provides a theoretical framework, background information, and empirical evidence that underpins and supports the integration of microblogging in the context of this study. First, constructivist learning theory, social constructivist learning theory in particular, and the newly-emergent connectivism theory lay the foundation for this study on the grounds that the use of microblogging tools in learning is derived from constructivist and connectivist perspectives. Second, the term, online learning is analyzed and elaborated upon in this chapter since the majority of instruction in this case study was delivered in an online learning environment. The characteristics of online learning, factors that affect online learning, and assessment of
online learning are enunciated. Many related concepts, such as blended learning, online courses, online environments, and online learning communities are defined to provide contextual information in this study. Third, the use of the microblogging tool, Twitter is introduced in great length. How Twitter functions, namely, how it is used by individuals, organizations, and businesses is explained in this chapter. Along with its general use, a meta-analysis of empirical research studies on the use of microblogging in education is conducted to inform the possibilities as well as the challenges of using Twitter educationally. Since the microblogging integration in this study was chosen to be implemented primarily as a form of backchannel communication supported by varying degrees of instructional guidance, a discussion on the notion of backchannel communication and empirical research studies on the effects of instructional guidance are then included in this literature review. The TAM model, which is used as an underlying model to understand factors that influence students' perceptions, is also discussed in detail.

**Learning Theories**

**Constructivism.** Constructivist learning theory fundamentally sets the theoretical groundwork for this study. Constructivism as a paradigm shift postulates that people’s view of learning changes from a relatively passive to a more active, creative, and self-regulatory process (Fosnot, 1996). It posits that learning occurs through learners’ active construction of meaning using the information given. Learning resides in learners' own construction and interpretation of the learning materials presented to them. Constructivism learning theories provide multiple implications for online learning. In the
late 1990s when the Internet started to boom, researchers posited that constructivist learning theories would be well applicable in online learning environments (Conceicao-Runlee & Daley, 1998).

At the crux of constructivism, it is suggested that students should be provided with ample opportunities and appropriate facilitation to construct their own knowledge. The provision of instruction should be interactive so that it can motivate students to learn proactively and encourage learners to interact with other students and the instructor (Murphy & Cifuentes, 2001). The incorporation of modern technologies of any sort, either traditional computer technologies like laptop computers or most prevailing new media technologies, can be understood from a constructivist point of view (Fox-Turnbull & Snape, 2011). These technologies essentially align with implications in constructivist learning on the grounds that they can be used for the creation of student self-constructed knowledge building; for example, via a blog entry, a video presentation, or some web pages. A single tweet, despite of its brevity in its content and spontaneity in time, could be a self-constructed product from a learner, and thus in turn an actual representation and demonstration of student learning. In essence, the encouragement of using such technologies echoes the core notions of constructivist learning (Payne, 2009).

Constructivism implies that learners should be given sufficient time and opportunity to reflect. Researchers believed that reflections and metacognition are crucial to the construction of knowledge and meaning (Walker, 2002). Learners need to take the time to reflect on their own learning in order to internalize the information learned. Questions and prompts on the learning content can be asked throughout the class as forms
of formative assessments to encourage reflection. Additionally, reflection can take the form of a learning journal through which students write and reflect on the processes and outcomes of their own learning. A wide variety of Web 2.0 technologies, such as blogs, a simple personal website that enables diary writing, are constantly adopted in classrooms for such reflection practices (Yang, 2009). Recently, microblogs was also found to support such endeavors and received welcoming responses (Rinaldo, Tapp & Laverie, 2011; Wright, 2010).

Researchers believe that an understanding of the essential constructivist theories is necessary for educators due to the increased use of technological applications to support teaching and learning (Jelfs & Colbourn, 2002). A grasp of the implications for constructivist learning can help teachers better integrate technology use in learning environments. Gold (2001) indicated a positive correlation between instructors’ understanding of constructivist learning and their potential implementation of new technologies into teaching.

Social constructivism. Social constructivist learning theory, as one major strand of constructivist learning theory, focuses on the social aspect of learning, rather than considering learning as an individual endeavor of knowledge construction. Social constructivists hold that social interaction, in which dialogues allow learners to actively construct and organize knowledge, is fundamentally critical in the process of cognitive development (Vygotsky, 1978). Vygotsky believes that the connections between learners and the sociocultural context where they act and interact in common experiences are critically important to achieving learning (Crawford, 1996). In other words, learning does
not occur in individuals' minds; instead, learning is more likely to occur when learners place themselves in a social environment where they can interact and socially construct meaning in collaboration with others.

The crux of social constructivist learning theory lies in the importance of social interaction in human learning. Particularly in an information age, the Internet fundamentally evolves people’s day-to-day social environment and advances it further to an online community with which people live their lives. Web-based technologies allow users to be virtually connected and afford a shared virtual territory on the Internet in which learners can interact and collaborate. Being contextualized in this connected environment afforded by web technologies creates more learning opportunities for the learner. Thanks to web-based technology, learners become active knowledge creators who shoulder responsibilities for constructing their learning experience online (Conrad & Donaldson, 2004). As to educators, employing and leveraging various online technologies to enhance interaction becomes markedly critical.

Different types of interaction can promote learning from different aspects. At a lower level, there exist non-human interactions in which learners interact with the learning interface and the learning content (Berge, 2002). At a higher level, social interaction takes place between learners, instructors and experts. (Rourke, Anderson, Garrison, & Archer, 2007). Technologies often play an important role in facilitating such high-level social interactions.

The microblogging integration into an academic course can help learners embark on their learning through a social-constructivist approach. In a constructivist classroom,
learners are provided with multiple opportunities to engage the learning materials and therefore promote learner-content interaction. Through the virtual classroom space expanded by microblogging, students are equipped with an additional participatory territory where active and meaningful learning can take place in concurrence with the instructor’s real-time lecturing as well as in students’ leisure time after class. Such an expanded learning environment beyond the regular face-to-face classroom can largely enhance learner-to-learner, learner-to-instructor, and instructor-to-learner interactions. Epidemic microblogging tools like Twitter brings in an entire Twitter-based online professional community where numerous experts and professionals congregate to share information and ideas in real time, which allows possibilities for learner-to-expert interactions.

Situated learning. Similar to social constructivist perspectives, situated learning stresses the social and physical contexts in which learning occurs. Situated learning theory suggests that learning emerges from learners’ social experiences, interwoven with the cognitive, physical, and cultural nature of the activity (Lave & Wenger, 1991). In order to have a full grasp of concepts, learners must learn and apply them in the social and physical environments in which they are situated (Brown, Collins & Duguid, 1989). The process of situating learning in a certain context is necessary and critical as the process is modeled and transferred to other activities in which meanings are negotiated and therefore constructed by the learners. The social and situated component of learning becomes a critical element for learning to occur.
The underlying pivotal notion of situated learning in combination with social constructivism theory is to understand learning as a collectively and socially engaged course of action rather than a solitary one. It places a crucial emphasis on the social environment and mechanism in which individual learners have the ability to collectively and collaboratively learn with others. Through this mechanism, learners are able to construct their own understanding of the information in collaboration with other people. Additionally, Turnbull (2002) posited that reflecting authentic and practical technological experience is critical for technology education within the classroom. Understanding technological processes is conducive to actively engagement in social interaction and learning practice.

Considering microblogging as a physical and social mechanism through which learning is to take place and under which learning is situated and matters with regards to design of instruction, is of critical interest to educators. The integration of microblogging can play varying roles in facilitating the situating process. More often than not, microblogging is used to provide a natural platform to maximize the opportunity for participation in presentations and lecturing (Elavsky et al., 2011; Ross, Terras, Warwick, & Welsh, 2011). In other cases, microblogging can be creatively embedded in an educational activity specifically designed to achieve particular educational goals. For example, games and activities aimed at enhancing student second-language communicative competence can be designed to situate within the microblogging platform (Borau, Ullrich, Feng, & Shen, 2009; Perifanou, 2009).
The pedagogical implication of learning theories including constructivist learning theory, social constructivism and situated learning is that students are to be provided with tools, means and facilitations to assimilate, internalize, and construct their own meaning rather than merely cramming information into their heads. Microblogs, such as Twitter, have great potential to facilitate this overall knowledge construction process and/or be integrated into any specific segment of the process through various means and manners.

**Connectivism.** Connectivism theory is viewed as another paradigm shift in educational theory, which is a newly emerging learning theory based upon new premises about learning that fits the needs of the 21st century. Connectivism is a learning theory that recognizes the networked society that we live in the digital age and how the characteristics of this digital and networked society impacts human knowledge acquisition. The theory builds on ideas that have emerged since the introduction of widespread interaction and access to information through the Internet and is underpinned by complexity theory (Siemens, 2004).

Connectivists first proposed the theory by recognizing how quickly the knowledge of today has grown in comparison to that of half a few decades ago. Gonzalez (2004) coined the word *half-life* of knowledge, which refers to the quickly-shrinking time span from when knowledge is acquired until it becomes obsolete. With the boom of web technologies, knowledge is growing at such a phenomenal speed that it sometimes even loses its value by the time it is fully grasped. Web-publishing tools have equipped humans with instant publishing abilities, in contrast to the old media age when it took days, weeks, or months for something to appear in the public's view. The half-life of
knowledge suggests that learning occurs in a diverse manner and it is a continual process that lasts lifetimes. Knowledge nowadays exists in databases, blogs, video, and numerous other information channels. Learning is so decentralized that it does not have to occur in professional institutions or from individuals with expertise; it occurs in a distributed network that connects to anyone and any organization within that network (Davis, Edmunds, & Kelly-Bateman, 2008).

Connectivists presume that learning occurs not only inside of an individual person's brain; instead, it could often occur along with technology integration outside of people, such as when it is stored and manipulated by technology. The founder of Connectivism, Siemens (2004) stated that "Learning is a process that occurs within nebulous environments of shifting core elements - not entirely under the control of the individual (p. 5)." Simply put, Connectivism is a theory that considers the interrelation of people, organizations and technology and how this composite collaboratively constructs knowledge. In Siemens's words, Connectivism is a new learning model that "acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity" (p. 5).

Based on the above premises and definitions, Siemens (2004) posits the following principles of Connectivism:

- "Learning and knowledge rest in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known."
• Nurturing and maintaining connections is needed to facilitate continual learning.

• Ability to see connections between fields, ideas, and concepts is a core skill.

• Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

• Decision-making itself is a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision” (Siemens, 2004, p. 5).

Connectivism as a learning theory for the digital age advocates to examining learning as a continual process within a complex technology-enhanced environment. The essence of Connectivism is to understand that learning in the digital age is largely enhanced through unlimited new connections supported by technologies within the networked society, thus generating new and ever-changing interpretations and understandings for new knowledge construction (Starkey, 2012). The notion of Connectivism itself has evolved continually due to a variety of educators and researchers' discussions and debate of the theory through open online networks including blogs and microblogs. Above all, Connectivists advocates that "learning does not occur in a single environment; instead, it is distributed across the web, and people's engagement with it constitutes learning" (Kop, 2011, p. 20).

**Interconnection among theories.** The theories discussed above provide theoretical underpinnings for the implementation of microblogging-based activities of this study. Constructivism serves as an overarching theoretical framework that is
fundamentally connected with and supported its subsets, theories of social constructivism and situated learning. While all three theories acknowledge the pivotal role of students' prior knowledge, social interaction, and collaboration, social constructivism and situated learning theories place a further emphasis on the social aspect of student learning and therefore more strongly underpin the use of social technologies such as Twitter. These three theories collectively guided the design of the Twitter-supported activities in this study, including exploring educational hashtags, holding discussions, backchanneling, and participating in live chats. Connectivism, as an emerging theory that specifically recognizes the networked society and digital age where we live in, again echoes with the idea of bringing students into Twitter live chats as a real-world experience where educational professionals from all over world converge, connect, and communicate. The concept map in Appendix A shows the interwoven relationship of theories and Twitter-supported activities.

**Online Learning**

While the earliest face of online learning, distance education, has existed for merely a few decades, the evolution of online learning has been growing exponentially in the higher education field. Driven by economic, social, and technological changes of the digital era, online learning has been rapidly taking the place of traditional face-to-face classroom learning and becoming one of the most promising practices in higher education (Rudestam & Schoenholtz-Read, 2010). Owing to limited classroom space and increasing student enrollments, a plethora of colleges and universities have begun to consider and implement online learning in the format of online courses and programs. According to the
latest Survey of Online Learning from Sloan Consortium, the number of students taking one online course at the minimum has now reached 6.7 million (Blair, 2013). Presumably, online learning may eventually be the new educational norm in the future.

**Characteristics of online learning.** The term online learning is often used interchangeably with e-learning, Internet learning, distributed learning, networked learning, virtual learning, computer-assisted learning, web-based learning, distance learning and so on (Anohina, 2005). As all these terminologies imply, online learning encompasses the use of a wide variety of electronic media and information and communication technologies to achieve educational purposes. Essentially, in online environments, the learners and the instructor are often geographically isolated; the instructor delivers the instruction via some form of online delivery platforms and the learners on the other end access learning materials and interact with the instructor through the same virtual means (Anderson, 2008).

Online learning is often characterized as a flexible mode of learning as it allows for flexibility and easy access to learning materials from anywhere and usually at any time. In comparison to traditional face-to-face learning environments, such a level of flexibility and free access to vast amounts of information is powerful and unimaginable (Sitzmann, Kraiger, Stewart, & Wisher, 2006). Essentially, online learning enables learners to collapse geographical and temporal barriers and be able to access the most up-to-date and relevant learning materials ubiquitously (Driscoll, Jicha, Hunt, Tichavsky, & Thompson, 2012). Particularly in asynchronous online environments, learners have the free option to learn at their own pace. Using synchronous means, learners are able to
interact with experts in the field. With multiple web technologies, learners are equipped with abilities to review, revisit the challenging portions of learning materials and study at their most comfortable time and place.

Online learning can cater to a diverse group of learners. In a traditional classroom setting, typically the instructor's lecturing dominates the conversation of the classroom and students' characteristics and learning styles play minimal roles. Contrastingly, the use of multimedia and assistive technologies can align with the learner's characteristics and support their varying needs using a wide variety of different media platforms (Cheng, 2010). Additionally, the online environment provides a more comfortable space for participation among reticent students. Students who are intimidated by face-to-face classroom interaction are then given advantageous opportunities to have a voice for themselves (Clark-Ibáñez & Scott, 2008).

Another characteristic is that well-designed online learning is often student-centered. In an environment where instructors are absent and usually not able to provide immediate feedback, learners are required to be responsible for their own learning and are pushed to take initiative in the learning process (Logan, Augustyniak, & Alison, 2002). Active learning tends to take place more often when students are relatively more self-motivated and self-regulated, as they are required to participate directly in active knowledge construction and provided with affluent support to reach autonomous learning. As Driscoll et al. (2012) concluded, "Although such student-centered, active learning is certainly possible and does occur in well-designed F2F courses, the remote
nature of online education creates a structural impetus for this style of learning that is not automatically present in F2F classrooms” (p. 314).

**Different format of online learning.** Online learning can take shape in a wide variety of means. It has the potential to be used in many different ways and support different levels of learning, depending on how much online content and learning process occurs in online learning environments. Online learning can be classified using varying dimensions. Researchers tend to classify it based upon (a) the extent to which online learning activities are primarily synchronous or asynchronous; (b) whether the online instruction serves as a replacement for or an enhancement to traditional face-to-face instruction, and (c) the different types of learning experience and pedagogical approach (Bach, Haynes, & Smith, 2007). Each dimension is described in more detail below.

Whether or not online learning is synchronous or asynchronous depends on the degree of time delay between the presentation of instructional stimuli and student responses. If time lag in the online learning environment is minimal, such as in video conferencing and chat room environments where learners receive instant or immediate feedback, it is considered synchronous. In contrast, in asynchronous online learning environments the time lag that occurs between interactions is drastically longer. Tools such as emails and discussion forums are used in asynchronous learning as students can learn at their convenience and immediate responses are neither expected nor mandated.

Online learning is often classified according to its objective. Some forms of online learning serve as a replacement for face-to-face instruction while others serve as an enhancement or it is supplementary to face-to-face instruction. When it is used as a
course enhancement, it is typically via a simple application of online learning materials or certain instructional events and activities that occur in an online environment. For example, this could simply be the use of a course management system that distributes course materials and carries out course administration; it can be a gateway that directs students to additional online materials; or use an online communication platform to enable students and outside experts’ interactions and collaboration. Online learning can take the place of face-to-face instruction in the form of a blended or completely online course.

**Online course.** An online course is a type of online learning where the learning unit is delivered completely online with little or no face-to-face contact. Online courses are often offered by universities and associated with degree programs. More and more universities have started to offer degree programs through online courses only. The most major difference between online courses and face-to-face courses is the delivery method of instruction (Arsham, 2002). While learning content remains the same in general, the way it is delivered changes from a direct synchronous manner to a mediated, often asynchronous manner. Using a variety of web tools, students can learn anywhere and anytime through the Internet. Learner and instructor interaction can occur through asynchronous communication such as discussion forums or synchronous communication such as videoconference programs (Zi-Gang, 2012). Virtual office hours can be held through online synchronous platforms such as video conferencing and live chat programs as well. In recent years, massive open online courses (MOOC), as an emerging type of online course aiming at grand-scale participation and open access through the web, has
attracted significant attention from both researchers and educators (Clara & Barbera, 2013; Kop, 2011).

**Hybrid course.** Another major form of online learning is hybrid courses, which is a blended learning model that combines online and face-to-face instruction. Although the proportion of online or face-to-face instruction varies in specific settings, blended or hybrid learning takes place when a certain percentage of the program occurs in a face-to-face mode and the rest occurs online (Shivetts, 2011). In higher education, blended learning has become an increasingly popular learning approach that many institutions have started to adopt (Bonk, Kim & Zeng, 2005). As early as 2003, survey results revealed that 80% of higher education institutes offered blended leaning courses (Arabasz & Baker, 2003). According to current research studies, the benefits of hybrid courses that use the blended learning model are plentiful, among which are combining guidance and self-directed learning, integrated face-to-face instruction with online learning, and the opportunity to maximize the potentials of enabling a community of inquiry (Kamolbhan & Julian, 2006; Usova, 2011). These benefits are all pivotal to transforming and improving current practices in higher education.

**Best practices in online learning.** Previous research studies manifested that a variety of factors can influence students’ perception of their online learning experiences, including course design, comfort with online technologies, motivation of the learner, instructors’ facilitation, affective response, sense of community, and social presence. Being consistent in course design, maintaining an ongoing interaction with instructors, pursuing a student-centered discussion, allowing opportunities to communicate with
teachers and peers online, and providing adequate training to use necessary technologies are found to be conducive to online learning (Schramm, Wagner, & Werner, 2000; Swan et al., 2000). In contrast, large class size, lack of immediacy in responses, lack of instructor-student and student-student interaction, and lack of a sense of community can impair online learning (Essex & Cagiltay, 2001; Hara & Kling, 2000; Vonderwell, 2003).

Researchers believe that enhancing instructor and learner communication is critical to the success of online learning (Berry, 2009; Keramidas, Ludlow, Collins, & Baird, 2007), which echoes the first principle in the Seven Principles for Good Practice in Undergraduate Education (Chickering & Gamson, 1987). To promote instructor and learner communication, trust and enabling a sense of community are critical and should be continually established through personalized communication (Elison-Bowers, Sand, Barlow, & Wing, 2011). This personalized communication can take the form of personal and emotional messages and comments, or delivering a message of concern and offering study tips (Berry, 2009). Such personalized means of communication can help establish an instructor-student relationship by showing sincere care and concerns from a teacher, which can eventually provide students with substantial support not only intellectually, but emotionally also. Timeliness of instructor and learner communication also plays an important role in establishing a strong connection between instructor and learner. A lack of immediacy in responses and lack of interaction between instructor and student can harm students' perceived learning experiences (Vonderwell, 2003). Previous studies noted that students in online environments preferred to receive synchronous and prompt
feedback for their inquiries and questions (Ahren, 2005; Chang, 2011; Sitzman & Leners, 2006).

Along the same line of instructor and learner communication, the level of interaction among learners has been predictive of the degree of perceived learning in online courses (Rovai & Barnum, 2003). With higher amounts of peer interaction, students are more likely to be focused on the learning subject, which lays the foundation for promoting critical thinking and reaching higher levels of learning (Driscoll et al., 2012). In addition, learner-to-learner communication also provides conditions for social and collaborative learning. According to the social constructivists, learning resides in learners' social interactions rather than individual endeavors. Social interactions are especially important in building a community. In online environments where learners are at a distance from each other, learner-to-learner communication needs to be supported through both synchronous and asynchronous communication tools and diverse types of learning task and activities. In being engaged students in activities that promote learning and learner communication, such as peer reviewing activities, students can benefit from the engaged social interaction and learn from each other’s thoughts and insights (Nagel & Kotze, 2010).

**An Introduction to Twitter and Microblogging**

"Microblogging has become an increasingly popular phenomenon since Twitter was launched in 2006" (Gao et al., 2012, p. 783). By far, it is the most popular microblogging platform with over 500 million registered users (Lunden, 2012). In 2012, Twitter became the fastest-growing social platform, attracting 5% of online adult users
(Smith & Brenner, 2012). To date, Twitter's global traffic rank topped #10, according to Alexa, a notable website that provides commercial web traffic data. It is astonishing that Twitter thrust itself into public view only a few years ago and now has become a worldwide phenomenon.

**How Twitter works?** The simplest tasks one can do on Twitter is to post tweets and read other people's tweets, which are the most typical features that microblogging tools have. By signing up and logging onto the Twitter website, users on Twitter are able to publish and share their brief updates of no more than 140 characters (called tweets) with millions of people in the Twitter community. By subscribing to any other Twitter user's posts, which is called follow in Twitter terms, users can create a personalized live stream of feeds that shows the recent tweets of all individuals he or she is following.

Additionally, using a pound sign (#), which is called hashtag, as a keyword classifier, users are able to search for and explore tweets or join a conversation on similar topics. Users can also use the @ symbol before a Twitter username and/or insert it within a public post so that conversations can be directed to the intended user. Users can reply or repost each other's posts, among which the second is called a retweet in the Twitter domain of language. Through these simple actions of tweeting, following, searching for hashtags, replying, and retweeting, interactions and collaborations can take place among people from virtually any corner of the world (Java et al., 2007).

Other than possessing all the features that microblogging tools typically carry, users can employ a wide variety of third-party applications that work in conjunction with Twitter to largely leverage their Twitter experiences. In fact, part of the appeal of Twitter
is that it is linked to varying applications that make posting, sharing, tracking, monitoring, and the entire Twitter experience extremely fun and easy-to-do (Morris, 2009). For example, rather than having to refresh the Twitter page over and over again, a third-party application, such as TweetDeck or Twitterific, easily fetches the tweets from a user's account and display them on a dashboard. Users can manage Twitter easily on their desktop and receive alerts sent from these tools when other people respond to their tweets. Tools such as TwitVid and Twitpic enable users to break off the limit of text-based content and incorporate multimedia including images and pictures into the Twitter sphere, which makes posting a picture or video and sharing it on Twitter markedly effortless. In addition, Twitter is connected to other types of third-party applications that facilitate displaying and visualizing its data, such as The Archivist, MentionMap, and Visible Tweets (Kilpatrick, 2013). These visualizations tools are constantly utilized in live events such as conferences to enrich and benefit attendees' conference experiences.

**What can Twitter do?** Twitter can be used in numerous ways to reach different purposes. Although inherently it is a simple social networking tool that could bring people together, it provides infinite opportunities for both individuals and organizations to be able to achieve a wide variety of tasks and accomplishments. O'Reilly and Milstein (2011) categorized the use of Twitter into four strings: to listen in, to hold great conversation, to share information and ideas, and to reveal yourself. Diaz-Ortiz and Stone (2011) crafted "a T.W.E.E.T. framework" (p. 12), which means to target, write, engage, explore, and track. Based on these pre-established frameworks, three commonly used
words, to search, to connect, and to share, are used to briefly explain and summarize what people can do with Twitter.

**To search.** O'Reilly and Milstein (2011) called Twitter "a goldmine of ideas, feelings and conversations" (p. 65). On Twitter users can find the latest news and the greatest ideas because it is often where people talk about the most recent matter that happened and the most inspirational thoughts and sparks that have in mind (O'Reilly & Milstein, 2011). In some sense being on Twitter is similar to being on Google search engine; users can search for almost anything they want. Users certainly would not reach the level of breath and depth that Google affords, but the power of Twitter lies in that when using Twitter search, users can actually "read people’s thoughts and [are granted] the ability to overhear conversations as if you were a fly on the wall" (p. 65).

**To connect.** Twitter is a place about connections. Although it can simply be a broadcast medium, its major role is a discussion and networking channel that engages millions of people from all over the world at any time anywhere. A study revealed that of 1.2 billion tweets that were collected in two months, 29% generated a reaction in the form of a reply or a retweet; 92.4% of all retweets occurred within the first hour of when the original tweet was published (Sysomos Inc., 2010). What distinguishes Twitter from other social media is that it maximizes the chances to connect, as it allows users to reach a markedly-wider audience than ever before through their 500-million user base. Another unique means that users connect through is by developing an ambient intimacy (O'Reilly & Milstein, 2011). As users are constantly updating their statuses, which could seemingly be mundane and uninteresting, there is in fact a lightweight but meaningful type of
connection that occurs within the user's network, often silently and unnoticed. This ambient connection lays the groundwork and provides the virtual base for meaningful and continuous communication to occur on the Twitter platform.

**To share.** Twitter is superb for sharing information and ideas. It has become one of the information repertories that are purely based on user-generated content. In June 2012, the Twitter CEO stated that Twitter hits 400 million tweets per day (Farber, 2012). More surprisingly, by the end of October, he revealed that the number of tweets was skyrocketing as Twitter had generated half a billion tweets daily (Martinez, 2012). When everyone on Twitter is sharing tweets, it can be so powerful that the information can be disseminated to anywhere possible in the world within seconds of time. In times of emergency, Twitter plays a heroic role that actually saves lives. In both Haiti and Japan's natural disasters, Twitter served as a real-time information channel that broadcasted the latest updates of the disasters because everyone was sharing about whatever they knew about the events (Diaz-Ortiz & Stone, 2011).

**Twitter use outside of education.** Twitter is often strategically utilized by organizations and businesses. Many organizations such as non-profits and religious groups use Twitter to build an online community where members can connect and communicate, which creates infinite possibilities of engagement beyond the online sphere (Diaz-Ortiz & Stone, 2011). Organizations use Twitter for publicity and fundraising purposes. The online presence created using Twitter can be so powerful that it renders unlimited opportunities for these organizations. Obama's presidential campaign in 2008 was one of the best examples that spoke to how an organization can utilize Twitter to its
full strength (Stirland, 2008). Not only used for publicity, Twitter has been used for advocacy, calling for actions, and fundraising, all of which have been a tremendous success.

Twitter is being even more widely adopted in the business world and is able to achieve many goals for business groups. In 2011, 77% of Fortune Global 100 companies used Twitter and this number is undoubtedly much larger today (McNaughton, 2011). Nowadays almost all business groups are using Twitter because it holds unlimited potentials. Many business groups use Twitter to do marketing (Brito, 2011). By searching potential user groups on Twitter, companies can better understand their target clients and therefore target the right clients with precision. A wide array of tools provides measurements and analytics that help companies understand their marketing and sales performance and how it relates to Twitter (Smith, 2009). In addition, Twitter creates tremendous opportunities to engage and network with customers. Interactions can occur directly and immediately on Twitter through simple Q&A types of inquiry sessions. Feedback is personalized from individual customers and often immediate, which is incredibly important to the success of a business. Twitter has penetrated into advertising, public relations, after-sales service and has helped thousands of millions with their sales and services (Brito, 2011; Ojeda-Zapata, 2008).

**Educational Use of Microblogging**

It has been widely acknowledged that Web 2.0 tools 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). Microblogging
tools have been employed not only to facilitate classroom learning activities but also to support a more digital, flexible and open mode of learning beyond the classroom. In recent years, microblogging has been used in online courses (Hsu & Ching, 2012; Kop, 2011; Pauschenwein & Sfiri, 2010).

It is believed that microblogging tools have great potential in education. "With microblogging, resources can be shared instantly among learners, and instructors can exchange ideas with students in a timely manner (Click & Petit, 2010; Hansen, 2011; Paz, 2009; Thames, 2009)" (as cited in Gao et al., 2012, p. 783). Real-time and asynchronous communication supported by Twitter can help create learning communities under informal learning settings and benefit learning outside the classroom (Ebner et al., 2010; Junco et al., 2011). "Microblogging, therefore, promotes a collaborative virtual learning environment" (as cited in Gao et al., 2012, p. 783). Although this interaction and collaboration is often informal and even "sometimes playful" (Dunlap & Lowenthal, 2009, p. 129), scholars have been conducting research examining the unique educational benefits of microblogging and exploring ways of incorporating it into a variety of learning scenarios.

**Formal learning.** The majority of research studies were conducted in formal learning settings in which researchers integrated microblogging into classroom learning activities. Microblogging has been used in traditional classroom lectures to enhance student’s virtual participation through opening up opportunities on Twitter. In Elavsky and his colleagues’ (2011) study, microblogging was used as a backchannel in a live event to encourage immediate participation from the audience. These researchers
contended that the single speaker paradigm, as it often occurs in conventional lectures or conference presentations, constrains the presenter-audience interaction (Elavsky et al., 2011). The use of microblogging as a backchannel opens up a backchannel for virtual participation and thus enhances this presenter-audience interaction.

Microblogging extends the participation beyond the classroom or conference room by engaging those who are not physically present. Virtual networks of learning may be formed with learners, practitioners, professionals and other interest groups. In Rinaldo, Tapp and Laverie’s (2011) study, the professor’s tweets in a consumer behavior course received attention from a few companies, who started to follow the professor’s tweets, thus creating an expanded learning community. Such virtual participations were particularly valuable in literacy and language learning, where using the language for real communication was crucial (Antenos-Conforti, 2009). (as cited in Gao et al., 2012, p. 789)

Many researchers used microblogging to enable students to connect to the Twitter community in which the majority of people are native English speakers. In this way, students were able to immerse themselves in authentic language learning environments to practice utilizing a second language (Borau et al., 2009). Borau et al (2009) contended that students' communicative and cultural competencies were reinforced through doing such tasks on Twitter.

Scholars implemented various in-class microblogging-based synchronous activities to enhance student motivation and engagement. Perifanou (2009) conducted a series of microblogging-enhanced games in her Italian language class to promote student
learning. Although she characterized *fun* as a major theme of the microblogging-enhanced activities, students learned in a more engaging and positive manner than in her usual didactic lecturing. She stated that the use of microblogging provides unique communication channels for meaningful interactive learning, in which 21st-century skills such as higher-order thinking are honed simultaneously with students' having fun (Perifanou, 2009). Scholars also employed Twitter in their literacy class to motivate students' learning interest. For example, students were assigned to different characters in a play and asked to tweet to impersonate those characters so students may reflect their own understanding (McWilliams, Hickey, Hines, Conner, & Bishop, 2010). Students' overall engagement and collaborative participation were reported to have improved in their studies.

In learning real-world concepts, researchers also used the learning-by-doing approach to engage student with real cases on Twitter.

Lowe and Laffey (2011) believed that microblogging enabled educators to bring real-world marketing concepts to the class in a timely fashion because the tool provided instantaneous access to the up-to-date news stories. When microblogging was solely used for instructors to post information, however, students might not be actively engaged, and did not respond often to the instructors' tweets (Lowe & Laffey, 2011). In contrast, students participated actively when they were invited to contribute and share information and resources (Dunlap & Lowenthal, 2009; Perifanou, 2009). (as cited in Gao et al., 2012, p. 790)
Informal learning. Microblogging integration also occurs in various informal learning settings outside of the classroom. The concept of informal learning, which goes beyond the formal classroom of teaching and learning, is reflected in many studies (Dunlap & Lowenthal, 2009; Ebner & Maurer, 2009). The facilitation of informal learning supported by microblogging tools can be achieved intentionally by instructors' course design as well as by students' voluntary and spontaneous learning.

Microblogging was often used as a social networking tool to aggregate information and to be involved in extracurricular activities (de Waard et al., 2011; Junco et al., 2011; Kop, 2011; Kop, Fournier, & Mak, 2011). In Junco and colleagues' (2011) study, Twitter was used to post course announcements and to organize study groups and other extracurricular activities. Students reported an increased question-asking and engagement with faculty members on Twitter as compared to Ning, an alternative social learning platform (Junco et al., 2011).

Dunlap and Lowenthal (2009) employed Twitter to support informal learning and search relevant resources to help with student coursework. The integration was rather successful even though it was not bound in a curriculum design nor did the instructor mandate it. Students were asking questions, seeking help, sharing resources, and even interacting with professional practitioners through Twitter.

Ebner et al. (2010) later extended and expanded the informal learning concept to process-oriented learning. Upon completion of their course, microblogging was demonstrated to become a new type of communication. They further explained that the transfer of information or status messages was not a crucial factor that contributed to
process-oriented learning; instead, the opportunity to "be a part of someone else's process" (Ebner et al., p.98) by reading, commenting, and discussing the tweets was the key to the formation of an informal learning community.

**Use in online course settings.** Recently, microblogging has more seen to be appropriated in online courses to promote learning through various learning activities. For example, instructors in numerous massive open online course settings adopted microblogging tools along with alternative social networking tools to disseminate and deliver information (de Waard et al., 2011; Kop, 2011; Kop, Fournier, & Mak, 2011; Pauschenwein & Sfiri, 2010).

Online course instructors developed creative activities using Twitter for knowledge construction. In Hsu and Ching's (2012) class on instructional design, students were required to find graphics that contain design problems, use mobile phones to take a picture, and post on Twitter. Through sharing of the problem-design posts and discussions with peers, students were able to convert deep conversation into short but frequent message exchanges. By posting pictures and verbalizing various design problems found in the pictures, students conveyed meaningful messages on instructional design-related knowledge and thus internalized their learning in such microblogging-supported contexts.

Pauschenwein and Sfiri (2010) adopted microblogging to cultivate participants’ motivation for learning in five online courses. As the researchers stated, "microblogging environments can nourish participant's needs for relatedness, personal growth
and transcendence and suggest the creation of strong social bonds within groups of participants in e-learning settings" (p. 25).

**Benefits and Advantages**

It is evident that microblogging tools have been incorporated into different scenarios, which serve varying purposes for learning and teaching. All the researchers claimed that educational benefits were achieved during the microblogging experiment. Some major benefits are synthesized in this section.

**Learning community.** Microblogging has often been adopted to promote learning communities in multiple studies. The notion of a learning community denotes that learning is a process where learners engage in socially-involved activities (Dawson, 2006; Overbaugh, 2006; Rovai, 2002). According to a multitude of studies, microblogging can be integrated into a course design to facilitate the formation of a learning community through various means (Borau et al., 2009; Dunlap & Lowenthal, 2009; Hsu & Ching, 2012; Junco et al., 2011).

Junco's et al. (2011) affirmed that although the class only met one hour per week, the adoption of Twitter enabled students and teachers to continue discussions, building a vibrant learning community among students. Wright (2010) also stated that via the reflective activities enforced by the instructor throughout the academic term, a sense of community was gradually created during the Twitter practice, which largely reduced the sense of isolation among some student groups.

Students in Dunlap and Lowenthal's (2009) study continued to communicate and collaborate with their facilitators and the other study participants after the course ended.
Holotescu and Grosseck (2009) also found identical results in their research study. Once the course ended, the students continued their connection to the microblogging platform. They also found that the platform itself could tailor the course pedagogy to be more responsive to students' needs. Ebner and Maurer's earlier research (2009), found that microblogging largely enhanced student groups' a sense of community and ability to network with each other.

Borau and his colleagues (2009) placed emphasis on the use of the @ symbol in promoting conversations in learning communities. They claimed that as Twitter is not designed for conversation but rather for updates, interaction between multiple users is not often perceived. Therefore, they claimed that people’s use of the @ symbol to respond to each other in a conversational setting represents "social coherence and community forming" (p.84).

In Hsu and Ching's (2012) graduate-level online courses, Twitter was employed to strengthen the virtual learning community through interactions and collaborative learning activities. Mobile devices were utilized to support this effort. Students' sense of community was generally high and they reported positive microblogging experiences. Social interaction and community building through Twitter was recognizably successful and effective.

**Participation and engagement.** Related to the learning community notion, research shows that microblogging integration can help increase participation and engagement.. Ebner et al. (2010) stated that the introduction of microblogging allowed students to participate more actively in learning activities that they would otherwise. In
Junco et al.'s (2011) research, students' participation was also enhanced through their online participation on Twitter, which resulted in "a culture of engagement" and a "deepening of their interpersonal connections" (p. 129).

Similarly, in Agherdien's (2011) study, students were required to post weekly summarizations of selected readings for social interaction and engagement purposes. Most students in this study perceived the Twitter integration favorably and found the use of Twitter fun and educationally rewarding.

The increased participation and engagement may be attributed to several reasons. First, microblogging offered students a convenient channel to express their ideas. According to Junco et al (2011), the integration of Twitter as a communication tool encouraged participation from some students who otherwise may not be active participants in class. Second, microblogging provided students with opportunities to communicate virtually at any time. As a result, students’ engagement with the course content or relevant activities was extended beyond the limited class time. For example, with the aid of microblogging, the instructor’s brief digression in class could trigger an in-depth discussion lasting several weeks (Elavsky et al, 2011). Finally, once a microblogging community was formed, the social networking factors sustained participants’ willingness to stay connected (Antenos-Conforti, 2009) and maintain the communication even after the original learning tasks had been completed. It was evidenced that learners remained active even after the course had ended, communicating and
interacting with facilitators or other participants (Dunlap & Lowenthal, 2009; Holotescu & Grosseck, 2009). (as cited in Gao et al., 2012, p. 791)

**Social presence.** Microblogging can be integrated into an online course to enhance social presence. Kop (2011) reported that these increased level of social presence and involvement enhanced the depth of learning and subsequently the learning experience. In his study, Twitter was incorporated in combination with other social networking tools to aggregate information and facilitate learning in an online course. In using such tools, students' level of presence increased, suggesting students were more involved with the online activity and exhibited greater depth of learning.

In Lomicka and Lord's (2012) French language classroom, researchers used Twitter to increase student sense of community and social presence. Using the three indicators in Rourke, Anderson, Garrison, and Archer's (2001) framework on social presence, researchers found that more affective and interactive indicators were found than the cohesive ones. The Twitter integration was successful in promoting students sharing live events and provoking conversations among themselves, which therefore leveraged students' community building to be achieved in a fun and interactive way.

Additionally, Twitter was used in Sinnappan and Zutshi's study (2011) both inside and outside of the class for a brief four-week research duration to further classroom discussions and share information. Using Garrison and Arbaugh's (2007) Community of Inquiry model, researchers found that Twitter is conducive to enhance and complement all presences in their study. When Twitter was used during a class, students’ tweets revealed an elevated level of social, cognitive, and teacher presence.
**Collaborative learning.** Research demonstrates that microblogging integration in classrooms can support collaborative learning activities, such as having book discussions, organizing study groups, and working on collaborative course projects (Junco et al., 2011; McWilliams et al., 2011; Perifanou, 2009).

Across all the studies, Junco et al.’s (2011) is among the few that examined student learning outcomes affected by the collaborative microblogging-based activities. By comparing students’ grades between the experimental group, in which Twitter was incorporated, and the control group, they concluded that the grades of the experimental group were significantly higher than those of the control group. Junco et al (2011) noted, however, the increases in grades may be explained more by the instructor’s overarching attitude about teaching and learning than the microblogging technology itself. They called for future research taking into consideration of other variables that might have impacted students’ grades. (as cited in Gao et al., 2012, p. 792)

Furthermore, in Holotescu and Grosseck's (2009) research, they designed a series of collaborative learning activities through the use of Cirip.ro, which is another microblogging program similar to Twitter. They concluded the results of their study by stating "collaborative activities proved to be an effective tool for professional development and for collaboration with students, which can change the rules of the courses and models good pedagogy responsive to students' learning needs" (p. 3).

**Reflective thinking.** Researchers examined different methods of microblogging incorporation to promote reflective thinking, especially just-in-time reflections (Ebner &
Maurer, 2009; Wright, 2010). The use of mobile devices enables users to post and share new messages with no temporal or geographical constraints. Such information sharing is instantaneously archived online, which also allows for future review and revisit.

Wright (2010) found evidence of reflective thinking by reading students' tweets. Instead of viewing the 140-character limit as a constrictive condition, participants in this research all agreed that they were in fact forced to think more in-depth about the content. Participants further reported that because a tweet has a 140 character limit, it encouraged students to write more clearly and concisely.

In Ebner and Maurer's research (2009), they found that the microblogging approach allows the possibility for more critical and personal statements. The ability to immediately document and distribute their ideas indeed eased the generation and development of thoughts. Besides, students could manage to engage in the task continuously, which led to a deeper level of reflection. The researchers concluded that over time students were able to be actively involved in a more in-depth cognitive process due to this prolonged engagement in writing on Twitter.

**Challenges and Constraints**

Even though microblogging holds great potential for the promotion of learning, researchers have found challenges coexist with its benefits. Some of these challenges may be caused by the inherent characteristics of microblogging, while others may be attributable to the educators' specific pedagogical use of the technology in the class. Many scholars believe that more research needs to be conducted in this field to explore
the unknown areas of microblogging in education (Lomicka & Lord, 2012; Kassens-Noor, 2012; Thoms, 2012).

**Difficulty in promoting deep learning.** Studies have examined the 140-character limit as one of the most important characteristics of Twitter that may hamper the depth of potential conversation and student learning. The research conducted by Ebner et al. (2010) found it potentially harms the quality of dialogue. Partially due to this 140-word limit, the tweets analyzed in their study were found to be exclusively social in nature, which they believed suggested that only trivial and arbitrary information exchange was attained during the activity.

In Wright's (2010) research study, the 140 character limit of tweets was also initially found restrictive by students. Similarly, in Cohen and Duchan's study (2012), students perceived that 140 characters is an extremely limited space for any meaningful information exchange.

Thoms (2012) further enunciated this challenge by labeling Twitter as a "broadcasting technology" (p. 191). In his study, students were able to effectively share information with the class and view other members' shared posts because Twitter successfully brought new information into the course and allowed students to explore new information. However, most students in his class only chose to rebroadcast information on the Internet and they hardly attempted to engage in the greater Twitter community. Accordingly, Thoms (2012) suggested that the Twitter platform only allowed students to share information limited to their class members and offered minimal interaction beyond that.
Information overload. Researchers also found the amount of noise information on Twitter may overwhelm students and bring distraction. In Luo and Gao's (2012) study, students expressed their concerns with the use microblogging because it was difficult for them to keep track of and pay special attention to any specific tweets when a large number of tweets were aggregated simultaneously.

Ebner et al. (2010) believed that singling out important tweets and pinpointing specific tweets would be difficult for instructors. They stated that microblogging can sometimes lead to "an unwieldy information flow, known as information overload" (Ebner et al., 2010, p. 98), in spite of its ability to facilitate multitudes of communications. Such noise information can be a distraction to some students as they may feel that they wasted their time reading posts that do not contain much useful information (Holotescu & Grosseck, 2009; Rinaldo et al., 2011).

Participants' unfamiliarity with microblogging. Studies suggested that many learners lacked prior experience in using Twitter, and some even found it complicated and daunting to use (Agherdien, 2011; Cohen & Duchan, 2012; Costa, Beham, Reinhardt, & Sillaots, 2008; Rinaldo et al., 2011; Welch & White, 2012).

Researchers believed that the affordance of microblogging was compromised and the scope of interactivity was limited due to participants' inexperience in microblogging (Lowe & Laffey, 2011). A recent report from Pew Internet Project surveys echoed researchers' concern (Lenhart, Purcell, Smith, & Zickuhr, 2010). Lenhart et al. (2010) stated that Twitter was only employed by 8% of 12-17 year old web users and only 19% of adult web users used Twitter or alternative microblogging platforms to publish or view
others' posts, in spite of microblogging's mounting popularity. Therefore, researchers recommended that Twitter can be used more creatively for educational purposes with possible rewards and incentives introduced by the instructor (Rinaldo et al., 2011).

**Participants' unwillingness to participate.** It is found that only limited number of students actively participated in the act of microblogging and the rest remained inactive. For example, only ten out of 150 attendees actively participated in Ebner's (2009b) study; 23% of the registered attendees participated in the DRHA conference in Ross et al.'s (2011) study; and 40-60 out of 1616 individuals participated in Kop’s study (2011). Antenos-Conforti (2009) found echoing results, stating that more than half (12 out of 22) of her students were not able to tweet the minimum amount.

In Cohen and Duchan's (2012) study, students expressed high interest in participating, but in practice few started to tweet and shared their information with the followers. They stated that it might be due to students' lack of experience, personal preference, or heavy study load. Welch and White (2012) further provided insights on the reasons of students' unwillingness to participate. They attributed the lack of participation to students' unwillingness to change their technology routine, as well as being wary about modifying their classroom regularities because some students opposed to bringing mobile devices to the classroom.

Other researchers indicated that students' lack of participation may be attributable to a strong personal preference of a restrictive use of Twitter and social media in general in non-work or non-academic contexts (Lin, Hoffman & Borengasser, 2013). According
to their study in which students could opt in to tweet, they found that students' frequency of tweeting dropped dramatically as the semester progressed.

**Mobile device accessibility.** In addition to the abovementioned challenges, scholars also found that mobile phone accessibility can be a critical factor affecting students' participation. Although the proportion of participation from those using a mobile device was limited in multiple studies (i.e. merely 20% of students reported that they posted from a mobile device in Cohen & Duchan's study), researchers believed that it was possible that an increase in smart mobile devices among students may alternate the amount of Twitter use and allow more opportunities for synchronous communication (Cohen & Duchan, 2012; Wright, 2010).

Hsu and Ching's (2012) study stressed the importance of ensuring mobile phone accessibility as it afforded the convenience and ubiquity of accessing Twitter apps on mobile devices as well as eliminated the process of logging into the Twitter page and extensively composing a message. Without mobile phones, students would be largely hampered in terms of promptness and ease of participation in microblogging activities.

**Guidelines for Microblogging Implementation**

Researchers provided many guidelines for the introduction of microblogging into teaching plans. For example, five suggestions were offered by Dunlap and Lowenthal: "(a) establishing relevance for students, (b) defining clear expectations for participation, (c) modeling effective Twitter use, (d) building Twitter-derived results into assessment, and (e) continuing to actively participate in the Twitter community" (p. 132).
Kruger-Ross, Waters, and Farwell (2012) provided multiple insightful suggestions for teachers' Twitter implementation in the classroom: "(a) be sensitive to privacy issues and students' fluency with the technology; (b) recommend and demonstrate supplemental software that may help students manage their Twitter accounts; (c) make any expectations for Twitter usage explicit; (d) use 4-6 character hashtags for the class to keep tweets relevant and organized; (d) serve as a Twitter role model to demonstrate etiquettes; and (e) provide private space for reflecting on Twitter experience" (p. 129).

Additionally, Lowe and Laffey (2011) recommended employing hashtags and abbreviated URLs in tweets. They provided pedagogical suggestions for Twitter integration, including: "a) communicating with students the rationale of using Twitter, b) avoiding over tweeting and information overload, c) weaving important tweets into lecture and class discussion, and d) using tweets to supplement and back up course material" (p. 189).

Holotescu and Grosseck (2009) suggested that instructors should create a specific scenario where students' participation in microblogging is specifically evaluated. They also microblogging tools along with alternative collaborative tools. Luo and Gao (2012) stressed critical role of teaching in providing abundant guidance and scaffolding for microblogging-based activities. They noted that teachers should take into consideration both the learning content and the characteristics of their students, and choose corresponding strategies to support microblogging-based activities.
**Backchannel Communication**

The term backchannel communication has been increasingly brought to public attention in recent years alongside the boom of social media. Because of the ubiquitous and widely available nature of social media, people are taking advantage of these newly-existing technologies to communicate with one another, both intentionally and unintentionally, with known friends and unknown wanderers online, often in a self-directed, undisciplined and unorganized manner. Although it has yet been strictly defined in any academic discipline, scholars who studied this phenomenon have denoted it as a type of unregulated and unofficial communication that occurs complementarily to the media and interaction that take place at the front channel (Cronin, 2011; Kearns, & Frey, 2010). Due to the boom of social media and portable devices, backchannel communication often occurs in the event of political conflicts, natural disasters and emergencies (Malizia, Bellucci, Diaz, Aedo, & Levialdi, 2011).

Educational backchannel communication also has garnered researchers' interest, as social networks and mobile devices allow for more opportunities for backchannel communication to occur and expand (Cronin, 2011). In many professional conferences, backchannel communication enabled by social networking tools such as Twitter and Facebook is often used to enhance attendants' conference experience and to encourage collaboration and the co-construction of knowledge (Ross, Terras, Warwick, & Welsh, 2011). These irregular and unofficial means of communication can extend the conversation beyond the physical conference lecture room and help professionals to engage further across the community (McCarthy & Boyd, 2005). The dynamics of the
lecture room are also altered by backchannel communication from a speaker-led "one-to-many transmission to a many-to-many interaction, without disrupting the main channel communication" (Ross et al., 2011, p. 215).

In classroom settings, it has been argued that backchannel can provide multiple benefits and be employed as a feedback system that is not otherwise attainable (Cronin, 2011). To be more specific, Cronin (2011) summarized several advantages of using backchannel communication to achieve academic purposes

- Students can use it to take notes, but these notes, unlike jottings in a notebook, are immediately available to everyone in the class. The backchannel can, in effect, become shared note-taking.
- Students can amplify the lecture or discussion by offering examples, pointing out errors, raising objections, etc.
- Attendees can ask questions they might be too shy to ask out loud, and get answers from other attendees.
- Backchannel comments can be reviewed by instructors after class to glean information to improve their effectiveness in subsequent classes.
- Electronic backchannel communication may reduce whispered private conversations among the students that both the instructor and others in the class may find distracting. (p. 57)

In addition, immediate participation from the audience is often enabled through backchannel communication (Elavsky et al., 2011). Researchers argued that single speaker paradigm, often occurred in traditional lectures and conference presentations, can
hamper the audience's participation as well as presenter-audience interaction (Elavsky et al., 2011; Ross et al., 2011). Microblogging tools such as Twitter now make it easy for the audience to ask questions, discuss issues, share resources, and create shared comments on learning materials (Ebner, 2009a; Ebner, 2009b; Ross et al., 2011). Such immediate and interactive participation from the audience group allows presenters to respond dynamically to audiences' reactions and provides a means for the audience to actively interact with the content presented. Backchannel communication also encourages virtual participation that connects to participants who are not physically present. People outside of the classroom community, such as experts in the larger Twitter community, can often be brought into a conversation with students inside the classroom community, thus holding great potential to enhance meaningful conversation and increase learners' sense of belonging in a wider professional community (Kearns & Frey, 2010; Rinaldo et al., 2011).

Meanwhile, the research studies mentioned above should be looked at with caution. Results from research on the implementation of backchannel communication (or no guidance) are limited to the specific learning setting and participants involved, which results in limited generalizability to other learning settings and student groups. It is suggested that with older age groups and smaller student enrollments in the class, backchannel communication can be more beneficial concerning its classroom integration. Both Cronin (2011) and Kearns and Frey's (2010) studies were conducted in a graduate-level classroom setting with limited class sizes.
The backchannel communication certainly raises educators' concerns as it disrupts the regular dynamic of classroom learning and could jeopardize student learning if not implemented properly. Cronin (2011) cautioned that the successful implementation of backchannel communication stands in need of higher "educational maturity" (p. 61) and therefore it is more advisable to be considered for upper-class and graduate courses. Whether or not backchannel communication can be equally conducive to lower grade levels or middle-sized courses are largely unknown given the current literature base.

Additionally, Cronin (2011) noted that the tone of conversation used, whether it is professional or in vulgar or obscene terms, and students' capability of multitasking may potentially affect the learning outcomes of backchannel communication. While students are simultaneously attending to the backchannel alongside the major form of instruction being given, it is likely that they may miss important information about the lecture itself. The underresearched domain of educational backchannel communication requires further exploration and investigation.

**Providing Instructional Guidance**

Providing instructional guidance during teaching is pivotal to the success of student learning. Many seminal instructional and learning theories and models have placed a special emphasis on the importance of instructional guidance. For example, in Gagné et al. 's (1992) classic instructional model, providing learner guidance is among one of the critical nine events of instruction that instructors should use to present material to students in order to optimize their learning. In Gagné's words, by providing students with instructional guidance on how to learn, learning increases because students are more
likely to achieve their goals and objectives. Instructional guidance entails a wide variety of learning strategies and pertinent resources on the subject domain. Scaffolding techniques, such as providing cues, hints, and prompts that can be removed after the student completes the learning task are often used to help novice learners. Learning strategies, such as mnemonics, concept mapping, visualizations and graphic organizers are other forms of instructional guidance that instructors tend to use typically.

Instructional guidance exists in various forms. Instructors can provide accessible domain-specific information as a form of guidance (Leutner, 1993). Adjunct questions (Holliday & McGuire, 1992), prompts and cues (Lin & Lehman, 1999), assignments, activities or tasks that guide learners' inquiry processes (de Jong & van Joolingen, 1998) are all considered mechanisms of instructional guidance. In addition, expert modeling, study guides, resources and tools are also forms of guidance and scaffolding (An, 2010).

Different types of instructional guidance have been proposed by researchers to provide a classification scheme with which to examine this subject. In the collaborative learning domain, researchers also classify the types of instructional guidance as cognitive- or social tasks-related, which aligns with key concepts in the socio-cognitive demands of collaborative design (Lehrer, Erickson, & Connell, 1994; O'Donnell & O'Kelly, 1994). Cognitive guidance aims to provide adequate task schemas to guide students' problem-solving processes, whereas social guidance is to support effective social interaction during group communication and teamwork processes. A plethora of studies on small group collaborative learning suggest the critical role of effective social interaction in social learning processes and outcomes (Nastasi & Clements, 1991;
O'Donnell & O'Kelly, 1994). Melero, Leo, and Blat (2012) recently proposed a classification of instructional guidance types based on the granularity level of learning processes. They defined *macro-scaffolding* as a more generic type of guidance that relates to how to approach learning tasks or problems, whereas *micro-scaffolding* purports to provide detailed, on-the-spot, specific guidance that allows for resolution of specific learning activities.

A predominant number of empirical studies that compared unguided versus guided learning approaches have shown the superiority of the guided approach in teaching knowledge and skills from a wide variety of knowledge domains since the 1950s (Mayer, 2004). Much research that used experimental designs to allow for controlled experiments suggested that students should be guided explicitly on what to learn and how to learn when their prior knowledge on the subject is largely lacking (Elshout & Veenman, 1992; King & Rosenshine, 1993; Ardac & Sezen, 2002). For example, in teaching problem-solving skills, students who were placed in guided discovery groups learned more efficiently and performed better on tests of both immediate and delayed retention (Craig, 1956; Kittel, 1957). A recent study in veterinary education indicated that the guided usage of multimedia learning materials leads to higher levels of knowledge and skills mastery (Govaere, Kruif, & Valcke, 2012).

Meta-analysis and literature review studies have informed educators that full-flown guidance is tremendously more effective than partial or no guidance for novice learners who encounter a new content area (Kirschner, Sweller, & Clark, 2006; Mayer, 2004). Researchers attributed the superiority of the guided approach to specific brain
functions; in other words, the structure of cognitive architecture. The process of cognitive learning is one in which information stored in short-term memory transfers into long-term memory and thus alters the existing structure of long-term memory. According to information processing theories, the working memory is limited to process a significant amount of information at a given time. If the working memory is overloaded, it hampers the abilities of humans to solve problems and successful transfer to long-term memory (Chandler & Sweller, 1991; Sweller, 1994). With minimal or no guidance, working memory is easily overloaded with extraneous information; therefore, less capacity is available for information-processing and for learning to occur (Kirschner et al., 2006). In particular, for novice learners who have scarce prior knowledge, it is undoubtedly more effective to provide direct instructional guidance on the subject matter than to use the discovery approach, in which learners attempt to discover knowledge and ways to learn on their own (Mayer, 2004).

The merits of guided approach reside not only in the fact that it helps novice learners to acquire new knowledge; researchers also found that the guided approach prevents students from digressing from the learning topic (de Jong, 1991). Furthermore, guided approach drives the learning process by presenting students with pre-designed tasks along with explicit instructions and providing feedback in relation to those tasks. Any misconceptions and misunderstandings that occur during the learning process can be easily identified and tackled by the pre-designed tasks (Collins & Stevens, 1983).

Researchers found that in computer-based instruction, guidance tends to be increasingly needed due to the higher cognitive load placed on students in an unassisted
computerized-simulation environment (Reiser, Cohen, Hamid, & Kimberg, 1993). Because they are out of reach of instructors' direct instruction and immediate feedback, students who learn in computer-based environments are required to have higher levels of meta-cognitive and intellectual skills in order to achieve expected learning outcomes as compared to face-to-face classroom environments where immediate feedback from instructors is often available (de Jong & van Joolingen, 1998; Swaaket, van Joolingen, & de Jong, 1998). Mayer (2004) concluded two major reasons to which the superiority of the guided approach can be attributed: (a) students' prior knowledge bases are activated to allow for more meaningful knowledge construction; (b) students are able to sort and incorporate new information into existing knowledge bases held in their long-term memories.

In collaborative and peer learning environments, the success of student learning is closely related to whether instructors provide guidance and structure for group interaction. Unstructured and unguided group interactions leave much room for unequal participation and dominated or ignored conversation, thus leading to negative social and cognitive processes (O'Donnell, Dansereau, Hall, & Rocklin, 1987; O'Donnell & O' Kelly, 1994). Except for expert learners and high achievers who possess advanced cognitive and social skills, structured and guided interaction always results in more significant learning outcomes (O'Donnell & O' Kelly, 1994).

On the other hand, some researchers also cast doubts on whether guided approach is applicable across different subject matter and to learners with varying characteristics. Researchers cautioned that the implementation of instructional guidance in the
experimental studies is confined to the specific learning contexts and participants targeted in those studies. The generalizability of such findings is questionable given the limited settings and target learners (Webb & Farivar, 1994). After all, the success of learning largely relies on student-related factors, such as students' intellectual ability and motivation, rather than purely instructional factors (Elshout & Veenman, 1992). Other research bolstered non-or minimal guidance because external interventions from instructors may interfere with learners' natural learning processes and their learning styles (Schmidt, 2000). For instance, high achievers and intrinsically motivated students may not need as much instructional guidance, structure and control (Reeve, 1996). External control can even work against learners with higher levels of autonomy and intellectual ability (Deci & Ryan, 1987; Ryan & Grolnick, 1986).

Many current empirical studies examining the use of microblogging in educational settings also explicate the importance of providing guidance for microblogging-based activities (Dunlap & Lowenthal, 2009; Holotescu & Grosseck, 2009; Kruger-Ross et al., 2012; McWilliams et al., 2010). Researchers stated that careful planning of microblogging activities that involve high levels of instructional guidance and structure can help eliminate distraction and ameliorate information overload (Holotescu & Grosseck, 2009; McWilliams et al., 2010). However, very few studies have been done to examine the specificity of this guidance, such as how to structure and support microblogging activities, as well as how much and what types of guidance are appropriate in what learning contexts. In the current study, different variables, modes of learning (guided versus unguided), and types of guidance (social versus cognitive) were
manipulated in a series of microblogging-supported collaborative learning tasks and therefore examined to what extent and in which aspects instructional guidance affects the effectiveness and student perception of microblogging-supported learning.

**Use of four Underlying Constructs in the TAM Model**

To understand individual's acceptance of information technology, researchers have developed a wide array of models and proposed varying theoretical constructs. The TAM model (Technology Acceptance Model) was considered the most commonly used and cited theoretical framework for the investigation of the adoption of emerging technology and it has well predicted technology adoption and use (Davis, Bagozzi, & Warshaw, 1989; Venkatesh & Davis, 2000; Venkatesh & Morris, 2000). The two key constructs in the TAM research are *perceived usefulness* and *perceived ease of use*, as first posited by Davis (1985). Ease of use is "the degree to which the...user expects the target system to be free of effort," while perceived usefulness is referred to as the user's "subjective probability that using a specific application system will increase his or her job performance within an organizational context" (Davis, Bagozzi, & Warshaw, 1989, p.985). Over the decades, a multitude of empirical research has been conducted to validate this theoretical framework and demonstrates its general capability of explicating user behavior across a wide variety of information technologies and populations.

The original TAM model has gone through multiple stages of modifications with new constructs being included on the basis of their precursors (Venkates & Davis, 2000; Venkates & Bala, 2008). TAM model was extended to TAM 2 and 3 to introduce more external variables to predict perceived usefulness and perceived ease of use. TAM 2
essentially combines attitudinal and behavior variables into intention to use, and adds more external variables to predict perceive usefulness, such as subjective norm, image, and job relevance. TAM 3 further refines those external variables and introduces new predictive variables for perceived ease of use, such as computer self-efficacy, perceived enjoyment, computer playfulness, and objective usability. All of these variables were identified as salient determinants in explaining individual's adoption of information technology by later studies (Compeau & Higgins, 1995; Venkatesh & Davis, 2000; Venkatesh, 2000; Webster & Martocchio, 1992).

Despite its variations, all the TAM models including the original TAM, TAM 2 and TAM 3 share similar theoretical constructs and stem from one continual string of research path. Both TAM and the new alternations, TAM 2 and 3, have been validated as a model to predict and explain the use of varying online and offline technologies (Halawi & McCarthy, 2007; Lederer, Maupin, Sena, & Zhuang, 2000; Saade, Nebebe, & Tan, 2007, as cited in Saeed, Yang, & Sinnappan, 2009). In recent years, with the boom of Web 2.0 technologies, research suggests that TAM has been viewed as a valid and parsimonious theory that predicts users' acceptance of these innovative social technologies (Van Raaij & Schepers, 2008).

In hopes of synthesizing prior research on TAM, Venkatesh and Bala (2008) combined the above variables in TAM 1, 2, and 3, and proposed a more conclusive means of classification that epitomizes the cumulative body of research over the years from TAM research. This method of classification consists of four underlying theoretical constructs of perceived usefulness and perceived ease of use: 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.

In order to capture all the possibly reasonable factors and investigate these factors from a more comprehensive perspective, this study uses the four underlying constructs to guide the investigation of potential factors that affect students' perception of microblogging integration as stated in the third research question. To be specific, individual differences, in the case of Twitter integration, can be referred to students' prior use and perceptions of Twitter, in additional to their demographical characteristics. Research has shown that these prior uses or habits of using Twitter positively affect behavioral intention to Twitter use (Agrifoglio, Black, Metallo, 2010; Barnes & Böhringer, 2011). System characteristics represent the specific features of the microblogging platform that help students develop their favorable/unfavorable perception of a technology system. For example, the limited length of posts on Twitter (140-character limit) has constantly raised an issue across multiple studies (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. For instance, researchers posited that social networking sites give power to youth and help them to foster a personal community where they negotiate identity and intimacy, which may explain the predominant social and recreational use of social networking among teens and young adults (Ito et al., 2010). The facilitating conditions in the case of microblogging particularly refer to instructional support in and out of the classroom. A plethora of research has placed an emphasis on the role of instructional support in the success of microblogging-based learning (Holotescu & Grosseck, 2009; Luo & Gao, 2012; Rinaldo, et al., 2011; Perifanou, 2009). Rather than using these constructs as predictive or explanatory variables to conduct quantitative analysis as a typical approach of using the TAM model, 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.

**Summary**

This literature review section provides both theoretical and empirical lenses through which readers can reach a deeper understanding of the exploration and examination of microblogging integration in this current study as well as practical suggestions to inform and guide the actual implementation of the microblogging-based activities. The contemporary paradigm shift from constructivism, social constructivism to Connectivism has increasingly placed the significance of social technologies to the forefront of educational evolution. Any implementation choices made in the process of
microblogging integration is closely linked to the applications of those discussed learning theories.

The existing empirical evidence on microblogging integration in education indicates that there are still much more to be explored with regards to the effects of new form of technology-supported instruction. As a unique technology that can support both spontaneous, immediate and sustained communication, many aspects of microblogging are worth researching and evaluating. Specifically, studies in this literature view suggest that microblogging tools can be used in a wide variety of educational environments (both online and face-to-face environments) to support different types learning (in-class formal learning and after-class informal learning settings). Researchers employed microblogging tools in a wide array of activities to achieve different educational goals, among which backchannel microblogging is the most common and well accepted. Although many researchers noted the important role of guidance played in microblogging integration, none of them varied the degree and type of instructional guidance or measured the differing effects in their studies. Researchers also noted the discrepancies in the frequency and volume of students' individual use as well as their perceptions of microblogging-based learning, but research rarely reported potential factors that bring about this differences.

This literature review suggests that current empirical studies of microblogging are limited in its number, scope, and robustness of their methods. Therefore, assessing the effects of microblogging-supported instruction with varying degrees of instructional guidance as well as understanding the potential factors that affect students' perceptions of
microblogging integration in a hybrid course with both online and face-to-face learning portions becomes considerably necessary and worthy of the researcher's efforts.
Chapter 3: Methodology

Introduction

This dissertation study was conducted using a case study design. The purpose of this study was to examine and describe students' experiences and perceptions of various forms of microblogging integration in a hybrid course. Using a case study design, this study examined multiple sources of qualitative and quantitative data to provide a thorough understanding of students' participation and interaction patterns as well as to reveal the potential reasons of individuals' differences in student perceptions of Twitter integration.

This chapter enunciates the research design and methods. In the first section, more conceptual evidence that justifies the case study research design is explicated for readers to understand how the research methodology was chosen to fit into the big research picture. Next, more concrete descriptions about the research components, including the research setting and participants, are provided in detail. Researchers' assumptions, suppositions, and hypotheses are also described. The second section concerns the Twitter intervention, which elaborates on the implementation and rationale of a series of instructional activities designed by the instructor. The third section, explains the different data sources and data collection procedures used in this study. In the data analysis section, the chosen types of analysis and instruments are articulated. How to enhance trustworthiness, validity and credibility of the data is then discussed. A pilot study is explained and more specification of the study was included in the appendix of the
dissertation. A summary provides the research questions, the instruments including coding schemes, and the interview questions and survey questions.

**Research Design**

A case study design was justified for multiple reasons. First and foremost, a case study allows an in-depth investigation of a unique case to answer multiple complicated research questions. The use of microblogging in the context of a hybrid course presented a unique case because it consisted of a combination of a medium and setting rarely studied by researchers. As Yin (2008) indicated, a case-study approach not only allows researchers to provide descriptive and exploratory evidence of the case, it focuses on how and why questions, which probe into a contemporary, complicated phenomenon. In this study, the researcher was interested in knowing how students participated during the online course, how did they perceive their experiences, and what potential factors can be attributed to their perception. Additionally, the researcher, as a course instructor, was able to fully devote to the single case, which is a hybrid-learning classroom, in order to gain a holistic and in-depth understanding. Meanwhile, the researcher is also not particularly interested in replicating the findings of the case; rather, the researcher focused more on the practical significance of the results based on the exploratory nature of the study (Newman & Hitchcock, 2011).

**Research Setting**

The research setting in this case study was a college-level hybrid course designed for pre-service teachers seeking licensure to teach in K-12. The hybrid course was offered by the College of Education at a midwestern university as a required course for all
education majors on various levels. In this section, the researching setting, which was the hybrid college-level course, is introduced and described in detail. Specifically, the course learning objectives, learning contents, format and technology demands of the class are explained below.

**Course objectives.** The major purpose of this course was to acquaint students, who were also pre-service teachers, with technological applications commonly found in educational settings. Additionally, this course was aimed at increasing students' confidence and competency in the use of computers in various learning environments through demonstrating how technology is used to increase the effectiveness, efficiency, and appeal of instruction.

**Content.** Since acquainting students with technology applications was the main objective of the course, all topics covered in this course centered on specific types of technologies. According to the textbook, approximately 30 different educational tools and software were classified into eight main strands to be introduced to students. These tools included mainstream Web 2.0 tools such as blogs, microblogs, wikis, social networks, audio and video editing tools and others. In addition, key concepts, principles, and issues in the domains of instructional design and distance education were instilled to students in order to support learning of the tools and to enhance their understanding of online learning.

The weekly assignments typically involved using one technology application taught during the week to create an instructional artifact, which ranged from a simple picture editing product to a more sophisticated higher-level product such as an
educational website. For example, if Audacity, an audio editing program, was the technology application being taught in the week, the corresponding weekly assignment was to use Audacity to create an educational podcast.

**Format.** This course recently adopted a hybrid format in which the class met three times face-to-face throughout a 15-week semester and the remaining course work was completed online. The decision was made to familiarize pre-service teachers with online learning environments and therefore better prepare them for future teaching in online settings. Each week the instructor posted reading materials relevant to that week's learning topics and provided videos and/or textual tutorials to help students learn how to use that specific educational tool. The instructor also determined the format of online meetings, whether synchronous or asynchronous, the venue, the meeting frequency, and the learning environments where specific learning activities take place.

**Technology demands.** The hybrid course was hosted on primarily on wikispace.com. In Wikispace, the course instructor posted course materials, and made regular announcements regarding course requirements and reminders. Blackboard learning management system was also used for students to post their weekly assignments and receive their grades.

Adobe Connect was a piece of web conferencing software employed as a venue where students and the instructor meet online synchronously. The instructor used the online meeting to deliver brief lectures on the learning topics, recapitulate issues and address problems occurring with assignments from the preceding weeks, as well as to strike conversations and discussions with students on certain learning topics.
Occasionally, the instructor provided a demonstration of the technology to be taught in the week while students can follow and ask questions. All online meetings were recorded for later viewing.

A Wordpress blogging venue was another major learning environment where students reflected on their learning progresses on a weekly basis. Other collaborative learning tools, such as Google docs, were occasionally introduced to support specific instructional activities depending on the learning content.

**Participants**

The students in this course were undergraduates enrolled in Teacher Education Programs of a College of Education at a large midwestern university in the United States. The specific majors to which students belong included Early Childhood Education, Middle Childhood Education, Special Education, Physics Education, Pre-Specialized Studies, and Outdoor Recreation & Education. Their grade year ranged from sophomores to seniors. The participants were intentionally chosen, as they will be the teachers who will introduce technology to the next generation. There were 24 students in the class. All of them were younger-generation college students born in the 1990s. Those students are considered Millennials who are relatively technology-savvy and have many areas of their lives connected to the online world (Florida, Kaimal, Oblinger, & Blessing, 2003).

**The Researcher and Her Suppositions**

The researcher's role and her own suppositions in this study are crucial. In a case study, the researcher serves as the main instrument for the data collection and analysis process (Patton, 2000). As the researcher's assumptions will inevitably influence the data
gathering and analysis process, it is advisable to be reflexive and upfront with the researcher's existing assumptions as well as to acknowledge that bias serves as a part of the research (Miles & Huberman, 1994).

The researcher of this study is an international graduate student in the Instructional Technology program who teaches this hybrid course. The researcher majored in Communication and Development Studies for her Master's degree and Journalism and Mass Communication for her Bachelor's degree. Her background in communication as a discipline provided her the chance to probe into the area of new technologies. Prior to her doctoral study, she was employed as a full-time English instructor at a private college in China. The problems and challenges that she experienced as an instructor urged her to be innovative as well as open-minded. Additionally, she worked as a social media expert in an American non-profit organization to develop social media strategies. This practical experience equipped her with a more profound understanding of social media integration into organizational settings, and ignited her enthusiasm in using social media to reach other purposes. All these prior experiences, both academic and professional, have provided the researcher with solid knowledge and expertise on social media integration and furthered her interest in research surrounding it.

The researcher’s interest in using microblogging as a particular communication technology to facilitate learning started in spring 2011 when she was required to teach one form of educational technology for a class project. Based on her knowledge and enthusiasm for Twitter, she chose to teach the use of Twitter in classroom settings and received an unexpectedly high amount of positive feedback. This anecdotal experience
largely incited her interests in furthering her research on Twitter integration. To date, she has conducted three empirical studies using Twitter in the classroom in different settings and published two journal articles related to the Twitter integration in education. Her personal interest in using Twitter to facilitate learning has become a major impetus for this research.

As the researcher has been actively exploring educational potentials of microblogging integration and personally has a strong belief in the value of microblogging in education, she also acknowledges its challenges and constraints. These challenges have consistently appeared in the findings of prior research studies as well as in her own teaching and experimenting with microblogging. First of all, microblogging is not for everyone. The amount of initial training and education may be tremendous and outrageous in order to prepare learners, both cognitively and psychologically, to reach a degree suitable for microblogging. Depending on the learner's age group, technological literacy level, motivation, prior use, and additional internal and external factors, the efforts undertaken to instill their microblogging-related knowledge and to practice the technical skills needed to familiarize learners to learn in microblogging-based environments may be formidable to some teachers. Therefore, ongoing and specific instructional guidance is highly necessary, especially for novel microblogging users or seasoned users who carry an opposite viewpoint of how microblogging tools should be used.

Second, the tool itself has its own limitations that may not be ideal for learning. Microblogging in its nature is a modern communication tool designed to facilitate mass
communication and open connection with people around the world. To repurpose the tool to suit learning needs, much caution has to be taken when it comes to actual implementation and delivery in any learning contexts. For example, the 140-character limit may not be ideal when learners are engaged in higher-level argumentation process in which an extended length of words is needed to provide an elaborated articulation of meaning. In other cases, the openness and unlocked status of microblogging tools may pose harm to the suitability of the learning environments because learners do not perceive it as a safe environment to openly voice their opinions. Moreover, the excessive amount of noise information that learners are likely to be exposed to in the microblogging environment could overload learners' cognitive capacity and therefore induce substantial distraction.

Third, the unknown and undiscovered aspects of microblogging are plentiful. Similarly, as with many Web 2.0 technologies, such tools have only prospered for a few years and developers have constantly revamped and renovated these tools. New features and enhancements were seen to be added to these tools on a regular basis. Along with the continuous technological enhancements, the researcher believes that the exploration and investigation of such tools to pursue educational purposes need to be up-to-date. The exponential development of technology has intricately and imperceptibly transformed the way learners learn and acquire information and has posed a threat to the relevancy and timeliness of empirical research. Therefore, more investigations and examinations in this area are much needed.
In terms of the assumptions specific to the research questions of this research study, the researcher has the following preconceptions. In regard to participation, the researcher assumes that the volume of participation in online environments may be higher than in face-to-face environments due to the limited time for face-to-face meetings. The relevancy of participation may vary, but the researcher has no prior assumption on which one may be higher. In terms of interaction, the researcher assumes that Twitter communication in online settings may reflect a higher level of interaction because it is a more open and accepting space where students can communicate with each other at their own pace. When students had to tweet in face-to-face classrooms, it became a supplementary backchannel activity that was restricted in both time and space. The level of interaction in such face-to-face settings is highly dependent on how the instructor sets up the in-class activity.

The researcher assumes that the guidance approach should improve both volume and relevancy of participation. The assumption was made given prior experience of teaching the same class. When instructional guidance was present, students were obliged to post their tweets and the participation increased accordingly. Without instructional guidance, student activity on Twitter tended to diverge as they were easily distracted by miscellaneous tweets shown on their Twitter pages. Regarding the influence of different types of instructional guidance, the researcher assumes that social guidance may be more helpful to increase the volume of participation, as students will be constantly reminded of the tweeting tasks and will be asked to interact with one another. The relevancy of participation may remain the same. The researcher assumes that the guided approach will
also affect the level of interaction. Types of interaction will certainly vary as the amount and types of guidance differ. The researcher believes overall with social guidance students may have a higher level of interaction. However, the researcher has no presumptions of how specific types of interaction may vary based on the difference on the amount and types of guidance.

As stated in Chapter 2, the TAM model was used as an underlying framework to understand potential factors affecting students' perceptions of microblogging integration into instruction. To be specific, the factors can be categorized in four different categories, namely, individual differences, system characteristics, social influence, and facilitating conditions. The researcher assumes that individual differences, such as students' prior usage pattern and perceptions of Twitter, their demographical characteristics, grade year, and their mobile phone ownership, may all play a role in their preferences of using Twitter educationally. System characteristics, such as how students perceive the functionality and some features of the Twitter platform, could affect their perceptions. Social influence concerns the social and cultural presumptions of Twitter use that affect individuals to formulate their perceptions and influence their actual use. For instance, how they perceive their peers use Twitter, and how they perceive the general public uses Twitter, can affect their own perceptions. The facilitating conditions in this study particularly refer to instructional support in and out of the classroom. These conditions encompass how the instructor introduced the Twitter activity, how the initial training and following instructional activities were implemented, and the level and amount of guidance and scaffolding provided throughout the entire investigation period. The
researcher assumes that this broad spectrum of factors implied in the TAM model should have a rather complete coverage of all potential factors that may influence students' perceptions. In the meantime, the researcher is expected to discover additional unanticipated factors.

**IRB Procedures**

In conformity with Ohio University's ethical guidelines for research, any research studies that involve human subjects are required to undergo review by the Ohio University Institutional Review Board (IRB). The IRB assures that the purpose and procedure of the research study are in compliance with the prescribed guidelines of ethical research and cause no harm to research participants. The IRB also ascertains the protection of privacy for all research participants. The researcher obtained permissions from the IRB prior to implementing the study. This study initially received an IRB approval in September 2012 for its pilot study, and it was subsequently amended and renewed in January 2013. All participants in the study were older than 18 years old and they all signed a hard copy of the informed consent forms.

**The Implementation of Twitter-supported Activities**

**Operationalization of microblogging integration.** The implementation of microblogging integration in this study is tri-fold. First, backchannel communication with microblogging was implemented in the face-to-face meetings to support lectures and student presentations. Previous research suggested multiple benefits of using microblogging-supported backchannel communication in the physical classroom or conference room, such as enabling immediate feedback, allowing virtual participation,
and enhancing student engagement (Ebner, 2009a; Ebner, 2009b; Elavsky et al., 2011; Ross et al., 2011). In the current study, the instructor opened up Twitter as a backchannel to allow comments, feedback, and questions as lectures or student presentations were going on simultaneously. The purpose of holding this backchannel was to allow feedback from a maximal number of students and enhance their active participation in contributing to the present lecture or student presentations. In order to control the potential noise information received from this enabled backchannel, the instructor did a training session to familiarize students with the micro blogging environment in order to help students focus on learning tasks. The instructor also encouraged students to create an account exclusively for this class.

Second, the instructor designed three types of microblogging-based activities as partial weekly assignments for students to explore the educational value of Twitter outside of the classroom. These activities were comprised of exploration of educational hashtags, discussing course-related topics, and participating in educational live chats, each of which lasted for four continuing weeks. These three activities were chosen to fit the instructional objectives of the class and the decisions to incorporate those activities were informed by the current literature and results from the pilot study. Using hashtags to explore the Twitter-sphere is one technique recommended to understand how Twitter works and how it can be beneficial (Diaz-Ortiz & Stone, 2011), which could be an interesting introductory activity for students attempting to become familiar with Twitter.

Researchers also recommended discussion-based activities that students can all participate in and share their thoughts through even when they are remote from each
other (Borau et al., 2009; Kruger-Ross et al., 2012). With #Edchat being an influential microblogging community for teachers' professional development involving thousands of educators and administrators from various countries around the world (Terrell, 2009), the live chat activity in #edchat not only provided opportunities to understand how educators converse with one another on the Twitter-sphere, but it also actually engaged students in a much broader professional community than they otherwise would have had access to.

Third, besides the required weekly activities, students were encouraged to use Twitter as a Q & A platform where they could freely ask questions and receive prompt feedback from the instructor. In many previous studies, researchers employed Twitter as a space to allow questions and conversations outside of the formal classroom space and received increasingly positive feedback from students (Dunlap & Lowenthal, 2009; Hsu & Ching, 2011; Thoms, 2012). A list of suggested uses of Twitter was posted as a reference, but it was not mandatory for students to tweet aside from the required weekly activities.

**Operationalization of instructional guidance.** As noted in the literature review, different variables concerning guidance were manipulated in the microblogging-supported collaborative learning activities to examine to what extent and in which aspects instructional guidance affects the effectiveness and student perception of microblogging-supported learning. In the current study, different variables, modes of learning (guided versus unguided), types of guidance (social versus cognitive) and volume of guidance (daily versus weekly) were manipulated in a series of microblogging-supported collaborative learning tasks and therefore examined to what extent and in which aspects
instructional guidance affects the effectiveness and student perception of microblogging-supported learning.

**Mode of learning.** The instructor modified the mode of learning (guided versus unguided) in both online and face-to-face activities. In the face-to-face portion, backchannel communication was used to support both lecture and student presentations but at different times. According to the typical schedule of the class, instructors lectured twice and students presented twice among the three face-to-face meetings. The guided mode of learning was initially implemented in the first lecture where a microblogging-supported backchannel was created simultaneously and then altered to an unguided mode in the second lecture. For student presentations, modifications of the mode of learning followed the same string (See Table 2). In the online portion, the instructor modified the mode of learning every two weeks. Simply put, in each online activity (hashtags, discussions, and live chats), the instructor used a guided mode for the first two weeks and an unguided mode for the following two weeks (See Table 3).

<table>
<thead>
<tr>
<th>Face-to-face</th>
<th>Week 1(Meeting 1)</th>
<th>Week 7(Meeting 2)</th>
<th>Week 14(Meeting 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor lecture</td>
<td>Guided</td>
<td>unguided</td>
<td>(not part of meeting)</td>
</tr>
<tr>
<td>Student presentation</td>
<td>(not part of meeting)</td>
<td>guided</td>
<td>Unguided</td>
</tr>
</tbody>
</table>
Table 3

*Schedule of Online Twitter Activities*

<table>
<thead>
<tr>
<th>Online meetings</th>
<th>Activities</th>
<th>Guided</th>
<th>Unguided</th>
<th>Social guidance</th>
<th>Cognitive guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Explore</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Week 2</td>
<td>Hashtags</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Week 5</td>
<td>Discussing</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 6</td>
<td>Topics</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Week 9</td>
<td>Live Chat</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 10</td>
<td>(#edchat)</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Week 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

*Type of guidance.* Type of guidance (social versus cognitive) was modified in the online activities. Cognitive guidance involved either emphasizing the cognitive dimensions of the design task, such as providing instructional prompts for the task, breaking down the discussion topics, providing resources and pertinent information to facilitate the task. Contrastingly, social guidance focused on supporting group
collaboration, such as developing cooperative and pro-social norms for conversation, encouraging students to socialize and help with one another on the learning tasks, etc. Examples of different types of guidance are illustrated in Table 4. Due to the limited time in face-to-face meetings, this variable was maintained at a constant. As weekly online activities were an on-going event that occurred on a regular basis within a longer time frame, the variable, type of guidance, was chosen to be modified here to examine its potential influences on student learning. For example, within the first two weeks in which guided approach was used for the "Explore hashtags" activity, cognitive guidance was provided in the first week, followed by social guidance in the second week. The same order was stipulated in the remaining two activities. Table 4 shows the modifications of the two variables, mode of learning and type of guidance, in the online activities.
**Sample Instructional Prompts**

<table>
<thead>
<tr>
<th>In-class lectures &amp; student presentations</th>
<th>Cognitive</th>
<th>Social</th>
<th>Unguided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide at least 1 question or comment on the concepts I explained in this class.</td>
<td>How have your tweets been going?</td>
<td>Provide some feedback using Twitter (say it once prior to the lecture/student presentation)</td>
<td></td>
</tr>
<tr>
<td>Provide at least 1 suggestion on how to improve this project presented by your peers.</td>
<td>Let me see if I have some feedback on Twitter from you yet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide at least 1 issue or problem that you notice on this website that your peers designed.</td>
<td>I hope you are tweeting to give feedback while your peers are presenting.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discussion Topics</th>
<th>What are the pedagogical use of XXX?</th>
<th>@XXX @XXX you guys are discussing topics of the same nature. Could you share your ideas more in detail with each other?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>What's your understanding of XXX?</td>
<td>@XXX you haven't posted anything yet about this week's discussion. What are your thoughts?</td>
</tr>
<tr>
<td></td>
<td>What are the benefits and constraints of XXX?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>How can these concepts XXX be applied in teaching and learning?</td>
<td></td>
</tr>
<tr>
<td>Live Chat (#edchat)</td>
<td>Provide the instructor's own direct opinion on the topic and guide students in-depth thoughts</td>
<td>(Social greetings and conversations with students)</td>
</tr>
<tr>
<td></td>
<td>This topic XX relates to the concept XX we learn in class. What do you guys think?</td>
<td>Hello all! I am bringing in my own students/pre-service teachers to join #edchat!</td>
</tr>
<tr>
<td></td>
<td>Here are more resources XXX about this topic.</td>
<td>@XXX: you guys are having a heated discussion!</td>
</tr>
<tr>
<td></td>
<td>I agree with XXX on XXX</td>
<td>@XXX: I haven't seen your tweets much. Any thoughts on this topic?</td>
</tr>
<tr>
<td></td>
<td>I disagree with XXX on XXX</td>
<td></td>
</tr>
<tr>
<td></td>
<td>XXX because....</td>
<td></td>
</tr>
</tbody>
</table>

| Discuss any interesting topic that we have covered in this week's content (posted materials and book chapters) | Not participate with students in live chats |
**Instructor's use of Twitter.** For the instructor, Twitter was used predominantly as a supplemental learning management tool throughout the entire semester. A course account was set up by the instructor and different hashtags, a pound sign #, were used in a tweet as an identifier to facilitate the varying instructional activities in the class. All hashtags were pre-examined to ensure its uniqueness in the Twitter public domain. Every week, the instructor used it to send out class announcements and reminders of assignments, projects, online meetings, as well as post links and resources on related instructional topics. Another primary use of Twitter was to maintain timely and effective student-teacher communication. In the events of students inquiring about course-related subjects, the instructor often provided immediate and succinct feedback. The just-in-time immediate feedback was aimed to help students to resolve problems on the spot, which at the same echo the nature of quick and brief nature of communication on Twitter. For the three required ongoing activities, the instructor also provided social and cognitive guidance in the forms of instructional prompts and social conversations (See Table 4 for sample prompts). At times, the instructor provided additional emotional support for students, such as supportive statements to encourage students to be motivated during finals week. The instructors' use of Twitter also serves as expert modeling of Twitter's educational use for students to observe and learn.

**Students' use of Twitter.** Students used Twitter to support face-to-face classroom activities including lectures and presentations and a wide variety of activities in online environments as instructed by the instructor. Operationalization of the two key notions, backchannel communication and guidance were applied in students' use of
Twitter, in addition to their free personal use both academically and socially. Overall, students' use of Twitter was guided progressively by the instructor from initial training to more cognitively and socially advanced activities.

For the initial training, a hands-on workshop where students were guided to sign up Twitter and post their first tweet using the designated class tag #edct2030 was conducted in the first face-to-face meeting. The instructor demonstrated both typical and creative use of Twitter in education. A Twitter101 lesson where students can find abundant resources on Twitter was accessible in a collaborative-learning wiki environment. Pertinent issues, such as Twitter's technical glitches, privacy considerations, use of hashtags, management of personal tweets, were also specifically discussed in the face-to-face workshop. This workshop was aimed at cognitively and technologically preparing students for the incoming weekly activities.

During the face-to-face lectures, students were encouraged to use Twitter to bring up questions and comments simultaneously as the class progressed. In concurrence with in-class group presentations, students were required to use Twitter to provide immediate feedback for their peers. The variable, instructional guidance was modified in both lectures and student presentations based on the schedule (See Table 3). For the guided approach, students had expressive instructions on what to tweet, how to tweet, and how much to tweet, while in the unguided approach, students were only loosely instructed to tweet their comments and feedback.

Twitter was also progressively mandated in students' out-of-class learning online activities. The sequence of those three required activities, exploring hashtags, discussing
topics, and participating in educational live chats were arranged based on their degree of cognitive difficulty. In exploring hashtags, students were first given specific hashtags to explore with guidance and later asked to freely explore any educational hashtags without guidance. Similarly, for discussions, students were initially given prompts and questions to discuss restricted topics and later only given keywords. Regarding participating in educational live chats, the instructor first joined those chats with students simultaneously, while instructor presence was absent in subsequent live chat meetings. The cognitive versus social guidance depends on whether the instructor only casually chat with students and provide social and emotional support, or provide instructional resources or direct instructions towards cognitive growth.

In addition to the weekly activities, the students were also encouraged to use Twitter to (a) share links to their blog posts and online presence and other resources, (b) communicate with the instructor and ask course-related questions, (c) interact and collaborate with one another, (d) and engage with the broader Twitter professional community. Students were provided with a guidelines sheet that divides these loosely-structured informal tweeting activities into three stages and specifies the suggested use of Twitter in each stage.

**Data Collection**

The primary sources of data are qualitative data collected from the class were observations, interviews, and documents including students’ tweets and blogging reflections. The secondary quantitative data were collected from end-of-the-class
summative survey and the quantitative measures of students tweeting activity were collected from the social networking analysis software program.

**Observation.** Observation data provide thick descriptions of the setting, the activities that occurred in such setting, the participants who were involved in the activities, the interpretations of these observed setting and activities from both the participants' and the researcher's perspectives (Patton, 2002). Through direct observation, researchers are able to better understand the context in which participants are involved and how they interact with one another. As observation tends to be an unobtrusive method that takes place in a naturalistic setting, it allows the researcher to be more open and inquiry-oriented as they are less likely to depend on pre-assumptions (Patton, 2002). In comparison to other methods such as interviewing, observation provides the researcher an opportunity to move beyond *selective perceptions* meaning an inquiry only stemming from selective interviewees, and therefore the researcher can obtain a more comprehensive understanding of the setting rather than relying solely on the interview data.

In this study, the goal of this observation is to maintain an overarching, ongoing and systematic noting and recording of what happens during the process of was done as regulated noting of students' reactions towards the tweeting activities in both face-to-face and online environments. As the researcher is the instructor of this course who designed and implemented all the microblogging-supported activities, her role is a full participant observer in the setting. She carried both insider and outsider perspectives as she is both an instructor and a single observer/researcher of the class. However, the researcher did
not give notice to students about the observations so that regular instruction and learning was not impacted. The observation lasted for an entire semester, which entails an observation of all face-to-face classroom sessions as well as an ongoing monitoring of the Twitter activities occurred during the course.

The observation items were designed based on the focus of the study. Student participation and interaction in both face-to-face and online activities, as well as their reactions that reflected their perceptions of the Twitter integration were observed and noted. Specifically, in the physical classroom, observations entailed attending to students' observable behavioral responses to the tweet requirements, such as the immediacy of tweeting (how quickly they started to tweet), physical or bodily cues that students expressed (what body or verbal language they had when they were asked to tweet), and their in-class verbal reflection on the tweeting activity (what did they say about after tweeting was done). In online environments, every single tweet related to the class was archived as artifacts for further analysis. Besides tweeting, other types of student-instructor communication (such as emailing) that touched on the topic of tweeting activity, was documented as well. The observation in this study was both an evolving and emergent process.

**In-depth interviewing.** Apart from the observations, in-depth interviews were conducted to understand students' experiences and perceptions of using Twitter in the online course. Seidman (1998) postulated that interviewing involves a process "selecting constitutive detailed experience, reflecting on them, giving them order, and thereby making sense of them that makes telling stories a meaning-making experience" (p. 1).
Punch (2005) stressed that interviewing is a powerful method to access participants' perceptions, meanings that they attach to those perceptions, and how they construct their own meanings. By inviting participants to depict their known constructions of the reality using their own languages and terms, researchers can understand them without imposing any prior postulation.

Patton (2002) categorized three means used to approach qualitative interview data: (a) the informal conversational interview, (b) the general interview guide approach, and (c) the standardized open-ended interview (p. 342). The informal conversational interview typically is an unstructured interview that occurs without the interviewee's awareness as part of the observation. The strength of the informal approach lies in its ability to gain flexible and spontaneous responses from the participants. In contrast, the interview guide approach employs a series of predetermined questions and issues in the interviewing effort to ensure the seeking of fundamental lines of inquiry. The level of detail and specificity of the questions asked varies, depending on to what extent the interviewer can specify and predetermine the importance of the issues to each interviewee. The standardized open-ended interview is a fully structured interview instrument in which all questions asked in the interviews are completely specified and sequenced. This approach provides a high level of detail and specificity as each interviewee "get asked the same question- the same stimuli- in the same way and the same order, including standard probes" (p. 344). Patton (2002) also highlighted a combination approach that combines all three aforementioned approaches. He also cautioned on the timeframe in which each strategy is adopted. The informal conversational interview is usually conducted in the
early stage of the research, followed by the interview guide approach, and then closing with the standardized open-ended interviews.

In this study, the researcher employed all three approaches in an integrated manner. First, the conversational informal interviews were conducted occasionally throughout the 14-week of class. It took place in the beginning and closing section of a formal online or face-to-face meeting where the instructor tentatively inquired about students' experiences or perceptions of the Twitter integration based on recent Twitter-related events or activities. It also occurred a few times when students come in during the instructor's office hour. This situational informal interview provided the researcher with students' feedback in a timely manner so that the researcher could adjust the specificities of the Twitter intervention or the research design following an emergent design principle (Patton, 2002).

The primary interviewing endeavor was a summative interview at the end of the course that employed the standardized open-ended approach in collaboration with interview guide strategy. A set of structured questions were queried in a standardized format at the first section of the interview. The standardized question set was laid out according to the TAM model to explore potential factors affecting their perception and participation in the Twitter experience. The standardized question set was 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.
Beside, students were asked about their overall comment on the benefits and drawbacks of the Twitter integration, and specific questions targeting varied instructional activities implemented throughout the course. In addition, 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 different questions that only pertain to their individual characteristics and Twitter usage pattern. These add-on questions were considered exploratory topics following the interview guide approach, which the researcher can further explore at their own discretion.

Eighteen out of 24 students voluntarily participated in the in-depth interviews at the instructor's office. Interviewees were inquired on a one-on-one basis format that follows a semi-structured protocol. The researcher informed all the participants that their participation was completely voluntary and their responses would not affect their grades. A hard copy of inform consent was given to each participants and had to be signed before the commencement of interviews. Participants had opportunities to ask questions and have them answered by the instructor before they choose to participate. After gaining their consent, semi-structured interviews were used and the duration of each interview ranged from twelve minutes to 30 minutes, depending on the flow of the conversation and questions being asked.

All interviews were recorded, transcribed, and kept safe. A code was assigned to each student's data file and each time when interviews were conducted the instructor
replaced the student’s name with the code. The code and the data were kept separate and store securely. The interview protocol can be found in Appendix A.

**Documents.** Documents were another important type of qualitative data in this study. Patton (2002) specified documents to be records, documents, artifacts, and archives; in a broader sense, documents as data are "all kinds of entities leave a trail of paper and artifacts, a kind of spoor that can be mined as part of fieldwork" (p. 293). In an online learning environment, students' behaviors are not usually recorded on paper or in any physical manner as Patton stated; instead, they can be easily collected and archived by online programs, which still leaves a spoor of what students have done in such an environment.

In this study, the documents included students' posts on Twitter and their blogging reflections of their Twitter experience. The researcher collected the students' posts from Twitter on a weekly basis using a social network analysis software called NodeXL. NodeXL is a free open-source program that allows for archiving tweets and collecting many other useful social network measurements (Hansen, Shneiderman, & Smith, 2010). The class hashtag, #edchat2030, was used to identify student tweets pertinent to this class. Tweets not tagged by #edct2030 were not collected and therefore excluded from this study. Through using NodeXL, many quantitative measurements of students' tweeting behaviors (i.e. when they tweet, how many time they tweet) and properties of their Twitter accounts (i.e. how many followers, how many people they follow) were automatically collected alongside the content of the tweets.
In addition, students were required to write a blogging reflection of 300 words to reflect on and summarize the three major Twitter activities. Towards the end of each online tweeting activity (Exploring Hashtags, Discussion Topics, Live Chats), students wrote a blog entry to reflect on that specific activity and share with their peers. Specific prompts for each blog assignment were provided by the instructor. The researcher collected students' blog entries as part of the documents of this study.

**Surveys.** As pre-existing survey instruments in prior research do not apply to the current research study, the researcher created her own survey instrument unique to the specific activities conducted in this study. The purpose of using such survey instrument was to understand student participation in and perception of microblogging-based activities. Survey data concerns an end-of-the-course summative survey that incorporated both Likert-like scale closed-ended question and open-ended questions that asked them to justify their responses to the Likert-like scale questions. As Dillman et al. (2009) noted, closed-ended ordinal questions allow accurate measurement of gradations of opinion, attitude and behaviors, while open-ended questions provide students with opportunities to justify their responses to the ordinal questions and express their opinions that fail to be covered.

The end-of-the-course survey consisted of three sections: (a) students' demographic information, educational background, mobile phone ownership, and frequency of Twitter in the class; (b) questions that inquired students' perceptions of the backchannel microblogging in face-to-face meetings to facilitate lecture and student presentations; (c) questions that inquired students' perceptions of three required activity
(explore hashtags, discussion questions, live chats); (d) open-ended questions that explained and justified the Likert-like scale questions. The survey also incorporated questions where students evaluate the educational benefits of Twitter integration and all other purposes of using Twitter. An end-of-class survey can be found in Appendix B.

**Instrumentation**

Instrumentation in this section particularly refers to the measurement of *participation and interaction* as reflected in students' tweets in response to the first research question. The two variables, participation and interaction, were examined through a content analysis of students' tweets.

An examination of the coding schemes used by previous researchers suggested that researchers developed different coding schemes based on their purposes of study and the type of activity. Some focused on the types or functions of tweets. For example, students' tweets in Elavsky et al.'s study were coded into 11 categories, including "type (of tweet, i.e., original post, retweet, or direct reply), aim (whom the tweet was directed at), construction (whether and how the tweet was related to class and its discourse) and more" (Elavsky et al., 2011, p. 223). In Pauschenwein and Sfiri’s (2010) work, student tweets in an online course were coded to categories such as expressing personal disposition/mood, addressing issues in regard to course content, supporting others, acknowledging the achievements of others and so on. Naaman et al. (2010) found that when no specific purpose was demanded for Twitter users, users typically are engrossed in (a) posting messages about themselves or (b) more informative, conversational engagement with their followers. Their overarching categories in the coding scheme were:
information sharing (IS), self-promotion (SP), opinions/complaints (OP), statements and random thoughts (RT), me now (ME), question to followers (QF), presence maintenance (PM), anecdote me (AM) and anecdote other (AO). Such coding schemes serve as foundations of instrumentation of the two variables in the current study.

Overall, number of tweets has been used as an indicator of participation across multiple studies on microblogging-based learning (Elavsky et al., 2011; Luo & Gao, 2012; Ross et al., 2011). In this study, the variable participation was sub-divided into volume of participation and relevancy of participation. Different measurements were used to measure the volume of participation (See Table 5). Additionally, relevancy of participation was measured based on the degree to which a tweet is related to the learning activity or learning content. Tweets that reflect as relevant to the learning content were coded as on-task, while the irrelevant tweets were coded as off-task. These two categories emerged after the initial coding of participation.
Table 5

*Instrumentation of Participation and Interaction*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of participation</td>
<td>Number of posts, number of participants, number of posts per person, total number of characters, number of characters per post, number of characters tweeted per person</td>
</tr>
<tr>
<td>Relevancy of participation</td>
<td>Number of on-task/off-task tweets in three instructional activities</td>
</tr>
</tbody>
</table>
| Initial coding for type of Interaction | Self-reflection  
Elaboration/clarification  
Alternative/complementary proposal  
Internalization/appropriation  
Conflict/disagreement  
Support  
(was modified into a new coding scheme) |
| Level of Interaction               | Tweet  
Mentioned  
Replies to |

Student interaction has been a key variable that is often measured in collaborative learning contexts but has rarely been examined in microblogging-supported learning contexts. Prior researchers have developed different coding schemes to measure interaction. For example, Pena-Shaff and Nicholls (2004) created an instrument to capture the interaction and meaning construction process in collaborative learning environments. The entire list consists of 11 categories, including questions, reply, clarification, interpretation, conflict, assertion, consensus building, judgment, reflection, support and other. This list provides a holistic and meaningful framework to understand how learning occurs in bulletin board-mediated online discussion learning environments. A similar coding scheme to analyze types of interaction was developed to fit student posts in social annotation tools-based online discussion environments (Gao, 2013).
Due to the similar nature between online discussion posts and tweets, this coding scheme (Table 6) was selected as a preliminary framework to measure types of interaction and demonstrate students' learning processes. A modified coding scheme was developed when actual data collection was complete.

In addition, all tweets were coded according to the levels of interaction using a specific feature of the social networking analysis program NodeXL. In NodeXL, the tweets can be classified based on the differences in Twitter functions, including a single tweet, mentioned, and replies to. These different functions represent varying levels of interaction (Hansen et al., 2010). A (single) tweet reflects no interaction with others, mentioned reflects a lower level of interaction, while replies to suggests a higher level of interaction with other members in the class. Table 5 explains specifically how each of one of these variables was measured in this dissertation study.

**Development of a New Coding Scheme**

The analysis of interaction was essentially using the same student tweets data but doing qualitative content analysis to find common patterns in the text. A single tweet was again selected as a unit of analysis. Critical in coding is the idea of contextualizing each
Table 6

*Gao’s Coding Scheme for Types of Interaction*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Behaviors</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self- reflection</td>
<td>Learners reflect on and interpret what they have</td>
<td>“I love the idea of a survey for a book review! It is a quick and easy way to get immediate feedback about books and choose future materials catered to your students’ interests….“</td>
</tr>
<tr>
<td>Elaboration/clarification</td>
<td>Learners build upon an existing comment by adding supporting examples and justification</td>
<td>“I would agree with you both just thinking of my own experiences when a teacher would review something and I would look around and there would only be like 3 students that were paying attention because everyone else knew what they were talking about.”</td>
</tr>
<tr>
<td>Alternative/complementary proposal</td>
<td>Learners offer a complementary or alternative view</td>
<td>“While I think this is a great way to get student feedback on the books they have read, this could also pose potential problems. Students who read other students’ comments could avoid reading a book because several students gave a book a bad review….“</td>
</tr>
</tbody>
</table>

tweet in a conversation, as many tweets were associated with adjacent tweets and can be only coded in reference to those connected tweets. As Pena-Shaff & Nicholls (2004) noted, one message/tweet could be coded into various categories, or a single category, relying on how this single message is being interpreted in the thinking processes demonstrated in the text.

Beginning with the existing selected coding scheme in Gao's (2013) study to conduct the first round of analysis, tweets collected from all weeks were read and coded
and the categories and indicators were revised as needed. The researcher then fine-tuned
the categories using a detailed *line-by-line analysis* known as the grounded theory
approach (Strauss & Corbin, 1998). New unanticipated categories emerged as the
researcher assessed and categorized the data and therefore were added to the existing
coding scheme. As more categories were generated, the researcher went back to the
existing coding schemes in previous studies, such as Pauschenwein and Sfiri’s (2010) and
Naaman et al.’s (2010) to eliminate unnecessary categories and combine them into new
meaningful codes. A modified coding scheme was established after the researcher's
examination of tweets in the non-live chat activities (See Table 7). When it come to the
Live Chat activity, the researcher noticed that not all codes from the pre-established
coding scheme can be applied to those tweets due to the different nature of online
communication (asynchronous versus synchronous). Therefore, another modified coding
scheme was created exclusively for tweets generated in the live chats.

As a check on this coding-scheme modification process, one colleague as external
investigator browsed approximately 200 sample tweets and discussed with the researcher
about how to combine the categories and code the tweets into meaningful categories due
to the ambiguity among different categories. The indicators for each category then
became more distinct and established. The newly established coding schemes for both
settings were presented in Table 7 and 8.
### Table 7

**Coding Scheme for Non-live chat Tweets**

<table>
<thead>
<tr>
<th>Codes</th>
<th>Indicators</th>
<th>Example of Tweet</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR - reflection</td>
<td>Acknowledge learning new knowledge and recognize its significance</td>
<td>Twitter is very significant for discussions and thought! Interested to see how it works for #edct2030</td>
</tr>
<tr>
<td>EL - elaboration</td>
<td>Expand learning content, build on existing comments by sharing thoughts and/or show examples</td>
<td>@xxxxx I completely understand. I think there is definitely an age barrier for certain types of technology #edct2030 #edtech</td>
</tr>
<tr>
<td>AP - alternative proposal</td>
<td>Offer alternative perspectives</td>
<td>I like the polls but if I didn't know the answer I would just wait for others to answer #edct2030</td>
</tr>
<tr>
<td>IT - internalization</td>
<td>Paraphrase the concepts/ideas, synthesize ideas, showing an application and/or transformation of concepts/ideas</td>
<td>Using clickers in the classroom would be a good way to involve everyone in class discussions or to check for understanding #edct2030</td>
</tr>
<tr>
<td>SP - support</td>
<td>Express agreement, establish rapport, or share similar feelings with none/little elaboration</td>
<td>Very energetic presentation! #edct2030</td>
</tr>
<tr>
<td>DA - disagreement</td>
<td>Show disagreement or conflicting opinions</td>
<td>You need to be careful of subliminal messages in visual media. Even some kids' media reinforces gender and racial stereotyping #edct2030</td>
</tr>
<tr>
<td>SL - socialization</td>
<td>Greet and be acquainted with one another</td>
<td>@xxxxx Hi! What's your major?! #edct2030</td>
</tr>
<tr>
<td>RS - resources sharing</td>
<td>Share information, media, and other resources related to course content</td>
<td>How Do I Use Twitter's Suggestions For Who To Follow? <a href="http://t.co/6YlvWpiYys">http://t.co/6YlvWpiYys</a> #edct2030</td>
</tr>
<tr>
<td>CB - conversation building</td>
<td>Back-and-forth questions and replies to reach discussion of the course-related content</td>
<td>@xxxxx What do you think are some of the best practices of using graphics and videos? #edct2030</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Tweet</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>DC - discussion of coursework</td>
<td>Discuss course assignments, share links of their assignments</td>
<td><em>I know it's late, but does anyone need an extra group member for our projects for tomorrow? Let me know! #edct2030</em></td>
</tr>
<tr>
<td>TD - technical difficulties</td>
<td>Report technical difficulties</td>
<td><em>Anyone having troubles typing in the form? I have a small space to write a lot. #edct2030</em></td>
</tr>
<tr>
<td>OT - off task</td>
<td>Irrelevant tweets, not focusing on the course content, tweets posted by outsiders</td>
<td><em>Finally got my #EDCT2030 Twitter set up! A little late...</em></td>
</tr>
</tbody>
</table>
Table 8

Coding Scheme for Live chat Tweets

<table>
<thead>
<tr>
<th>Codes</th>
<th>Indicators</th>
<th>Example of Tweet</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-self-reflection</td>
<td>Acknowledge new knowledge and recognize its significance</td>
<td>I saw one app for the ipad that zoomed in on a mouth as it made certain sounds, I thought it was really cool #slpchat</td>
</tr>
<tr>
<td>EL-elaboration</td>
<td>Expand learning content, build on others' comments by sharing thoughts and/or show examples</td>
<td>@xxxxx You can fit in whatever standards you need to around a topic, letting them choose just makes it more collaborative #rechat</td>
</tr>
<tr>
<td>AP-alternative proposal</td>
<td>Offer alternative perspectives</td>
<td>Although technology in the classroom is great, so students can't act mature enough to stay focused. #edchat</td>
</tr>
<tr>
<td>IT-internalization</td>
<td>Paraphrase the concepts/ideas, synthesize ideas, showing an application and/or transformation of concepts/ideas</td>
<td>Never put someone down for their opinions. Open minds are key to this profession. #edchat</td>
</tr>
<tr>
<td>SP - support</td>
<td>Express agreement, establish rapport, or share similar feelings</td>
<td>@xxxxx I completely agree with you on this and can see where you're coming from. #edchat</td>
</tr>
<tr>
<td>DA - disagreement</td>
<td>Show disagreement or conflicting opinions</td>
<td>@xxxxx I'm not sure if I completely agree with that. I think that is a generalized statement #edchat</td>
</tr>
<tr>
<td>SE - self-expression</td>
<td>Express themselves, show emotions and feelings, share thoughts about themselves</td>
<td>only 17 minutes in and I am so overwhelmed by #edchat I'm hoping this gets better!</td>
</tr>
<tr>
<td>SL - socialization</td>
<td>Connect and network with other</td>
<td>xxxxx, Ohio University undergrad, AYA Earth and Space science major #mdedchat</td>
</tr>
</tbody>
</table>

Note: Twitter username shown in the tweets were replaced with xxxxx.
Data Collection Procedures

1. At the beginning of the first face-to-face meeting, the researcher explained the purposes of the study, disseminated IRB consent forms, conducted a 15-minute training to explain the use of Twitter in this course.

2. The researcher started to take notes about observation and collect students' tweets using NodeXL. The collection of tweets and observation notes was sustained until the end of the semester.

3. By the end of Week 4, the researcher collected blog reflections for the Exploring hashtags Twitter activity.

4. By the end of Week 5, the researcher collected blog reflections for the Discussion topics Twitter activity.

5. By the end of Week 12, the researcher collected blog reflections for the Live chats Twitter activity.

6. From Weeks 12-14, the researcher conducted one-on-one semi-structured interviews with students in the class.

7. At the third face-to-face meeting (Week 13), the researcher collected the end-of-class survey.

Data Saturation and Sampling

Data saturation refers to the notion that there is a point in data collection at which no new or relevant information emerges concerning the theory construction process (Given, 2008). The underlying notion is that researchers usually use collected data to explain a phenomenon or an event and then create theories and findings generated from
the data. The inception of data collection denotes the starting point of theory construction. When saturation is reached, a researcher marks this point indicating that no more data need to be collected. The notion of data saturation informs and determines the sampling process in qualitative data collection. Research noted that qualitative research studies need to conduct qualitative power analysis in order to inform sample sizes and sampling designs congruent with the research goals (Onwuegbuzie & Leech, 2007).

Sampling guidelines concerning data saturation vary according to different methodologists and the discrete research designs. Creswell (2002) proposed that qualitative researchers should interview 15-20 people for a grounded theory study and interview up to 10 people in phenomenological study. Morse (1994) suggested that a minimum of six participants is needed for qualitative inquiries if the goal of the research is to understand the essence of experience. It is also suggested that the sample size and data saturation point differs depending on the homogeneity of the sample. Kuzel (1992) recommended that six to eight data sources or sampling units will suffice in a homogeneous group and that 12-20 sampling units generally are necessary.

In this case study, the researcher initially had planned to use stratified purposeful sampling (Onwuegbuzie & Leech, 2007) to interview 12 out of the total 24 students in the class. This decision was made primarily based on the fact that it is a relatively homogenous group of students with a similar age and educational background. The researcher assumed that students' orientation of viewpoints on microblogging integration might diverge into both positive and negative directions. Therefore, stratified purposeful
sampling that employed six sampling units from each direction might have been needed to gain detailed information on their differences in perceptions.

In the actual interviewing process, students' perception was in fact rather homogenous, which created difficulty to stratify the population into two groups with an even number of participants. Only two students demonstrated an overt aversion towards Twitter. Because the participant population pool was limited to 24 students, data saturation concerning negative perspectives could not be assured with only two negative samples.

In the meantime, students demonstrated noticeable individual difference in their prior use and experience with Twitter, representing a wide user group spectrum from non-users, novice users, moderate users, to heavy users. Individual differences then emerged as a new way of stratification, which replaced the original orientation of viewpoints. The researcher paid close attention to the notion of data saturation as she continued to interview students from each category of individual differences. Data was saturated when no further information was achieved from each specific strata. In the end a total of 18 students out of the population of 24 were interviewed, indicating a fair coverage of participants in each strata of user group.

**Data Analysis**

Data analysis in qualitative research essentially means to make sense of the data. Bogdan and Biklen (1982) defined data analysis as a process of "systematically searching and arranging the interview transcripts, field notes, and other materials that you
accumulate to increase your own understanding of them and to enable you to present what you have discovered to others" (p. 145).

Qualitative methodologists suggest varying manners to conduct qualitative data analysis. For examples, LeCompte (2000) postulated a five-step data analysis approach, including (a) tidying up, (b) finding items, (c) creating stable sets of items, (d) creating patterns, and (e) assembling structures. Similarly, Rubin and Rubin (2012) proposed a five-stage analysis model to analyze qualitative interview data: (a) recognizing and finding concepts, themes, events and topical markers, (b) clarifying what is meant by specific concepts and themes and putting together an overall narrative, (c) coding—figuring out a brief label to designate each and then mark it (d) sorting the data by grouping all the data units with the same label into a single file, and (e) final synthesis—combining concepts to suggest the relationships, evaluations and possible theories.

Data analysis in this study proceeds in five stages. The first stage involved tidying up and organizing the data. All data sources, including observation notes, student tweets, student blog reflections, interview transcripts, and survey responses were all compiled and put together. Preliminary descriptive analysis was done to analyze and provide descriptive information on the quantity of tweets and qualitative survey results. Regarding the first research question, quantity of tweets was one major benchmark to measure student participation in varying conditions (online environment versus a face-to-face; guided versus unguided; social guidance versus cognitive guidance). Other quantitative measurements, such as number of students participating in each condition and frequency of tweets (average tweets per day per student) were also collected. In the
meantime, descriptive analysis was done to provide insights on students’ perceptions of each microblogging activity according to students' ratings in the end-of-class survey.

The second stage of data analysis involved coding and understanding the student tweets data. Student participation was coded following the criteria specified in the instrumentation section. Student interaction, especially types of interaction, was coded using both top-down and bottom-up strategies (Chi, 1977). The development of coding scheme was specified in the prior section. In order to enhance the validity of data analysis, another external researcher used the established coding to code one fifth of the original dataset. The degree of agreement was 93% between two coders' results. Disagreements were resolved through further discussion.

The third stage was to analyze the interview data. Student perceptions of all microblogging-supported activities and the factors influencing their perceptions were the two key interests of investigation, as stated in research question two and three. Grounded theory approach (Charmaz, 2006; Strauss & Corbin, 1998) is reemployed to gain ideas of students' perceptions. Concepts and themes emerged from the interview data as the researcher went along the process of analyzing the interview transcripts. The researcher went through a systematic line-by-line open-coding process to find out fresh and rich results as new topics and themes are evolving throughout the process.

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 as it was also the way the interview protocol was designed. Themes and concepts were extracted from the data and later coded in the four pre-
established categories according to the TAM model, namely, individual differences, system characteristics, social influence, and facilitating conditions. The researcher then read and reread the transcripts to analyze emerging patterns and develop meanings from students' data. The patterns were later re-analyzed to confirm and disconfirm the codes across participants.

The fourth stage was to analyze the survey data and the supplemental documents including observation notes and student blog reflections. The qualitative measurements gathered from survey data in the first stage was used to compare and contrast with the data in the open-ended questions. Observation notes and student blog reflections were also examined as secondary data sources to complement the primary data. Coherence or incongruities may emerge during this compare and contrast process. The researcher attempted to find how the quantitative data and the qualitative textual responses interact with one another and how this interaction may further explain or add on to existing findings from the first three stages.

The final stage was data triangulation and final synthesis. Findings coming from all major data sources, including student tweets, students' interviews and surveys, were cross-analyzed to provide a deep understanding of the research questions. As Patton (2002) stated, this inductive process of creating cross-classification matrices helps to generate new insights and construct a meaningful logic from the data. In the final stage of reviewing each data source, specific methods were used to triangulate and confirm the meaning. Different analytical methods were used to analyze different data sources
independent of others, entailing the use of descriptive analysis, content analysis, and inductive and deductive analysis.

**Enhancing Trustworthiness, Validity and Credibility of the Data**

Trustworthiness, validity and credibility concern the quality and rigor of qualitative research. When the researcher becomes the main instrument for data collection, analysis, and interpretation, it is important to acknowledge that bias and assumptions are part of the qualitative research and that it is unavoidable (Miles & Huberman, 1994; Paisley & Reeves, 2001). Therefore, using multiple strategies to ensure the quality and rigor of qualitative research and attenuate the influence of bias are increasingly critical. The researcher employed the following strategies to enhance the trustworthiness, validity and credibility of this case study: triangulation, reflexivity, prolonged engagement, member check, and attention to transferability.

**Triangulation.** Triangulation is defined as a method of finding converging evidence across different methods, data points, theories, and investigators and (Newman & Hitchcok, 2011; Patton, 2002). In this case study, cross-method triangulation is the primary strategy to enhance validity. Research data was collected across multiple data sources, observations, students' tweets, surveys, interviews, and student reflection blogs. In collecting each data source, specific methods were used to triangulate and confirm the meaning. Different analytical methods and approaches were used to analyze different data sources independent of other data sources, which entails descriptive analysis, content analysis, inductive and deductive analysis and grounded-theory approach. Additionally, an external investigator was involved to provide alternative viewpoints of data.
interpretation. The external investigator assisted in the stage where the modified coding scheme was generated. Students' tweets were being coded as well as in the final synthesis stage when all data was analyzed and interpreted. In the coding scheme modification stage, the external researcher browsed approximately 200 sample tweets and discussed with the researcher, asking questions about what each tweet meant and comparing it to prior tweets to decide whether it was appropriate to keep or use a different category/code. After the coding scheme was finalized, the external researcher independently coded another one-fifth of the tweets based on the finalized coding scheme. Intercoder reliability was then calculated and a 93% agreement was achieved. Differences in coding were later resolved by discussion with the primary researcher. Furthermore, the researcher had the entire research study reviewed by her dissertation committee members to ascertain the quality of research questions, design, methodology, data collection and analysis.

**Researcher reflexivity.** Researcher reflexivity concerns researchers' attempts to understand their own assumptions, beliefs, and biases and their efforts to minimize the possibility of bias by documenting or journaling their thinking (Nastasi & Schensul, 2005). As the researcher has a strong value of microblogging, it is natural that her own thoughts, impressions, and potential biases at each stage of the study may impact the interpretation of the phenomenon studied, which could result in jeopardizing the study's validity. Therefore, it is critical to document the thoughts and ideas along with the research study process and acknowledge that interpretation of data may be subjective.
In this study, the researcher made these reflexive documents or journals prior to and during the process of the data collection, analysis, and interpretation stages. Prior to data collection, the researcher had reflected and acknowledged her own assumptions of results of this research study and noted them in writing. During the data collection and analysis process, the researcher continuously kept notes and records to make it clear to others and herself what she did. Each note was dated along with a description of what occurred, how long it lasted, and provided a summary of what it may indicate. Emerging ideas and thoughts were noted in the reflective journal. The researcher also noted decisions made, such as the determining of the data saturation point, the development and finalization of coding schemes, etc. This way the researcher made her own bias and assumptions transparent to herself and others, which ultimately increases the credibility and trustworthiness of the study. It also became a useful document she can refer to when it came to later writing stages.

**Prolonged engagement.** Researchers postulated that participant observation for a long period of time can produce more comprehensive data on levels of both scope and specificity than any other method (Becker & Geer, 1957). Similarly, multiple, in-depth interviews and a large volume of relevant documents can provide thick and rich description that ensures the study's soundness. Since the study was conducted within a 15-week period, the researcher’s substantial time and energy was spent to implement microblogging-supported instructional activities, observe student reactions, collect and read student tweets, and later on in the study to conduct interviews. This everyday involvement was done to achieve a deeper comprehension of students' behaviors, values,
and relationships involve in the microblogging-based learning context and to further capture certain events and phenomena that cannot be sufficiently examined in short-term study designs.

**Member checks.** Member checks, which is also referred to as respondent validation, concerns a method of soliciting feedback from participants in order to validate the data (Maxwell, 2009). It is "the single most important way of ruling out the possibility of misinterpreting the meaning of what participants say and do and the perspective they have on what is going on, as well as being an important way of identifying your own biases and misunderstandings of what you observed" (Maxwell, 2009, p. 244). In this study, member checks were done with participants to ensure the accuracy of the information collected. During the implementation of all microblogging-supported activities as well as the interviewing process, the researcher repeatedly encouraged students to report their true perspectives rather than disguising their true feelings in order to please the instructor.

**Transferability.** The notion of transferability gives rights of generalization to audiences and readers of qualitative research and allows them to determine whether the results are meaningful to their own studies or to a real life setting (Lincoln & Guba, 1985; Hellström, 2008). Lincoln & Guba (1985) placed an emphasis on the notion of fittingness, which is defined as "the degree of congruence between the sending and receiving context" (p.125). To establish fittingness, the readers construct their own understanding of not only the setting in which the research was conducted but also the setting in which one intends to transfer the results to (Hellström, 2008). As researchers,
one strategy used to enhance transferability is to provide a rich description of the setting (Hellström, 2008). In this study, the primary method to enhance transferability was to provide rich and thick description of data and context in which data were gathered. As the study was contextualized in a hybrid course, a rich and thick description of both the online environment and the physical setting of the school were provided. The specificities of the hybrid course entail the course objectives, course content, course format, and technology demands. Additionally, characteristics of students were stated to embrace readers' transfer of the results, including their demographic information, educational background, and technological capability. More importantly, the implementation of microblogging-supported learning activities was illustrated in great detail. With these thick and rich descriptions, readers will be able to make their own decisions on how to generalize the results from this study.

**Pilot Study**

The research study had undergone two iterations of pilot study prior to the actual implementation of the research study in Fall 2013. Results from the pilot study informed the current study in terms of both decisions in implementation of specific activities and selections of instruments for analyzing data. The implementation of specific microblogging-based activities in the actual study was expanded on a larger scale with more instructor support and scaffolding as compared to the pilots. Statistical analysis and focus groups were dropped from the current study due to the non-significant results and difficulties in managing the logistics of conducting focus groups. More specification of the procedures and implementation of the pilot study can be found in Appendix F.
Summary

This study employs a case study research design to examine student experience and perceptions of microblogging integration in a hybrid college-level class. The aforementioned descriptions of all the specificities in this research methodology helped the researcher by guiding her to collect data and subsequent analysis as well to be more aware of her own bias and suppositions in the research process. To conclude, the following table presents an alignment of all research questions and instruments.

Table 9

Research Questions Crosswalk

<table>
<thead>
<tr>
<th>Research Question 1</th>
<th>Research Question 2</th>
<th>Research Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>How did students participate and interact in microblogging-supported learning environments? a. How did student participate and interact differently in an online versus a face-to-face environment? b. How did student participate and interact differently using a guided versus unguided approach? c. How did student participate and interact differently using a social guidance versus cognitive guidance approach d. How did student participate and interact differently across three instructional activities (Exploring Hashtags, Discussing Topics, and Live Chats)?</td>
<td>How did students perceive their microblogging-supported learning experience</td>
<td>What factors potentially affect students' perceptions of microblogging integration into instruction?</td>
</tr>
<tr>
<td>Participation: Volume-Number of tweets and other similar parameters</td>
<td>Interview questions:</td>
<td>Interview questions:</td>
</tr>
<tr>
<td>Relevancy- Number of on-topic tweets</td>
<td>4, 7, 8</td>
<td>1, 2, 3, 5, 6</td>
</tr>
<tr>
<td>Interaction</td>
<td>Survey questions</td>
<td>Survey questions</td>
</tr>
<tr>
<td>Type of interaction- modified Gao's (2013) Coding scheme</td>
<td>7, 8, 9, 10, 11, 12</td>
<td>1, 2, 3, 4, 5, 6, 13</td>
</tr>
<tr>
<td>Level of interaction- used NodeXL functionality</td>
<td>14, 15, 16, 17, 18, 19, 20</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 4: Results

RQ1: Student Participation and Interaction

**Overall participation.** Participation was gauged by volume of tweets and relevancy of tweets. The following presents the quantitative analysis of students' tweets collected throughout the 12-week time span in the semester.

**Volume of participation.** Throughout the semester, all 24 students participated in tweeting at least at some point using the #edct2030 hashtag. One tweet per week was set as a minimum requirement for the students, however, in none of the weeks did all students participate. Among the 955 total tweets collected through hashtags for week one to eight and through students' archiving of live chats, 848 (88.8%) were posted outside of class with 107 (11.2%) during face-to-face class time. Of particular interest is that tweets produced during the live chat activities account for 56.7% of the total tweets posted throughout the semester, which significantly outnumbers any of the other type of in-class or out-of-class online tweeting activities. The volume of participation was at its peak in week 9 (250 tweets) when students joined a Tuesday's live chat, #edchat, together with the instructor.

With the minimum required number of tweets being one tweet per week, the volume of participation by individuals varied considerably. During the first eight weeks, the student with highest participation rate posted total 37 tweets, while the least-active one only posted eight. During the succeeding four weeks in which students engaged in the synchronous live chats, the most active participant tweeted 95 times. Conversely, the least active participant had only one tweet and two others failed to participate. This result
may be indicative of a high degree of variation in students' psychological interest and belief in using Twitter as an instructional tool as well as their cognitive ability to adopt and repurpose Twitter from purely communicative and social purposes into professional and academic purposes. This drastic contrast can be explained by various factors, which will be discussed and triangulated with other sources of data.

Looking at the entire class's volume of participation, it is found that overall there is an increasing trend in regard to students' participation in tweeting. In the first four weeks, as students were learning to purposefully use Twitter to reach academic goals, their volume of participation increased at a relatively steady rate. In the succeeding four weeks, the average volume of participation seemed to be slightly higher than before. This may be attributed to the fact that students became more acquainted with using Twitter and developed a more open and positive disposition toward its professional and academic use. During the weeks of live chats activity, the volume of tweets soared in comparison to the preceding weeks. The sudden substantial rise in participation again may be due to students' cognitive and attitudinal growth in perceiving Twitter as a learning tool, but more importantly, the more interactive nature of live chats played a pivotal role in rendering this increase. Figure 1 and 2 present data on the volume of tweets across a 12-week time span.
Figure 1. Overall number of tweets

Note: students' tweets in face-to-face meetings were filtered out in this figure.

Figure 2. Volume of tweets across different activities

Note: students' tweets in face-to-face meetings were filtered out in this figure.
**Backchannel communication.** Table 10 presents the volume of students' participation when Twitter was used for backchannel communication in face-to-face meetings. Backchannel communication on Twitter serves as a form of complimentary channel where interaction and communication can occur sideways without interrupting regular lectures or presentations in a face-to-face classroom. Under the guided settings, students were asked to post tweets as a form of feedback in response to classroom lectures or presentations. Similar to the participation pattern in non face-to-face weeks, not all students followed the instructor's requirement to tweet. This finding concurs with Elavsky et al.'s (2011) prior finding that "the quantitative level of student engagement with this technology was not as pervasive as might have been expected" (p. 223). When guidance was lacking in the third face-to-face meeting, the number of participants immediately dropped to only seven. This again shows that tweeting is not a norm of interaction in face-to-face environments. Students are much less inclined to tweet when instructional guidance is not at play.

However, mode of guidance was not a determinant factor of students' volume of participation. While guidance was absent during Week 7's guest speech, students tweeted even more than the number in Week 1's guided mode. This may be perhaps explained by students' growing comfort level of tweeting, but more importantly, the type and topic of the lecture played a crucial role in the increased participation. The lecture in the second face-to-face meeting was certainly more intriguing in terms of topic of the speech, with the content of lecture lending itself to more questions, as the guest speakers were
conveying messages that were innately more provocative and novel to the students. Additionally, the two guest speakers' messages were easier to induce questions as they were sharing their personal experiences, which in contrast were more interesting and affectively attached to the students than didactic content in the textbook, as it was in week 1. Additionally, the students may be more emotionally attached to the personal experiences shared by the guest speakers than to didactic content in the textbook, as presented by instructor in week 1. This may have induced more questions from students.

Student presentations in weeks 7 and 14 had a higher level of comparability. The finding is patent that students in the guided mode tweeted more times than those in the unguided mode. In week 7, students were required to post three tweets about their comments on the presentations. Accordingly, the volume of tweets in week 7 slightly outnumbered the required one. It is also interesting that students tended to write lengthier posts in week 7 when students tweeted to provide comments for one another. This again may be due to the nature of front-channel communication. Without guidance, the majority of students ceased to tweet and even those who tweeted, tweeted in much shorter length.
Table 10

*Volume of Tweets in Face-to-face Meetings*

<table>
<thead>
<tr>
<th>Week</th>
<th>Activity</th>
<th>Guidance</th>
<th>Total Characters</th>
<th>Number of participants</th>
<th>Number of Posts</th>
<th># of posts per person</th>
<th># of characters per person</th>
<th># of characters per post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Instructor lecture (G)</td>
<td>Yes</td>
<td>1902</td>
<td>17</td>
<td>21</td>
<td>1</td>
<td>112</td>
<td>91</td>
</tr>
<tr>
<td>Week 7</td>
<td>Guest speaker lecture (UG)</td>
<td>No</td>
<td>2212</td>
<td>16</td>
<td>30</td>
<td>2</td>
<td>138</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Student presentation (G)</td>
<td>Yes</td>
<td>3873</td>
<td>15</td>
<td>49</td>
<td>3</td>
<td>258</td>
<td>79</td>
</tr>
<tr>
<td>Week 14</td>
<td>Student presentation (UG)</td>
<td>No</td>
<td>423</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

**Tweeting activities.** Table 11 presents the volume of student participation when students were required to tweet one time per week at the minimum outside the classroom over the 12-week time frame. Students' volume of participation differed to a great extent across all three activities. Overall, students tended to tweet more over time. When looking at the specific numbers, student participation in terms of total characters they typed and number of characters typed per person varied significantly, while number of posts per person and number of characters per post remained rather consistent. This result reiterates the greater variability among individual participants and the complexity of relationships between the effects of tweeting intervention and the possible contributing factors at play, such as carryover and novelty effects.

In general, students were apt to tweet more in guided environments. Both frequency of tweeting, indicated by number of tweets, and length of tweets, indicated by
total characters and number of characters per person, tended to outweigh the number in unguided environments. The only exception was in the week 1 Exploring Hashtags activity. Paramount among all potential reasons for this exception seems to be characteristics of this student group. As teacher candidates, this group of students tended to be slow and more cautious in regard to technology adoption, requiring themselves more time in evaluating and contemplating on the values of such technology rather than taking immediate action to use it. These pre-service teachers who are already struggling to allocate time and effort for their teaching find it even more difficult and discouraging to keep up with the ever-changing and often frustrating technologies. This implication was reaffirmed in the survey and interview data. One methodological issue that may engender this low number of tweets collected in the first few weeks is that students confused the differing use of symbols: hashtag # and @. As tweets were collected using the hashtag#, tweets that contained the @ symbol were therefore filtered out. In terms of the comparison between cognitive and social guidance, based on the data it seems that social guidance is more conducive to higher volume of participation.
Table 11

*Volume of Tweets Generated in Online Activities*

<table>
<thead>
<tr>
<th>Online settings</th>
<th>Activity</th>
<th>Guidance</th>
<th>Total Characters</th>
<th>Num of participants</th>
<th>Num of Posts</th>
<th># of posts per person</th>
<th># of characters per person</th>
<th># of characters per post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Exploring hashtags</td>
<td>Cognitive</td>
<td>1443</td>
<td>9</td>
<td>16</td>
<td>2</td>
<td>160</td>
<td>90</td>
</tr>
<tr>
<td>Week 2</td>
<td></td>
<td>Social</td>
<td>3593</td>
<td>17</td>
<td>35</td>
<td>2</td>
<td>211</td>
<td>103</td>
</tr>
<tr>
<td>Week 3</td>
<td>Social</td>
<td>No</td>
<td>3070</td>
<td>19</td>
<td>31</td>
<td>2</td>
<td>162</td>
<td>99</td>
</tr>
<tr>
<td>Week 4</td>
<td>Social</td>
<td>guidance</td>
<td>3861</td>
<td>20</td>
<td>37</td>
<td>2</td>
<td>193</td>
<td>104</td>
</tr>
<tr>
<td>Week 5</td>
<td>Discussing topics</td>
<td>Cognitive</td>
<td>6167</td>
<td>20</td>
<td>54</td>
<td>3</td>
<td>308</td>
<td>114</td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td>Social</td>
<td>6276</td>
<td>16</td>
<td>55</td>
<td>3</td>
<td>392</td>
<td>114</td>
</tr>
<tr>
<td>Week 7</td>
<td>Social</td>
<td>No</td>
<td>3688</td>
<td>12</td>
<td>34</td>
<td>3</td>
<td>307</td>
<td>108</td>
</tr>
<tr>
<td>Week 8</td>
<td>Social</td>
<td>guidance</td>
<td>2181</td>
<td>8</td>
<td>45</td>
<td>3</td>
<td>282</td>
<td>100</td>
</tr>
<tr>
<td>Week 9-10</td>
<td>Live Chats</td>
<td>Guided</td>
<td>33338</td>
<td>17</td>
<td>320</td>
<td>19</td>
<td>1961</td>
<td>104</td>
</tr>
<tr>
<td>Week 11-12</td>
<td>Live Chats</td>
<td>Unguided</td>
<td>22560</td>
<td>14</td>
<td>221</td>
<td>13</td>
<td>1611</td>
<td>102</td>
</tr>
</tbody>
</table>

**Relevancy of participation.** Table 12 displays contextual information about each tweet activity, including the number and percentage of off-task tweets across different weeks, settings, guidance modes, and excerpts of student tweets. Tweets generated from the live chats activity were excluded from this analysis because there were no off-task tweets; thus, all tweets collected from live chats were considered relevant. The nature of synchronous chats allows all forms of tweeting behavior, while in specific activities, only tweets that addressed the learning content and conformed to the requirement of the activity were considered relevant.

Overall, only 7.2% of total tweets were considered off-task. The content of off-task tweets primarily concerns students' self-expression, as they tweeted to express their feelings, emotions and to report what they were doing. This number is particularly small compared to what previous researchers reported in their studies (Naaman et al., 2010; Pauschenwein & Sfiri, 2010; Ross et al., 2011). For example, "Meformers," as coined by
Naaman et al. referred to users posting messages relating to themselves or their thoughts, consisted 80% of the total users. Since the hashtag was used to collect student tweets, the small number of off-task tweets could certainly be associated with this methodological issue. If all student tweets were brought to analysis, the number might have been larger.

On the other hand, the role of guidance is of great importance to keeping students' participation relevant. When instructional guidance was present, the number of off-task tweets decreased dramatically. One exception was that in week 1's face-to-face settings when students were all exhilarated to post their "first tweet" in the classroom, but the tweets were not considered pertinent to the learning task. Another exception was in week 7 when guest speakers gave a lecture. Even without guidance, students only tweeted relevant topics as they were fully engaged by the learning content. Difference between cognitive and social guidance did not seem to be prominent in this string of analysis.
Table 12

Relevancy of Tweets and Excerpts in Face-to-face Settings

<table>
<thead>
<tr>
<th>Week</th>
<th>Activity</th>
<th>Setting</th>
<th>Guidance</th>
<th>Total</th>
<th>Off-task</th>
<th>%</th>
<th>Excerpts of off-task tweets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lecture</td>
<td>Face-to-face</td>
<td>G</td>
<td>21</td>
<td>5</td>
<td>23.8%</td>
<td>1. I had an awesome time doing my field observations Friday at a #middleschool #edct2030</td>
</tr>
<tr>
<td>7</td>
<td>Student presentation (Guest speaker) Lecture Student presentation</td>
<td>G</td>
<td>49</td>
<td>1</td>
<td>2.0%</td>
<td></td>
<td>2. Finally got my #EDCT2030 Twitter set up! A little late...</td>
</tr>
<tr>
<td>14</td>
<td>Student presentation</td>
<td>NG</td>
<td>30</td>
<td>0</td>
<td>0.0%</td>
<td></td>
<td>3. first tweet #edct2030</td>
</tr>
<tr>
<td>1</td>
<td>Exploring hashtag</td>
<td>Online</td>
<td>CG</td>
<td>14</td>
<td>1</td>
<td>7.1%</td>
<td>4. #EDCT2030 First tweet in class wooooh!</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>SG</td>
<td>34</td>
<td>4</td>
<td>11.8%</td>
<td>5. turtles with glasses</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>NG</td>
<td>31</td>
<td>6</td>
<td>19.4%</td>
<td>6. Tigers are huge</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>SG</td>
<td>37</td>
<td>3</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Discussing topics</td>
<td>CG</td>
<td>54</td>
<td>1</td>
<td>1.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>SG</td>
<td>55</td>
<td>0</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>NG</td>
<td>34</td>
<td>1</td>
<td>2.9%</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>43</td>
<td>6</td>
<td>14.0%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>414</td>
<td>30</td>
<td>7.2%</td>
<td></td>
</tr>
</tbody>
</table>

Overall interaction. Student interaction was analyzed using qualitative content analysis. As stated in the methods section, two coding schemes were used to separately reveal patterns of interaction due to differences in data collection as well as nature of interaction between live chats and all other tweeting activities. Interaction was initially classified by levels of interaction based on the differences in Twitter functions (Hansen et al., 2010). One step further was to classify them by types of interaction, using the researcher-modified coding scheme to categorize each tweet and identify the most
common patterns of interaction in Twitter-mediated discussions. Findings from different types of tweeting activities were presented discretely and then jointly.

**Levels of interaction.** Overall, it is patently evident that a single "Tweet" is the dominant form of interaction, which represents a low level of interaction across eight weeks of tweeting activities. Regardless of differences in time, type of tweeting activity, and guidance mode, students tended to simply post a single tweet rather than to engage in a conversation with others. This finding echoes what many researchers have found in online discussions. The majority of messages posted in online discussion environments are rarely referenced and most of the interaction fails to sustain in online environments (Gao et al., 2013; Pena-Shaff & Nicholls, 2004). Table 13 presents how number of tweets was distributed across different levels of interaction.

Distribution of tweets collected from live chats again showed them to be substantively different from that collected from non-live chat activities. The highest-level of interaction, as shown in "Replies to" type of tweets, formed 57.9% of the total tweets. Contrastingly, single tweets that showed the least interaction made up only 22.7% of the total tweets. The higher level of interactivity in synchronous communication certainly explains this finding.

While instructional guidance seemingly promotes the volume of participation, levels of interaction barely seem to increase in guided environments. The proportion of highest-level interactions in non-guided environments, as represented by "Replies to" type of tweets (21%), was markedly higher than that in guided environments (4.4%). Even in live chats environments that are fundamentally different from asynchronous
online discussions, students seemed to be engaged in a higher level of interaction in unguided environments. The proportion of highest-level interactions in non-guided live chat environments, as represented by "Replies to" type of tweets (63.8%), was higher than that in guided environments (53.8%), even though this contrast is apparently smaller than the proportion of highest level interactions in non-live chat activities. In regard to the comparison between social guidance and cognitive guidance as we looked at the data in weeks 1 and 2 and the data in weeks 5 and 6, students' level of interaction was higher in socially-guided environments.
Table 13

Number of Tweets Distributed across Different Levels of Interaction

<table>
<thead>
<tr>
<th>Guidance</th>
<th>Levels</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mentioned</td>
<td>Replies To</td>
</tr>
<tr>
<td>NG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 14 f2f</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Week 7 f2f</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Week 3</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Week 4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Week 7</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Week 8</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19</strong></td>
<td><strong>38</strong></td>
</tr>
<tr>
<td>Live chats</td>
<td>35</td>
<td>141</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 14 f2f G</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Week 7 f2f G</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Week 1 CG</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Week 2 SG</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Week 5 CG</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Week 6 SG</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>10</strong></td>
</tr>
<tr>
<td>Live chats</td>
<td>70 (21.9)</td>
<td>172 (53.8)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 1 f2f G</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Week 7 f2f G</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Week 14 f2f</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>NG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 7 f2f NG</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Week1 CG</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Week2 SG</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Week3 NG</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Week4 NG</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Week5 CG</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Week6 SG</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Week7 NG</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Week8 NG</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>67</strong></td>
<td><strong>48</strong></td>
</tr>
<tr>
<td>Live chats</td>
<td>105</td>
<td>313</td>
</tr>
</tbody>
</table>

(15.8%) (21.1%) (21.9%) (19.4%)
(63.8%) (4.4%) (53.8%) (57.9%)
(20.4%) (74.4%) (24.4%) (22.7%)
Types of interaction. Students' learning processes was analyzed by capturing how students interacted and collaborated in all the tweeting activities. This section presents the analysis of student interactions across different activities and provides a synthesized result.

Exploring Hashtags. Student interaction during the exploring hashtags activity was rather limited and primitive as this activity was first aimed to prepare students for a higher-level of Twitter-based learning domain. Type of interaction is demonstrated in Figure 3 and 4. The knowledge construction process was predominantly self-reflection (33.1%), resource sharing (14.4%) and elaboration (11%). Through searching for a wide variety of educational hashtags, students acknowledged their learning new information, and shared what they found and learned from this activity. Few students elaborated on their learning from the hashtags they explored and fewer students internalized the new knowledge through paraphrasing the tweets posted from the hashtag accounts or making inference, conclusions, and hypothesis about what they learned from those hashtags. Additionally, as for many students this was the first time for them to use Twitter for educational purposes, they were still in the stage of muddling through, which can be seen from the relatively sizable proportion of off-task (OT) tweets.
During the succeeding four weeks when students were discussing course-related topics, they seemed to reach a higher level knowledge-construction process. More higher-level types of interaction appeared in this time span.
The proportion of elaboration (14.9%) and internalization (14.4%) types of interaction slightly rose, as well as alternative proposal (9%), support (12.2%), and disagreements (5.3%). Compared to the exploring hashtag activity, the Discussion Topic activity may require a higher cognitive capability in that students were not simply asked to seek information and report the findings. After all students were asked to reflect on their learning of course-related topics and show how they interpreted and internalized the topics. Instructional prompts were provided in the guided weeks and questions were asked by the instructor. This scaffolding process may be the primary reason that leads to a higher level of interaction and knowledge construction. The support and disagreements types of interaction, which show a direct interaction between at least two students, substantially increased. This finding demonstrates that students in this stage also learned through agreeing to and debating with others, in addition to reflecting on their own learning. It may also imply a higher level of social cohesiveness. As Pena-Shaff and Nicholls (2004) suggest, participants in online discussion environments are more likely to acknowledge each others’ ideas, make reference to one another, and socially interact with one another as the learning period progresses.

Additionally, with an increased familiarity with Twitter's educational use, the amount of off-task tweets (4.3%) and tweets in relation to technical difficulties (0.5%) were subsequently dropped, as compared to the preceding four weeks. The rise in Twitter literacy, both technologically and cognitively, seemed to help students to stay focused on reflecting on their own learning and constructing new knowledge. Figure 5 and 6 show the breakdown of different types of interaction in the Discussion Topics activity.
Figure 5. Type of Interaction from Week 5-8 (pie chart)

Figure 6. Type of Interaction from Week 5-8 (bar chart)

**Live Chats.** As acknowledged previously, a different coding scheme was used to understand interaction patterns in live chats. Classification of tweets was modified due to
the more casual and informal nature of learning interaction that occurred in synchronous chats. Tweets that were previously considered off-task, such as tweets that exclusively reflected feelings and emotions of the moment, were placed into a new category, self-expression. Some other categories, including resource sharing, discussion on coursework, and technical difficulties were not applicable in live chat settings. Only SL (socialization) and the original six knowledge construction types of interaction were preserved.

The distribution of tweets represented by types of interaction shows that students were able to reach a high level of collaborative knowledge construction in synchronous live chats. Self-reflection (26%) was demoted as the second largest type of interaction, while support (26.4%) became the most predominant type. This finding again shows a high level of interactivity, confirming the same results in the analysis of levels of interaction. Instead of posting tweets simply to share their own thoughts, more students sought to interact with other professionals who joined the same chat synchronously. Notably, most participants of the live chats with whom students interacted were not their instructor or classmates, but professionals with whom they had never spoken. However, this switch in subjects of communication did not affect the interactivity of such discussions.

Interestingly, even though the overall interactivity was much higher than other settings, two types of interactions, the proportions of AP (alternative proposal) and DA (disagreements) remain consistently low. This finding concurs with the prior research on computer-mediated learning, suggesting a low rate of disagreement type of interaction in
online discussion environments (Jeong, 2003; Pena-Shaff & Nicholls, 2004). Figure 5 and 6 show the breakdown of different types of interaction in the Live Chats activity.

![Type of Interaction in Live Chats](image)

**Figure 7.** Type of Interaction from Week 9-12 (pie chart)

![Live Chats](image)

**Figure 8.** Type of Interaction from Week 9-12 (bar chart)
Tweeting in face-to-face meetings. Twitter-mediated interaction in face-to-face environments seems to be quite different from that of online environments. Self-reflection became more dominant compared to the online environments, forming almost half of the total types of interaction. Most of self-reflection type of interaction was in the form of acknowledging the importance of the subject of learning. Reflective question also prevailed in face-to-face meetings, primarily aiming to seek further information from lecturers in the moment. Support (SP) takes the form of showing positive feedback to the presenter or lecturer. Since this type of interaction occurred in face-to-face environments where participants were familiar with one another as well as at the presence of one another, support became more common than it was in the online discussion environments. As people are less likely to create tension in the face of each other, showing support and positive feedback is always much more common than critical and negative feedback. What is also noteworthy is that the proportion of off-task tweets showed an increasing propensity in face-to-face settings. One possible reason is that students are apt to digress from the learning topic when social networking tools and cell phones are easy to reach in face-to-face environments. Prior researchers also commented on the possibilities of creating possible distraction being one common drawback of using social networking tools like Twitter (Gao et al., 2012; Luo & Gao, 2012).
Summary. Overall, student participation and interaction on Twitter seemed to be high on both quantitative and qualitative levels. With respect to number of tweets, student
participation slightly increased over the first eight weeks and surged in the last four weeks of live chats activity. Volume of participation across different individual students varied significantly. The analysis of types of interaction suggests that a vast majority of tweets were relevant to the class and reflected on students' learning process. Twitter was able to support different kinds of cognitive thinking processes, with self-reflection and support being the two most prominent types of interaction. The three different tweeting activities as well as the backchannel use of Twitter in the face-to-face classroom seemed to engage students in different types of interaction. As compared to the other activities, live chats apparently maintained a much higher level of interactivity among participants. The use of guidance seemed to be able to slightly promote interaction and participation. The results show that other factors must account for differences in students' interaction and participation as well. The overall data exhibits a high level of complexity and lends itself to multiple potential interpretations. Table 14 presents a crosstabulation by week, type of interaction, and guidance mode with specific numbers. Figure 11 uses bar charts to present a more visual-friendly version of the data. Table 15 presents some excerpts of students' tweets in each category of interaction that demonstrate typical interactions.
Table 14

*Week * Type * Guidance Crosstabulation*

<table>
<thead>
<tr>
<th>Code</th>
<th>1st f2f</th>
<th>2nd f2f</th>
<th>3rd f2f</th>
<th>1st G</th>
<th>2nd G</th>
<th>3rd G</th>
<th>4th G</th>
<th>5th G</th>
<th>6th G</th>
<th>7th G</th>
<th>8th G</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>30</td>
<td>7</td>
<td>8</td>
<td>10</td>
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<td>15</td>
<td>12</td>
<td>7</td>
<td>17</td>
<td>141</td>
</tr>
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<td>0</td>
<td>0</td>
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<td>5</td>
<td>4</td>
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<td>5</td>
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<td>0</td>
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<td>0</td>
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<td>24</td>
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<tr>
<td>RS</td>
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<td>1</td>
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</tr>
<tr>
<td>TD</td>
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<td>1</td>
<td>4</td>
<td>6</td>
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<td>OT</td>
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<td>30</td>
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<td>37</td>
<td>54</td>
<td>55</td>
<td>34</td>
<td>43</td>
<td>414</td>
</tr>
</tbody>
</table>

Note: the explanation of each code can be found in Chapter 3.
Figure 11. Type * Guidance crosstabulation

Table 15

Excerpts from Student Tweets

<table>
<thead>
<tr>
<th>Code</th>
<th>Excerpts</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR</td>
<td>I find it interesting now a days there are more and more live Twitter feeds happening during public speech's #edct2030</td>
</tr>
<tr>
<td></td>
<td>An instructional video and lesson plan due in the same week really makes you focus on spending your time wisely. #edct2030</td>
</tr>
<tr>
<td></td>
<td>I always make sure I have time to just sit and relax each day #21stedchat Nov 04, 2013</td>
</tr>
<tr>
<td></td>
<td>A.1 in order to balance my time I have to first prioritize what is most important to me #21stedchat Nov 04, 2013</td>
</tr>
</tbody>
</table>
| **EL** | A great way to use graphics and videos in lessons is a supplement to the lessons already taught #edct2030  
@xxxxx I agree with you! Every educator is going to connect with their students in a different way. #edchat Oct 22, 2013  
@xxxxx I agree with you. Using skype and Twitter can help to be used all over the world #edchat #edct2030 Oct 22, 2013 |
|---|---|
| **AP** | However, some videos and audio may be good for the lesson, but not really draw the attention of the students. #edct2030  
@xxxxx I also think it is a great way for students to re-enforce the information that they have learned #edct2030  
@xxxxx I wonder if it eals with a generation gap. I feel that more people from our generation will be open to staying connected #edchat Oct 22, 2013  
@xxxxx True but I think as teachers we need to expose students to tech just like we need to expose them to art Oct 22, 2013 |
| **IT** | The best way to use a video in class is as a supplemental tool. They should never be the sole part of the lesson plan. #edct2030  
Lesson plans do not have to always be 8-9 pages long, but they do need to cover standards and be an effective planning tool. #edct2030  
A4 have positive relationships with students and families to encourage education and community #mdedchat Nov 13, 2013  
Reaching out in everyones own way is extremely important, connection is not the same for everyone #edchat Oct 22, 2013 |
| **SP** | @xxxxx I agree! I think its a great thing to incorporate in your teaching. #edct2030  
@xxxxx @xxxxx I agree with Michael thanks for posting that good information #edct2030  
@xxxxx I also agree with that! I love that for #edct2030 I can always re-watch the videos  
@xxxxx I bet that would be very helpful for students with speech disabilities!! #slpchat Nov 17, 2013  
RT @xxxxx: Every teacher can use these in their practice to help with assessment http://t.co/cKW2FId9Wk #edteach #hiphoped #mdedchat… Nov 13, 2013 |
Table 15: Continued

**DA**  
*I think a problem with using any type of technology visual in teaching is the concern that it can't always be relied upon #edct2030*  
*Using graphics can be great but sometimes I wonder if they could be a distraction #edct2030*  
@xxxxx I'm not sure if I completely agree with that. I think that is a generalized statement #edchat #edct2030 Oct 22, 2013  
@xxxxx I don't think they are connected simply because not enough of them utilize their tools. Word needs to be spread about #edchat Oct 22, 2013

**SL**  
@xxxxx I'm an Intervention Specialist major (special education). #edct2030  
@xxxxx early education you? #edct2030  
@xxxxx Hi! What's your major?! #edct2030

**RS**  
How Do I Use Twitter's Suggestions For Who To Follow?  
http://t.co/6YlvWpiYys #edct2030  
“@xxxxx: 50 Educational Podcasts You Should Check Out. Let's exercise our minds. http://t.co/Sj34rtknTw” #edct2030  
I thought this was an interesting article http://t.co/EoOZgzDN1w #edct2030

**CB**  
@xxxxx What do you think are some of the best practices of using graphics and videos? #edct2030  
@xxxxx Do you think that the use of visual literacy in the classroom is a good idea? #edct2030  
@xxxxx Do you feel that will be useful for the students or the teachers or both #edct2030 #EdTech

**DC**  
@xxxxx I had a hard time with iMovie, but I figured out things on it I wasn't able to figure out before so that was cool. #edct2030  
For the ECOT video evaluation - why won't the boxes let me type down, it just types across? #edct2030  
I know it's late, but does anyone need an extra group member for our projects for tomorrow? Let me know! #edct2030

**TD**  
Can't figure out how to post my blog.. #Frustrated #EDCT2030  
Anyone having troubles typing in the form? I have a small space to write a lot. #edct2030

**Note:** Twitter username shown in the tweets were replaced with xxxxx.

**RQ2: Student Perceptions**

This section shows the end-of-class survey results. Twenty-two out of the 23 total participants took the survey in the final face-to-face class meeting. One student was absent at the end of the semester due to medical reasons. Six students were male and 16
were female. Their average age was approximately 21 (Mean = 20.5, SD = 1.06). In terms of year in school, 50% them were third-year students, 23% were second-year students and the same number were fourth-year students, while one of them was at his/her fifth year.

**Twitter use and pre-perception.** Students were first asked about their use of Twitter during the class period. Students reported that they sent out approximately three tweets per week that were pertinent to the class (Mean = 2.91, SD = 2.31), where as in general they sent out 12 tweets in total (Mean = 11.50, SD = 10.65), including those for social and recreational purposes. The use of smartphones was pervasive as 19 out of 22 of them owned a smartphone. Out of the 19 students, only two did not use Twitter on their smartphones. When asked about their frequency of communication with their classmates on Twitter, 41% reported "sometimes," 32% reported "rarely," 18% reported "often," 5% reported "never" and the same proportion reported goes to "all the time." When asked about their frequency of communication with the instructor, 32% reported "sometimes," 41% reported "rarely," 14% reported "often," 5% reported "never" and 9% reported "all the time."

When asked about their Twitter pre-perceptions, 41% considered themselves a proponent (e.g., I can see how Twitter can be used professionally or for educational purposes), 9% a skeptic (I doubt its educational and professional purpose), while half of them as neutral (e.g., I am in the middle of the road. I can see both its benefits and constraints). When it comes to frequency of Twitter use, 23% considered themselves a novices (e.g., I don't even have an account or I have an account but only have a few
tweets), 45% a member (e.g., I have an account and I tweet or follow other people's
tweets, but not too enthusiastic), and 32% a veteran (e.g., I tweet all the time, almost
every day and I love it!)

This data shows that variation in Twitter use is incredibly high among this group
of students. A few students did not have a Twitter account and had never tweeted prior to
this class, while in contrast the most active Twitter user reported that they posted 40
tweets per week. Although the majority of students were already active Twitter users,
their pre-perception towards Twitter's educational value seems to be ambivalent. More
than half of the students were not aware of its educational and professional use prior to
the class.

Technology comfort levels. Four questions in the usage survey investigated
students’ technology comfort level. When asked the question "As a technology user, I
consider myself as __." Approximately 18% of the students considered themselves as an
"Advanced Beginner," 50% as Intermediate, 32% as Advanced, but no one considered
themselves as a true beginner or expert. When asked about their perceptions of adopting
new technologies, a similar distribution of answers showed up as in the first question. No
one reported himself or herself as an innovator (I am usually the first to buy or try new
technology item to explore how the new technologies work.) or a skeptic (I am not
interested in trying new technology at all). Approximately 50% believed they were
pragmatists (I require assurances that the technology is going to work out before I adopt
it. I dislike unpredictability.), while 23% think they are early adopters (I am highly
motivated in adopting new technologies to accomplish tasks or solve problems.) and 27%
believed they were conservatives (I am risk-averse and tend not to be comfortable with new technology. I usually wait until the new technology has become a standard before I adopt it.)

According to these results, this group of students tended to be pragmatic or even somewhat conservative towards the use of technology. These results concur with prior studies; pre-service teachers were overly concerned with the risks and drawbacks of using technology, as well as relatively slow in adopting new technologies and integrating technologies into classrooms (Allsopp, McHatton, & Cranston-Gingras, 2009; Vannatta, Beyerbach, & Walsh, , 2001; Wang, 2002). The negativity and ignorance, both attitudinal and behavioral, towards technology still seem to exist in this new-generation of pre-service teachers.

**Perceptions of Exploring Hashtag activity.** Overall, participants perceived a high value of participating in the Exploring Hashtag activity. They found themselves to be able to effectively construct their own learning (Mean = 5.05, SD =1.0), express their own learning (Mean = 4.77, SD =1.1), and focused on learning the topic (Mean = 4.86, SD =.94). The interaction within this activity was relatively low as compared to the other activities, and therefore, the rating was also slightly lower (Mean = 4.64, SD =1.05). This finding is generally in accordance with general results from the content analysis of student tweets. As exploring hashtags was the initial step in the process of learning Twitter's educational use, students were more focused on reflecting on their own learning and processing new knowledge attained from the hashtags. Therefore, interaction both in
and outside the class community was limited. Table 16 displays the means and standard
deviations of students’ ratings of their perceptions of the Exploring Hashtag activity.

According to comments collected from open-ended questions, students were able
to search for more relevant information and resources on educational technology and
learn the professional and academic use of Twitter through the Exploring Hashtag
activity. Twelve out of 17 students who provided qualitative comments reported that this
was their first time trying to search for an educational hashtag and learning Twitter's
professional use. They were reported to have gained information that they would not have
had without exploring hashtags. Among those who had scarce Twitter experience, this
activity was particularly mind-blowing and eye-opening. As one student put it, "The
hashtag exploration was beneficial for me because I hadn't previously used Twitter. It
helped me learn to navigate the site and exposed me to many professional resources on
Twitter. Without this, I probably would have been less receptive to the idea that Twitter
can be used professionally." Another student commented that even though he knew how
hashtags worked, he was unaware that there were hashtags that could connect them to
educational communities. In contrast, avid users found this activity less intriguing. As
one students noted, "I already understood the concept of a hashtag so it was something
that I already knew how to do."
Table 16

Student Perceptions of Exploring Hashtag Activity

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Explore Hashtags activity (Week 1-4) allowed me to effectively focus on learning the topic.</td>
<td>22</td>
<td>4.86</td>
<td>.94</td>
</tr>
<tr>
<td>The Explore Hashtags activity (Week 1-4) allowed me to effectively interact with my classmates.</td>
<td>22</td>
<td>4.64</td>
<td>1.05</td>
</tr>
<tr>
<td>The Explore Hashtags activity (Week 1-4) allowed me to effectively express my own understanding.</td>
<td>22</td>
<td>4.77</td>
<td>1.11</td>
</tr>
<tr>
<td>The Explore Hashtags activity (Week 1-4) allowed me to effectively construct my own learning.</td>
<td>22</td>
<td>5.05</td>
<td>1.0</td>
</tr>
<tr>
<td>The Explore Hashtags activity (Week 1-4) allowed me to effectively interact with the instructor.</td>
<td>22</td>
<td>4.73</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Perceptions of Discussion Topics activity. As with the previous activity, students overall favored the use of Twitter in discussing course-related topics. However, based on the ratings, the students' regards towards this activity are in general lower than the exploring hashtag activity. This might be due to the loss of novelty effect of using the technology. The first item, focusing on learning the topic, received the highest rating, which may suggest that the use of Twitter provides an additional channel in which students can engage and interact with useful content knowledge. The students' ratings on student interaction were slightly higher than the other ones, indicating that an increased interaction perhaps was most valued by students among all the other potential affordances. This again can be confirmed by results in the content analysis - the proportion of self-reflective type of tweets decreased in the Discussion Topics activity and the support, elaboration, and disagreement types of tweets rose considerably. Table 17 displays the
means and standard deviations of students’ ratings of their perceptions of the Discussion Topics activity.

In the open-ended comments, students stated the overall benefits of having discussion over course-related topics as well as some perceived challenges. Of the 16 students who commented, 13 tended toward favoring the activity because of the improved student interaction. One student commented that it allowed the students to interact outside of the classroom effectively. As one student put, "it was somewhat beneficial because I was able to talk to other students who I did not know and who I never talked to which make it exciting to receive a tweet and see what that student had to say. It was nice to discuss with other classmates." Students also believed it helped work their way into the live chats. Noticeably, some students, in fact, doubted the authenticity of such interaction. Two students pointed out that the tweets seemed forced instead of thoughtful. All students were asked to post at least one tweet, however, some posted only one to fulfill the requirement without engaging in a discussion with their peers. Another student commented on the use of guidance, "I liked these because we had a prompt. It was also a way to keep up because I could see what others were tweeting about."
Table 17

**Student Perceptions of Discussion Topics Activity**

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Discussion Topic activity (Week 5-8) on Twitter allowed me to effectively focus on learning the topic</td>
<td>22</td>
<td>4.64</td>
<td>1.18</td>
</tr>
<tr>
<td>The Discussion Topic activity (Week 5-8) on Twitter allowed me to effectively interact with my classmates</td>
<td>22</td>
<td>4.59</td>
<td>1.18</td>
</tr>
<tr>
<td>The Discussion Topic activity (Week 5-8) on Twitter allowed me to effectively express my own understanding</td>
<td>22</td>
<td>4.45</td>
<td>1.14</td>
</tr>
<tr>
<td>The Discussion Topic activity (Week 5-8) on Twitter allowed me to effectively construct my own learning</td>
<td>22</td>
<td>4.55</td>
<td>1.14</td>
</tr>
<tr>
<td>The Discussion Topic activity (Week 5-8) on Twitter allowed me to effectively interact with the instructor</td>
<td>22</td>
<td>4.45</td>
<td>1.22</td>
</tr>
</tbody>
</table>

**Perceptions of Live Chats activity.** Overall, participating in live chats seemed to be a favorable experience for students. The overall ratings of live chats were positive.

Students reported that the live chat activity allowed them to focus on learning topics (Mean = 4.64, SD = 1.40), express their own understanding (Mean = 4.64, SD = 1.40), and construct their own learning (Mean = 4.59, SD = 1.33). Since during live chats students were engaged in interactions with professionals outside of the class community, their interaction with their classmates and the instructor was therefore lower. It is noteworthy that the standard deviations in student ratings of live chats were higher than that of the previous two activities. This result is consistent with the evident variations in
volume of participation. Table 18 displays the means and standard deviations of students’
ratings of their perceptions of the Live Chats activity.

Students voiced differing opinions about participating in live chats. The majority
of students (16 of 18) acknowledged the benefits of asynchronous chats, such as
connecting with professionals, sharing ideas and thoughts with other educators, and
gaining help and recommendations from senior educators. Being able to connect and
share using social media is a prominent theme commonly found across all comments. As
one student stated, "Live Chats totally opened my eyes to the vast number of
professionals interested in using social media for professional development. It was also
inspiring to hear other teachers' success stories and learn about their efforts." Due to
limited Twitter chatting skills, many students found it difficult to keep track of tweets and
post their own simultaneously. Few students experienced logistical difficulties in
participating, such as finding the proper time in their schedule to participate, and that
some chats were not promptly held at the anticipated time.
Table 18

*Student Perceptions of Live Chats Activity*

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Live Chats activity (Week 9-12) on Twitter allowed me to effectively focus on learning the topic</td>
<td>22</td>
<td>4.64</td>
<td>1.40</td>
</tr>
<tr>
<td>The Live Chats activity (Week 9-12) on Twitter allowed me to effectively interact with my classmates</td>
<td>22</td>
<td>4.36</td>
<td>1.30</td>
</tr>
<tr>
<td>The Live Chats activity (Week 9-12) on Twitter allowed me to effectively express my own understanding</td>
<td>22</td>
<td>4.64</td>
<td>1.40</td>
</tr>
<tr>
<td>The Live Chats activity (Week 9-12) on Twitter allowed me to effectively construct my own learning</td>
<td>22</td>
<td>4.59</td>
<td>1.33</td>
</tr>
<tr>
<td>The Live Chats activity (Week 9-12) on Twitter allowed me to effectively interact with the instructor</td>
<td>22</td>
<td>4.27</td>
<td>1.35</td>
</tr>
</tbody>
</table>

**Perception of Twitter use in face-to-face settings.** Students' views on the Twitter integration in face-to-face classrooms were overwhelmingly positive. The ratings of face-to-face classroom use were consistently higher across all items as compared to the other tweeting activities. Meanwhile, the standard deviations were lower, indicating homogeneity across each individual student's perception. The backchannel integration during the lecture sessions seemed to be considerably beneficial to students in that it allowed another venue where students could reflect on their learning through posting their reflective questions and indirectly interacting with the lecturer and their classmates. During student presentations, Twitter was used to as a backchannel for students to
provide peer feedback. Akin to the backchannel integration during the lecture sessions, the Twitter use in student presentation sessions was highly favored by students. Table 19 displays the means and standard deviations of students’ ratings of their perceptions of Twitter use in face-to-face settings.

Students' written comments demonstrated several reasons why they favored the backchannel integration. One common theme is that students believed the backchannel integration during the lecture period allowed them to ask questions and provide comments without disrupting classroom regularities, enabling a unique form of participation. More importantly, students believed it promoted active learning in which students were better focused on the learning content and engaged in cognitive information processing. As one student commented, "It enabled us to focus on the topic without having to remember or jot down our own questions, and encouraged us to participate. This made the learning more unique to us and encouraged student-driven learning." The social interaction enabled by the Twitter backchannel seemed to take student learning to a higher level, lending it to higher cognitive processing where students could reflect upon, express, and construct their own learning. Students expressed more concerns about the issues in the student presentations. Few students (3 out of 18) argued that the comments that students provided on Twitter were devoid of depth, in the sense that critical and constructive feedback that students could take beyond the classroom seemed to be lacking. Two students also commented that it could be distracting and made it hard to focus on other groups' presentations.
Table 19

*Student Perceptions of Twitter Use in the Face-To-Face Setting*

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Twitter backchannel integration allowed me to effectively focus on learning the topic</td>
<td>22</td>
<td>4.91</td>
<td>.92</td>
<td>4.91</td>
<td>1.11</td>
</tr>
<tr>
<td>The Twitter backchannel integration allowed me to interact with my classmates</td>
<td>22</td>
<td>5.05</td>
<td>1.05</td>
<td>5.14</td>
<td>.94</td>
</tr>
<tr>
<td>The Twitter backchannel integration allowed me to effectively express my own understanding</td>
<td>22</td>
<td>5.05</td>
<td>1.09</td>
<td>4.86</td>
<td>.94</td>
</tr>
<tr>
<td>The Twitter backchannel integration allowed me to effectively construct my own learning</td>
<td>22</td>
<td>4.59</td>
<td>.96</td>
<td>4.73</td>
<td>1.03</td>
</tr>
<tr>
<td>The Twitter backchannel integration allowed me to effectively interact with the instructor</td>
<td>22</td>
<td>5.36</td>
<td>.66</td>
<td>4.86</td>
<td>.99</td>
</tr>
</tbody>
</table>

**Perceptions of instructional guidance.** When asked whether the tweeting activity needed to be guided, 32% believed that it should, more than half of the students (55%) believed it should not, and 14% believed it should be a mixture of both, such as being guided initially and but always moving toward student independence. It is evident that their preference over guidance largely relies on their familiarity and comfort level with Twitter. Many advanced Twitter users agreed that Twitter is easy-to-use enough that they could have been given more freedom to tweet, which may have bred creativity and higher interaction. As one student put, "It should not be guided because we had a good time completing the Twitter discussions and hash tag searches on our own." Less Twitter-
comfortable students acknowledge the importance of guidance, especially in the initial stage the exploring hashtags and discussion activities. They commented that the online presence of the instructor is critical to them, because "It is hard to understand Twitter at first so it was nice to have someone helping" and "it was helpful to have someone's example to follow." Five students proposed the progressive model of guidance in which guidance can be taken out when the familiarity and comfort level reached a certain stage. As one student stated, "It is important to have some guidance due to Twitter being such a large engine, but freedom allows for students to explore their own interests later and be creative." Overall, most students valued instructional guidance as they believed that students could also wander off-task or drift if instructional guidance is absent.

Other perceptions and future use. Students were asked about their perceptions on Twitter's potential in enhancing communication with the instructor, collaboration opportunities with their classmates, and growth in knowledge on technology integration. Evidently, students believed their interaction with their classmates was strengthened due to the use of Twitter, particularly given the hybrid format of this class. Some of them also used Twitter to communicate with the course instructor. According to the qualitative comments, students also expressed concerns of delayed responses as they did not always receive their classmates' response immediately. The entire Twitter experience enriched their knowledge on technology integration into education, especially the impact of social media use in education. As one student stated, "social media is a major part of students today so being able to incorporate Twitter into the classroom will greatly enhance the technology aspect of the classroom." Additionally, they acknowledged that it exposed
them to a wide range of new professional resources. Table 20 displays the means and standard deviations of students' ratings on each item.

In regard to prospective use of Twitter, students' opinions tend to be conservative. More than half of the students (55%) reported that maybe they will use Twitter for educational purposes again in the future, 31% were positive about their prospective Twitter use, while 14% said they would not. Those who highly valued the benefits of synchronous live chats commented that it was an interesting and worth-retrying form of professional development that they would certainly participate again in the future.

Table 20

*Other Perceptions*

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Twitter incorporation enhanced my communication with the course instructor.</td>
<td>22</td>
<td>3.36</td>
<td>.96</td>
</tr>
<tr>
<td>The Twitter incorporation enhanced collaboration opportunities with my classmates.</td>
<td>22</td>
<td>4.06</td>
<td>1.06</td>
</tr>
<tr>
<td>My knowledge on technology integration into education has grown due to the Twitter incorporation.</td>
<td>22</td>
<td>4.50</td>
<td>1.14</td>
</tr>
</tbody>
</table>

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

RQ3: Potential Factors

**Individual difference.** Students were asked about 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 seemed not to affect the students' perception and
their use of the Twitter integration, as these differences were minimal among this group of students. The rest of the differences will be explained below in great detail. Personality seems to be a latent factor that contributes to students' differences in their Twitter perception and adoption, but it was not examined in the interviews.

**Prior use.** Students were asked about 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 "don't 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 student is "check it daily" and "tweet a couple times a week." Many seasoned Twitter users also reported a change in their tweeting habits over time. Some of them used to tweet all the time when they were high school, but now they reported a plummet in the number of tweets because "I had a lot more to do." Some others first signed up for Twitter just by their friends' influence, but as time elapsed they found it more interesting and started to tweet more.

According to the interview results, prior use is certainly closely associated with their perceptions of the Twitter integration in this class. Overall, the ones who were high on 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 hated it.

Prior perceptions. Students also reported their perceptions on Twitter before the
class. Many students perceived Twitter as a type of social media they often resort to. Six
out of 18 students were extremely enthusiastic about Twitter and recognized it as the
predominant social media that they engaged in. One student even 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 they believed Twitter is taking the
place of Facebook and becoming the trendiest type of social media amongst younger
generations.

When asked about how they perceived its educational and professional use, only
one student stated that she had used it for another class. Three students noted 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." They were all not aware of the details of its professional and educational use to this
extent prior to this class.

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 tended to value more its educational and professional use. It is equally interesting that for those who were skeptical about its professional use and who were only interested in its social and recreational use, many started to change their perceptions on Twitter due to their use of Twitter in this class. Noticeably, two students who detested Twitter remained negative after their Twitter experience in the class.

*Mobile ownership.* All students reported that they owned a smartphone during the time of the Twitter integration. The vast majority (14 out of 18) stated that they used their smartphones 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. Only one student reported that he did not use Twitter on his phone because his smartphone was an older generation that loaded applications very slowly. Mobile ownership seems to only slightly affect student perceptions and use, as most of the students carried smartphones. However, those with less positive opinions (3 out of 18) did report a relatively inactive engagement with their smartphones.

*Technology comfort level and familiarity.* Students were also asked about how comfortable they are with technology and their opinions and use towards 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 are "okay with technology." They used some common technologies, such as smartphones, 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 also 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.

Personality. Personality was not specifically inquired about during the interviews. However, when the researcher probed further on the extreme cases to investigate why some students just love Twitter regardless of how to use it, while some disliked it after using it professionally or other ways, personality started to emerge as a prominent theme from the interview data.

For example, Student [14], who had an overall negative opinion on the Twitter integration, conveyed a strong message about his own personality. He first considered himself as a person who is "reserved," reporting that "[I] don't 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 to people who she does not know- "I just don't like to talk to strangers. I don't see a point doing it. I have many other valuable things to do in life." She also admitted that she valued privacy highly. In her own words, "I’m a very private person when it comes to social media, so I tend to make statements in which I choose carefully what I say and choose to not elaborate. I don’t like when people I don’t know can contact me and join in conversations, voicing opinions on things that may be far out of my comfort zone." Even though she had been on Twitter for about two years, she only followed her friends and always kept her account private. In terms of her opinions about the Twitter integration, she stated that she perceived many advantages of Twitter after now she understood how people become connected through Twitter. However, she still believed that she would not consider doing it, simply because "I just don't feel like talking to strangers."

Contrastingly, many enthusiastic Twitter proponents tended to be open-minded, expressive, sociable, and love 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, also commented how she loved to share her ideas with others and connect with new people out on the Internet. These students even 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.

**Social influence.** Students' perceptions and the use of Twitter were evidently affected by their friends and the people around them. All students reported that their friends used Twitter in some fashion. 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 they were not under the influence of their peers- "I don't really care what others do and think."

Students also reported that their peers' use of Twitter was exclusively personal or social. None of the students observed any type of professional use from their friends as what they themselves experienced in this class. Not surprisingly, they expressed concerns of "looking different" or "weird" as compared to how their peers tweet because of the massive professional tweets that they would post. Therefore, all of the students who had an account prior to this class signed for an alternative account.

**Facilitating conditions.** Students were asked about how they perceived the guidance the instructor provided over the 12-week period. All students reported that they favored "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 (probably not).

Students all believed that their instructor's guidance was useful for them. Many of them, especially those who were not familiar 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 also commented that they enjoyed seeing the instructor's own tweets on Twitter because "it feels like you are there." Similarly, some students reported that they felt more safe and comfortable joining the live chats with the instructor, as a result of the Twitter instruction. 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 modeling for them to actually see how they should tweet.

Ten students pointed out clearly that they liked the way in which the instructor guided the tweeting activities in that it was 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 reckoned the Exploring Hashtag activity 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, and certainly not in live chats. Students stated that their engagement in exploring hashtags and discussions to a large degree had prepared them into joining the live chats. Four students also believed that they liked the mix of guided and unguided portions of the tweeting activities. Students also
stated that the type and amount of guidance could be varied depending on the difference of the activity. For example, exploring hashtags may be given less guidance than live chats as it is rather simplistic and most students are familiar with it.

**System characteristics.** Students were asked about how they perceived Twitter's interface and its features. It is reported that in regard to the technical aspect, Twitter is very easy to use and the basic functions are self-explanatory. Only three students commented "it took me some time to figure out." In the meantime, 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. It is universally acknowledged by students that the threshold to learn and use Twitter as a technology is extraordinarily low.

Students also reported some specific features that they believed were more geared toward learning and education. The vast majority of the students (15 out of 18) deemed the Discover Tab as the most useful function to acquire new information. What the Discover Tab is closely associated with is the hashtags because users have to use the hashtags to discover. 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 were also frequently referring to the Connect Tab in 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-trained about its benefits and risks.

The 140 character limit has been a controversial issue for this group of students.
All students acknowledged that it brought them some degree of discomfort when they
had to rewrite the sentence that they intended to post. However, their perception on this
character restriction varied significantly across different individuals. Out of 18 total
interviewees, ten favored 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. Contrastingly, the opponents believed that the 140
character limit discourages elaboration and sacrifices the depth of content, as well as
partially accounts for the shortened attention span that we often recognize in teens and
youngsters nowadays. One student also attributed the lack of creditability of information
on Twitter to the 140 character limit- "given the character limit on the tweets it was
difficult for me to gauge their goals and sources of information they were posting."
Opponents also believed that in doing discussions students were unable to express their
full understanding and put forward their full statements owning to this character
constraint.

Overall, as the user becomes more experienced and comfortable with Twitter,
they are less likely to perceive this character restriction as a challenge. Reportedly, most
of the students who perceived the 140 character limit positively were all seasoned
Twitters users who had more than three years of Twitter history and had maintained a
regular tweeting practice. With an increased tweeting practice over time, these seasoned users had developed a deeper understanding of what the 140 character limit really means to them and what it could offer. Not only did this character limit make their messages more concise and to-the-point, some students reported that it ultimately affected their cognitive thinking process as well. Due to this character limit, students postulated that they had to think in-depth enough to reach the very core of meaning and then convey it. This perspective is in drastic contrast with the opponents who were all inexperienced to Twitter. Student [3], who had seven years of tweeting, put it this way-

"It's the best part of it. It does force you to cut out the slop, you have to be concise. Even sometimes you are concise, you realized that you have to be more concise. It really gets down to the basic idea, which is the best way to learn. If you can't explain simply, you can't explain it at all really."

Proponents also contended that it is the 140 character limit that distinguishes Twitter from other types of social media. "Twitter is not like Facebook, no one wants to see paragraphs after paragraphs on social media. It makes people get to their point instead of going on and on and on. That's why Facebook is fading out. You just have to get your full point out in 140 characters."

In regard to the openness of Twitter, students' opinions again varied considerably. The pattern of opinion was considerably akin to that for the 140 character limit. Students with higher Twitter experience tended to view the openness of Twitter much more favorably, whereas those with little experience were more concerned with its risks and constraints. Despite some potential risks, these students strongly believed that the
benefits outweigh the challenges. For the students who held 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. These students also perceived an absolute freedom of speech and expression on Twitter. Three students expressed that its openness makes people more open and honest with their thinking; in other words, they can be honest and "be themselves" on Twitter. In the meantime, these students acknowledged that in spite of its openness, they can always modify privacy settings and other features to protect their activities on Twitter from being influenced by others and limit their scope of seeing other tweets. As student [2] stated, "You're in complete control of what you see and what you don't see. Anyone can say whatever they want. But I'm in complete control of what I want to see."

In contrast, students with less experience tended to perceive 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 provided that it is used appropriately. Often times they interpreted its openness as negative, especially in regards to issues such as cyberbullying, potential distraction, information bombardment, and 'getting out of control.' Notable among these is how they associated this with their own roles as teacher candidates. These students tend to put themselves in the role of a teacher, showing much concerns for younger-aged students who have lower maturity and who may be highly likely to abuse the use of Twitter and thus engender misbehaviors, which can lead to disastrous consequences. For example, as student [1] put, "It is dangerous coz people can say whatever they want, it
could be inappropriate for the education system, it can eventually fall back on you, as a
teacher using that in the classroom."

More interestingly, students who favored Twitter's openness were reported to be
more proactive and self-regulated. Instead of finding fault with Twitter, these students
perceived these potential risks as a way to challenge themselves and make themselves
more self-disciplined and responsible with their own use of technology. The following
shows how Student [1] elaborated on this idea,

"In a classroom, you could be walking around and keep track of everybody. If
you're on Twitter, you're also on the Internet. It could go anywhere. It could be a
distraction tool, but kids are gonna get distracted regardless of what they are
doing. I mean, if they don't wanna listen to you, they are not gonna listen to you.
It's a little different when you want to use technology, but it's not really. There are
gonna be distractions everywhere. You just have to do the right thing for
yourself."

Chapter Summary

The present chapter reports findings of the study related to the Twitter integration
in a hybrid format classroom. Overall, a fairly high amount of student participation and
interaction existed across different microblogging-supported learning activities. The
majority of students perceived the integration of Twitter positively. The four dimensions
of factors in the TAM model seem to lay out an appropriate framework denoting critical
factors that potentially affect students' perception and participation.
Different types of data sources are generally in agreement with one another. Among all the activities, students seemed to favor the face-to-face integration during guest speakers’ talk and the Live Chats activity the best. The relevancy of participation was the highest for the face-to-face integration and the student ratings for this activity was also the highest. The interview data also suggested a unanimously positive perception of Twitter's use during the guest talk. The Live Chats activity, according to the tweets data, received the highest number of tweets and level of interactivity. The moderately high rating in the surveys and high standard deviations of their ratings seemed to suggest a high variability in student perception of this activity. This finding can be further explained by the interview data, which indicated that students with a higher level of Twitter proficiency benefited much more in Live Chats. It also suggested that students' prior knowledge and experience with Twitter stands out to be the most prominent factor influencing their perception and participation in these tweeting activities. Table 21 illustrates some major findings across each data source.
Table 21

*Major Findings across Each Data Source*

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Research Question 1</th>
<th>Research Question 2</th>
<th>Research Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student tweets</td>
<td>How did students participate and interact in microblogging-supported learning environments?</td>
<td>How did students perceive their microblogging-supported learning experience?</td>
<td>What factors potentially affect students' perceptions of microblogging integration into instruction?</td>
</tr>
<tr>
<td></td>
<td>A fair amount of participation existed across all activities. Tweeting during guest talk had the highest relevancy of participation. Live chats had the highest number of tweets and highest level of interactivity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surveys</td>
<td></td>
<td>Student ratings were all high across different activities. Face-to-face interaction had the highest.</td>
<td></td>
</tr>
<tr>
<td>Interviews</td>
<td>Perceived these activities positively</td>
<td>All factors in the TAM model are relevant. Prior experience and knowledge stood out to be the most impactful factor.</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 5: Discussions

Analysis of Student Participation in Twitter-supported Learning Environments

Quantity of participation. Throughout the first eight weeks, except for those who were Twitter enthusiasts, many students seemed merely to fulfill the course requirements by posting one or two tweets per week. This result concurs with what Pena-Shaff and Nicholls (2004) found in their studies concerning the participation rate of online discussions in bulletin board environments. Using number of active participants as a parameter, the average number of participants who tweeted on a weekly basis is 16 out of the total 24 students. This number was a slight increase when compared to Antenon-Conforti’s (2009) study in which 12 out of 22 students did not reach the required minimum number of tweets. Overall, findings of this study agree with findings from Gao et al.'s (2012) meta-analysis on microblogging in education, in which only a small percentage of participants actively tweeted or posted on microblogging platforms.

Despite educators' overarching motivation and interest in microblogging integration into education, this study, along with results from many prior studies, suggests that participation rates have been consistently low or moderate. This may be explained in the following aspects. First, most students are unfamiliar with Twitter's educational and professional use. As Twitter's social and personal use has been ingrained and deep-seated, some students are resistant to any alternative utilization of Twitter and are unwilling to adopt its educational and professional use. The second aspect may be attributed to the low participation requirement from the instructor, as students were only required to post one week per week. As with Pena-Shaff and Nicholls's (2004) study,
student participation is largely contingent on the nature of instructional activity, regardless of differences in the types of technology integrated in such learning activities. In this study, as the type of activity and guidance mode varied, both number of tweets and active participants underwent a noticeable change. Evidence from the study suggests that instructional factors are an important determinant to students' amount of participation. Third, novelty effects may also play a role in explaining the decreased quantity of participation, as demonstrated by the decreased number of tweets in later periods of the semester. Not a single dominant factor is sufficient to account for students' quantity of participation. All these factors will be discussed further in succeeding sections of this dissertation.

Relevancy of participation. With respect to relevancy of participation, student tweets in the current study were evidently more relevant to class topics than in previous studies. Chapter four identified two potential factors that accounted for this high rate of relevant tweets, the means by which tweets were collected and the role of instructions. However, the proportion of on-tasks tweets were still much higher in this study even compared with results from pilot studies of this current research in which tweets were collected using the same hashtag-identifier method. For example, results from the pilot study revealed that in a 1.5-hour face-to-face classroom where Twitter was used as a backchannel, approximately 30% (115 out of 165 tweets) of student interaction on Twitter was considered irrelevant. These tweets simply were concerned with statements about expressing their feelings in the moment and chatting with their friends outside the
classroom. By contrast, the proportion of off-task tweets in this study ranged from zero percent to only 14.3% regardless of the difference in guidance mode.

The primary difference between the implementation of Twitter in the pilot studies and the current research is the degree to which consistent and specified Twitter activities were enforced and maintained over time. From an instructor's perspective, this indicates that a long-term commitment is perhaps a necessity by the instructor to achieve any positive and sustainable effects in carrying out Twitter activities and a high level of specificity in its implementation. A vague and momentary snapshot type of Twitter intervention may instigate students' aversion in that the educational approach of using Twitter is innately contrary to students' habitual social and recreational use. Disrupting or interfering students' habitual Twitter practices without informing and educating them in a proper and explicit manner may even result in various counter-effects, as was implied in Lin et al.'s (2013) recent study.

**Analysis of Student Interaction Demonstrated by the Knowledge-Construction Process through Twitter**

The qualitative content analysis of student tweets can be largely understood under the context of social constructivist learning, especially concerning the process of knowledge construction and collaborative learning. As social constructivists posit, knowledge is constructed through learners' active interaction with others as well as with the environment (Jonassen et al., 1995). Being able to interact with others and participate in a meaningful discussion is a central premise of knowledge construction. Only through the process of reflection, articulation, clarification, internalization, and elaborating on or
arguing with others, can learners ultimately achieve knowledge acquisition and
construction (Vygotsky, 1998). The overall findings from this study show that Twitter,
serving as an instructional technology platform to facilitate student learning, was able to
engage student in reflective and meaningful knowledge creation. Students employed
Twitter to reflect on their learning and to discuss with their peers on various learning
subjects. As shown in Chapter 4, student tweeting was considerably pertinent to the
instructional activities, as most of tweets represented that students were involved in a
meaningful interaction in the knowledge construction process. Reflection, support,
elaboration, and internalization types of tweets were found to be widespread. Twitter was
able to support various aspects of the knowledge construction process, with self-
reflection and support being the two most prominent types of interaction.

The self-reflection type of interaction seems to be most commonly supported by
Twitter. Data analysis demonstrated that reflective tweets stood out as the dominant type
of interaction occurring across microblogging-based learning activities. All required
tweeting activities conducted throughout the semester required a certain level of
reflection. During the Exploring Hashtag activity, students reflected on their
understandings of the specific educational hashtags, including those that were designated
by the instructor and hashtags that were discovered by the students on their own, as well
as the educational content they found through searching the hashtags. Similarly, during
the online discussions, students actively reflected on the week’s learning content,
including topics from the textbook and other readings, as well as issues and problems
they had with their assignments. This finding concurs with prior studies that reflective
activities implemented using Twitter have been commonplace in previous studies (e.g. Agherdien, 2011; Hsu & Ching, 2012; Kassens-Noor, 2012; Rinaldo, et al., 2011; Wright, 2010). Researchers generally agreed on the promises that Twitter holds for promoting reflective activities.

Alternatively, some scholars have casted doubts on the depth of the reflections, especially in comparison with other technology-supported means of reflection. For example, Ebner et al. (2010) noted that participants in their study employed the microblogging tool rather "naively" (p. 97). They did not seem to use the tool with intentional purpose except to receive the grade, and therefore, the posts on the platform were non-reflective in nature. Kassens-Noor (2012) compared Twitter with traditional essay writing and in-class discussion types of reflective learning activity, identifying some pitfalls of Twitter as a reflection tool. The 140 character limit provided students little "space to think" (p. 16). Two possible reasons that may be attributable to Kassens-Noor's results come from the participants' unfamiliarity with Twitter (only five out of her 15 students used Twitter before) and the short-term engagement with Twitter (less than a month). In Ebner et al.'s (2010) study, the duration of intervention was six weeks and no information on student technological capability was provided. Due to these differences in individual participants' Twitter pre-use and duration of Twitter intervention, results from the current study are in opposition with those researchers' findings and claims.

Based on findings from this study, along with the predominance of self-reflection type of interaction, other interaction types implied in the knowledge construction process, such as internalization, proposition of alternative perspectives, and disagreement types of
interaction seem to be less supported in the Twitter-mediated learning environment, based on findings from this study. This result is in agreement with Gao's (2013) study in which social annotation tools were used to support online discussions; the author also found that the most dominant type of posts in social annotation tools-supported environments is self-reflection. Additionally, this finding is also in congruence with Jeong's (2003) study, showing a lower proportion of disagreement type of interaction occurred in online discussions.

By looking into the content of student tweets, it is not uncommon to find that most self-reflection tweets were identified when students' posted a tweet on Twitter to answer the reflective questions being asked in the instructor's prompts for the first time. However, interactions identified in student tweets hardly represent an iterative process of meaning articulation, negotiation, or modification, neither did they imply a high level of synthesis or application. In other words, many interactions were suspended at the self-reflection level where students posted one tweet to reflect on a surface level, while interactions that require higher cognitive level or interactivity with other learners were rarely seen. Twitter as an instructional tool cannot assure that learners will reach higher-order thinking and learning (Lin et al., 2013; Perifanou, 2009). This implication echoes what researchers found about online discussion environments (Gao, Zhang, & Franklin, 2013). In fact, many Web 2.0 tools share the similar downsides when utilized in discussion-focused learning activities. How to advance the knowledge construction process will be further discussed in later sections.
Benefits and Challenges of Using Twitter across Different Instructional Activities

As is implied in the previous sections, discrepancies across these distinct tweeting activities exert influences on students' participation and interaction. Accordingly, student perceptions toward each activity vary since these activities carry different characteristics and have different meanings to students. This section articulates student participation and interaction that are contextualized in the knowledge construction process, and identifies their perceptions including perceived benefits and challenges.

Exploring Hashtag activity. To many students, exploring hashtags with the intent to understand the notion of hashtags and practice the act of hashtagging their tweets is a fundamental and critical step toward a more comprehensive grasp of Twitter as an educational and professional learning mechanism. For many Twitter novices and even some Twitter veterans, they would not have known enormous volume of knowledge and educational content without exploring those educational hastags. As indicated by students in the surveys and interviews, exploring hashtags was a starting point where they experienced a mental shift on the purpose of Twitter, as a pure social and personal tool to a professional and educational tool. In regard to the technical aspect of using Twitter, many novel Twitter users struggled to distinguish the difference between hashtag # and the @ sign, requiring constant reminder tweets from the instructor. Mistakes such as these by novice users unfortunately caused inaccuracy when collecting hashtagged data. However, students showed much enthusiasm while exploring hashtags, as evidenced by the volume of students' engagement within the context of exploring hashtags, as well as students' survey, interview, and blogging data. It is clear that, guided by the instructor,
students were introduced to educational Twitter exploration; as they began to understand the alternative uses of Twitter, many embraced it.

The content analysis of all tweets indicates that, despite the large volume of reflective tweets, students were engaged in lower levels of knowledge construction with little occurrence of dialogue or discussion. The focus on reflection seemed to be prominent during the Exploring Hashtag activity. Students not only sought to find hashtags, they were instructed to reflect on their learning by tweeting what they learned from the search and by sharing it on Twitter. As a result, students reflected what they learned from specific content found using hashtags (i.e. smart board) and shared thoughts about their understanding and interpretation of the educational hashtags themselves. Take #edchat as an example—students' tweets reflected on topics such as the meaning or definition of #edchat, specific methods about how to use #edchat, and resources and links shared or tagged by #edchat. Sharing information, which takes the form of sharing resource web links and retweets, was also salient in the Exploring Hashtag activity. Their own tweets sometimes were even shared beyond the classroom and by people outside of the network. According to Guanawardena, Lowe, and Anderson's (1997) critical thinking model, sharing information is an initial phase in the process of knowledge construction. Most students only expressed their own understanding of the hashtags without any reference to other students’ tweets. The amount of alternative types of interaction, proposal, support and disagreement, implied minimal higher-level learning.

Students commented that the merits of exploring hashtags mainly lie in three aspects. The most obvious benefit is that students were exposed to a wide array of
collective knowledge and resources. During students' time using Twitter for educational pursuits, they ran across numerous articles they found interesting and informative relating to the field of education. They also commented on the breath and extensiveness of knowledge and information available on Twitter. Due to the embedded content as actualized in hyperlinks, students were often led to an extended, limitless world of information, which may sometimes have seemed staggering to them. The second but probably more important insight that students perceived was this experience changed their stereotypes about Twitter and enabled them to value its educational use. Many students recognized this perception change in the end-of-course interviews and subsequent blog reflections. Without this experience, they would not have realized that Twitter is laden with useful and legitimate information. In addition, students witnessed the possibilities of connecting with one another through the use of hashtags. In spite of the limited interaction among themselves within this activity, students were reportedly more cognizant of how the connection was made possible by hashtagging each tweet. Some initial interaction was also voluntarily performed among the class members through searching the class hashtags. Premature as it seems, this activity did lay the groundwork for the more interactive type of communication that was to occur in later tweeting activities.

Students did identify a few challenges. Some students found it difficult to identify useful information from the massive amount of tweets that were hashtagged. The volume of information can be too overwhelming and difficult to organize, regardless of the use of hashtags. Students also questioned the credibility of Twitter-shared information. Students
commented on the discrepancy between information and opinion, reporting they believed the opinion-based tweets were less useful due to the difficulty of evaluating the authenticity or validity of such information. Moreover, the depth of content and the actual weight and substance of tweets were questioned by some students. Some students deemed the content on Twitter "too trivial and too broad." Several students believed that they observed little interaction, deep thought, or real exchange of opinion on Twitter. Lastly, a few students argued that there are no competitive advantages to exploring hashtags on Twitter in comparison to other means of acquiring information, such using search engines. Interestingly, one student used a metaphor to describe her experience of immersing in the Twitter environment: "it feels like being in the atmosphere of everyone shouting through their own microphone, and that’s exactly what it feels like. Little listening or thought."

In summary, exploring hashtags is one critical step to prepare students to be more Twitter-proficient in the long run. Controversial as this activity initially seemed to some students, most of them in the end-of-course interviews acknowledged the importance of exploring hashtags. Through exploring hashtags, students developed an alternative view of Twitter as having some value in educational use. Although many students had not seen any competitive advantages of Twitter, this activity was a unique experience for them to pursue a new means of using Twitter and to reflect on their Twitter-supported learning from this experience with reference to their old tweeting habits, finally leading to a perception change at the end of the course.
**Discussion Topics activity.** The Discussion Topics activity is a form of asynchronous discussion-based activity intended to engage students in in-depth and interactive discussions where they can reflect on learning topics, elaborate on those topics, negotiate their meanings and ultimately construct or co-construct knowledge along with their peers. The nature of this activity shares much commonality with discussions occurring in any online or computer-mediated communication method, such as discussion forums, bulletin boards, and other types of online discussion tools. In these activities, students are given discussion prompts by the instructor and they are required to post their responses in those online discussion environments. Twitter becomes a unique environment employed in this particular discussion activity, which perhaps leads to differences in student participation and interaction as compared to other online tools.

Although the numbers of tweets in this activity overall resembled the Exploring Hashtag activity, the qualitative content analysis of these tweets did show discrepancies in the proportion of types of interactions. Higher-level interaction types, such as internalization and elaboration, witnessed a noticeable increase. As stated in the results section, this may be due to the instructor's guidance, especially the social guidance that encouraged students' quick and immediate response on Twitter. As they reported in the interviews and blogs, most students found it useful to discuss different learning topics with their peers on Twitter. However, self-reflection types of interaction remained the most dominant. This finding is largely in congruence with other researchers' findings regarding online discussions. Students tend to simply post their answers without reference to the perspectives of others (Kim & Bateman, 2010; Murphy, 2004).
Many students reported numerous benefits to holding discussions on Twitter. The most striking theme that emerged across all different types of data concerns the notion of social presence. As with many prior research studies (Dunlap & Lowenthal, 2009; Kop, 2011; Lomicka & Lord, 2012), students in general believed that "it feels good to know we [they] are studying together on Twitter." Although the discussion on Twitter may fall short in terms of the depth of content, the sheer fact that students all congregated in a common and familiar social network to converse with one another and discuss a learning topic seems to motivate and appeal to many students. Students commented that the discussions on Twitter invite more participation because students with reserved characters are more likely to speak up and voice their thoughts as well as feel more comfortable with their peers. Some students felt that they can easily help one another, have discussions, and answer one another’s questions, which establishes a strong community within the classroom and encourages students to be proactive about their education.

Moreover, students reported that they learned by observing the discussions between peers or between their peers and the instructor. Since students followed their peers and instructor, they were able to see those Twitter feeds as long as they logged onto Twitter. Several students reported that even though they did not join in every conversation, they benefited because they might also have had the same problem or thought, and then gained a solution or perspective by observing others tweets. This may be considered as vicarious learning in which the learner can learn through copying or modeling the actions of others (Bandura, 1986). Other unique benefits of the Twitter-
supported discussion environment encompasses promptness in receiving responses, conciseness in conveying messages, and the potential to reach out a wider audience and impact on people out of the classroom learning community.

In other instances, students found it challenging to convey one of their ideas to its full length. A few students commented that the discussions in Twitter only stay on the surface level because of the 140 character limit, which hindered them from articulating and elaborating their ideas. Several students commented on the interactions among their peers. Some students felt the interactions seemed forced since they were graded. Students would not have desired to interact with one another if it was not required. Other students reported that conversation died very quickly because of the unresponsiveness of some students. Overall, the depth of discussion was difficult to sustain. The issues of trust and readiness to discuss were also raised by students in the interviews. Since this activity initiated during the fourth week of the online class when students' acquaintance was at a relatively lower level, trust and rapport was not readily established; therefore, it was difficult for the group to discuss with one another in a meaningful manner.

The aforementioned challenges largely echo the challenges educators have with Web 2.0 technologies. Consistent in recent studies, Web 2.0 tools tend to support short-term knowledge sharing or ideas generation. In Zhang's (2009) words, "Although embracing participatory sharing, Web 2.0-based practices are generally weak in the commitment to sustained progress of ideas, which represents a much deeper commitment than displaying and sharing knowledge" (p. 275). In the Twitter-supported discussion environment, students' lack of commitment and inability to sustain the conversation is in
agreement with researchers' postulation on Web 2.0 tools. Despite overall students' motivation and enthusiasm on using Twitter, it is unrealistic to hold a discussion on Twitter and assume that all students will learn and engage in the activity autonomously. To achieve deeper learning and higher interaction among students, more instructional strategies and pre-planning ought to be in place to advance the surface level of knowledge and dialogue generation.

**Twitter use as a backchannel.** Twitter was also utilized as a backchannel in face-to-face classrooms to allow comments and feedback from the audience. In the lecture sessions, students provided their questions and thoughts to the speaker; while in the student presentation sessions, students' tweets were peer feedback geared towards their peers. The nature of Twitter use in backchannel settings is different from discussion-based activities, as it does not aim to focus on any pre-determined textual content (e.g. textbooks or readings); rather, it is a form of live feedback that students both provided and received to disrupt the single-speaker paradigm and enhance interactivity in face-to-face classrooms.

The volume of participation and interaction during the face-to-face classroom varied case by case. In particular, Twitter's utilization during the guest speakers' presentation was bolstered by all students. Looking into this most successful case, it is found that the content analysis of tweets demonstrates that almost all tweets took the form of questions to the speakers, with very little exceptions. These questions were all reflective type of interaction, which typically gave rise to more clarification and elaboration as the speakers responded to them. Speakers' responses deepened students'
understanding of the topic and therefore strengthened their knowledge construction process. Some other tweets raised new issues, indicating a new way to start a discussion or seek additional information, thus also enriching the scope of student learning. It seems that using Twitter as a question forum is intensely appreciated and welcomed by students, provided that the subject of learning in the front-channel is novel, controversial, intriguing, and often question-provoking.

The comparison on the proportion of different types of interaction between the backchannel activity and the remaining activities indicates an underlying difference between online and face-to-face environments. Overall, the interaction type was again reflection-dominant, even with a higher rate occurring in face-to-face settings. Meanwhile, student interaction among themselves was rarely seen on Twitter during the face-to-face classrooms. This may be explained by the fact that students were so preoccupied by the front-channel learning tasks that no more remaining attention could be spared to focusing on making interaction with one another on Twitter. Concurring with cognitive load theory (Sweller & Chandler, 1994) suggests, students were overloaded by information presented to them from the front-channel so that they did not have sufficient cognitive ability to process more from the backchannel. Owing to learners' individual differences in learning, some preferred to multitask and tweet their questions immediately after they thought about it, while others tended to concentrate on the front-channel learning and disregard this Twitter backchannel until the completion of the guest speech. In other words, students need to be mindful of distinguishing the tweeting activity from the regular classroom learning tasks such as listening to the
instructor or taking notes and determine how much focus they would like to place on the tweeting end, whereas in online environments the division and allocation of attention is nearly non-existent. For backchannel use, instructors may need to allocate additional time to help students to separate the two different tasks or to provide options so that students can choose to participate in tweeting or not based on their personal preferences.

Students' perceptions for the use of Twitter in face-to-face classrooms were overwhelmingly positive as compared to the other tweeting activities. They recognized multiple benefits of using Twitter in face-to-face classrooms. As it was stated in the results section, the most commonly acknowledged benefit was that Twitter allows a just-in-time feedback approach in which students can deliver their messages without disrupting the classroom regularities. It also helps students to overcome the mental barrier of delivery delay in which they have to mentally hold the comments and thoughts and wait for the front-channel lecture or presentation to complete. Second, the enabling of a backchannel enhances both the volume and diversity of student participation and promotes dialogues around learning among teacher and peers in the classroom, which helps instructors/speakers deliver high-quality information to students about their learning. Students commented that they appreciated the fact that the instructor can go over all their questions and comments after the class. Third, Twitter's affordance to document and archive makes students' follow-up remediation and teachers' long-term monitoring and evaluation easier to achieve. Students believed that Twitter is a resourceful tool because they can go back and reread others' in-class comment after the
class, which expands their classroom learning and creates more learning opportunities outside of the classroom.

It is also noted that the incorporation of Twitter could lead to digression from the classroom routine. Some students who were against multitasking in classroom settings believed that it can be a distraction for them to open this backchannel during a lecture session. Not only could audiences who sit in the classroom become distracted, but the speaker could also be affected if the audiences constantly look at their computer screens. In terms of the quality of Twitter-based feedback, some students noted that the comments that they received were either too brief or too insignificant. Higher-level feedback such as constructive criticisms were rarely seen, whereas praise in the form of brief affective statements was more provided by their peers, especially in unguided, naturalistic learning contexts. Due to distraction and information overload, students may find it difficult to provide high quality feedback, which reconfirms the critical role of instructional guidance and scaffolding in microblogging-based learning (Holotescu & Grosseck, 2009; Luo & Gao, 2012).

**Live Chats activity.** Twitter live chats have become an increasingly well-known practice for savvy Twitter users across many disciplines and professions. Using hashtags (#) as a way to organize and identify Twitter groups and topics, professionals around the world congregate in the Twitter sphere to participate in live discussions on a regular basis. For example, #edchat is a Twitter live chat that educators use to participate in discussions once a week on a selected topic. The principle goal of bringing teacher candidates into the live chat community was to expose them to a world of connected educators and
professionals on Twitter and to have them experience a form of online collaborative learning on a massive scale.

Student interaction in the Live Chats activity presented to have the highest interactivity according to the content analysis of tweets. Compared to the other tweeting activities, higher-level interaction types, such as elaboration, support, and disagreement, were all found in this activity. A more diverse and scattered distribution of different types of interaction was seen in the live chats, whereas in the previous tweeting activities self-reflection had been predominant. This finding certainly indicates a higher-level learning and knowledge construction occurred in the Live Chats activity. Looking at the specific tweets, the means in which students participated in the chats varied, which was also contingent on the specific chat they chose to participate. A lower level of participation usually pertains to using the chat to receive information, advice and assistance regarding the questions students raised during the chat, while a higher-level participation involves being more of an active content contributor who provides opinions and gives advice. This indicates a higher level knowledge construction process during the live discussion, including presenting students' own opinions and comments, confronting with others' thoughts in the live chat, and providing their own solutions to other participants in the live chat. The degree of participation also varied across different individuals and different specific chat sessions. During a one-hour live chat session, Twitter-savvy participants posted more than 30 tweets, while less active participants only had one or two retweets.

As many students posited, participating in these educational live chats was an invaluable experience to them. First of all, their original perception of Twitter as an
exclusive social network was again challenged thoroughly. Many students stated that it was mind-blowing to realize the existence of such educational live chats and educators around the world collaborating in the Twitter-sphere. Some also commented that chats were definitely useful and they would continue to participate in the future. Second, students were impressed by the breath of such professional network and the depth of content being discussed in the live chats. A majority of students commented that joining these live chats made them connect to other educators and professionals around the world. Some of the students also gained followers due to their participation in these chats. They perceived many chat participants as "senior educators," "innovative thinkers," and "inspiring people." Being able to connect with advanced-level professionals made it an honorable and worthwhile experience for many students. Third, the resources, advices, and information students attained from the live chats were also useful, among which many were something that they can take home and apply into their own future classrooms.

Challenges of participation in live chats also coexist. It seems that due to the lack of experience and understanding of Twitter's educational potentials, many students were not able to benefit from this activity to its full extent. More than half of the students reported ineptitude in keeping pace with the flow of those live chats. Students experienced mental and behavioral frustrations. Many reported that they were not fast enough in typing or they found the 140 character limit was restrictive when attempting to type out their tweets. Even when they were not typing, their minds could not keep track of various threads of tweets, making them feel lost and distracted at times. In other instances, students reported that more time was spent on reading others' tweets and trying
to understand the live chat mechanism, in lieu of making actual contribution by posting
tweets. Students who were unfavorable to the use of Twitter found it even less
comfortable joining these chats. They believed these tweets during live chats only
presented some "common sense" types of bold statements, rather than constructing solid,
concrete and meaningful content.

Based on the analysis of data across all sources, it is found that prerequisites of a
successful live chat experience comprise at least three components. The first and
foremost is students' Twitter proficiency level, including both cognitive and behavioral
aspects. Participants need to both cognitively understand and appreciate the value of
educational tweeting, and master the practical techniques to participating in a live chat
(i.e. being able to follow the strings of conversation as well as contributing to the
conversation) in order to gain the best experience from it. Some logistics factors are at
play. Students have to find a live chat time that fits their personal schedule, which could
be difficult due to the mounting high demands from other academic courses or the
institution at large. Third, the delivery end of the live chats, meaning how the live chat is
held and managed, also impacts students' experience. The chair/host's role in live chats is
approximately equivalent to the role of instructors in classroom settings. How the chat
activity is designed, planned, and moderated relies largely on these people. Many
experienced moderators could make the live experience much more organized,
educationally sound, and even fun, but inexperienced ones often turn to the opposite.
Whether the selected topic is of value and interest to students is also critical in keeping
students engaged and motivated.
In conclusion, despite its enormous potentials, students need to reach a high level of both conceptual knowledge and practical skills in order to have an optimized experience in educational live chats. Although it was a good starting point to prompt students to experience what it means by educational live chats and open their views of such grand-scale collaboration, the threshold to be able to fully benefit from this chat is extraordinarily high. As educational live chat is a relatively new phenomenon, this area is certainly worth more practices and investigation from both educators and researchers.

**Implications: A Working Model of Twitter Integration in Education Classrooms**

The above analysis of each individual tweeting activity indicates that a composite of all the above-mentioned activities could in fact become a series of steps that could be taken into actual implementation of Twitter's classroom use. The three central activities, exploring hashtags, discussing course topics, and participating in educational live chats, as well as some peripheral activities, such as the backchannel Twitter use in face-to-face settings, using Twitter for classroom management, formulate a working model that represents and models the process of Twitter integration into classrooms. Despite the fact that these activities were not initially designed to be complementary or hierarchical with respect to its cognitive and technological development level, a post-hoc re-analyzation of these activities along with student feedback suggest that these activities seem to naturally build upon one another, which lends to a sequential working model that could be potentially employed by educators who are interested in incorporating Twitter into classrooms. Below all three central activities are recapitulated coupled with some pedagogical suggestions and recommendations.
Exploring hashtags. Exploring hashtags is the fundamental activity that prepares students to attain a deeper understanding of Twitter hashtag and that bridges students' perspective transformation from viewing Twitter as a purely social and personal tool to an educational and professional tool. In this activity, students will practice the very acts of searching for a hashtag and hashtagging a tweet. The anticipated level of interactivity is relatively low in this stage, as the key of this activity is to familiarize students with the Twitter hashtag function and gain at least a preliminary idea of the educational aspect of Twitter. The instructor may guide students to interact with one another by sharing the hashtags they explored, but the major type of interaction is self-reflection that allows students to reflect on the educational hashtag learning process.

Serving as good models, the instructor should designate specific hashtags as exemplars for students to search as well as provide them some degrees of flexibility so that they can search based on their own interests. These exemplary hashtags need to be preselected from the instructor in order to decrease the amount of possible noise information contained in the tweets that they search. Meanwhile, students should be asked to tweet what they have discovered from searching these education hashtags so that the instructor can monitor this exploration process. When choosing these hashtags, the instructor can choose by content area (i.e. maths: #mathchat, language arts: #engchat, science: #science), as well as by topic (i.e. social media in education: #lrnchat, mobile learning: #mlearning, project-based learning: #pbl, cyberbullying: #cyberbullying). Once the preselected hashtags were explored thoroughly by the students, the instructor can then provide a listing of educational hashtags and allow freedom for students to explore on
their own. Caveats and warnings should be also given to students to inform them that they may encounter hashtagged tweets that have nothing to do with the hashtagged topic itself or have less educational value.

**Discussing Topics.** The Discussing Topics activity assimilates any form of asynchronous online discussions in which students are congregated in the online environment supported by Twitter and posted their answers to course-related discussion questions and prompts provided by the instructor. The key in this discussion activity is to cultivate ways to enable meaningful conversations among class members and make these conversations sustained. All students' responses to the discussion prompts need to be hashtagged so that others may search for them and build upon each other's ideas. These hashtags could be set up distinctly to label different discussion topics; alternatively, the instructor can also utilize a universal course hashtag for all discussions in one class.

The main goal in this activity is to train students into using the Twitter environment as a discussion forum and to build trusting rapport among all class members. This is a stage in which students take considerable efforts to practice the act of writing a tweet to convey meaningful messages about their learning of content covered in the curriculum. Rudimentary as it initially seems, this activity requires a significant time and effort commitment to be able to convert students' habitual tweeting practices into writing meaningful and in-depth content in their tweets. The instructor's guidance, including what types of discussion questions are provided and how the process is modeled and scaffolded, is of extraordinary importance to the success of this activity. Variations in scaffolding the activity are encouraged as well. In the initial stage students could be given
more definitive questions, such as a dichotomous question (Yes or No) with a one-sentence explanation. Progressively, more open-ended questions and rebuttal types of questions can be provided, as students are more capable to convey and construct their own understanding in an elaborated and in-depth fashion. Alternative discussion questions entail asking students to write a brief but concise summary or synthesis of an article, to find a real-life example upon which a learned concept or idea is built, or to provide contrary statements on certain existing ideas. The discussion tasks and questions ought to present a high level of specificity so that students can focus on providing meaningful responses that represent constructive learning and critical thinking instead of giving short answers that only demonstrate lower-level thinking.

How to effectively foster meaningful interaction with their peers is another indispensable element in this activity. To keep this activity more methodic and ensure student interaction to occur among predetermined class members, the instructor can structure the activity by assigning each student with discussion partners or grouping students into pairs or triplets. As a result, student interaction is more guaranteed as they feel more obligated to participate when their participation is bounded by another person in the same class. Promptness in responding to each other's post is another critical issue. Even in traditional online asynchronous discussions, students should be required to respond to each other in a timely manner. The instructor can impose timeliness by setting a time frame for each round of discussion to occur within a designated time period. For example, first round of responses is required to be posted two days after the instructor posted the discussion question and at least two comments to each other as the second
round is mandated within the succeeding three days. Over time, students will learn more about each other's opinions as well as their personalities by the way the tweet to answer the discussion questions. Alternatively, the instructor can hold synchronous chat sessions with the students to expand the discussion on certain topics. A synchronous chat among class members can serve as an apt preparation for any succeeding massive-scaled live chats based on the similarities across all synchronous chats. Interactivity will be enhanced in synchronous chats and students' sense of community and level of trust will be therefore leveraged when engaged in a live chatting experience.

**Live Chats.** Participating in educational live chats requires the highest level of Twitter proficiency as well as cognitive thinking in general. Since the live chat activity is the third stage in the working model, students are supposed to be well prepared in regard to their technical proficiency level as well as their conceptual understanding of Twitter's educational value. A lack of either the technical operation of Twitter in live chatting environment or their psychological belief in Twitter's educational value will attenuate the educational effects of this activity.

As indicated in previous sections, the success of live chats activity relies heavily on students' prior Twitter knowledge and Twitter operating skills. Students can benefit tremendously if they are well prepared and the activity is well-planned. It will be a unique way to connect with teachers worldwide and learn to cope with practical problems in students' own future classrooms that someone in the field has already had to deal with. Students can gather information from seasoned teachers and adapt some of their concepts and ideas into their own future learning and teaching. More importantly, the live
discussions that students engage along with other professionals demonstrate a grand-scale social collaboration and co-construction of collective knowledge. Overall, it can help students as teacher candidates to gain support from other teachers as well as co-construct knowledge of important trending issues in education.

Because students' levels of readiness vary, instructors should allow different levels of participation to accommodate individual differences in each student. Additionally, when considering of integrating Twitter live chats into classrooms, the different levels of participation may depend on the characteristics of distinct chats that students choose to participate in. These characteristics encompass the pace of tweets posted, number of participants, and the topic to be discussed. The lower-level participation involves simply receiving, reading, or retweeting tweets coming from other professionals and only a few self-written tweets are posted. The actual interaction demonstrated by back-and-forth tweeting between the student and other live chat participants is minimal in lower-level participation pattern. A higher-level participation requires students to be prepared in a full-fledged mode. To reach a higher-level participation, students first need to attain a certain level of Twitter proficiency both in terms of how it operates and what it means for education. Additionally, they may need to rehearse the anticipated chat prior to the actual live chat session. More specifically, they can learn the to-be-discussed topic ahead of time and think through what their opinions are on those topics and practice verbalizing them before virtually participating in the live chat. This type of warm-up tasks can help students further contribute to the conversation, in lieu of being in the live chats but feeling unable to engage in a conversation.
The instructor can introduce several strategies and techniques of effectively participating in live chats. These strategies are summarized partly from students' interviews in which the Twitter veterans shared tips and provided suggestions on how to engage in live chatting conversation. First, participants in the live chats need to have a clear opinion on the selected topic and are willing to speak up. If the participant him/herself cannot stand up for his/her opinion, it is very unlikely that he/she will be able to initiate a conversation with other unknown participants in the chat. The mindset of being open to different views but also staying firmly on their own personal opinions is important as a starting point. Second, participants need to create a focused channel in which they can engage in expressing their own opinions, rather than being busy with keeping track of others' tweets. It is critical for participants to learn to interject their own thoughts while seeing others' conversation coming out simultaneously. Participants can pick their own channel and start to converse with other people who may have responded to their tweets. If one conversation dies, participants should create another channel or find another tweets that they have something to say. Third, participants should be selective in reading and posting tweets, rather than trying to keep up with all conversation/tweets that are pushed into the Twitter feeds. If one tries to read all tweets or have a conversation with everyone in the live chat, the experience must be inevitably overwhelming because it is impractical to understand and follow all strings of thoughts.

**Summary.** The following table (Table 22) provides a visual scheme that highlights this three-staged working model of Twitter incorporation in education classrooms. Note that this working model can be adopted on a micro level as well as a
macro level. On a micro level, instructors can adopt it when introducing a concept or topic in education, such as project-based learning or cyberbullying. The first step is to have students search for educational hashtags on such topic(s). This is followed by stage two where students are engaged in asynchronous or synchronous discussions with only class members. In the third stage the instructor can select pertinent live chats for students to join synchronously with educators from all over the world. This integration model can be cyclical and iterative when more topics are introduced following this procedure. On a macro level, instructors can plan for multiple sub-activities for each stage and continue this integration throughout an entire semester. In this approach students will be more prepared in each stage and the effectiveness of such activity will be less contingent on students' interests, but it becomes a longitudinal intervention aimed to enhance the conventional educational classroom. Other peripheral activities such as backchannel use or classroom management use of Twitter can be carried on concurrently with the three key activities.
Table 22

A Working Model of Twitter Integration in Education Classrooms

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activity</th>
<th>Goals</th>
<th>Cognitive level</th>
<th>Focus in the knowledge- construction process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exploring Hashtags</td>
<td>Prepares students to attain a deeper understanding of Twitter hashtag</td>
<td>Low</td>
<td>Self-reflection, resource sharing</td>
</tr>
<tr>
<td>2</td>
<td>Discussions</td>
<td>Train students into using the Twitter environment as a discussion forum</td>
<td>Medium</td>
<td>Clarification, elaboration, internalization</td>
</tr>
<tr>
<td>3</td>
<td>Live chat</td>
<td>Connect with educators worldwide and reach co-construction of knowledge</td>
<td>High</td>
<td>Alternative proposal, support, disagreement, co-construction of knowledge,</td>
</tr>
</tbody>
</table>

Implications: How to Make Twitter Work?

In this section four critical issues in making Twitter work for classroom learning are discussed in detail. The discussion of these issues is grounded in the framework of the TAM model (Technology Acceptance Model), which is associated with potential contributing factors analyzed in all data sources in response to the third research question. All four dimensions of the TAM model, individual differences, social influence, facilitating conditions, and system characteristics, are all speculated on varying degrees and through different lenses. 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.
**Acquiring Twitteracy.** The term *Twitteracy* is a term coined here in this study to denote a person's capability to use Twitter to achieve educational goals and benefits. This term was first coined by the researcher's dissertation chair and advisor Dr. David Moore. This origin of this term may be traced back to Rheingold's (2012) book *Net Smart* in which he discussed varying distinctive characteristics of Twitter that only people with *Twitter literacy* can resonate. As Rheingold (2012) contends, Twitter literacy can be generally understood as the condition or quality of being knowledgeable and skillful in the use of Twitter. Despite its ease-of-use and simplicity, such fundamental knowledge and skills of Twitter, as here referred to be *Twitteracy*, are essential to anyone who intend to use it more than a banal communication tool. Without certain level of Twitteracy, it would be difficult for Twitter to yield any educational effects.

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 abandon their old perception of Twitter and be more open and receptive to the idea of *educational Twitter*. In spite of 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 where to pay attention to in the crowd of information on Twitter and be able to discern
what to take and what to disregard. After all, what Twitter can do for a user all depends on how he/she sees and grasps it. It is undeniable that most students still use it exclusively for social and recreational purposes, as this study showed along with many other prior studies (Ebner, 2013; O'Reilly & Milstein, 2011). It is partially the educators' responsibility to bring the educational concept of Twitter into classrooms and teach students to be literate about its educational use. The integration of Twitter into classrooms initiated by innovative instructors, to many students in the world, could simply be a stepping-stone on which they stand up to taste the educational flavor of Twitter. Of great importance is this first step, which not only could be an instructional technique, used in the classroom, but it could also exert a long-term impact that may change students' perception and habit in prospect.

The study also shows that the acquisition of Twitter literacy requires practice. Those who recognized Twitter's educational value but failed to spend time using it for educational purposes were not able to gain an optimal experience of using Twitter in the classroom. The acquisition of Twitter literacy, just as any other types of literacy, is developmental in nature and perhaps recursive. Rather than taking a crash course on Twitter literacy or experiencing one instance of integration and over-optimistically believe that they acquire it, students need to continuously practice its actual use and learn to improve their abilities through time and experience. Simply being open to the educational possibilities of Twitter is far from being able to grasp its full potentials. An ongoing purposeful exploration and commitment of using Twitter is indispensable to take full advantage of Twitter.
Acknowledging learners at different levels. Data analysis in this study 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. As Twitter-enthusiastic instructors, it is pivotal to assess to what degree the learner is ready at the moment, both cognitively and technologically, and guide their learning forward from that point.

The interview data, in particular, suggests a taxonomy of Twitter users consisting of four types of students in this study. This taxonomy may help prospective instructors to place their students into a big picture according to students' prior experience and thus guide instructors to align the degree to which Twitter could be implemented with students' characteristics including perceived usefulness and usage behavior. These students are hierarchically categorized into four types, expert, novice, veteran, and resistor, according to the level of easiness for Twitter to be integrated. Figure 12 presents a graphical scheme of this taxonomy. The characteristics of each type of students are illustrated below.

**Expert.** The expert type of students is the most welcomed and ready ones for the incorporation of Twitter. These students possess a high level of proficiency with Twitter use and think highly of the educational and professional use of Twitter. Expert students tend to be early adopters of Twitter; they probably have used Twitter for more than five years prior to the Twitter integration. They have developed certain insights on how Twitter can be used for varying purposes and they have been practicing its use over time. Not surprisingly, these students may often times have a better grasp of Twitter than the
instructor. It is critical for the instructor to recognize these students and have them take
the leaders' or facilitators' role in regards to Twitter's implementation. Some tweeting
activities such as exploring hashtags may seem stagnant to them, but these activities
could also be perfect refreshments in which expert students could set live examples to
other types of learners and help those learners in many specific ways.

**Novice.** The term novice here does not necessarily indicate that these students
have not heard of or have never used Twitter, but rather the Twitter for education idea is
novel and interesting to them. Because these students hardly developed any fixated pre-
perception of Twitter and they tend to be open and positive to its educational use, the
Twitter integration is relatively easy to work for them. Although they are highly likely to
experience some technical frustrations and feel cognitively challenged, novices tend to be
able to cope with those difficulties and ultimately achieve a positive perception change
after the Twitter implementation. In the meantime, novices prefer a significant amount of
guidance and they prefer the guidance to be explicit, step-by-step and ongoing.

**Veteran.** The term veterans refer to skilled skeptics who have acquired a great
deal of skills and experience using Twitter but they only used it for personal and
recreational purposes. Twitter veterans who possess a fixated usage pattern of Twitter
tend to be skeptical to the educational Twitter idea. Although these students could also be
Twitter early adopters, they have utilized Twitter exclusively as a social networking tool
and are reluctant to leave off their old perception and usage pattern. The 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 any 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 these veterans' preconception by providing authentic modeling and ongoing guidance. Additionally, instructors may consider provide an optional implementation for these skilled skeptics so that they can voluntarily choose to participate or not. Imposing the Twitter integration without taking these learners' prior experiences into account could easily push them toward the negative end of spectrum of their perception.

**Resistor.** Twitter resistors are those who are low on both the perceived usefulness and usage behavior axes. They often consider Twitter as useless and a waste-of-time and most of time they have never signed up an account to this date. Twitter as a social networking tool has been under the spotlight since 2006 and has gained tremendous prevalence in recent years among younger generations (Lenhart et al., 2011; Lunden, 2012). Students in the interviews also unanimously reported that almost all of their friends are using Twitter. If one chooses not to join Twitter till this date, he/she may have already developed a deep-seated negative attitude toward it. These people also may have a stubborn and unyielding personality. The Twitter integration in classrooms could be dismissed by these Twitter resistors from the very beginning. In attempts to alter these people's attitude, instructors are obliged to take great lengths to even make a tiny change on these people. Instructors' efforts could even be of no avail to Twitter resistors. Especially for an intervention of a short time span, instructors should be cautious about
whether or not to continue the Twitter integration plan if Twitter resisters are found to be the dominant type of learners prior to the implementation.

**Summary.** The above taxonomy provides a conceived blueprint of different types of Twitter users in a class. This taxonomy demonstrates some unique characteristics with which different learners possess and suggests some pedagogical implications for instructors before they advance their Twitter implementation plan. This diagram serves as a conceptual framework for instructors to better understand the discrepancies in student perception and usage behavior, thus further helping them develop instructional techniques customized for each type of students. Validation of this conceptual framework would be further enhanced through future research and examination.

![Figure 12. A taxonomy of Twitter users](image)
Providing instructional guidance as facilitating conditions. As Web 2.0 tools are increasingly common in educational settings especially in higher education, questions on how to guide, monitor, and optimize their use effectively in learning environments have then become more pertinent (Davis et al., 2013). In the light of such vision, this current study aims to contribute an initial step towards answering the question of what difference could instructional guidance make to the results of microblogging-supported learning. The overall results suggest that compared to an unguided mode, student participation in terms of volume and relevancy in the guided environments were relatively higher. The level of interactivity failed to improve in guided settings. Additionally, 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. Results from survey and interview data also agree with these overall results, suggesting a critical role of instructional guidance, especially for those novel Twitter users.

These overall findings can be explained primarily from three perspectives. First, instructional guidance is conducive to eliminating digression from learning topics and thus avoiding the extraneous cognitive load. This result was particularly evident when comparing the relevancy of student tweets during student presentations sessions in guided versus non-guided environments. Since learners' working memory is easily overloaded in computer-assisted multimedia learning environments, instructional guidance can be of exceptional help to reduce cognitive overload (Mayer, 2004). Although microblogging is a new type of media that has rarely been studied with regards to instructional guidance,
results from this study suggest that the presence of instructional guidance indeed helped students stay focused on tasks and therefore increased the relevancy of tweets. These findings are in conformity with prior studies about the possibilities of initiating a conversation with people outside of class or reading irrelevant noise information on an open microblogging platform, which could largely be reduced with the aid of instructional guidance (Dunlap & Lowenthal, 2009; Holotescu & Grosseck, 2009; Luo & Gao, 2012).

Second, unless guidance was intentionally aimed at promoting social interaction, the level of interactivity may not be associated with the existence of instructional guidance; on the contrary, it might also serve as a repressing factor. This was represented by the fact that interactive tweets ("mentioned" and "replied to" types of tweets) was not enhanced in guided environments. Surprisingly, tweets representing higher-level of interactivity in fact were more seen without instructional guidance. Perhaps students in unguided environments may perceive less structure, which prompted them to reach out for more social interaction with their peers. A few prior research studies in collaborative computer-assisted learning also suggested that over-structuring in these collaborative learning environments might attenuate the level of interactivity among participants (Nastasi & Clements, 1991; O'Donnell & O'Kelly, 1994). Intuitively, the comparison between social versus cognitive guidance also suggest that social guidance seems to be able to promote more social interaction than cognitive guidance in Twitter-supported environment. This particular result seems to also conform to prior research, suggesting
the benefits of social interaction-related guidance in computer-based collaborative
ingvironments (Barron, 2003; Zahn, Krauskopf, Hesse, & Pea, 2012).

Third, it is also implied that students' prior knowledge and skills with Twitter's
educational use largely determine their perceived value as well as the effects of
instructional guidance. As students' cognitive understanding of Twitter and their
technologically comfort level with Twitter increased, instructional guidance tends to be
less important. This result can be drawn from the analysis of tweets in the later live chats
sessions as higher-level interaction still occurred in live chats even without instructional
guidance. Students' interview and survey data also informed that 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 reemphasizes the role of instructional guidance
for novice learners who have scarce prior knowledge and experience, as is implied in
previous studies (Mayer, 2004).

This study offers pedagogical implications in terms of providing instructional
guidance in microblogging-supported learning. The rule of thumb is that instructional
guidance should always be present at the beginning stage of microblogging integration
with salience, explicitness, and consistency. Concurring with implications from multiple
previous studies, this study again shows that students need to be guided or otherwise they
will easily switch to their habitual ways of using microblogging (Lin et al., 2013; Luo &
Gao, 2012). For example, students should be clearly informed of the purposes of using microblogging and guided through a progressive ongoing process. Advanced training of microblogging use in education may be needed prior to the class in order to educate students and transform their habitual use, especially for those with existing usage patterns. As what has been discussed in the three-step working model of Twitter integration and the taxonomy of Twitter users, a developmental and ongoing guidance that targets different user groups is necessary for the instructor to take into consideration. The duration of the tweeting activity (e.g. long-term versus short-term) as well as the goal of the activity (e.g. providing a just-in-time Q and A platform versus a discussion forum to train critical thinking) matter a great deal as to what type of guidance is desired.

Notably, in order to provide facilitating conditions for the Twitter incorporation, instructors themselves need to develop and progress on their own perception and use of Twitter. It is unwise to assume that instructors know Twitter better than their students and they can acquire its educational use effortlessly. In fact many instructors in reality are more inclined to shy away from its classroom integration simply because of their own denying attitude on Twitter. To cultivate a better understanding of Twitter and to augment Twitter's educational value, instructors should also be more mindful and proactive in advancing their own knowledge and skills of utilizing Twitter. Assuming a cookie-cutter recipe for Twitter's classroom use is both unrealistic and counterproductive. In order to support and facilitate student learning with Twitter, the instructor ought to be willing to spend time and effort to invest on their own experimenting and learning of Twitter as an instructional tool.
Some specific instructional techniques, such as small-group collaborative microblogging activities will allow more opportunities for personal and specific feedback as well as reduce the amount of distraction. Timing tweeting tasks and allowing intervals for students to tweet between each activity can help students stay more concentrated on the learning tasks. Additionally, instructional prompts and cues should be given explicitly and recurrently in microblogging-based learning. Diversification in forms of prompts and cues including verbal, visual, and textual may also be considered to accommodate individual differences of student characteristics.

**Understanding functionalities of Twitter.** As indicated by multiple research work on Twitter, regardless of the specific academic discipline such as business, communication, sociology, or education, it is universally acknowledged that certain functionalities, or using terms from the TAM model, system characteristics of Twitter make it unique and irreplaceable given the contemporary outlook of social media (Cho et al., 2013; Ebner, 2013; Rheingold, 2012).

Overall, Twitter is very easy to use and the basic functions such as tweeting, following and to be followed by others on Twitter are self-explanatory. Most students can acquire the basic features seamlessly. In the meantime, results from this study also show immense individual difference in their beliefs and utilizations of Twitter. Consistent among many Twitter researchers is the belief that Twitter is a multi-faceted and all-inclusive tool that can be employed for a wide variety of purposes (Cho et al., 2013; Diaz-Ortiz & Stone, 2011; Ebner, 2013; O'Reilly & Milstein, 2011; Rheingold, 2012). Researchers postulated the notion of interpretive flexibility, suggesting that the tool
"Twitter can mean different things to different people" (Cho et al., 2013, p.53). The tool in and of itself has no good and bad; the question of how Twitter should be perceived and incorporated relies on the objectives, interests, and social environments shared by different user groups and individuals. Two most unique and indispensable functions, hashtags and the 140 character limit are explicated below.

**Hashtag #.** 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 hashtag in a tweet enables to link to an ambient virtual community and contextualized the interaction, and meanwhile makes it searchable to the open world. As instructors, it is vital to recognize the power of using hashtag and guide students into exploring them to gain a deeper understanding of Twitter. Often times these hashtags not only mean 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.

**140-character Limit.** The 140 character limit can be both a constraint that challenges people's ability to be concise and an asset that empowers the use of Twitter. 140-character limit means that users often cannot just say what they want to say without rethinking and rewriting it. On the one hand, students perceived it as a benefit that restricts what they want to say so it can be said in the simplest terms and keeps people from rambling on. On the other hand, when students feel the need to be more elaborated
and detailed, they are challenged because it is not allowed given the 140-character limit. However, 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 learn to be more concise and to-the-point in conveying messages on Twitter because Twitter forces them to be brief and make their points clear and direct. With a short amount of information distributed on the Twitter sphere, more collective intelligence can be aggregated and exchanged in a wider spectrum. Instructors should understand that initially the character limit could pose a challenge to students; however, over time students will pick up the merits of being simplistic and clear of their messages and then appreciate this functionality. In terms of the design of instructional activity, it is also cautioned that Twitter may not be desirable for explanatory or ruminative activities that require detailed and lengthy elaboration and clarification.

**Chapter Summary**

This chapter discusses the major findings of the study and extends beyond these findings. First, the quantity and relevancy of participation was elaborated and interpreted in relation to findings from prior studies. Second, a discussion on the qualitative content analysis of tweets was carried out under the context of social-constructivist learning, especially with respect to the process of knowledge construction and collaborative learning. Third, this chapter discussed student participation, interaction, and perception, along with goals, benefits and challenges for each activity, since discrepancies across these distinct tweeting activities largely influence student learning on varying dimensions. Fourth, based upon the in-depth discussion of each activity, a working model of Twitter
integration in education classrooms was then proposed to suggest a pragmatic model that can be applied into an actual implementation of Twitter's classroom use. The three core activities in this working model - exploring hashtag, discussing class-related topics, and participating in educational live chats - were again expounded with specific pedagogical suggestions and recommendations. Lastly, using the TAM model as an umbrella framework, this chapter details several critical issues in making Twitter work for classroom learning with respect to the potential factors that contribute to differences in student perception and participation. Specifically, to make Twitter work takes instructors' effort to help students acquire Twitter literacy and to recognize individuals' difference of prior use and experience, to acknowledge learners at different levels, to provide instructional guidance as facilitating conditions, as well as to understand those unique functionalities of Twitter.

**Future Research in Microblogging**

Improving learning in Web 2.0 environments has been highlighted in contemporary education (Greenhow et al., 2009). To investigate this issue, the current study chose microblogging as an exemplar of Web 2.0 tools to explore student participation and interaction in the context of knowledge construction processes, examine students' perception, and investigate potential factors contributing to student participation and perception. Although this study enhances the understanding of student learning in microblogging-based environments, future studies can advance in many approaches. First, as this study only examines student participation and interaction in a particular setting, the results are limited in the sense that it may only be applicable to
populations and settings with similar traits. The differences in student samples, choice of microblogging tools, purposes of adopting microblogging, and specificities in implementations are all likely to bring alternative findings. The difference in data and time at which the microblogging activity was implemented may also have carry-over effects to the later one. Therefore, researchers should be cautioned when making generalizations of the findings from this study to heterogeneous settings or populations. The limited sample size also restricts the generalizability of results. Future replication studies in other settings, with a larger sample size, and different populations will certainly provide further insights on student learning in microblogging-based learning.

Second, future research may focus on how learning occurs in microblogging-based discussion environments. This current study researched several types of interaction in the knowledge construction process, but it did not provide further insights on how learning occurred in such environments. Specifically, the sequence of such interactions was unknown given that the types of interactions were only studied separately. A sequential analysis, as suggested in Jeong's (2003) study, could provide more insights on whether or not there is a model of students' knowledge construction process and how each type of interaction (reflection, clarification, internalization, support, disagreement, etc.) interrelate with one another.

Third, future research may broaden the investigation of microblogging tools beyond the single case, Twitter and expand the study of its text-based features to pursue research in alternative microblogging tools and functionalities. As stated in the introduction section, a wide variety of microblogging tools coexist with Twitter and the
number of such tools has been increasing. Whether findings of this study hold true for other microblogging tools is certainly worth examining. As to the Twitter functionalities, this study only explores the text-based affordance of Twitter; however, with the increased multimedia features that Twitter supports, future researchers could explore other possibilities. For example, students can be asked to take pictures and write text along with the pictures they took. Other types of learning activities involving multimedia other than text-based information are certainly worth researching.

Fourth, this study has provided three conceptual frameworks, including the profile of Twitter learners, the three-step working model of Twitter integration, and the potential factors attributable to participation and perception of the Twitter integration. However, these frameworks and models are preliminary as they were first proposed based only from results of this study. Future research should test how well these hypothetical frameworks and models can be applied in additional settings because this study was not designed to produce findings that could be generalized to additional settings. Future studies may advance research in microblogging integration with respect to further examining these variables. Other factors, such as the setting (i.e. face-to-face versus an online class), the research site, the goal of the learning activity (i.e. to learn argumentation skills versus to improve English writing), the instructor's role, student characteristics, selection of microblogging tool (i.e. Twitter versus Tumblr), and the course content could all be of potential interest for future research.

Fifth, methodologically, this study used the program NodeXL to only capture tweets that were hashtagged and employed these as the entire data to examine student
interaction and participation. As it was discussed previously, this selection could be biased as student interaction also occurred when hashtags were not used. How to fully capture the entire course of tweeting and how to avoid the missing information could be challenging to researchers. Advanced data collection techniques may be explored to ascertain the completeness of data collection. In addition, many students noted the vicarious learning when they were not tweeting but also learned from what they observed on the Twitter sphere. How to measure this type of silent vicarious learning is worth investigating as well.

**Conclusion**

Social media and technologies hold enormous potential for addressing issues and concerns in our educational system and open new pathways for revolutionizing student learning. What is lacking in current schools and universities are open-minded and forward-looking pioneers who are willing to pursue the uncharted pathway, explore those mounting possibilities, and investigate this new world of social media-supported learning with the students. Even though the world is bombarded with variety and selection of social media applications, what we as educators have known about this specific type of social learning is far from enough.

This study showcases distinct means of microblogging integration into classrooms and models different appropriate use of microblogging in education. The use of microblogging can serve a wide variety of educational purposes and fit into different learning environments and settings depending on the design of learning and instruction. The microblogging-based learning activities in this study epitomize how microblogging
tools can be employed in teacher education classrooms, which can be seamlessly extended to classrooms of alternative disciplines, arenas, and areas of interest. With the facilitation of Twitter, students succeeded in being engaged in a highly participatory and interactive learning experience in which they supported and learned from one another.

The idea of educational microblogging is generally welcoming among students. Most students were favorable to integrating microblogging tools into classrooms and perceived benefits of this integration in spite of the challenges. This study shows that students' perspective of social media tools relies heavily on what instructors do with the tool. Instructors' scaffolding and support is instrumental in keeping students on task and engaging students with meaningful events, thus ensuring the success of microblogging-based learning activities.

Lastly, just as any type of media or technology, microblogging in and of itself does not change learning and instruction. Factors that influence student perception and actual learning with and through microblogging are numerous. An individual's difference in prior use and perception plays a significant role in leveraging social technologies to facilitate engagement with learning content and to encourage the learning process. This study proposes a taxonomy to understand individual student social media users and a working model to incorporate social media into the classroom, but these propositions are in great need of further empirical examination and verification. The field of social media for education is booming, but the scope of the unknown is still immense.
References


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Appendix A. Interview Protocol

1. Can you tell me a little bit about yourself?
   
   Probe: age, major, grade-level, comfort level with technology, mobile phones ownership

2. Identify Prior Use and perceptions of Twitter
   
   a) What's your Twitter use prior to the class? Have you had an account before?
   
      If yes,

   b) What do you usually use Twitter for?

   c) How often do you log on to Twitter each day? # of tweets do you post per day?

   Whether prior use affects use of Twitter in the class
   
   d) Does your prior use affect your Twitter usage pattern in this class and your perception? If yes, how?

   e) If you use Twitter regularly, do you feel the Twitter integration conflicted with your regular use? How?

   f) Did you open a new account exclusively for this course, or did you use the original account that you used before?

3. (social influence)
   
   How do people around you use Twitter?
   
   Probes:

   Do your friends use Twitter? If yes, what do they use Twitter for?

4. Weekly required tweeting activity

   a) How do you feel about our weekly Twitter activity overall?

   b) What do you think about the explore hashtags activity?

      (what hashtags did you explore and what did you learn from those hashtags?
      What are the values of exploring hashtags? Did it contribute to your learning of technology integration in education, if yes, how? )

   c) What do you think about the discussion topics activity?

      (How did you tweet about the discussion topics? What are the values or challenges of doing it? Did it contribute to your learning of technology integration in education, if yes, how?)

   d) What do you think about the live chat activity?
(How did you participate in the live chat activity? What are the values or challenges of doing it? Did it contribute to your learning of technology integration in education, if yes, how?)

e) How do you feel about the in-class use of Twitter to support lecture and presentations
(How did you tweet in the f2f meetings? What are the values or challenges of doing it? Did it contribute to your learning of technology integration in education, if yes, how?)

5. (system characteristics)

a) After the intensive use of Twitter throughout the entire semester, do you think it is easy to use?

b) Which functions of Twitter do you believe are ideal for learning? Which ones are not? Why?

c) What do you think about the 140-character limit?
   Probes: is it restrictive or does it help you to be more concise and parsimonious in your wording?

d) What do you think about the openness of Twitter? Have you considered keeping it private?

6. (facilitating conditions)

a) Was the instructor's guidance helpful to you in doing each of the activities?

b) Do you prefer a guided or unguided mode? Why?

c) If instructional guidance is absent, would you tweet the same way as you did in this class? Why?

7. Besides weekly required activity

a) Has it helped you to communicate/interact/collaborate with peers? Why?

b) Do you feel you're able to speak/ask a question openly to classmates on Twitter?

c) Has it helped you to communicate with the instructor? Why?

d) Do you feel you're able to speak/ask a question openly to the instructor on Twitter?

e) How do you feel about the feedback you received from the instructor (timely, useful, clear)?
8. For positive students

It seems that overall you tend to perceive the Twitter integration positively. If this is the case, could you tell me...

a) How did the Twitter integration contribute to your learning?

b) Which part of the Twitter integration do you think is most successful? (i.e. tweet to ask questions, share resources and your own projects, using Twitter to support lecture, communication with instructor, etc). Why was it successful?

c) Which part of the integration do you think is the most unsuccessful? Why?

d) What do you personally benefit most from your weekly tweets?

e) What are the challenges about this Twitter integration?

f) What are your suggestions on how to better incorporate Twitter into classroom learning?

g) Did you include Twitter integration in your final project? Why?

h) Will you use it in the future? Why?

i) Any final words and comments that you want to talk about?

For negative students

It seems that overall you tend to perceive the Twitter integration negatively. If this is the case, could you tell me...

a) How did the Twitter integration affect your learning?

b) Which part of the integration do you dislike the most? Why was it unsuccessful?

c) Which part of the Twitter integration do you think was most successful?

d) What did you find interesting about this Twitter integration?

e) Could you tell me some reasons why you disliked the Twitter integration?
   (prompts: discomfort sharing to the public? personal belief? Misunderstanding of its usage? Word limit?)

f) What are your suggestions on how to better incorporate Twitter into classroom learning and make it become helpful to you? Or total objection?

g) Will you use it in the future? Why?

h) Any final words and comments that you want to talk about?
Appendix B. End-of-class Survey

Dear Students,

You may or may not be aware of it, but we have already been using Twitter in our class for 14 weeks! I bet it has been an exciting journey to all of us. You have used it to explore hashtags, discuss various educational topics, participate in a few live chats, and perhaps share knowledge and resources, pose questions, communicate with the instructor and your classmates, share your own work with each other and many more!

Now it's almost the end of our course and it's time to have some reflection altogether! This survey asks you to reflect on and share your experience of using Twitter in our class EDCT 2030. It also asks you to explain your behaviors. Please be as detailed as possible when you give a written explanation. Take this opportunity to think about the affordances and constraints of this Twitter integration and how you may use it for your own teaching in the near future.

Thank you very much for your participation!

-Tintin

1. Age in years

   ___________

2. Gender at birth

   ☑ Male
   ☑ Female

3. What year are you in your college study?

   ☑ First year
   ☑ Second year
   ☑ Third year
   ☑ Fourth year
   ☑ Other ___ (please specify)

4. Do you own a smartphone?
☐ Yes
☐ No

If yes,
Did you use Twitter on your smart phone?

☐ Yes
☐ No

5. On average, how many tweets do you send out per week that are in relation to the class?

___________

6. On average, how many TOTAL tweets in general do you usually send out per week, including your regular communication with friends?

___________
7. Overall, how would you rate your experience of this Twitter incorporation into the class?

- Very Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very Dissatisfied

8. The Twitter backchannel integration during the lecture period allowed me to effectively

<table>
<thead>
<tr>
<th>Activity</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<td>Focus on learning the topic</td>
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<td>Interact with my classmates</td>
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<td>Express my own understanding</td>
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<tr>
<td>Construct my own learning</td>
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<td>Interact with the instructor</td>
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Was the Twitter activity an engaging learning experience for you during the lecture period? Why or why not? Please write your comments in response to your answers from the last question.
9. The Twitter backchannel integration during the **student presentation** allowed me to effectively

<table>
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<tr>
<th>Focus on learning the topic</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tr>
<td>Interact with my classmates</td>
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<td>Express my own understanding</td>
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<tr>
<td>Construct my own learning</td>
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<td>Interact with the instructor</td>
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Was the Twitter activity an engaging learning experience for you during the student presentation period? Why or why not? Please write your comments in response to your answers from the last question.

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10. The Explore Hashtags activity allowed me to effectively

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<tr>
<th>Activity</th>
<th>Strongly Agree</th>
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<td>Explore new knowledge</td>
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<td>Express my own understanding</td>
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<td>Construct my own learning</td>
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<td>Interact with the instructor</td>
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Was the Explore Hashtags activity a beneficial learning experience for you? Why or why not? Please write your comments in response to your answers from the last question.

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11. The Discussion Topic activity on Twitter allowed me to effectively

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<th>Activity</th>
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<th>Strongly Disagree</th>
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<td>Express my own understanding</td>
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Was the Discussion Topic activity a beneficial learning experience for you? Why or why not? Please write your comments in response to your answers from the last question.

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12. The Live Chat activity on Twitter allowed me to effectively

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<th>Strongly Agree</th>
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Was the Live Chat activity an engaging learning experience for you? Why or why not? Please write your comments in response to your answers from the last question.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

13. Do you think the above three activities (Explore Hashtag, Discussion Topics, Live Chat) need to be guided by the instructor?

☐ Yes
☐ No

Please write your comments in response to your answers from the last question. Why should it be guided by the instructor (or not)?

________________________________________________________________________
________________________________________________________________________
14. The Twitter incorporation enhanced my communication with the course instructor.

☐ Strongly Agree  
☐ Agree  
☐ Neither Agree nor Disagree  
☐ Disagree  
☐ Strongly Disagree

15. Throughout the entire semester, how often do you communicate with your instructor on Twitter (include reply, @, retweets, favorites ...)?

☐ Never  
☐ Monthly  
☐ Weekly  
☐ Daily

16. The Twitter incorporation enhanced my interaction with my classmates.

☐ Strongly Agree  
☐ Agree  
☐ Neither Agree nor Disagree  
☐ Disagree  
☐ Strongly Disagree

17. Throughout the entire semester, how often do you communicate with your classmates on Twitter (include reply, @, retweets, favorites ...)

☐ Never  
☐ Monthly  
☐ Weekly  
☐ Daily

How was your interaction with your classmates on Twitter? Did Twitter incorporation help you interact more with your classmates? Why or why not? Please provide your explanation as detailed as possible.

________________________________________________________________________

________________________________________________________________________
18. The Twitter incorporation enhanced collaboration opportunities with my classmates.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

Did Twitter incorporation help you collaborate with your classmates? Why or why not? Please provide your explanation as detailed as possible.

________________________________________________________________________
________________________________________________________________________

19. My knowledge on technology integration into education has grown due to the Twitter incorporation.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

Did the Twitter incorporation help you to learn more about issues in technology integration into education? Why or why not? Please provide your explanation as detailed as possible.

________________________________________________________________________
________________________________________________________________________
20. Will you use Twitter for educational purposes again in the future?

- Yes
- No
- Maybe
Appendix C. IRB Approval

The following research study has been approved by the Institutional Review Board at Ohio University for the period listed below. This review was conducted through an expedited review procedure as defined in the federal regulations as Category(ies):

Project Title: Facilitating Lecture-Based Undergraduate Courses Using Microblogging: A Case Study

Primary Investigator: Tian Luc
Co-Investigator(s):

Faculty Advisor: David Moore
Department: Educational Studies

Rebecca Cale, AAB, CIP
Office of Research Compliance

9/11/12 Approval Date
9/16/13 Expiration Date

This approval is valid until expiration date listed above. If you wish to continue beyond expiration date, you must submit a periodic review application and obtain approval prior to continuation.

Adverse events must be reported to the IRB promptly, within 5 working days of the occurrence.

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved by the IRB (as an amendment) prior to implementation.
Appendix D. IRB Amendment

The amendment, detailed below, and submitted for the following research study has been approved by the Institutional Review Board at Ohio University.

Project: Facilitating a College-level Online Course Using Microblogging: A Case Study

Amendment: Revised Timeline, Instruments, Study Title

Primary Investigator: Tian Luo

Co-Investigator(s):

Advisor: David Moore

Department: Educational Studies

Rebecca G. Cale, AAB, CIP
Office of Research Compliance

Protocol Expiration Date: 9/16/2013
Appendix E. Consent on Survey

Ohio University Consent Form

Title of Research: Facilitating a college-level online course using microblogging: A case study
Researcher: Tian Luo

You are being asked to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your participation in this study. You should receive a copy of this document to take with you.

Explanation of Study

This study aims to examine the use of microblogging in facilitating college-level online courses and how it affects students' formation of learning community. Throughout the EDCT 2030 course, we have used microblogging in various means to facilitate student learning. The required activities include the weekly reflective tweets and the in-class discussion-based activities. In this research, we intend to evaluate these microblogging-supported activities by investigating the educational effects of the microblogging integration in our class.

If you are over 18 years old and agree to participate in this research, you will be asked to complete a pre- and post- questionnaire, individual interviews and focus groups. The questionnaires will inquire about your perceptions of using Twitter in the class to facilitate each instructional activity and whether or not it has affected your sense of learning community. The interviews and focus groups will inquire you more precisely about your experience of using Twitter in various activities throughout the class and how those Twitter-supported activities affect your learning process in various dimensions. If you choose not to consent to the research, your data generated from the required Twitter-based activities (e.g., weekly tweets that you posted on Twitter) will not be included in the research.

The questionnaire will be delivered to you prior to and after the microblogging-supported activities in the course EDCT 2030 and individual interviews and focus groups will be conducted upon the completion of the course. These evaluative methods will help to understand how the microblogging integration affects student learning and to provide
more insights on the use of microblogging. Your participation with the questionnaire, interviews, and focus groups is completely voluntary.

Your participation or not in the study will in no way affect your grade in the course.

**Risks and Discomforts**

No risks or discomforts are anticipated.

**Benefits**

Your participation will provide me with valuable and critical information to understand how the microblogging integration potentially contribute to student learning. To extend my appreciation for your completion of this survey, once I finish collecting the data, I will send you a link to the results of our study for those who are interested.

**Confidentiality and Records**

Your answers are confidential and anonymous. All responses will be confidential and only aggregated or agglomerated data will be published. Completion of the survey, interview, and focus groups is voluntary and implies your consent use your responses for research purposes. The data that are with possibility of identification, including master code list and audio recordings, will be destroyed by May 2014.

If there are any other concerns and questions, please feel free to contact Tian Luo at tl303308@ohio.edu.

Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with:

* Federal agencies, for example the Office of Human Research Protections, whose responsibility is to protect human subjects in research;
* Representatives of Ohio University (OU), including the Institutional Review Board, a committee that oversees the research at OU;

**Contact Information**

If you have any questions regarding this study, please contact Tian Luo at tl303308@ohio.edu.

If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.
By signing below, you are agreeing that:
you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions and have them answered
you have been informed of potential risks and they have been explained to your satisfaction.
you understand Ohio University has no funds set aside for any injuries you might receive as a result of participating in this study
you are 18 years of age or older
your participation in this research is completely voluntary
you may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you and you will not lose any benefits to which you are otherwise entitled.

Signature_________________ Date_________________

Printed Name________________________
Appendix F. Specification of Pilot Study

A pilot study involving implementing microblogging-supported activities into the selected EDCT 2030 class was carried out for both semesters in the academic year of 2012-2013. In the Fall semester the number of participants was 19, while the Spring number was 24. Results from the pilot study have informed the current study in terms of both decisions in implementation of specific activities and selections of instruments for analyzing data.

**Procedures.** Tweeting activities were required for both fall and spring semester. The same Twitter class account and hashtag #edct2030 was used for both semesters. These activities are comprised of sharing news and resources, discussing course-related topics, communicating with the instructor, and collaborating with peers. Although the activities in both semesters were similar, in the second semester the implementation took a more gradual approach where activities were divided into three stages, each of which were notified and guided by the instructor. The idea of the modification into a gradual approach came from students' feedback from the first semester. In both semesters, the pre-and posttest survey was conducted using the Classroom Community Scale before and after the implementation of Twitter integration. At the end-of-the-course course, a summative survey that incorporates questions on evaluating student perceptions on each Twitter-based activity and open-ended questions to explain those activities was conducted in both semesters. Blogging reflections were also collected in the last week of both semesters, as well as all the tweets from students and the instructor. One-on-one interviews were also conducted with 8 students in the Fall semester.
Implementation. Feedback from both sessions (fall and spring) indicates that it is necessary to conduct more comprehensive training on Twitter before implementing the activities. Although students are considered digital natives and assumed to have advanced technological skills, many were ignorant of Twitter's educational use and simply took it as a way to update their daily status. In addition, students' unfamiliarity with Twitter caused them to encounter issues such as setting up the account as private, which resulted in others including the instructor and their peers not being able to see their tweets. Other cases, such as being unable to join the Twitter list created by the instructor, being unaware of how to use the hashtag # and the @ symbol, caused practical problems that jeopardized the educational value of participating in the Twitter activities. A hands-on in-depth lesson on Twitter not only showcasing its educational use, but also allowing abundant active opportunities for students to be acquainted and actually practice its use would be necessary to conduct prior to the weekly activities in order to ensure delivery of its educational promises.

Students commented that providing suggested uses of Twitter in a guideline sheet was insufficient to guide their educational use. When the tweeting practices were set to be mandatory, students preferred more specific and concrete tasks in terms of what to do, how to do, and how much to do on Twitter. Students perceived less benefits and even felt forced into activities lacking educational value, given the tweeting activities were required but provided with minimal guidance. Students also suggested that instructors' guidance should be consistent throughout the entire semester. Since using Twitter for educational purposes is a novel intervention for most students, an ongoing modeling of
Twitter use will better help students to learn and grow their knowledge on Twitter's educational value.

**Data analysis.** The pre- and posttest were conducted using the Classroom Community Scale survey. The class community scale (CCS) was used to answer research questions concerning students' development of a sense of learning community. This instrument, created by Rovai (2002), purports to measure the sense of community in a classroom learning context. This instrument consists of 20 items to be rated on a 5-point Likert scale, ranging from 5 being "strongly agree, agree, neutral, disagree, and 0 being strongly disagree. The total score of the 20 items measures the classroom community construct. The possible points for the scale vary from 0 to 100, with higher scores reflecting a stronger sense of classroom community. Two sub-constructs in the CCS are validated and named as connectedness and learning. The instrument also presents a high level of reliability based on multiple studies that used this instrument (Dawson, 2006; Miyazoe, 2009; Overbaugh, 2006).

However, in this study, the pre-and posttest of the Twitter intervention did not produce in any statistically significant results in both semesters. For some items, the ratings even decreased for the posttest. These results can be attributed to (a) the Twitter intervention did not specifically target to increasing students' sense of community. In other words, there were no mandatory activities that demanded students to collaborate or communicate with one another; students' activities on Twitter may not directly associate with community-building types of affects; (b) the small sample size (n1=19; n2=23) often leads to insufficient statistical power, which makes the comparison of pre- and
posttest less meaningful. (c). the brief intervention period (roughly 11 weeks excluding the initial training phase) and the changing educational environment (from face-to-face to online environment) confounds the results and may cause insignificant results as well. Given these considerations, this pre-planned instrument, Classroom Community Scale, was excluded in the actual dissertation research.

**Coding Scheme.** Originally, students' tweets were planned to be analyzed using the coding scheme employed in Elavsky et al.'s (2011) study. In their study, students' tweets were coded into 11 categories, respectively, "ID (use of real name or pseudonym), date (week of class), time (in or out of class), URL (in tweet), type (of tweet, i.e., original post, retweet, or direct reply), aim (whom the tweet was directed at), construction (whether and how the tweet was related to class and its discourse), topic (of the tweet), topic of URL (in the tweet), and collective enterprise (whether the tweet expressed collective sentiment, i.e., ‘we’ or ‘us’)" (Elavsky et al., 2011, p. 223). A reliability test using Cronbach’s alpha to test the internal consistency of each category presents to be high (range from .83 to .94). However, although many categories developed by Elavsky et al. remained meaningful in this current study, some of them are not applicable given the differences in the nature of the activities implemented. All the backchannel communication in their study occurred in a face-to-face lecture classroom, whereas in the current study the majority was in asynchronous online settings. Therefore, Elavsky et al.'s coding scheme was not deemed appropriate for the current study. After all, the development of the coding scheme largely depends on the data collected from the research study. Since students were using Twitter in both in-classroom face-to-face and
out-of-classroom online settings and for different types of activities with varying instructional goals, different coding schemes using an open-coding approach would be developed to apply to these disparate learning contexts and instructional activities.

**Focus groups.** A focus group that involves conducting an interview with a small group of people on certain focused topics was initially planned at the closing stage of the course. As participants of the focus group are multiple individuals, this method is relatively more cost-effective and the interaction among participants can enhance the data quality because they provide *checks and balances* on each other (Kruger & Casey, 2000). Additionally, more diverse shared viewpoints can be found from participants, which is useful in identifying common themes and patterns of discourse (Patton, 2002). Based on the survey and observations, the researcher previously planned to pre-assign students into different groups that represent participants who have similar perceptions and have them discuss and share their experience and views of the Twitter integration. However, given the logistics of the study, focus groups were difficult to implement. Allocating class time in the third face-to-face meeting to conduct focus groups would exceed the regular time frame of the class agenda, while conducting in after-class period did not seem to be possible. Students had a tight schedule in the final week and they were immediately off campus after finals; even individual interviews were difficult to schedule at the closing stage of the semester. Also, many questions for focus groups overlap with those in interviews and reflection blogs. Too much data collection may cause participants' *research fatigue* and harm the validity and reliability of results (Clark, 2010). Given the
above considerations, focus group as one of the pre-planned data collection was dropped in the actual study.
Appendix G. Concept Map Showing the Interconnection among Theories