Preservice Teachers' Microblogging: Professional Development via Twitter

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Abstract

Twitter has demonstrated potential to facilitate learning at the university level, and K-12 educators' use of the microblogging service Twitter to facilitate professional development appears to be on the rise. Research on microblogging as a part of teacher education is, however, limited. This paper investigates the use of Twitter by preservice teachers (N = 20) in a face-to-face undergraduate teacher education course taught by the author. The participants completed student teaching the subsequent semester, after which a survey was conducted to explore whether they had continued to use Twitter for professional purposes and why or why not. In reflections upon the fall semester's experience, preservice teachers noted several benefits to the use of Twitter in the course, including support of resource sharing, communication, and connection with educators both inside and outside of the class. During the spring semester, the majority of participants stopped professional Twitter activity, with many citing a lack of time. Those who continued use in the spring most commonly did so to gather teaching resources. The majority of participants maintained a positive opinion of Twitter's educational potential and indicated intentions to utilize it for professional purposes, including classroom applications, in the future.

The microblogging service Twitter allows users to share 140-character messages—what Twitter, Inc., calls "small bursts of information" (Twitter, Inc., n.d.). Belying its reputation as the domain of celebrities, narcissists, and callow teens, Twitter reportedly has grown increasingly popular among K-12 educators (e.g., Davis, 2011; Lu, 2011), who use it for a variety of purposes, including networking, communication with students and parents, and sharing teaching resources. Such informal, grassroots professional development (Carpenter & Krutka, 2014b; Forte, Humphreys, & Park, 2012) is notable given the formal, topdown nature of much teacher professional development.

Meanwhile, research in higher education settings suggests microblogging also offers potential benefits to teaching and learning processes and outcomes (Domizi, 2013; Junco, Heiberger, & Loken, 2011, Rinaldo, Tapp, & Laverie, 2011). Twitter's use in teacher education, however, appears to be uncommon and relatively unstudied.

Background and Rationale

Social media such as Facebook, Tumblr, and Instagram have an important place in many young people's lives (Ito et al., 2010). Many educators, however, have been ambivalent regarding the role(s) such media should play in teaching and learning (Selwyn & Grant, 2009), with school districts often blocking access to popular social media sites. Nonetheless, in a 2014 survey, 31% of K-12 teachers reported using social media for professional purposes, such as communication with colleagues, students, and parents (University of Phoenix, 2014). Given their increasing role in modern life, it seems likely that social media services will be part of school life during current preservice teachers' careers.

Twitter is one social media tool that appears to offer affordances for teaching and learning (EDUCAUSE, 2007) that merit investigation by teacher educators. Twitter's concise, open, and ubiquitous nature potentially provides opportunities to increase teacher-student and student-student interactions, both inside and outside of the physical classroom. The activity of K-12 educators on Twitter also presents opportunities for preservice teachers to connect with practicing teachers and participate in professional discussions in new ways (Jenkins, Purushotma, Weigel, Clinton, & Robinson, 2009).

Twitter may, therefore, be able to help develop preservice teachers' professional identities and professional networks, as well as their habits of professional learning. Collaborative technologies such as Twitter can help teachers to take control over and personalize their professional development (Risser, 2013). Evidence already indicates that teachers are utilizing online communities for professional purposes (Hur & Brush, 2009), and Twitter appears to offer opportunities for just such community (Wesely, 2013).

The popularity of education Twitter chats (Carpenter & Krutka, 2014a) and active Twitter backchannel conversation at many K-12 education conferences (Lu, 2011) appear to indicate the uptake of microblogging by a significant number of educators. Twitter is, thus, potentially a tool that can be used to help both enrich teacher education coursework and encourage preservice teachers' participation in professional communities that can extend beyond graduation and into the induction period.

Such opportunities for preservice teachers are attractive given that novices are unlikely to learn everything they need to know about teaching and learning in the relatively short duration of even the best university-based teacher education programs. In addition, the traditional professional development (PD) they often encounter in the field has a long history of failing to support continuous improvement (Hawley & Valli, 2007).

Theoretical Perspective

Prior to the rise of Web 2.0, educator access to informal learning opportunities was often limited (Garet, Porter, Desimone, Birman, & Yoon, 2001), but social media services appear to present more avenues for informal PD activities. Social media services can, in theory, harness the Web's interactive potential to foster both collaborative and learner-centered experiences. The characteristics of social media tools such as Twitter align well with social constructivist approaches to learning (Vygotsky, 1978), because they can support discussion spaces that allow participants to build knowledge through their interactions with other users (Jenkins et al., 2009).

Gee (2004) argued that the Internet provides access to "affinity spaces" where users can interact around topics of shared interest. These spaces allow those with varying degrees of knowledge and experience to contribute and mentor each other. The ways affinity spaces are utilized vary according to individual interests, needs, skills, and expertise, with some participants taking on active moderator and curator roles and others primarily benefitting from the resource and idea sharing common in such spaces.

Although Twitter did not exist when Gee first conceptualized affinity spaces, and not all uses of Twitter can be considered affinity space activity, the ways in which many K-12 educators have been utilizing Twitter appear to align with many of the qualities Gee described. A variety of hashtags (e.g., #mathchat, #engchat) provide spaces in which farflung educators with shared interests can connect, share resources, and build community (see Wesely, 2013, for further discussion of use of Twitter hashtags to generate professional communities). These hashtag affinity spaces allows for varying degrees of participation, from lurking to live chat moderation.

Through Twitter, preservice teachers can, thus, potentially participate in affinity spaces with in-service educators in ways that might not be possible in traditional PD settings that are more structured, hierarchical, and bureaucratic and face more temporal and geographic constraints.

Literature Review

Founded in 2006, Twitter's potential as a learning tool in a variety of settings was quickly identified (e.g., EDUCAUSE Learning Initiative, 2007), and the education press and various blogs regularly report on or advocate for educators' employment of Twitter (e.g., Davis, 2011; Lu, 2011). Seaman and Tinti-Kane's (2013) survey indicated higher education faculty were more likely to employ Twitter for their own professional purposes than in their classroom teaching.

Despite this limited classroom use, research on microblogging has been conducted in various higher education contexts, including bachelors (e.g., Junco et al., 2011) and masters (e.g., Ebner, Lienhardt, Rohs, & Meyer, 2010) degree programs, as well as in continuing education settings (e.g., Chen & Chen, 2012). Twitter use has been studied in large lecture (e.g., Elavsky, Mislan, & Elavsky, 2011) and fully online courses (e.g., Dunlap & Lowenthal, 2009), courses with multiple sections (e.g., Junco et al., 2011), and for practicum experiences (Wright, 2010).

There is also an international flavor to the extant research; although the majority of studies have occurred in U.S. higher education, research has also been conducted in Austria, Australia, Ireland, New Zealand, and Taiwan. Research has explored in-class (e.g., Elavsky et al., 2011) and out-of-class use of Twitter (e.g., Ebner et al., 2010).

For example, in-class applications have included Twitter serving as a means for backchannel conversation or functioning as a classroom response system similar to clickers (i.e., classroom response systems), while out-of-class uses have ranged from submitting responses to reflection prompts to following a class account used by the instructor to disseminate course-related information. Research methodologies have included surveys, focus groups, content analyses of tweets and Twitter interactions, and software-based social network analyses

Several studies have reported positive student perceptions of Twitter as a part of the teaching and learning process (Elavsky et al., 2011; Lowe & Laffey, 2011; Wright, 2010). For example, in Gikas and Grant's research (2013) students (N = 9) from three institutions indicated in focus group interviews that using Twitter felt more natural and immediate than formal learning management systems. In Rinaldo, Tapp, and Laverie's (2011) research, students (N = 276) in four different course sections indicated in surveys that Twitter helped increase involvement and satisfaction with courses and facilitated achievement of their academic goals

In addition to students' generally positive perspectives on microblogging, research has suggested other benefits of Twitter's use. For example, Junco and colleagues (2011) used a control group in their research on prehealth professional majors and reported that those students using Twitter as part of an introductory course (N = 125) had significantly higher engagement and grades.

Several studies have found that microblogging was effective in encouraging informal learning beyond the physical university classroom (Ebner et al., 2010; Gikas & Grant, 2013; Kassens-Noor, 2012). Microblogging appears to have potential to enhance communication between instructors and students (Dunlap & Lowenthal, 2009) and, in particular, to encourage students who might be too shy or inhibited in certain situations to speak directly to the instructor (Chen & Chen, 2012; Voorn & Kommers, 2013).

Various studies have identified benefits to Twitter's use for specific purposes or in certain contexts. For example, in a large-lecture class setting, Elavsky and colleagues (2011) found that when given the opportunity a majority of students (n = 300) chose voluntarily to contribute questions and comments to a live Twitter feed during class sessions. This backchannel activity included student-instructor and student-student communication, and deepened and extended opportunities for engagement with course themes.

The literature review conducted by Gao, Lu, and Zhang (2012) reported that microblogging services such as Twitter have the potential "to encourage participation, engagement, reflective thinking as well as collaborative learning under different learning settings" (p. 783). Previous research in higher education, thus, suggests that Twitter offers a number of potential teaching and learning affordances.

Challenges and Obstacles

In addition to the various benefits attributed to Twitter, research suggests some impediments to its use in higher education settings. Learners and instructors who are already actively using other social media may be hesitant to adopt yet another service (Rinaldo et al. 2011; Young & Kraut, 2011). Despite students' generally positive post-use perceptions of Twitter's place in the classroom, some may initially doubt Twitter's educational potential or may not welcome their instructors' presence in their social networking space (Ebner et al., 2010; Krutka, 2014). Some instructors have also expressed general concerns about social media in relation to privacy issues and the

academic integrity of student submissions (Seaman & Tinti-Kane, 2013). One recent survey of teachers found that, while almost half believed that participation in social media as a part of school activities could enhance students' educational experiences, 80% of respondents were concerned about conflicts that could occur as a result of using social media with students or parents or both (University of Phoenix, 2014).

As with any pedagogical tool, educators put Twitter to use with varying degrees of effectiveness. Research suggests that although Twitter can increase peer interactions it does not inevitably do so; it appears educators must encourage or scaffold such interaction (Chen & Chen, 2012). Lowe and Laffey (2011) discovered that they needed to integrate students' Twitter activity into class discussion for microblogging to have the most impact on student learning.

Two studies have suggested that the format of Twitter may not be ideal for encouraging reflection (Ebner et al., 2010; Kassens-Noor, 2012), but Wright (2010) found that microblogging was an effective tool for her students to share reflections with peers. Thus, although compelling reasons exist to use Twitter, prior research suggests educators should not assume that implementation will be without hitches or that Twitter is appropriate in all situations.

Teachers, Teacher Education, and Twitter

Although a number of pieces describe various uses of Twitter for teacher and student learning (e.g., Junco et al., 2011), its application in teacher education settings and for educator professional learning is much less researched. Recently, Moon and colleagues (2014) asserted that little was yet known about how "social media capacities interact with teacher learning and whether or how they are in line with established ideas about professional learning in general" (p. 175).

Three recent studies suggest Twitter's potential to support the professional development of K-12 teachers. Risser (2013) described the case of a novice high school mathematics educator who used Twitter to create for herself an informal mentoring network that facilitated her successful transition from student teacher to first-year teacher. Wesely (2013) analyzed the Twitter activity of a group of world language teachers ($N = 9$) and determined that Twitter constituted a professional community that supported the teachers' ongoing learning and growth. Finally, a survey of 755 educators found that Twitter's capacity to reduce various types of isolation and the personalized, positive, and collaborative community it facilitated were valued by many respondents (Carpenter & Krutka, 2014c).

I found five published studies focusing on the use of Twitter in teacher education. Wright (2010) had eight of her students in New Zealand use Twitter during their student teaching experiences. The participants microblogged to share brief reflections upon their daily experiences in the classroom. This activity reportedly helped the student teachers generate and develop self-reflection and combat the potential isolation and emotional overload of teaching.

The preservice teachers in Krutka's (2014) research used Twitter, Facebook, and Edmodo as a part of their methods course with the author, and found Twitter to be the most useful professional tool of the three. In Young and Kraut's (2011) study, aspiring English language arts teachers used their instructor's Twitter account to post tweets that shared language-related resources.

Mills (2014) similarly focused on an instructor's account, describing in this journal how a teacher educator's use of Twitter with his preservice teachers helped incline many of those novices to using Twitter to learn about new classroom strategies and technologies. In contrast, Lord and Lomicka (2014) reported the benefits of Twitter use in teacher education in terms of the formation of a community of practice among preservice and in-service language teachers.

These studies each reported positive experiences with Twitter and contribute to the knowledge base on Twitter's use in education. However, several of the studies arguably describe limited uses of Twitter. In Wright's (2010) study, student teachers tweeted amongst each other privately; microblogging was not used as a way to interact with a larger professional community. In Young and Kraut's (2011) case, the focus was on the instructor's account, rather than on student accounts. Practicing educators who microblog do not typically do so in such limited ways; Young and Kraut even admitted that the students in their research "might not be making full use of the tool" (p. 3786). Also, four of the five studies explored Twitter use only during a single course. Research is thus needed on more unrestrained professional use of Twitter in teacher education and its influence on novice teachers' ongoing professional development.

Purpose of the Study and Research Questions

Given the limited nature of research on Twitter in teacher education, this study seeks to contribute to a fuller understanding of the challenges and opportunities associated with its use. The research questions examined were as follows:

1. How did preservice teachers use Twitter for professional purposes, both through assigned coursework and of their own volition?
2. What are preservice teachers' perceptions of the use of Twitter for professional purposes, both as assigned coursework and of their own volition?

Methodology

Participants

Participants were undergraduate teacher education students whom I taught in a required course during the fall semester of their senior year; 20 of 23 students in the course consented to participate in the study. I taught all of the students in previous semesters in a course that did not incorporate microblogging. The participants were preparing to teach in five content areas: secondary English, history, and mathematics, as well as music and physical education and health at the K-12 level.

These students attended a private university of approximately 6,000 students in the southeastern United States. The sample consisted of 75% females and 25% males. Nineteen (95%) of the participants identified as White, and 1 identified as Multiracial. Eleven (55%) of the participants used Twitter prior to the study, and 3 of these students reported prior use for an educational or professional purpose. Four participants indicated initial skepticism regarding Twitter's use in educational settings.

Course Twitter Activities

At the beginning of the fall semester, students were briefly introduced to Twitter in class and required to create a professional account. They were also required to do the following:

- Follow Twitter accounts. Students followed each other's accounts and a minimum of 30 other accounts related to their content areas. This requirement was intended to extend discussions beyond the classroom and to support sharing and acquiring of resources.
- Send two weekly education-related tweets. Tweets could include students' original ideas or share others' resources and opinions. A class-specific hashtag (#edu355) was included in tweets.
- Participate in Twitter chats. One-hour, live weekly chats addressed various education topics. Students were required to participate in at least three sessions related to their teaching interests and to contribute at least nine total tweets to the chats. This tweeting was in addition to their weekly tweets.
- Submit an online survey regarding their experiences utilizing Twitter. Students were asked at the end of the semester to comment on how or why Twitter contributed or failed to contribute to their learning. They were also asked to indicate whether they planned to continue using Twitter and, if so, how and why (see Appendix A).

The students combined Twitter activities accounted for 10% of their grade for the semester. Finally, at the end of the subsequent spring 2013 semester, an electronic survey was sent to the participants (see Appendix B). Sixteen (80%) of the participants completed this second survey about their use or nonuse of Twitter during the student teaching semester. One of the nonrespondents elected not to complete the teacher education program and, thus, did not take part in student teaching, and 3 participants did not respond to two invitations to complete the survey.

Data Sources

The sources of data for this study were as follows:

- participants' Twitter activities, including the number of accounts they followed and the number of accounts that followed them;
- instructor's field notes and analytic memos from throughout the fall semester;
- participants' fall end-of-semester online surveys (Fall Survey); and
- participants' poststudent-teaching online surveys (Spring Survey).

The first two data sources were used to answer the first research question, while the third and fourth data sources addressed the second research question.

Data Analysis

Participants' tweets, including the course hashtag, were aggregated and archived using Rowfeeder.com, a social media monitoring service. Descriptive statistics, including means and standard deviations, were generated to identify quantitative patterns and degrees of variation in participants' Twitter activities. Drawing on naturalistic methods (Lincoln & Guba, 1985), field notes and memos from during the semester, the students' tweets, follower-following activity, and both sets of survey responses were read and reread to identify patterns and themes.

Through the initial readings, one set of nine codes was developed for tweets and a second set of 11 codes was developed for the survey responses. Each tweet and survey response was then assigned a code or codes. An impartial peer familiar with Twitter audited the

coded data (as recommended in Lincoln & Guba, 1985) and provided feedback on the codes.

Tweets and survey responses were sorted in separate spreadsheets according to the initial codes, and the codes were reconsidered and revised (as in Charmaz, 2006). An additional eight codes were added to the tweet set, and two were added to the survey set, resulting in a final coding structure with 17 codes applied to tweets and 13 codes applied to survey responses (Table 1).

Table 1
Codes Sets

Codes for Tweets	**Codes for Survey Responses**
Interaction with classmate	Skepticism regarding Twitter
Bonding with classmate	Twitter limitations
Interaction with educator	Required course Twitter activity
Used hashtag other than class hashtag	Twitter chats
Included hyperlink	Resources on Twitter
Retweet	Learning via Twitter
Retweet with hyperlink	Learning about Twitter
Asked question	Professional identity
Twitter chat	Professional networking
Shared course related resource	Collaboration with classmates
Shared general education resource	Use with students
Shared article	Obstacles to use with students
Educational philosophy content	Obstacles to professional use
Educational policy content	
Educational practice content	
Shared curriculum materials	
Discussed course logistics	

The full corpus of data was reread and coded again with the revised code set. The frequency of codes was considered in order to identify trends in the data. Then, data were sorted according to individual codes so that all instances of particular codes could be compared and contrasted. Data were next sorted according to combinations of codes to try to identify relationships between and patterns among codes. Data presented in the following section have been anonymized to protect participant identities.

Results

Research Question 1

During the fall 2012 semester, the participants sent 1,259 course-related tweets, an average of 62.8 tweets (SD = 36.7) per individual. Ninety percent of the participants exceeded 35 tweets, the minimum number required by the course assignment (see Table 2). This large quantity of tweets resulted principally from the participants' Twitter chat activity; 80% of participants sent more than the minimum three tweets per chat. For example, one enthusiastic participant sent 43 tweets during a single 1-hour chat session.

In contrast, only 25% of the students sent more than the minimum requirement of weekly tweets.

In terms of following activity, participants followed 77.0 Twitter accounts (*SD* = 23.8) on average, with most surpassing the required number of 54 accounts. Regarding followers, participants should have had at least 24 followers, given that their classmates and instructor were required to follow them. Every participant ended the semester with more than 28 followers, with an average of 40.3 (*SD* = 11.2). Although these averages appear to suggest generally high engagement with Twitter beyond the minimum course requirements, the large standard deviations associated with those means do indicate substantial variability in students' Twitter behaviors. The most active participant on Twitter, for example, sent 158 more tweets than her least active peer.

Twice-weekly tweets. Several patterns emerged in the participants' twice-weekly tweets. First, the most common feature was the sharing of hyperlinks to online content: 77% of the biweekly tweets included links. Twitter facilitates such sharing by automatically shortening links for users. The tweeted links most often related to the course (37% of links), with links to general education-related topics (32%) and the content area for which the students were preparing to teach (31%) slightly less popular.

Tweets that included links related to course content often were sent in the days following in-class treatment of the particular content. For example, shortly after two lessons on literacy in the content areas, one participant tweeted, "Good video relating to our discussion on literacy in the classroom - how to choose vocab words and teach them http://t.co/oeOCYlnR #edu355." A peer tweeted, "Examples and tips of how we can infuse literacy into our different disciplines. http://t.co/AAM9wESl #edu355."

Tweets that featured links related to the students' content areas were unevenly distributed across the different content areas. The history and the physical education and health majors, although they accounted for 50% of the participants, sent 69% of the content-area-related tweets that included links. In terms of general education-related topics, participants shared links on a wide variety of matters, including diversity and social justice issues, and to articles on education news and policy matters, such as the Common Core State Standards and the Chicago Teachers Union strike that unfolded during the semester.

The participants included hashtags in addition to the required course hashtag in 37% of their twice-weekly tweets. Tweeting educators commonly use a wide variety of hashtags, including those associated with general education matters (e.g., #edchat), particular content areas (e.g., #engchat for English teachers), and geographic locations (e.g., #nced for educators in North Carolina), among other topics.

For example, a history major sent the following tweet, which included three hashtags in addition to the required course hashtag: "High School Psychology: Lessons, Ideas & Activities http://bit.ly/QtcDzK **#psych #sschat #edchat** #edu355" [bold added for emphasis]. Such hashtag use can facilitate connections between users who might not know each other until their common hashtag use indicates shared interests. The students organically adopted hashtag usage, as use beyond the course hashtag and as a part of the live chats was neither required nor encouraged. By including additional hashtags, participants increased the visibility of their tweets and the potential for interaction with other microblogging educators.

Twitter allows the addition of usernames, or "handles" to the body of a tweet, thus drawing those users' attention to the tweet; this convention is referred to as "tweeting at." In 17% of their twice-weekly tweets, students tweeted at other classmates to ask questions, discuss course logistics, share encouragement and humor related to teaching, or recommend educational readings, curricula, and resources. For example, one mathematics education student tweeted a link to a video at two of her peers: "@(classmate 1) @(classmate 2) this is awesome...Quadratic Formula Song to Adele's 'Rolling In The Deep' |http://t.co/pRx9zKyN #edu355."

Some participants tweeted at their peers more than others. For example, 3 of the history education majors each tweeted at classmates 15 or more times; most of these tweets involved resource sharing with other history teachers in the course. No similar consistent targeted sharing of resources was observed among students of other content areas. At an individual level, tweeting at peers ranged from 3% to 27% of participants' total number of tweets.

Another convention of Twitter is "retweeting," which is when users share someone else's tweet with their followers. Retweeting is one way in which ideas, links, information, and resources are quickly spread among Twitter users. In the participants' Twitter activity, 30% of the total of biweekly tweets were retweets. However, retweeting, like tweeting at, was not consistent across participants. At the two ends of the retweeting spectrum, 5 students never retweeted during the semester, while another 5 each did so on more than 20 occasions.

Twitter chats. Synchronous chat activity accounted for just under half of the participants' total tweets. Students were allowed to select chats that related to their interests and among them ended up participating in 16 different chats during the semester. They were required to contribute three tweets to each of three chats, for a total of nine tweets; 80% of the participants exceeded this minimum. On average, participants sent 27.5 (SD = 32.5) tweets during chats, although 1 student, in particular, skewed this average by sending 156 tweets during chats over the course of the semester.

Chat activity appeared to be more interactive than twice-weekly tweeting. Participants tweeted at specific users in 36% of their chat tweets, in contrast to 21% of twice-weekly tweets. In 21% of tweets sent in the context of chats, students asked a question. Approximately half of these questions were addressed generally to all participants in the chat, and the other half were directed to specific users.

Two-thirds of student questions were practical in nature, relating to classroom practice. For example, in a chat about flipped learning, a math major asked, "How do you choose what math lessons to flip? More straightforward topics? #21stedchat." Questions often sought clarification related to statements made by others in the chats. For example, when a teacher tweeted about having her students engage in a particular type of project, a participant asked, "What kind of timeline do you give your students? Is it a week/month/year project? #edu355." In chats, it was more likely that participants' questions received answers than was the case in the twice-weekly tweets. Chat activity frequently featured exchanges of multiple tweets back and forth between participants and other educators.

Across both twice-weekly tweets and chats, the participants sometimes used Twitter to extend classroom conversations or treatment of content. For example, flipped learning is a popular new instructional approach that was addressed briefly during the course. Three-quarters of the students subsequently tweeted questions, comments, or resources related to flipped learning. In a chat, one student asked a classroom teacher,

"@(classroom teacher) biggest challenge with flipped classroom? planning time? #21stedchat #edu355." Another asked, "I am interested in using flipped learning, but am struggling a little on how to use it in music classrooms...thoughts? #flipclass #edu355."

In one of his twice-weekly tweets, a student shared a link to a website related to flipped learning: "http://t.co/JC2iyYoj new TED-Ed blog just launched. Should have all sorts of cool flipping stuff soon #edu355." Thus, when class time allocated to a complicated and relevant topic was apparently insufficient, many of the participants took to Twitter to further explore. On five occasions, Twitter also provided a means for participants to consult other educators in their specific content areas regarding course content, as the music education major did in his question.

Use of Twitter during student teaching. Participants had no requirement or course-related incentive to tweet during student teaching. Based on survey responses and a review of participants' professional Twitter account activity, 7 of the fall course members (35%) continued Twitter activity during student teaching. Among those who maintained their professional use of Twitter, the most popular activities were reading tweets from users they followed (71%), reading articles or blogs that were linked to in tweets (57%), using resources tweeted about by others (57%), and reading tweets, including a hashtag of interest (43%).

None of the 7 participants who continued Twitter use employed it as actively as they had during the fall semester. They tended to utilize Twitter both less frequently and more passively. Weekly microblogging was required during the fall semester, but only two participants reported weekly activity in the spring. The other participants who continued Twitter activity reported utilizing the service approximately once a month.

Three of 7 participants indicated that they did not themselves continue to send tweets, but instead accessed Twitter only to find resources and professional reading material. Among those who sent tweets, two participants sent tweets with ideas or links to articles and resources they found. For example, one history student teacher tweeted about a successful connection she made in class between a popular song and an element of Progressivism and also shared an educational resource: "iPad Apps Separated by Subject Area http://bit.ly/RoFNHh #mlearning #edchat."

Another student occasionally tweeted commentary and links to education articles, such as the following: "This is my biggest issue with iPads in education; teachers are being wow'ed instead of wow-ing. http//:t.co/e6najft2lb." Such tweets were similar in nature to the twice-weekly tweets required in the fall, but only seven total were sent during the spring semester. In addition to this sharing of ideas and resources, two participants also tweeted questions about teaching:

- "Student teaching high school & need advice on being authority in the room. Suggestions? Articles? #ntchat #education #engchat."
- "Veteran teachers on twitter: how do you explain to your students that they cannot follow you on twitter? #edchat"

During the spring semester, only one student participated in a Twitter chat, which was the context of the most questions being asked and answered during the fall semester.

Two participants reported using Twitter with their students at their student teaching sites. One student teacher occasionally communicated course-related information to students who followed her professional Twitter account. For example, in response to a

question about an upcoming quiz, the participant tweeted, "Quiz is on all the vocab you learned on Monday and the concepts we reviewed today, like gross pay, net pay, and taxes." This student teacher also reported using Twitter on a few occasions to communicate with her mentor teacher.

A second student teacher had the students in her Civics class use Twitter for an election simulation project. In the simulation, student groups worked on different mock election campaigns, and each group created a Twitter account from which they tweeted information related to their campaigns. This student teacher reported that it was her students' idea to utilize Twitter in this fashion and that she was open to it because she had experienced using Twitter herself as a learner.

Research Question 2

Participants' perspectives on Twitter were measured twice via online surveys: at the end of the course for which Twitter use was required (Fall Survey) and at the end of the student teaching semester, when use was not required (Spring Survey).

Fall survey. At the conclusion of the fall semester, responses suggested participants were generally positive about their course-related microblogging experiences. Ninety-five percent of respondents indicated ways in which Twitter supported their learning. The four participants who noted feeling initial skepticism about using Twitter for professional purposes all reported ultimately finding it to be beneficial. For example, one commented, "I never realized that Twitter could be such a great resource for educational information!" Another of the initial skeptics noted, "I really appreciated the push into that learning space."

Participants were particularly enthusiastic about Twitter chats. When asked which aspect of Twitter they found most beneficial, 70% indicated chats. For example, students commented as follows:

- "Chats were oddly invigorating. It was great fun to hear everyone's ideas and have other educators react positively to mine." - English major
- "I learned different ideas from others in the education field when participating in Twitter chats." Physical education and health major
- "The chats were incredibly beneficial because those got us actively involved in education-related conversations" – English major

One participant noted how in the context of chats "I would ask a question about a specific topic, and multiple people would respond with helpful answers." One quarter of the students highlighted ways in which chats connected them to educators with whom they would not otherwise have had occasion to interact, particularly practicing classroom teachers.

Echoing this valuation of connecting to educators via chats, half of participants commented on how Twitter use, in general, facilitated their communication with educators outside the course. For example, students commented as follows:

- "I was able to talk to other educators about interesting education topics." - History major
- "I appreciated the nudge into the world of online education collaboration." – English major

One student reported that she valued these connections to other educators because "I liked the support system and feedback I got from others." Another described Twitter as, "a great place to connect to people who are as passionate about education as I am." Twitter's capacity to connect preservice teachers to a variety of other educators thus appeared to be important to these participants.

Several students noted ways in which Twitter affirmed their sense of themselves as members of a profession. Three students mentioned their excitement when Twitter chat moderators retweeted or responded to their ideas. One student described how during a chat an author whose work she had read for a different education course retweeted one of the student's contributions to the chat. The student wrote that prior to this interaction with the author, "I had not considered myself a teacher yet, or much less one of that quality or caliber."

The author's affirmation of the student's idea empowered the student to feel more like she "belonged and could even contribute" to her profession. Similarly, another student reflected that her activity on Twitter "offers me validation as an active member of the teaching community."

In addition to identifying Twitter's positives, students noted limitations of the medium. Two participants voiced concern regarding how Twitter activity might be too disconnected from the work at their school sites. One student elaborated, "I think Twitter is limited for [professional development] because it does not provide a consistent avenue for working with other teachers specifically at your school." Other participants pointed out additional weaknesses of Twitter:

- "Twitter supplies ideas and examples, but there is still a level of action required. This action takes a deeper level of understanding than Twitter typically gives." – Math major
- "As with many social media tools, too many people using it at once turns into a great deal of talking and not a lot of listening." – Music major

Participants thus recognized that Twitter was not a professional development panacea and appeared to notice both affordances and limitations of the service. However, the Fall Survey suggested an overall positive perception of Twitter, with 11 of 20 participants (55%) expressing intentions to continue to microblog for professional purposes, and 8 indicating that they might do so. Only 1 participant expressed no interest in future use of Twitter for professional purposes.

Spring survey. Seven of the 20 (35%) participants utilized Twitter for professional purposes during the student teaching semester. Comparing reported intentions from the Fall Survey to the Spring Survey results revealed that 5 of the 11 participants who indicated they were going to continue use did so, while 2 of the 8 who had indicated they might continue use did so (see Table 2).

Among those who used Twitter, a variety of perceptions were expressed. One theme touched upon by several student teachers was how Twitter served as a source of new ideas:

- "By scrolling through Twitter and participating where I could, I was inspired by new ideas that were being talked about." – Math major
- "During student teaching, my primary purpose of using Twitter was finding new ideas, particular on technology integration." – Music major

Table 2
Participants' Twitter Activity and Intentions for Future Use

Participant Majors	Tweets / Following / Followers	Intend Future Use – Fall Survey	Student Teaching Use	Intend Future Use – Spring Survey
1. English	39 / 53 / 31	No	No	No
2. History	57 / 71 / 44	Yes	Yes	Yes
3. History	35 / 62 / 26	Yes	No	Yes
4. History	78 / 74 / 32	Maybe	No	Maybe
5. PE and Health	24 / 75 / 30	Yes	N/A	N/A
6. History	182 / 119/ 63	Yes	Yes	Yes
7. English	125 / 111/ 59	Yes	Yes	Yes
8. History	56 / 67 / 31	Maybe	No	Maybe
9. PE and Health	37 / 69 / 29	Yes	No	Yes
10. Math	46 / 55 / 48	Maybe	No	Yes
11. Music	56 / 114 / 36	Maybe	No	No
12. English	43 / 63 / 30	Yes	No	Yes
13. English	43 / 58 / 35	Yes	No	N/A
14. Math	65 / 64 / 44	Maybe	No	N/A
15. History	68 / 73 / 39	Maybe	Yes	Yes
16. PE and Health	44 / 75 / 37	Yes	No	N/A
17. Music	28 / 75 / 54	Maybe	No	Yes
18. History	70 / 67 / 38	Maybe	Yes	Yes
19. Math	65 / 57 / 60	Yes	Yes	Yes
20. Music	94 / 138 / 39	Yes	Yes	Yes

One user valued the concise nature of Twitter, and another mentioned the opportunities to ask questions and connect with other educators. A different participant was, however, discouraged from using Twitter to ask questions about teaching when she posted a question and did not receive any response. She commented, "That time kept me from using it again for that purpose."

Amongst the nonusers who responded to the Spring Survey, a common theme was that using Twitter was not a priority, given the other demands of student teaching. For example, one participant explained, "I just had so much other work to do during student teaching that I did not even think to use Twitter for professional purposes." Another commented, "While I realize it could have potentially helped me out, I didn't even think about using it because I was so busy." Fifty percent of participants specifically mentioned lack of time as an obstacle to their use of Twitter, making comments such as the following:

- "Time was an obstacle. I was always too busy lesson planning or stressed out about teaching to think about using Twitter." – History major
- "I had neither the time nor the drive to follow tweets this semester." – Math major

Even two of those who did tweet for professional purposes during student teaching commented upon how time pressures limited that use.

Two participants indicated that they were deterred from using Twitter by concerns about interacting with their K-12 students via social media. One was preoccupied about establishing himself as an authority figure and felt that Twitter might undermine his efforts in that regard: "I wanted to avoid creating too personal a connection with the students while student teaching." Another participant reported, "Despite it being my professional account, my students would tweet at me regularly. I never responded to any, but their constant tweets led me to delete my account."

For these two participants, communication with students via Twitter was not desirable. However, other participants did not appear to share this concern about using Twitter with students, and two expressed frustration that school district policies hindered such interactions. Six participants indicated interest in using microblogging with their students in some way in the future.

Although not as many participants employed Twitter for professional purposes during student teaching as had indicated prior plans to do so, more than half maintained intentions to use Twitter in the future. Only two spring nonusers indicated no interest in using Twitter in the future. Five spring nonusers expressed interest in using Twitter in the future, when they hoped they would better be able to manage the multiple demands of teaching. For example, one student explained, "Time was my main constraint during student teaching; I don't see it being quite the same issue in the future." Another commented, "I wish I would use it (Twitter) more; I will try to in my first year of teaching if I find time."

In the spring survey, 69% of respondents still compared professional development via Twitter favorably to other forms of professional development. Two participants commented on Twitter's efficiency:

- "The sharing of links and resources on Twitter is much faster and streamlined than in traditional professional development." – Music major
- "Often times educators get longwinded trying to sell a particular philosophy or view of education, whereas Twitter forces them into an 'elevator speech' situation." – Music major

Twitter was also praised by multiple participants for providing access to a wide variety of ideas, people, and resources. One student teacher said of Twitter, "A variety of resources—school districts, news sources, educators from across the country, and my peers—were available at my finger tips and condensed onto one platform. It is easy to searchable [sic], and to contribute to." Furthermore, 32% of spring survey respondents noted ways in in which Twitter supported personalization of professional development. Various participants pointed out the autonomy Twitter facilitates, including the following comments:

- "Twitter allows teachers to follow personal questions and expand their knowledge at their own pace...all teachers are in different places in their growth." – Math major
- "The nice thing about using Twitter is that you get a choice of what you want to look into or ask questions about." – History major

Thus, although some participants did not tweet for professional purposes during student teaching, many still saw benefits and advantages to using the service.

Discussion

Twitter provided preservice teachers with free, convenient access to a quantity of professional resources, both in terms of content (e.g., articles, education news, lesson plans) and people (i.e., other educators) not typically available through teacher education coursework. In addition to benefitting from resources tweeted by their classmates, microblogging educators' use of hashtags means participants were not limited to exchanging resources with their existing networks. By monitoring and using hashtags related to their areas of study and participating in chats, the participants had the opportunity to give to and take from a wide stream of Twitter activity.

This study's results are consistent with research from other fields that suggests Twitter offers a means for users to share efficiently and acquire content with and from users with similar interests (Domizi, 2013; Rinaldo et al., 2011) and extends this research to show that such sharing can occur between preservice and in-service educators. Teacher educators have an opportunity through Twitter to connect their preservice teachers to a source of diverse educational content that can potentially enhance their engagement with course material and support their ongoing learning outside of the physical classroom.

In this study, Twitter facilitated expansion of the classroom space by extending conversations beyond the time during which the class met and by drawing nonstudents into those conversations. Participants saw content from class being discussed by practicing teachers in Twitter chats and were able to discuss ideas themselves with other educators. They also had their opinions and ideas validated in powerful ways by members of the profession they aspire to enter. Such an early sense of professional belonging and identity could arguably help combat some of the forces that cause high attrition rates among novice teachers (Luehmann, 2007).

In the past, preservice teachers in my courses typically interacted with their classmates and one in-service teacher through a field placement. However, the openness of social media, and Twitter, in particular, appeared to invite more connections. Twitter helped link the participants to many more educators than my courses have ever previously allowed.

Although preservice teachers' conversations and collaboration with preservice peers is certainly appropriate, there may be benefits to broadening the community of educators within which preservice teachers develop. Many teacher education programs rely primarily on the face-to-face mentoring one or two in-service teachers provides to each preservice teacher, which can be problematic. Individual mentors may be unable to meet all of the different mentoring needs of preservice teachers or sometimes might not be optimal personality matches with particular teacher candidates (Gareis & Nussbaum-Beach, 2007).

Social media such as Twitter may broaden novices' interactions with practicing teachers in ways that allow them to draw upon a variety of different mentoring resources. In affinity spaces, mentorship is distributed across many people (Gomez, Schieble, Curwood, & Hassett, 2010), and teacher education programs may be able to harness such mentorship for their preservice teachers' benefit.

Students followed and interacted with a wide variety of educators from the U.S. and abroad, including teachers, principals, instructional coaches, superintendents, school board members, education consultants, authors, and professors. Studies in other fields have similarly suggested that microblogging can facilitate interactions with professionals and experts in students' fields of study (Gikas & Grant, 2013; Hewett, 2013; Rinaldo et al., 2011), but this finding is particularly important in education given the isolation historically associated with teaching (Lortie, 1975).

Many of the participants reported valuing their Twitter connections and almost universally surpassed minimum requirements for following activity. Twitter thus exposed the participants to a voluntary online professional community (Hur & Brush, 2009) that benefitted them in the short term and could potentially be a place of professional growth in the future (Trust, 2012; Wesely, 2013). The participants used their access to practicing educators to seek further information about course content and regarding its practical classroom applications. Twitter and other social media may, therefore, be able to help bridge the theory-practice divide that teacher education students often lament (Gordon, 2007).

Similar to the findings of previous research, the vast majority of the preservice teachers were positive regarding their course-embedded use of Twitter (Krutka, 2014; Wright, 2010; Young & Kraut, 2011). The verdict regarding Twitter's use beyond the course, however, was less clear. During their student teaching semester, fewer participants maintained their professional use of Twitter than had expressed an intention to do. The demands of student teaching and lack of time to dedicate to Twitter were obstacles for several of the participants. For some, microblogging was perceived as another item that could not fit on a plate already full of responsibilities, rather than a tool that could help them deal with the full plate.

Risser (2013) described the case of a novice teacher who used Twitter to create an informal mentoring network that contributed to her successful transition into the profession, but it was not clear that any of the participants in this study were moving in such a direction. Those who maintained use during student teaching did so primarily to find teaching resources and not to interact directly with other educators.

These results suggest that a positive classroom experience with Twitter is not by itself enough to result in its continued voluntary use for professional learning. Although Twitter appears to offer potential benefits, some student teachers may feel that the connections and resource sharing available at their school sites are more important. It was noteworthy that two of the participants were uncomfortable with how their presence on Twitter could potentially lead to interactions with their students. Novice educators who are concerned that their students can undermine their authority may hesitate to embrace professional use of a social media tool that is perceived by many as frivolous.

Twitter can serve as one option for student teachers and novice teachers to access resources and network but is certainly not the only option. Although fewer than half of the participants continued using the service for professional purposes once they were no longer required to do so, the majority maintained a high opinion of Twitter's potential as a professional learning tool. Interestingly, several spoke of plans to use Twitter with their students in the future, even though Twitter had been presented to them more as a tool for teacher learning than student learning.

Finally, one unanticipated result related to the course's most prolific tweeter, a history major. She sent the most tweets, tweeted at people the most, had the most followers, and participated in more than the three required chats. This Twitter activity was in contrast to

the student's general reticence in whole-class, face-to-face discussions. I previously taught this student in another class in which she rarely shared in large-group discussions, and I did not anticipate her outspokenness on Twitter.

Chen and Chen's (2012) research suggested that microblogging can help more reserved students communicate with their professors, but Twitter seemed to give this particular student a voice to communicate, not only with her instructor, but with her peers and the broader education community as well. While the most extroverted students often dominate traditional classroom discussions, Twitter may provide a space where a wider variety of students' perspectives and ideas can be heard. Social media may create more equitable opportunities for participation in classroom discourse, which could, in turn, enrich preservice teacher learning through the sharing of a more full range of opinions and experiences.

Limitations of the Study

As a study of a single course, it is possible that the results of this research are idiosyncratic. Also, it is important to acknowledge the inherent limitations of studying one's own course and students. The preservice teachers' perceptions of what I wanted to hear may have influenced their survey responses. My observations of how educators are utilizing Twitter for professional purposes may have predisposed me to noticing positive aspects of the students' microblogging experiences. Furthermore, my experience with Twitter was relatively limited at the outset of the study; possibly an educator with a stronger understanding of the tool could have structured its use in ways that provoked more sustained use during student teaching.

Research on social media such as Twitter can be challenging because of regular changes in both technical features and users' habits. Possibly, as new social media tools are created Twitter could lose its general popularity in a relatively quick period of time. This study, therefore, provides a snapshot of Twitter use by preservice teachers during a particular time period.

Implications for Practice and Research

Despite the limitations of this research, its results have implications for teacher educators and researchers. Twitter is free and popular, has a concise format, and is accessible from a wide variety of technology platforms, all of which contribute to making it an effective and efficient way to introduce preservice teachers to the educational potential of social media tools. Also, teacher educators who are seeking to encourage their preservice teachers to connect and interact with in-service educators may find Twitter to be an appropriate tool for doing so. Thousands of practicing educators congregate on Twitter for professional purposes on a daily basis, and this study's findings suggest many are willing to share resources and interact with early-career educators.

Many preservice teachers could benefit from access to such an online community of practice (Wesely, 2013), given the isolation and challenges that novice teachers often experience during their entry into the profession. The use of social media such as Twitter in teacher education could present new opportunities for preservice teachers to jumpstart their socialization into their profession and their connections with its members. Furthermore, preservice teachers will likely benefit if they leave their teacher education programs with an eye for teaching and learning applications of social media.

In light of the increasingly pervasive role of social media services in the way people interact and communicate, further study of their educational applications is merited. Study of in-service K-12 teachers who use Twitter for professional purposes could help reveal how and why they use Twitter. The participants' enthusiasm for Twitter chats in this study suggests that research on this specific, synchronous use of Twitter would benefit the field. Research might seek to identify common patterns or themes in chat behavior and to understand what motivates educators, given the many other demands they face, voluntarily to dedicate their time to chats.

Investigation of factors that contribute to or impede persistence in voluntary online professional activity such as Twitter could help inform teacher educators' use of social media tools with their preservice teachers. Finally, research might follow preservice teachers who themselves experience social media as learning tools into the field to determine if those experiences translate into their using or teaching about social media tools in effective ways with their K-12 students.

Conclusion

The U.S. Department of Education's National Education Technology Plan 2010 encouraged schools to experiment with using social media to expand learning opportunities for both students and teachers. Teacher educators, as well, should consider joining in this experimentation and investigate ways to model for preservice teachers pedagogically sound uses of the technologies that are increasingly present in school and students' lives, in general. Given the growing body of evidence suggesting their educational uses, it is increasingly difficult to justify dismissing social media tools as merely vain or vapid.

Twitter, in particular, is a popular social media service that appears to offer affordances as a learning tool. Rather than relying upon Google's algorithms to find teaching resources, preservice teachers can employ tools such as Twitter to crowdsource the gathering and curation of education content. As seen in this study, Twitter's capacity to connect preservice teachers to new and diverse ideas and people recommends it as a social networking platform with real educational applications and potential.

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Appendix A
Fall Semester Survey

1. Did you have a Twitter account prior to this class project? Required *

- ○ Yes
- ○ No

2. If you had a Twitter account prior to this class project, had you ever used it to facilitate your learning or professional development as a future educator?

- ○ Yes
- ○ No

3. How did the Twitter Project contribute to your learning?

4. What use(s) of Twitter did you find most beneficial?

5. In what ways is Twitter limited as a tool for teacher professional development?

6. How could the Twitter Project have contributed more to your learning? I.e., What changes to the project would have enhanced its effectiveness? Required *

7. Do you intend to continue using Twitter for professional purposes? (e.g. to find teaching resources, learn more about teaching, etc.) Required *

- ○ Yes
- ○ No
- ○ Maybe

8. Explain your answer to the previous question about your intentions regarding Twitter. Required *

Appendix B
Spring Semester Survey

1. Did you use Twitter for professional purposes during your student teaching semester? If your answer is "no", skip to question #7. *Required

- ◯ Yes
- ◯ No

2. Indicate ways you used Twitter for professional purposes during the student teaching semester. Check all that apply

- ☐ I tweeted my own thoughts & ideas about teaching.
- ☐ I tweeted questions I had about teaching.
- ☐ I tweeted links to articles and/or resources I found.
- ☐ I retweeted tweets I liked.
- ☐ I read tweets sent by those I follow.
- ☐ I read tweets that included a particular hashtag of interest to me.
- ☐ I participated in twitter chats.
- ☐ I read articles/blogs tweeted by others.
- ☐ I used resources tweeted about by others.
- ☐ I followed new educators & organizations.
- ☐ Other: ☐

3. How frequently did you use Twitter for professional purposes?

4. What factors contributed to your use of Twitter for professional purposes?

5. What uses of Twitter for professional purposes were most important to you?

6. In what ways, if any, did your use of Twitter affect how or what you taught?

7. What factors were obstacles to your use of Twitter for professional purposes? *Required

8. What do you think of Twitter as a tool for teacher professional development and/or student learning? *Required

9. Compare and/or contrast professional development via Twitter with other forms of professional development you experienced during your student teaching semester. *Required

10. In what ways, if any, do you see yourself using Twitter for professional development or in your classroom in the future? *Required