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Article abstract

This research applied a mixed-method design to explore how best to promote learning in authentic contexts in an online graduate course in instructional message design. The students used Twitter apps on their mobile devices to collect, share, and comment on authentic design examples found in their daily lives. The data sources included tweets (i.e., postings on Twitter), students' perceptions about mobile microblogging activities, and self-reported Twitter usage. Based on the tweet analysis, we found that the students appropriately applied the design principles and design terms in their critique of design examples. While the students were mainly engaged in assignment-relevant activities, they spontaneously generated social tweets as they related peers' authentic design examples to their own life experiences. Overall, they had positive perceptions toward the mobile microblogging activities. The students also indicated that the design examples shared by peers through mobile microblogging inspired their own message design work. We synthesized instructional design suggestions and challenges for educators interested in incorporating mobile microblogging in their instructional settings.

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Abstract

This research applied a mixed-method design to explore how best to promote learning in authentic contexts in an online graduate course in instructional message design. The students used Twitter apps on their mobile devices to collect, share, and comment on authentic design examples found in their daily lives. The data sources included tweets (i.e., postings on Twitter), students' perceptions about mobile microblogging activities, and self-reported Twitter usage. Based on the tweet analysis, we found that the students appropriately applied the design principles and design terms in their critique of design examples. While the students were mainly engaged in assignment-relevant activities, they spontaneously generated social tweets as they related peers' authentic design examples to their own life experiences. Overall, they had positive perceptions toward the mobile microblogging activities. The students also indicated that the design examples shared by peers through mobile microblogging inspired their own message design work. We synthesized instructional design suggestions and challenges for educators interested in incorporating mobile microblogging in their instructional settings.

Keywords: Twitter; microblogging; mobile learning; social learning; online course; Web 2.0

Introduction

The recent advances in mobile devices make mobile learning possible through the powerful computing capability built into their conveniently small sizes, their Internet connectivity, and the availability of many types of easy-to-use mobile software applications ("mobile apps" hereafter) (Johnson, Levine, Smith, & Stone, 2010). The major affordances of mobile computing technologies for learning include (a) mobility, the small sizes of the devices, making them highly portable, which enhances user mobility (Brown, 2009) and easy access to mobile devices; (b) computing power, relatively strong computing power, which enables users to complete tasks on small devices as effectively as on larger and less portable devices (Lai & Wu, 2006); (c) connectivity, always-on and stable Internet connectivity with high bandwidth, which allows for instant access to large amounts of information and real-time communication regardless of location (Johnson, Smith, Willis, Levine, & Haywood, 2011). These features unleash tremendous possibilities for innovative uses in education.

Mobile technologies have the potential for innovative educational use because they allow learning to occur in authentic and meaningful contexts. Because of the mobility and strong computing power of mobile technologies, learning becomes ubiquitous and seamless (Liu, Tan, & Chu, 2009). Learners can now take mobile devices anywhere they want in order to execute tasks or continue their learning processes outside classrooms or traditional learning environments. Learners can also go into the field, where they can apply their knowledge and skills in real-world settings. For example, mobile devices equipped with cameras and GPS (global positioning systems) make possible a variety of educational uses, such as data collection and documentation in field learning and field research. Together, all these advantages allow mobile device users to learn in their desired or preferred locations and physical contexts.

In addition, the connectivity of mobile devices promotes social learning through communication and collaboration among learners (Zurita & Nussbaum, 2004). Social learning usually involves a group of learners who interact collaboratively to develop their knowledge or expertise in order to achieve their goals. Through sharing knowledge and experiences, learners can develop knowledge related to their field or their interests (Lave & Wenger, 1991). Mobile devices afford rich and varied opportunities for the communication and sharing (Motiwalla, 2007) critical to collaborative knowledge construction. In addition, learners can enjoy frequent and easier access to the Internet because they can be connected to the Web virtually anywhere. With the blossoming of Web 2.0 applications that emphasize participation and sharing (O'Reilly,2005) and the increasing availability of Web 2.0 applications on mobile devices, learning can now be enhanced in both mobile and social contexts.

Microblogging: A Web 2.0 Application for Social Learning

Web 2.0 applications, designed for communication, creation, and sharing, allow for collective and cooperative creation of content and knowledge through easy and dynamic communication and publication mechanisms (Hsu, Ching, & Grabowski, 2009). Unlike the passive knowledge consumption model of web use, Web 2.0 applications encourage and make

possible a participatory web where individuals contribute and participate in the creation of content and knowledge—together. As such, Web 2.0 applications can provoke different learning perspectives, including sociocultural, situated, and distributed views (Ching & Hsu, 2011; Hsu, Ching, & Grabowski, in press). Among these perspectives, social learning is particularly pertinent to Vygotsky's sociocultural theory, which holds that learners construct knowledge through intellectual exchanges during their social interactions. In this view of learning, the social environment plays a critical role in enabling individuals' development and learning (Tudge & Scrimsher, 2003). Considering their nature and purpose, Web 2.0 applications are ideal mediators for creating social environments conducive to social learning (Gunawardena et al., 2009) and helping to achieve social presence (Dunlap & Lowenthal, 2009). With these applications, social engagement critical to learning is extended beyond the cultural perspectives of a local community to groups that are diverse and geographically dispersed, such as groups of learners in online learning environments. Social learning enhanced by Web 2.0 applications is likely to increase motivation (Pauschenwein & Sfiri, 2010) and create relatedness and a sense of community (Wright, 2010) among learners.

Microblogging is one of the latest Web 2.0 applications and can best be exemplified by the highly popular Twitter application (Ebner, Lienhardt, Rohs, & Meyer, 2010). Like blogging, microblogging allows for personal publication and conversation between writers and readers. One unique key feature of microblogging is the short-and-sweet constraint it poses—the limited number of characters per entry. Twitter, for example, allows for only 140 characters per post. This prevents long-winded entries and forces microbloggers to post concise messages. While this format of publication may not allow for in-depth composition in any single entry, the lightweight requirement and mechanism make it easier for people to follow up on conversations and give immediate feedback (Ebner et al., 2010) because individuals do not need to put in too much time and effort at once. The short messages are very similar to exchanges of real-time text chat on Instant Messenger. However, Twitter does not impose time pressure on the conversant on either end for responding or turn-taking because it does not require synchronous presence. Participants in microblogging only get involved when they feel like it. In addition, microblogging applications allow users to easily share resources such as hyperlinks to web-based multimedia, including images or videos.

In some educational contexts, microblogging has been used for back-channel chat to enhance the communication between the presenter and audience. For example, Elavsky, Mislan, and Elavsky (2011) studied students using Twitter for in-class feedback and asking questions during lectures with large audiences (approximately 240 students in their study), where the customary method of asking questions by raising hands could have interrupted the flow of the class. Although Elavsky et al. found that students' class participation and enthusiasm improved, about 47% of the students did not actively use Twitter (posting one or no tweets) for class activities. While this type of microblogging activity helps improve class dynamics, it does not exploit the full potential for social learning because it mainly encourages instructor-to-student communication and lacks peer-to-peer interaction.

In other educational situations, microblogging was used as a social networking tool to pro-

mote social interaction and community building. Wright (2010) studied how microblogging helped education students develop self-reflective practices during their practicum. As the participants in Wright's study were required to regularly record and share their thoughts about their teaching practices using Twitter, they reported that they valued the constant contact within the community that was built using the microblogging (i.e., Twitter) because the interaction mitigated their feelings of isolation. Also, Waller (2010) incorporated Twitter to help struggling writers (primary school students) communicate their thinking to each other. It was found that students enjoyed writing and felt excited because they had a real audience that included not only their classmates but also other followers beyond the class.

From the learning perspective, microblogging fosters intellectual exchanges among students or between students and the instructor, through asking questions, giving feedback, exchanging ideas, sharing resources, and reflecting on learning (Ebner & Maurer, 2008). Examining college students using microblogging for project-oriented communication, Ebner et al. (2010) found that this tool supported informal learning and social interaction during group work. They also found that microblogging enhanced process-oriented learning because learners were able to help shape each other's developing ideas through posting thoughts and information pieces.

Microblogging applications have recently become available on mobile devices, and users can benefit from the mobility, computing power, and connectivity of mobile devices during microblogging. This availability, therefore, takes learning through microblogging to the next level—mobile social learning. Namely, social learning can now go with learners truly anytime, anywhere, and with ease. This enables both social learning and learning in authentic contexts that learners create, share, and communicate in real time. For example, learners who find good examples (e.g., photos) related to their learning can create a "sample" through the camera on their mobile devices, share it with peers through Twitter, and communicate their thoughts with short messages. Mobile social learning thus provides an environment where users can build an authentic learning context for their collaborative knowledge construction. The use of mobile social learning has opened up promising opportunities for social interactions, especially for learners in online learning environments who rely heavily on technology for communication.

Research Purpose and Questions

This study investigated the impact of mobile microblogging on students' participation in authentic learning. The following research questions guided this study:

- What kind of interactions are students engaged in when participating in mobile microblogging activities? Are the tweets more about designated coursework or social conversation? What kinds of social conversation would students be engaged in?

- How do students benefit from learning that is situated in authentic contexts and enabled by mobile microblogging?

Through this study, the authors aim to (a) provide useful design suggestions for educators to incorporate mobile microblogging in online learning in meaningful and engaging ways, and (b) explore challenges in design and implementation in order to inform instructional design decisions.

Methods

Study Context

This study was implemented in a fully online graduate course in instructional message design in a mid-size state university in the northwestern United States. This online course was hosted on the Moodle learning management system (LMS) provided by Moodlerooms, Inc. The goal of the course was to have students learn to apply learning and design theories and principles in order to select, combine, and design visuals to effectively communicate instructional information. With emphasis on instructional message design, students in class learned about visual graphic design principles and created graphics for instructional use in their own professional settings. The 16 students enrolled in this course included K-12 teachers, school technology specialists, military personnel, and corporate trainers. Students in this course were required to have smartphones or mobile devices with Internet and camera capability. With the mobile learning component being funded by a university grant (i.e., mLearning scholars), students had the option of purchasing a subsidized mobile device (i.e., the fourth-generation iPod Touch) if they did not have one or needed one for this course.

The Mobile Microblogging Activities in this Study

The mobile microblogging activities, lasting for nine weeks, were designed to help students leverage the potential of mobile computing and the Web 2.0 application Twitter during their learning. The goal of the activities was to extend students' learning context from the content in class to their authentic real-life settings. Each week, each student was required to post at least one original tweet with one graphic design example collected from his/her environment and to comment on the collected design examples. The students were encouraged to share examples related to each week's design topic, such as typography, color, or shape. Also, they were asked to reply to at least two peers' course-related tweets each week. In the activities, students took advantage of mobile device capabilities, documented design examples from their daily-life contexts using the on-device camera, concisely commented on design examples, and shared those examples with the class via Twitter mobile apps. In both original and response tweets, the students were instructed to include a hashtag followed by a designated course-related keyword so their tweets could be searched and located on Twitter by their peers.

The activities were designed to help students become more observant designers by having them consciously attend to potential graphic design examples in their daily lives and evaluate which design techniques/principles they learned in class applied to those examples. This allowed students to reciprocally connect in-class and out-of-class learning and fos-

tered learning in individuals' authentic contexts (e.g., design examples from a gas station on how to use gas pumps, emergency evacuation instruction) through interaction among peers via mobile microblogging. Students could also obtain inspiration for their own design work through the examples collected by themselves and their peers. Because the examples were not simply retrieved from the image search on search engines or photo sharing sites but were associated with peers' life experience, they carried contextual meaning associated with their peers in terms of time, place, and people, which could arguably be more lasting in one's learning experience.

Data Sources and Analysis

This study applied a mixed-method design. The tweets collected from students' microblogging activities were the major data source in this study. Students' tweets were analyzed using a qualitative method first, through open coding and constant comparison. The tweets were first imported into a spreadsheet and coded as original postings and replies. Students' retweets (i.e., tweets reposted from other resources) were not included in analysis since they were neither original tweets nor replies to peers' tweets. Strauss and Corbin's (1990) constant comparison method was then applied in data analysis in this study. With open coding, the authors developed coding schemes to examine the types of tweets. After open coding, the authors constantly compared the data and revised the categories based on the themes emerging from the data through continuous meaning negotiation. After coding and categorizing the tweets, quantitative analysis was applied to help reveal the extent of distribution of different types of tweets in our data set.

In addition to students' tweets, we conducted an online survey on students' perceptions about the mobile microblogging activities at the conclusion of the activities. The questions included the following:

1. Does the microblogging (Twitter) activity help you feel more involved in class as part of a learning community? Why or why not?

2. What do you like most about the microblogging (Twitter) learning activity in this course?

3. What do you dislike most about the microblogging (Twitter) learning activity in this course?

We also asked questions about students' Twitter experience before the mobile microblogging activities, such as whether they had used Twitter and, if so, which types of devices they had used to access Twitter. At the end of the activities, students provided information about the devices they used to share and discuss the design examples in this course.

Results and Discussion

Participants, Mobile Devices, and Time on Microblogging

Ten of the 16 enrolled students participated in this study. Before the microblogging activities in this class, four of the ten students had never used Twitter before. Among the six students who had used Twitter, four of them used smartphones to access or post on Twitter, one used a tablet computer, and one used a desktop computer. At the end of the microblogging activities, seven students were using their smartphones, two used iPod Touches, and one used a tablet. The tweet data of two participants were excluded from analysis because one of them participated minimally, with four original tweets and no replies, and the other removed her Twitter page altogether after this course. While students' time on collecting design examples could vary because finding the examples was incidental, we found that they did not spend much time during any of the nine weeks on microblogging. For each week, two students reported they each spent half an hour, three students each 10 minutes, and the other five students each less than 10 minutes on course-related Twitter activities. Regarding the frequency of checking Twitter, one student checked once a day, two students checked five times a week, three students checked three times a week, and the other four checked fewer than three times a week.

Tweet Analysis

During the nine weeks of activities, each student was required to post a minimum of nine original assignment-relevant tweets and 18 replies. On average, each of the eight students participating in this study posted 14 original tweets (see Category 1 in Table 1) and 28 replies (see Category 2 and Category 4 in Table 1). The average numbers of both original tweets and replies were 56% more than the required numbers. It is likely that the 140-character constraint makes posting tweets less overwhelming, and therefore participants were more willing to access the mobile devices for microblogging. It is also possible that the easy access and always-on connectivity of their mobile devices made it possible for students to check and reply often.

We collected and analyzed a total of 361 tweets posted by the eight participants. During our data analysis, we found and defined the following six coding categories emerging from the tweet data. The coding categories and descriptions of the categories are summarized in Table 1 below.

Table 1

Tweet Coding Category and Description

Category number	Coding category	Description
1	Assignment-relevant original tweets	Including tweets directly relevant to the assigned task of posting and commenting on one's own design example collected from his/her daily environment.
2	Assignment-relevant replies	Including tweets relevant to the assigned task of replying to peers' posted design examples.
3	Other course-relevant tweets	Including tweets on resources sharing; seeking help on Twitter usage (e.g., how to tag tweets or use tags for filtering); responding to other coursework questions; and reflection on learning.
4	Social tweets derived from assignment	Including replies on assignment regarding daily-life experience rather than graphic design aspects.
5	Social tweets not derived from coursework	Including tweets that did not originate from the assigned microblogging task but were rather general greetings among class members.
6	Resource-sharing tweets after the course ended	Sharing course-relevant resources.

Categories 1, 2, and 4, which contained 330 tweets (91% of all analyzed tweets), were related to the assigned microblogging tasks regarding collecting and sharing design examples. Figure 1 below provided a graphical summary of tweet distribution by category.

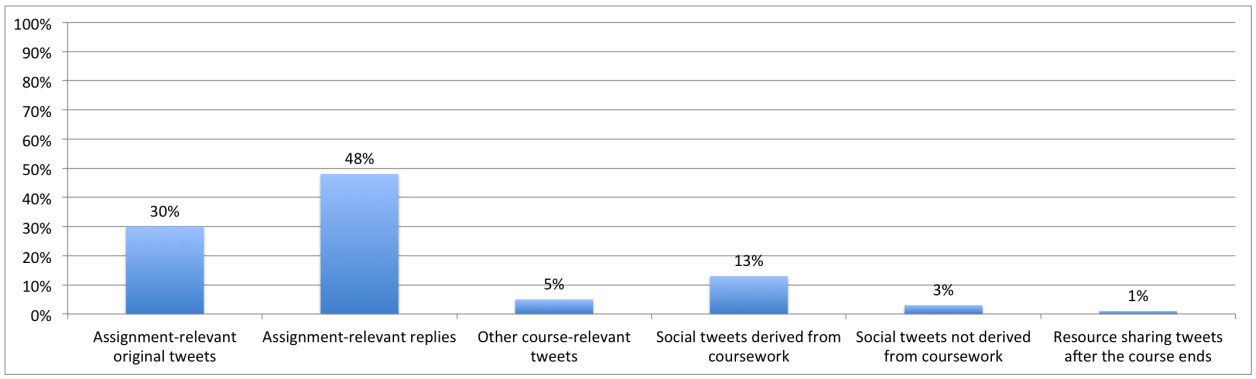

Figure 1. Tweet distribution by category.

In the following section, we discuss the different types of tweets in more detail and provide examples of these tweets.

Assignment-relevant original tweets (110 tweets; 30% of all tweets). This category includes the tweets that consisted of links to design example images found in authentic environments and documented by students, with concise comments on the contexts and design aspects of the images. For example, one student commented on a poster: "White space? No, black space, but same concept. I liked the balance on the page provided by the openness." [Image URL].

Another student posted about a commercial delivery package of a movie renting service: "color and depth, good contrast, drop shadow gives pop to the word." [Image URL]

As Figure 2 illustrates, one student shared a design example spotted by his daughter at a fast food restaurant. This figure shows the student posting this example and concisely commenting on the design principles (CARP—contrast, alignment, repetition, and proximity) being incorporated. This tweet showed another interesting aspect of this activity—some students often involved their family in their learning because it occurred in authentic family contexts, which also revealed the potential of mobile devices for learning in authentic settings. In this particular example, social learning has also been extended beyond the class because it involved interaction among family members, making it even more relevant and motivating.

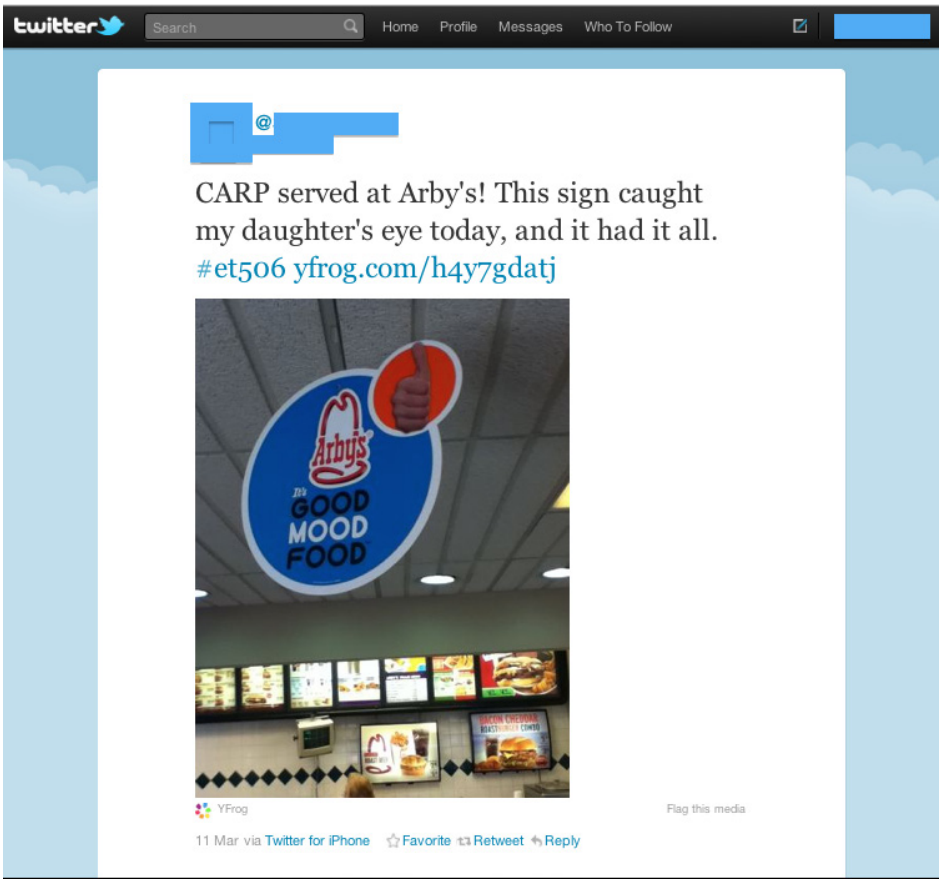

Figure 2. A tweet with a design example and concise comment on its context and design principles.

Most students were very active in this category and went beyond (56% more) what was required in terms of the numbers of postings. In examining the content of these tweets, we found that students, as observant learners, were able to use relevant design principles and terms to analyze and critique design examples found in their authentic contexts.

Assignment-relevant replies (173 tweets; 48% of all tweets). This category includes replies on the design aspects of the examples posted by peers. For instance, one student commented on the design technique of a peer's example: "they probably just bend the words along a path. That would be my best guess. Perhaps it[']s more sophisticated than that?"

Another student provided rationale for agreeing on the negative aspects of a design example: "Agreed. Too much motion. Not enough contrast w/ centered text on dark shape."

From the tweets quoted here, we found that although there is a conservative character limit per tweet, students did a good job of concisely analyzing design technique and critiquing examples using technical terms that they learned in this course.

The tweets included in Categories 1 and 2 provide examples of how learners can co-construct

graphic design knowledge/ideas through intellectual exchanges during social interactions via microblogging. It is worth noting that the students were very motivated to post more than 50% of the required number of tweets in both categories—they co-constructed knowledge with each other through active original postings and replies. These types of tweets also showed that students engaged in conversation that extended beyond their coursework and was at the same time situated in their real-life experience. Authentic graphic design ideas and examples were found in the social and cultural contexts surrounding the learners.

Other course-relevant tweets (18 tweets; 5% of all tweets). This category includes various tweets other than those related to sharing and commenting on design examples. One student shared a web resource featuring online pedagogy useful in general instructional design. Another student used Twitter to offer peers some tips about Twitter usage. Yet another student was inclined to seek help on Twitter usage on such questions as how to tag tweets or use tags for filtering tweets. An interesting use of tweeting in this category was to reflect on one's changes and learning during the course. One student asked his peers: "do [yo]u find [yo]urself looking at signs & designs differently since class began?"

Another student had a similar observation and stated, "It's really funny how this class has changed my perspective of the simplistic things like an instrument panel in a car."

These types of tweets seemed to indicate the Twitter environment could provide a casual atmosphere where students felt comfortable and willing to share the changes in their own learning and expose gaps in their knowledge.

Social tweets derived from assignment (47 tweets; 13% of all tweets). This category included tweets about how students related their own personal life experiences to peers' design examples. For instance, one student asked another student about his cooking plan after reviewing the design example of a seafood package. The student being asked responded, "Sorry, no grilling tonight. Was at Whole Foods and thought the fish would make a good background for the graphic."

On a graphic design example of gas pump instruction, one student commented: "Everyone assumes pumping gas can be figured out by all. My wife is from NJ. No self serve there. She had no clue how to."

This conversation was then joined by a tweet from another student: "I'm pretty sure in Oregon, they pump gas for you... That threw me for a loop when driving thru..."

The tweets in Category 4 showed that seeking real-life experience enabled students to bring their daily lives into their course discussions, which was conducive to sparking social exchange among the members in the community. These social exchanges, while not solely focusing on the content of this course, helped build connections among members and made them relate to each other through sharing experiences regarding various aspects of their lives. In accordance with Gunawardena et al. (2009), the microblogging platform, a type of Web 2.0 application, served as an ideal mediator to create an environment for learning and

developing graphic design knowledge and principles socially.

Social tweets not derived from coursework (11 tweets; 3% of all tweets). Some students simply connected with other students through compliments, greetings, or discussing the weather and the economy, without referring to any coursework. For example: "...like your user name!" or "Not a fan of drizzly and cloudy anymore. I like the sun. How's the economy doing there these days?"

This type of social tweet was not as common in this course, and 91% of these tweets came from one student. Comparing the distribution of tweets in Category 4 and Category 5, it seems the students were usually more engaged in assignment-relevant social tweets.

Resource-sharing tweets after the course ended (2 tweets; 1% of all tweets). Only one student posted this type of tweet, where he shared a Twitter mobile app with the instructor. This type of activity is not common. It could have to do with the student's interest in using Twitter as a social tool, as reflected through his continuous updates on Twitter. At the time of our in-depth tweet analysis (four months after this course), two of the eight participants still updated their Twitter postings for personal use.

While the instructor intended to have students focus on discussing design aspects of the shared examples via Twitter, the instruction did not specifically prompt students to do so because the instructor wanted to observe the spontaneous relative contributions of learning tweets versus social tweets. Of all 220 coursework-relevant replies (i.e., Categories 2 and 4), 79% were learning tweets and 21% were social tweets. The distribution of types of tweets seemed to reveal a major emphasis on learning aspects accompanied by a certain level of social bonding. This is likely due to the assignment being situated in the students' daily lives, which meant they could relate to their peers' examples if they had encountered similar life experiences or design examples. The convenience of accessing Twitter apps on mobile devices and the nature of short messaging on Twitter also allowed for quick posting without needing to extensively compose a message, which made it easier to connect with peers in a casual way.

While the instructor hoped that students would focus on design issues during their microblogging activities, social interaction during microblogging was not discouraged because social activities could be vital "glue" in helping students connect with each other and become more engaged in the activities—students could feel more bonded at a personal and social level. The spontaneous social interactions found in the tweets (e.g., mentioning personal dining plans or a wife's hometown) suggest that some students were able to identify with the community and found this microblogging a trusting environment in that they were willing to share their personal information or events with the learning community to build interpersonal relationships.

Benefits of Learning in Authentic Contexts with Mobile Microblogging

Promoting learning in authentic contexts. The data collected from the survey showed that students enjoyed mobile microblogging activities that helped connect learning with peers' everyday lives. One student commented that

> It provides an opportunity to seek out examples of content in the real world, and it is unique to one person because of the spread out nature of the students in the class (all over the world!). It is exciting to share findings with the class and comment on others' finds.

One student commented on becoming conscious of design principles applied to things in the environment: "I liked the way that it made me aware of all of the things that I read about being applied in everyday life. Examples of design that may have gone unnoticed by me were caught."

Reinforcing formal learning with informal learning. Students also found that the activities helped them with course-relevant learning. For example: "I did appreciate learning how to use Twitter, and I do like seeing a few examples of graphics since some helped to generate ideas for my own projects."

Sharing images provided a means to ground some of the textbook concepts as well as others' understanding of those concepts.

Enhancing social learning. In addition, students liked Twitter as a tool for social learning: "The class did feel a bit more like a community after starting this activity," "it's more of an informal way to connect with your fellow colleagues."

Overall, the students showed positive attitudes toward the mobile microblogging activities. They found mobile microblogging helped them learn about design examples that were authentic in individuals' contexts and widely geographically dispersed. The students also found that the activities helped them see how the design principles learned in class were actually applied to the design artifacts in their environments. In addition, they learned from peers' views about design and could connect with peers in an informal way.

Instructional Design Implication and Challenges

Our exploration of the different categories of tweets can help inform designing and planning of mobile microblogging for learning in authentic contexts. Instructors can consider the types of tweets (e.g., replies on design aspects or life experiences) they want to solicit and engage students in, and design instructions or prompts that help lead to outcomes aligned with their instructional objectives. The character limit of microblogging may enable a unique mode of communication. While students who prefer extended comments in single postings could find it inconvenient, the lightweight nature of microblogging eases the pressure of extended participation. Despite the character limit, microblogging can help to bring about deep conversation through short but frequent exchanges. While participants might

not be able to make a complete argument in one posting, microblogging is likely to promote the opportunity for co-construction of knowledge when participants take turns in elaborating or adding to others' short postings to make their own points clearer.

Implementing a program involving mobile microblogging activities requires early planning and communication. While students' participation and engagement in our mobile microblogging activities exceeded course requirements and instructor expectations, it was not without challenges. In terms of logistics, the instructor had to ensure that everyone in class had access to a mobile device with a camera feature so they could participate in the required tasks. It took some planning in advance to survey students' mobile device accessibility either before or early in the course. Fortunately, most students in this study (i.e., graduate students who are working professionals) owned a smartphone or at least planned to get one by the beginning of the activities. Students who did not have such mobile devices could purchase a subsidized device with the help of the first author's grant funding. If this type of resource were not available, it might be difficult to get all of one's students ready for such activities. In fact, we found that some students were not interested in purchasing the device even with the funding support. In this situation, instructors would want to make sure they could develop alternative activities so that students' learning opportunities were not compromised. In our situation, there was another section of the same course, so the instructor could arrange microblogging activities that did not require mobile devices with the camera feature. In situations where another section of the same course is not available, instructors might have to create two sets of instructions and accommodate two different learning groups in one course.

One student commented on the nuisance of having to remember to include a required hashtag-keyword combination (for searching and filtering) in posting tweets. While there is instructional and learning value in using tags for learning activities, this requirement further reduced the content posting quota because the keyword counted toward the character limit per tweet on Twitter. If learners engaged in conversation with peers, they would also need to include "@username" so the tweets could be directed to the conversant, which further reduces the amount of substantive content one can post in one tweet. Educators interested in incorporating Twitter in their instruction might want to consider these constraints during their planning. It might help to assign a shorter activity keyword or encourage students to create shorter usernames to allow more room for posting in each tweet.

Conclusions

In this study, we showed how to promote learning in authentic contexts through mobile microblogging. The affordances (i.e., mobility, computing power, and connectivity) of today's mobile devices and microblogging applications combined to make students' learning in authentic contexts possible. We found that the students in our study appropriately applied the design principles and terms they learned in class when they critiqued the examples collected by themselves and their peers. Students were able to co-construct knowledge through their exchange of tweets. Generally, they had positive perceptions toward the mobile microblog-

ging activities that allowed them to apply their knowledge about graphic design principles in authentic contexts. The students also indicated that the design examples shared by their peers via mobile apps inspired their design work. While being effective in supporting learning, mobile microblogging was also efficient in helping students connect with each other through short and quick social conversations. We hope the study presented here represents a promising example of integrating mobile microblogging in an online graduate course, one that could encourage educators to explore and experiment with the potential of mobile microblogging for promoting learning in authentic contexts and through social learning.

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