Microblogging for Strengthening a Virtual Learning Community in an Online Course

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Abstract: This paper examines how a microblogging tool (i.e., Twitter) can be effectively used to strengthen a virtual learning community (VLC) in the two sections of a fully online graduate course. Students in this course were consisted of K-12 teachers, school technology specialists, corporate trainers, and military personnel. The microblogging activities were designed to allow quick peer interaction to build the momentum of social learning in the VLC. In this study, we collected quantitative data on sense of community through a Likert scale survey, and rich qualitative data on students' perception about microblogging activities. It was found that students' sense of community was generally high and students were positive about their microblogging experiences. In addition, microblogging was found to be useful and valuable in sustaining students' learning by doing such as sharing real-world design examples, critiquing design examples with technical knowledge learned in class, and quick and short commenting with peer support in a VLC. Based on the findings, the authors aim to provide design suggestions for educators and instructional designers to incorporate this social web tool in strengthening virtual learning communities in a meaningful and engaging way.

Keywords: Microblogging; Twitter; Online Graduate Course; Web 2.0; Virtual Learning Community

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1. Introduction

Virtual learning communities (VLC hereafter) are computer-mediated learning communities (Luppicini, 2003) that provide virtual space for interaction. Virtual learning communities play critical roles in the success of student learning in an online environment because they have the potential to reduce learners' feeling of isolation that may contribute to learner drop-out form the course. A learning community refers to a context where a group of individuals with a shared will of learning participate in the learning process (Kowch & Schwier, 1997). Based on social constructivist view, learning is situated in a social and cultural context where learners interact with each other to construct their understanding of the world (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991). Learning in the community enables learners to collaboratively construct knowledge through discussion and meaning negotiation with peers and instructors. As members in the community possess different experiences and skills, they could support each other to develop beyond what each individual is currently capable of doing and to help individuals move to the next level of development. A learning community also offers learners opportunities of learning by doing where learners apply their learned knowledge in the hands-on activities, share their learning processes, exchange thoughts, reflections and experiences about their learning, and grow together as a community. An important aspect of an effective learning community is the active interaction and collaboration among the members in order for mutual knowledge construction.

In online learning environments, due to geographical constraints, learning communities are more likely to take the form of VLC where students and instructors interact in the virtual space. Students experience peer support and rich learning experience with the multiple perspectives contributed by its members in these learning environments. The virtual learning community serves as a context for students to engage in the conversations or dialogues that lead to meaning making and knowledge construction (Lock, 2002).

Forming a VLC requires well-planned protocol and facilitation (Moller, 1998). Interaction in online environments can be challenging because, unlike in face-to-face settings, it often lacks visual and other physical cues that help convey emotional or affective information among community members (Kreijns, Kirschner, & Jochems, 2003). In addition, in the face-to-face settings, learners in the community can easily engage in quick interaction that they ask questions, share developing thoughts, get feedback, or exchange useful resources. This type of interaction helps connect learners, establish their social presence, and create a sense of community. However, this type of interaction is less likely to happen in an asynchronous learning environment. Learners are often asked to compose long and well-formulated messages to elaborate their thoughts in online discussion forums. Quick, short and spontaneous interaction seldom happens or is often not encouraged in online discussion forums.

Recently, the booming Web 2.0 tools designed for communication, interaction, creation and sharing, (Hsu, Ching, & Grabowski, 2009), presented unprecedented opportunities for community building and social learning. These tools are easy to access, use, and help people connect. Considering the purpose and use of Web 2.0 tools (i.e., participation, creation, & sharing), they are ideal mediators to help achieve social presence (Dunlap & Lowenthal, 2009) and social learning (Gunawardena, Hermans, Sanchez, Richmond, Bohley, & Tuttle, 2009), increase motivation (Pauschenwein & Sfiri, 2010), and create relatedness and sense of community (Wright, 2010). The incorporation of the Web2.0 social tools coupled with a pedagogy that capitalizes the capability of the tools is believed to benefit students in fully online courses the most because they can engage students with peers, instructors and community in creating and sharing ideas (McLoughlin & Lee, 2008). Twitter, one of the most well-known Web 2.0 tools, allows microblogging activities where users post short messages and update status or useful web resources. The microblogging activities on Twitter actually have a unique term called "Twittering", namely, posting on Twitter. Microblogging is limited to 140 characters per post on Twitter. The lightweight nature resulting from the posting constraint of microblogging makes it possible for people to post quickly and post often. The frequent contact and update could help increase the bonding among community members. Users also could feel less pressure having to commit to reading or posting substantial content when participating in microblogging. This makes users more likely and willing to share their thoughts or ideas, hence increasing members' virtual presence—a critical element of successful VLC. Despite the promising technological features and pedagogical implications of microblogging, little research has examined the integration of such activities and their impact on facilitating learner interaction and community building.

2. Learning by Doing

Unlike the traditional acquisition model of learning that views learning as acquisition, the participation framework views learning as the process of knowledge construction through interaction and discourse among members in the community embedded in the social and cultural contexts (Sfard, 1998). When individuals construct knowledge together, they reciprocally create learning experiences for each other, and serve as part of each other's "learning environment." Accordingly, this situated knowledge construction emphasizes learning in context (e.g., activity, people, culture, and language) and learning is inseparable from doing (Brown, Collins, & Duguid, 1989). Through active participation, learners collectively inquire into specific topics, share and exchange thoughts and experiences, and make improvement of ideas to develop deeper understanding (Lave & Wenger, 1991). Based on this framework, a virtual learning community can serve as a meaningful context for learner interaction and knowledge construction where it encourages active participation, interaction, and collaboration among members for joint knowledge construction.

3. Virtual Learning Community and Sense of Community (SoC)

Rovai (2002b) defined a classroom community as a social community of learners who share knowledge, values, and goals, while learning on various levels is the essential goal of the community. Although online courses or learning environments are virtual and do not have a brick-and-mortar classroom, members undoubtedly aggregate for the same goal—learning. Therefore, members of a Virtual Learning Community should also share

knowledge, values, and goals, despite the possible variations at individual levels. Lock (2002) identified four cornerstones in an online learning community: communication, collaboration, interaction, and participation. A VLC can be created and strengthened through learning activities designed to promote communication, collaboration, interaction and participation among learners. However, communication and interaction can be challenging in virtual space because many of the visual cues, such as facial expression and other body language (Sia, Tan, & Wei, 2002), that can help with interaction and communication are not available. The fact that VLC members do not aggregate in the same physical location for regular meetings could easily lead to disconnectedness and require significant effort and sophistication for sustaining a learning community.

A good indicator of well-functioning and strong learning community is "sense of community," which consists of several essential elements: mutual interdependence among members, connectedness, trust, interactivity, and shared values and goals (Rovai, 2002b). These elements were recognized, examined carefully, and tested empirically through research of various efforts. For example, Rovai (2002a) established a measurement instrument of Sense of Community by infusing the elements above into two subscales of "connectedness" (i.e., feelings of connectedness among community members) and "learning" (commonality of learning expectations and goals). He then validated the scale with statistical tests, and tested the scale for reliability. Before Rovai could establish his instrument measuring sense of community, earlier researchers proposed various conceptualizations of this construct which established the foundations for the recent and widely adopted conceptualization of SoC by Rovai. For example, Sarason (1974) emphasized one's feeling of similarity to and interdependence with other members within a community. Also, Unger and Wandesman (1985) as well as McMillan and Chavis (1986) both emphasized one's feeling of belongingness in a community. In addition, social-emotional tie (Unger & Wandesman, 1985) and faith in committing on being together to meet community members' needs (McMillan & Chavis, 1986) also help bond members and strengthen a community.

4. Microblogging

Microblogging, best exemplified by the highly popular Twitter application, is one of the latest Web 2.0 technologies (Ebner, Lienhardt, Rohs, & Meyer, 2010). Among the Web 2.0 technologies, microblogging represents a unique style of participatory web that encourages conversation, and facilitates collective knowledge and content creation. Microblogging is in many ways similar to blogging such as personal publication, allowing conversation between writers and readers, and providing multimedia capability for users to share (the links to) web-based multimedia including images or videos. However, one unique key feature of microblogging is the short-and-sweet rule it poses (e.g., Twitter)—the 140-character limit per microblogging entry.

This constraint prevents long posting and forces microbloggers to post concise messages. While this format of publication may not allow for in-depth composition in one entry, the lightweight requirement and mechanism makes it easier for users to follow up on the conversation and give immediate feedback (Ebner et al., 2010) because individuals do not need to put in too much effort and time at once like when someone is writing on a blog. The short messages are very similar to those exchanges on Instant Messenger, but it does not impose time pressure on the conversant on either end for responding or turn-taking, since it does not require synchronous presence for those who engage in such conversations. Participants of microblogging only get involved when they

feel like to do it. It is the lightweight and minimal requirement that aids the popularity of microblogging activities.

In the educational context, microblogging allows interaction between students and the instructor and among students through asking questions, giving opinions, 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 in which learners were able to participate and help shape each other's developing ideas through posting thoughts and information pieces. The features of microblogging aid instructional practice in addition to its help with learning. As microblogging records the interaction in the text format, it helps instructors document the learning process where learner participation and contribution during the learning process can be monitored and consulted for the purpose of providing feedback and assessment (Ebner et al., 2010).

Microblogging, as a social networking tool, promotes social interaction and community building. Wright (2010) studied how microblogging helped teacher education students develop self-reflective practices during their practicum. As participants were required to log and share the thoughts of their teaching practices using Twitter regularly in her study, all participants reported that they valued the constant contact within the community built using the microblogging (i.e., Twitter) because the contact mitigated their feelings of isolation. Kowch and Schwier (1997) stated that technology needs to aid negotiation, intimacy, commitment, and engagement in order to create a virtual learning community. Microblogging tools coupled with learning by doing activities can provide a meaningful learning environment for knowledge construction and community building.

5. Research Purpose and Questions

The purpose of the study is to examine how a microblogging tool (i.e., Twitter) can be effectively used to strengthen a virtual learning community (VLC) in the two sections of a fully online graduate course. We asked the following questions to guide our study:

- What are students' perceptions toward microblogging activities for supporting their learning and social connection in a VLC?
    - How does microblogging support community building in a VLC?
    - How does microblogging facilitate learning by doing in the context of a VLC?

6. Method

6.1. Context

This online course was offered in a public university in the Western United States. This course focused on how to apply learning theory, principles of visual literacy, and graphic design techniques for instructional media development. Students learned to select and combine visual and textual representations to effectively communicate instructional information. In the two sections of this fully online graduate course, students were

consisted of K-12 teachers, school technology specialists, corporate trainers, and military personnel.

6.2. LMS and Discussion Forums

The online course was hosted on the Moodle learning management system (LMS) packaged and customized for the program by an external company. The LMS was maintained and administered by one of our department's faculty members. Students in this study were mostly familiar with taking an online course in the Moodle learning management system. In Moodle, the course instructor posted course materials, and made regular announcements regarding course requirements and reminders. Students posted their weekly assignments and provided peer feedback for each other regarding their design work in the discussion forums.

6.3. Instructional Strategies for Building VLC with Microblogging

The microblogging activities on Twitter were designed to achieve two main goals: 1) to broaden graphic design perspectives by having students actively search and share the real-world design examples around them in their daily lives, which can greatly enrich sources of inspiration on their learning of graphic design; 2) to allow quick peer interaction to build the momentum of social learning in the virtual learning community by taking advantage of the 140-character-per-entry constraint, assuming a relatively light requirement could make students more willing to participate with frequent exchanges of ideas.

During each of the 9 weeks of microblogging activities, students were asked to post weekly at least one design example from their daily life and comment briefly regarding the design example of their choice. Students were encouraged to apply the technical terms and knowledge they learned in this class to critique the examples shared on Twitter. Finding design examples in learners' daily life offered the opportunities of learning by doing and situated learners' development of graphic design skills in a meaningful context.

Students had the options of using their smartphones to take photos of the examples and then upload the photos to Twitter with the mobile apps (i.e., software applications) of their choice. They could also take photos of the examples with common digital cameras, transfer the photos to their computers, and then upload the photos to Twitter. In addition to their original postings (i.e., "tweets"), students were required to respond weekly to at least two of their peers' original tweets of examples. In both original tweets and responses, students included a hashtag followed by a course-specific activity keyword so their tweets can be searched and located by peers on Twitter. Figure 1. presents a snapshot of one student's weekly microblogging activities, including a series of responses to peers' tweets on the left column, and the highlighted original tweet of a design example found in his real-life context on the right column.

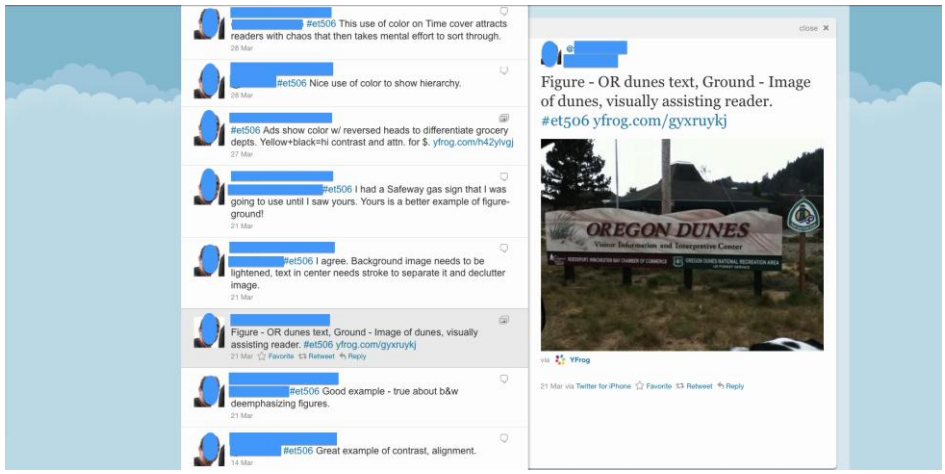

Figure 1. An example of microblogging activities in the Instruction Message Design course

In the activities, the instructor was involved minimally by providing directions and technical support, hoping to foster a self-sustaining VLC that belonged to the members of the community.

6.4. Data Collection

In this study, we collected multiple types and sources of data to provide a comprehensive picture of how to strengthen VLC in an online course. The following sources of data were collected: 1) quantitative survey data on student Twitter usage, class participation and sense of community (Rovai, 2002a); 2) rich qualitative data of students' comments on microblogging activities, such as preference and possible instructional improvement regarding learning and engagement level.

6.5. Survey Responses

Two surveys were administered. A pre-survey collected data on student Demographics, Twitter Usage, Class Participation, and Sense of Community. A post survey garnered data on student Twitter Usage, Class Participation, and Sense of Community. The authors of this paper created the questions on the Demographics, Twitter Usage and Class Participation using multiple-choice type questions. The questions on Sense of Community were adapted from Rovai's (2002a) work and used Likert-scale type questions. The sense of community scale consists of 20 questions, including 10 questions for each of the two subscales on *Connectedness* and *Learning* respectively. A four-point Likert scale was used instead of the original five-point scale that includes a "neutral" option. The authors decided to remove the midpoint "neutral" to prevent from introducing social desirability bias to responses (i.e., participants might want to appear to be helpful) as well as the tendency toward a less meaningful interpretation this type of answer could yield (Garland, 1991). While the whole course lasted for 16 weeks, the pre-survey was administered one week before the start of microblogging activities (i.e., Week 4), and the post-survey was administered one week after the end of microblogging activities (i.e., Week 15).

6.6. Open-ended Comments

In the post-survey, "Comments about Microblogging Activities" is added as another section to allow students to freely comment on if they felt as part of a learning community with the help of microblogging activities, and what they liked and/or disliked about the microblogging activities. This section is included to collect data that allow for data triangulation with responses from other sections of the surveys and to help provide a rich picture of how students felt about the virtual learning community fostered by the Web 2.0 application.

7. Findings

7.1. Demographics

Among the 40 students enrolled in this graduate course, a total of 22 students participated in this study. However, one of the students did not fill out the post-survey so this student's data were excluded from our analysis. Among the remaining 21 participants, 12 were males and 9 were females. Also, the majority of participants (14 people; 67%) were 26-40 years old, and there were 6 participants who ranged between 41-50 years old and 1 student reporting being between 51-60 years old.

7.2. Twitter Usage

Before the microblogging activities in this course, 47.6% of the participants had never used Twitter, 33.3% had experience with Twitter for less than one year, and 14.3% had experience with Twitter for more than 2 years. At the conclusion of microblogging activities, 14.3% reported checking Twitter messages once a day, 57.2% checked Twitter messages 3 to 5 times a week. There were also 23.8% of students reported they checked Twitter messages less than 3 times. As for the time spent on Twitter weekly, it varied from less than 10 minutes to one hour: 1) 42.9% spent less than 10 minutes; 2) 23.8% for 10 minutes; 3) 23.8% for half an hour; and 4) 9.5% for an hour.

7.3. General Class Participation/Activities

Participants by average spent 3.7 hours weekly creating graphics for course assignments until Week 4, and 5 hours weekly creating graphics by Week 15, which showed a significant increase ($t = 2.29$, $p < .05$) in time on assignments perhaps due to requirement and increasing complexity of assignments. On the other hand, the results showed participants had significant decreases on hours per week for: 1) responding to peers' posting ($t = -2.36$, $p < .05$), which might have to do with increasing demand from high-stake final project; 2) searching for or studying tutorials about image editing software ($t = -4.30$, $p < .001$), which could result from participants' increasing familiarity of image editing software of their choice; and 3) checking the course Moodle site ($t = -3.00$, $p < .005$), which along with 1) and 2) reflected participants' time allocation and management—spending more time on their own design assignments.

7.4. Sense of Community

7.4.1. Scale

For each item on the Sense of Community scale, the possible score ranged from 1 to 4 points[1]. The reliability scores (Cronbach α) based on the scores obtained from the pre-survey and post-survey were .881 and .910 respectively, which indicated high reliability of the responses to the SoC scale.

7.4.2. Descriptive Analysis

An examination of the item means showed that participants' responses mostly fell into the "agree" category (near or above 3), except for "feel like a family" and "feel member depending on me." (See Table 1)

Table 1. Survey item response mean scores

	Pre-survey Item Response Mean Score	Post-survey Item Response Mean Score
Classmates care about each other*	3.00	3.00
I am encouraged to ask questions	3.10	3.14
Feel connected to others	2.57	2.81
Feel easy to get help	3.14	3.10
Feel a spirit of community	2.81	2.95
Feel receiving timely feedback	3.24	3.10
Feel the course being like a family	2.10	2.33
Feel easy exposing gap in my own understanding	2.67	2.81
Feel not isolated in this course	2.95	2.86
Feel willing to speak/communicate openly	3.10	3.00
Trust others in this course	2.90	2.95
Feel this course resulting in more than modest learning	2.95	2.76
Feel able to rely on others in this course.	2.67	2.76
Feel other students helping me learn	2.95	2.95
Feel members of this course depending on me	2.14	2.24
Feel being given ample opportunities to learn	3.25	3.05
Feel certain about others in this course	2.71	3.00
Feel my educational needs being met	3.19	2.95
Feel confident that others will support me	2.80	2.76
Feel this course promoting a desire to learn	3.30	3.10

*Boldface: "Connectedness" subscale; non-boldface: "Learning" subscale.

When looking at mean scores across items, there were no differences between pre-survey and post-survey (M = 2.88 in both surveys). When further breaking the Sense of Community down into the subscales, there was a slight increase in feelings of connectedness, and a slight decrease in sense of learning. On average, learners responded to both the "Connectedness" and "Learning" subscales positively as the mean score fell

[1] 1 = Strongly Disagree; 2 = Disagree; 3 = Agree; 4 = Strongly Agree

into the "agree" category (near or equal to 3) from both pre-survey and post-survey (See Table 2).

Table 2. Survey mean scores by scales

	Mean Score across Items	
	Pre-survey	Post-survey
Sense of Community	2.88	2.88
Connectedness	2.67	2.77
Learning	3.09	3.00

It should be noted that other ongoing course activities were also likely to have an impact on learners' responses to this Sense of Community measure as the microblogging activity was not the only course activities. To further understand students' perceptions toward the microblogging activities, participants' responses to open-ended questions were analyzed to elicit student insights about microblogging as a tool to strengthen the virtual learning community and enhance their learning in the community.

7.5. Student Perceptions

Three open-ended questions were asked in the post-survey to examine student perception regarding the microblogging activity, including:

- Does the microblogging (Twitter) activity help you feel more involved in class as part of a learning community? Why or why not?
- What do you like most about the microblogging (Twitter) learning activity in this course?
- What do you dislike most about the microblogging (Twitter) learning activity in this course?

7.5.1. Supporting Community Building in VLC

Examining qualitative data from these questions, about two thirds of the students perceived the use of microblogging positively for community building. Several students commented that they felt more involved in the learning community through this Twitter activity and that this environment provided a relaxed atmosphere and an informal way to communicate with other classmates. One student commented that,

> I had never used Twitter before. I think that it helped unite the class because weekly we saw each other and weekly gave each other feedback. It helped to see people's pictures on Twitter. I feel like I know people better.

It is interesting while all students were required to participate in the discussion forum weekly, some of them felt they were more connected via Twitter. Comparing the two media, one student said "it (Twitter) seemed to connect us more than the forums, as it was easier to read the tweets and easier to respond."

Some students altered their perception after they experienced the activity. One student said,

> I was at first skeptical about Twitter as a class tool to promote a learning community. I ended up enjoying posting weekly tweets and looked forward to

> replies from my classmates. I also enjoyed following classmates to see where their travels took them related to course activities.

7.5.2. Learning by Doing

Students also liked the task of sharing and exchanging examples of graphic design that helped their learning by doing in real-life contexts, which was evidenced in the following comments:

> 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.
>
> It helped me to apply what I was learning—seeing the concepts of universal design that were developed in the real world. It helped me to become more observant while looking at billboards, directions, and other visuals.
>
> 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.
>
> [I liked] Being able to see the other peoples' communities and their ideas of image, design and communication.

The comments as exemplified above, showed that students appreciated the positive contributions of microblogging to develop the "connectedness" and "learning" aspects of their sense of community. In VLC, sharing and the willingness to share are critical and foundational because they are also representations of members having similar interest and interactivity. A shared vision, goals and aspirations create the cohesiveness of the community and help sustain the community (Lock, 2002).

On the other hand, not all of the students enjoyed the microblogging experience for a few reasons. For example, some students were not fond of using Twitter mostly due to the constraints set by Twitter or limited access to mobile devices. The limit of 140-character per posting reduces the possibility of expressing more complex thoughts and explanations, which was perceived to hinder communication by a handful of students. Some students also commented on the need of getting familiar with the technical rules of sharing required by Twitter (e.g., using a tag consisted of a hashtag and some keyword) to streamline the sharing process. Other limitations imposed by Twitter application included the lack of access to earlier tweets and lack of mechanism that provided easier access to or filtered for meaningful tweets.

8. Discussion

This study examines how microblogging activities can be effectively used to support and strengthen a virtual learning community (VLC), focusing on how the activities can facilitate learning by doing in the context of a learning community and increase students' "sense of community." The data shows that students' Sense of Community responses generally fell into the "agree" category, which is a positive indicator of students' feeling being part of the VLC in this online course. This finding suggests that this course provided a space for members of the VLC to interact, communicate, and construct knowledge together through sharing and exchanging ideas. The qualitative data further

supported this finding. Students' open-ended comments showed a generally favorable attitude toward microblogging activities that helped connect members in this course. Microblogging helped strengthen VLC members' virtual presence through quick weekly posting and interaction. Real-life design example sharing also helped students go beyond their own work shared on the weekly discussion forums. This advantage could be further enhanced if students took advantage of the convenience and immediacy of their smartphones and mobile applications for the activities.

Since VLC is built to support members' learning and knowledge construction, any activities designed to enhance such community should also support the intended purpose. In this study, students' comments showed that microblogging served this purpose. The microblogging activities engaged students in learning by doing through active searching of design examples and applying learned principles to critique the examples. The design examples they collected and shared collaboratively broadened each other's perspectives and inspire peers' design. As one student commented, "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." As good design can be inspired by good examples, being exposed to abundant design examples is the essential learning process of developing graphic design skills. In this sense, the microblogging activities enhanced the learning process and provided opportunities for learners to help shape each other's developing design ideas through interaction and discourse, a similar finding as suggested in Ebner et al. (2010).

While most students perceived the microblogging activities positively, a few students did not value the need of a learning community or the use of microblogging for community building. One student considered microblogging as just another weekly assignment, instead of a way to help connect members of the class. It is also likely that some students could be solitary learners and prefer not to interact with peers (Ke & Carr-Chellman, 2006). For example, one of the students indicated, "I am not looking for learning community per se." In addition, while the concise nature of Twitter posting allows for quick conversation among community members, a few students did not favor that since it does not allow for in-depth discussion. In this situation, it might help if the instructor strengthened communication with students about their expectations toward microblogging activities and the use as well as purpose of tools like Twitter, since microblogging can really help engage members in quick, continuous, and extended conversation to sustain the momentum of social learning. In addition to summative evaluation, instructors could also conduct formative evaluations while implementing the microblogging activities to solicit student feedback earlier to detect and communicate on potential negative perceptions regarding the constraint of posting of microblogging. Another possible solution to building momentum in social learning could be setting multiple mini deadlines in each week instead of one final deadline for each week's original postings and replies. This solution could help engage students in microblogging more often, rather than merely trying to make required number of postings.

Based on what we learned from the findings, microblogging might serve as good supplemental activities to help VLC members further strengthen their virtual presence and connect with each other. However, due to its constraint on length of posting, in-depth discussion is not possible (Wright, 2010). Therefore, microblogging should complement other activities such as in-depth forum discussions, instead of serving as stand-alone activities for building a learning community.

Despite the easy assess of microblogging tools on desktop or laptop computers, the availability of mobile technology also impacts student participation and perception of

the activity. Students who did not have mobile devices such as camera smartphones or the latest iPod touches with cameras reported having experienced less than smooth process completing or participating in the activities. For example, one student indicated not being particularly engaged in microblogging and learning community due to his/her "lack of mobile computing device …[to] check often and on the go." Without a mobile device, students might need to take photos with their digital cameras then use a USB cable to transfer the photos to their computers for uploading to Twitter on a laptop or desktop computer, instead of posting the photos on their phones to Twitter directly with a variety of mobile applications. In addition, students without mobile devices would not have instant and frequent access to peers' posting on Twitter from those devices.

9. Conclusion

Microblogging as a Web 2.0 tool helped strengthen students' sense of community in a VLC, as demonstrated by the qualitative data in this study. As a social learning and communication tool, the informal and relaxing atmosphere created on the Twitter platform promotes learner willingness of sharing and interaction. However, due to the system constraints of the microblogging tools—the character limit per post, we would not suggest it be the only tool used for building, supporting and strengthening a VLC. Instead, microblogging can be very useful and valuable for resource sharing (e.g., real-world design examples), peer support through short commenting, or quickly updating of members' learning process for strengthening VLC as presented in this study. We hope our findings and discussions on teaching and learning activity design could help inform educators interested in integrating such a tool in their online teaching.

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