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Instructional guidance in microblogging-supported learning: insights from a multiple case study

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Abstract Microblogging tools such as Twitter show potential to enrich classroom experience and benefit student learning. Research shows that instructional guidance is particularly necessary in computer-assisted learning environments, but no research has been done to study the effects of instructional guidance in microblogging-based learning. Using a multiple-case study design, the researcher examined student learning in terms of the amount of participation, ability to focus on task, and depth of thinking in guided, semi-guided, and unguided modes. The findings suggest that in guided environments, students achieved higher levels of learning, especially with respect to focusing on task and depth of thinking. Variations in depth of learning existed between the semi-guided and the guided mode. Students' perceptions of the benefits and challenges of using microblogging across three cases were also analyzed. The study has implications for future research on using microblogging tools for educational purposes and pedagogical practice.

Keywords Microblogging · Twitter · Computer-mediated communication · Social media · Interactive learning environments · Instructional guidance

Introduction

Providing instructional guidance during teaching is pivotal to the success of student learning. Despite ongoing debates over the impact of instructional guidance as opposed to the discovery approach, researchers increasingly believe that instructional guidance is much needed across a wide variety of disciplines, learning contexts, and environments (Clark et al. 2012; Kirschner et al. 2006; Mayer 2004).

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For instance, in computer-based instruction (CBI) where students learn from the computerized program, research studies have shown that learning with instructional guidance yielded superior learning outcomes regarding student achievement and performance (de Jong and van Joolingen 1998; Swaak et al. 1998).

As compared to traditional CBI, students now learn with and through new types of media, such as blogs, microblogs, and wikis, owing to the boom of social media and Web 2.0 technologies (Ito et al. 2010). These web-based learning environments differ from traditional computer-based learning because they allow flexible courseware modification, broad accessibility, and unlimited free online resources and materials (Greenhow et al. 2009). How students best learn in Web 2.0-supported learning environments and how to design effective Web 2.0-based instruction are of keen interest to researchers and educators (Craig 2007; Greenhow et al. 2009). Microblogs are a subset of Web 2.0 tools that permit users to publish short messages to be shared with other users on the Internet (Java et al. 2007). A great number of researchers (see, for example, Ebner et al. 2010; Gao et al. 2012) have argued that microblogging, in particular, holds great promise for enhancing student learning. Although researchers have found that student participation and engagement can be heightened in microblogging-based learning environments, challenges such as information overload and difficulties in engaging in deep learning may often coexist (Ebner et al. 2010; Junco et al. 2011; Luo 2014). In this study, microblogging-based learning was measured using student participation, focus on task, and depth of thinking as parameters. Furthermore, despite the pivotal role of instructional guidance in computer-based learning, current literature base has barely touched on the effects of instructional guidance in new Web 2.0-mediated learning environments, including microblogging tools. The purpose of the current study, therefore, was to explore the role of instructional guidance in such microblogging-supported learning environments and investigate the pedagogical implications of instructional guidance in microblogging-based learning.

Research on instructional guidance

Seminal instructional theories and models have all emphasized the importance of instructional guidance. For example, in Gagné's (1965) classic model, providing learner guidance is among one of the nine critical events of instruction that instructors should use to optimize student learning. By providing students with instructional guidance on how to learn the material under study, learning increases because students are more likely to achieve the lesson's objectives. Instructional guidance involves a wide variety of learning strategies and pertinent resources on the subject domain. Scaffolding techniques, such as providing cues, hints, and prompts that can be removed after the student has mastered the task or content, are often used to help novice learners (Hogan and Pressley 1997). Learning strategies such as mnemonics, concept mapping, visualizations, and graphic organizers are other forms of guidance that instructors typically use (Baddeley 1999; Mayer 2001; Novak and Canas 2008).

Instructional guidance is often undertaken by human instructors. Instructor-initiated human guidance, as compared to computer-programmed guidance, can be multifaceted, elaborate, diverse, and flexible (Webb 2009). Instructors can provide accessible domain-specific information as a form of guidance (Leutner 1993). They can model dialogue practices, design tasks for specific learning goals, and create activities to smooth group participation (Webb 2009). Expert modeling, providing study guides, resources and tools are also forms of instructors' guidance and scaffolds (An 2010).

In traditional computer-based instruction (CBI), instructional guidance is often embedded in the computer-based learning environment as part of the simulated, and often automated computerized mechanism. In other words, the design of CBI itself often incorporates various forms of self-embedded instructional guidance with the computer-based instructional system. For instance, adjunct questions (Holliday and McGuire 1992), sentence openers (Cho and Jonassen 2002), argumentative ontology (Schwarz and Glassner 2007), and prompts and cues (Lin and Lehman 1999) are typical types of instructional guidance provided by the computer-based medium. Essentially, CBI takes on the instructor's role not only to present learners with the subject material, but more importantly, to provide learners with a response system from which they can continuously receive feedback.

In contrast to instructional guidance embedded in the design of CBI, Web 2.0-supported learning environments often require instructional guidance from human teachers (Salmon 2004). Many Web 2.0 technologies, which are user-centered communication technologies by nature, are repurposed to serve educational needs (Craig 2007). Therefore, computerized instructional guidance as an embedded function is often absent in Web 2.0-supported learning environments, thus making the role of human instructor increasingly critical. In many e-learning course settings, the significance of guidance from human instructors has been largely discussed (Mazzolini and Maddison 2003; Paloff and Pratt 2001).

Researchers have further cautioned that the effect of guidance is also contingent on the medium; whether it is face-to-face and synchronous or computer-mediated and asynchronous, communication influences the impact of instructional guidance (Asterhan and Schwarz 2010). What we know from the literature about instructional guidance in face-to-face or CBI settings may not be easily generalized to learning in Web 2.0-supported environments. Due to a dearth of empirical research on investigating instructional guidance with regard to Web 2.0 technologies, it is necessary to explore its role in this increasingly popular learning environment.

Microblogging tools in education

In recent years, microblogging has garnered researchers' and educators' increased interest due to its promise for education. Microblogging tools can enable students to participate and engage in learning activities on a much wider scale, sustaining their in-class interaction as well as expanding the learning content (Gao et al. 2012). By posting a small amount of text on microblogging platforms in concurrence with the mainstream channel of communication, students can benefit tremendously through a

back-channel communication that enables active and immediate virtual participation, especially in a large lecture-hall settings (Elavsky et al. 2011). Microblogging can also open new opportunities for classroom discussion and formative assessments (Elavsky et al. 2011; Kop et al. 2011; Ross et al. 2011). Current research has revealed that with microblogging, students are able to participate in classroom discussion at a level that they would not normally be able to achieve otherwise (Ebner and Maurer 2009; Junco et al. 2011).

In addition to augmenting students' participation in classroom discussion, educators have also employed microblogging to facilitate a variety of collaborative learning activities. In McWilliams et al.'s (2010) study, students participated in a microblogging-based literacy activity to practice their writing and reading in the language under study while assuming the roles of different characters in a play. Likewise, Holotescu and Grosseck (2009) designed six collaborative learning activities with a microblogging platform called Cirip.ro to boost students' responsiveness to class discussion, and provide opportunities for collaborative learning. Perifanou (2009) concluded that the in-class microblogging activities employed in her study promoted collaboration, motivation, and participation of the students in her language class.

Current microblogging-based research makes a strong argument for instructional guidance when microblogging tools are used, as the amount of extraneous information on Twitter may overwhelm and distract students. In Luo and Gao's (2012) study, students reported that it was difficult for instructors to track and attend to specific tweets when a large number of tweets were aggregated simultaneously. Indeed, irrelevant information being posted simultaneously with the conventional online discussion or face-to-face lecturing brings nothing but distraction (Holotescu and Grosseck 2009). Likewise, Ebner et al. (2010) cautioned that microblogging can sometimes lead to "an unwieldy information flow, known as information overload" (p. 98), regardless of its affordance in facilitating communication. Findings from research studies suggest that an unfamiliarity and lack of prior experience in using Twitter educationally may result in students finding it difficult and intimidating to use (Agherdien 2011; Cohen and Duchan 2012; Costa et al. 2008).

Purpose and research questions

Given the importance of providing instructional guidance in microblogging-based learning environments, it is vital to develop an in-depth understanding of how instructional guidance facilitates student learning in microblogging- supported learning settings. Despite the strong call for instructional guidance in microblogging-supported learning as evidenced in previous studies, there has been a limited amount of rigorous research on examining the effect of instructional guidance in such settings. Not a single research study has evaluated the effects of student learning in microblogging-based learning environments supported with different levels of instructional guidance. The present article builds on current literature on microblogging-supported learning and further examines the effects of instructional guidance by comparing student learning with or without the presence of

instructional guidance. By primarily focusing on the impact of instructional guidance in formal classroom learning settings, this study also offers insights on how to design and facilitate student learning with microblogging tools.

This multiple case study explored the role of instructional guidance in microblogging-supported learning environments and investigated the pedagogical implications in microblogging-based learning across different cases in a college-level hybrid course. The study examined the relative effectiveness of instructional guidance mode (guided and semi-guided) versus unguided in facilitating student learning with respect to (a) amount of participation, (b) focus on task, and (c) depth of thinking. In addition, this study examined student perceptions of the use of microblogging tools across three different cases where these varying types of instructional guidance mode were implemented. The research questions were:

1. How does microblogging-supported learning in guided, semi-guided, and unguided modes differ from one another when considering (a) amount of participation, (b) focus on task, and (c) depth of thinking?
2. How did students perceive microblogging-supported learning across three cases with different instructional guidance modes?

Methods

To answer the research questions, this study employed a multiple case-study design. Case studies in general tackle *how and why* questions especially through multiple sources of evidence (Yin 2008). Although a single case provides opportunities to make an in-depth investigation of a single case, it is often criticized by its lack of representativeness, generalizability and the restrictive nature of the research design (Yin 2008). Therefore, evidence from multiple cases is often more reliable and, consequently, results and conclusions derived from this type of design tend to be more powerful (Herriot and Firestone 1983). Furthermore, the multiple case study design is effective in providing diverse perspectives on pedagogical issues that shed light on teaching practices (Divaharan and Lim 2010). In this study, three different case studies were cross-examined in order to provide an in-depth understanding of the research questions.

Setting

The three microblogging-supported learning cases took place at different times in a single college-level hybrid course designed for pre-service teachers. The course was offered at a Midwestern university as a required course for all education majors on various levels. The major purpose of this course is to acquaint students with technology applications commonly found in educational settings. The class met three times face-to-face throughout a 15-week semester and the remaining course work was completed online. Each week, students read textbooks and online articles on issues of technology integration with a focus on certain concepts and online

applications, learned practical skills to use a few tools, and discussed their potential integration in the classroom. The expected learning outcomes were that students would be able to use a wide variety of emerging Web 2.0 technologies to develop or enhance classroom instruction.

Implementation of microblogging-based activities

The implementation of microblogging-based activities varied significantly in the three cases, according to the differences in guidance mode. However, a few logistical variables were held constant across the three cases to ensure the comparability: (a) the implementation of microblogging served as a supplemental, back-channel communication while the principle learning activity was taking place concurrently in a face-to-face classroom setting; (b) the implementation was done by the same instructor in the same course, although at different times during semester; and (c) the duration of microblogging-supported learning in each case was approximately 1 h. Table 1 provides a summary of the microblogging implementation in each of the three cases. Table 2 displays a summary of variations in instructional guidance across the three cases.

Case 1: Guided microblogging to support lecture

Case 1 adopted a full instructional guidance mode where students were guided through the 1-h classroom learning. The learning objective of the lesson was to demonstrate how microblogging, as a Web 2.0 tool, can be integrated into classroom learning. The microblogging tool used in this study was Twiducate (www.twiducate.com), a variation of Twitter geared towards K-12 students. Twiducate was chosen as a beginning step for microblogging use because it offers a relatively closed and clean environment with few distractions. Instructional guidance in Case 1 included pre-course preparation events prior to the lesson and prompts and cues during the 1-h lesson. In advance of class, students were asked to familiarize themselves with the Twiducate environment and socialize with each other using the tool. The instructor used 5 min at the start of class time to walk through major functions in Twiducate with students, and shared a set of tweeting guidelines on Twiducate to inform students the expected means of participation.

Table 1 A summary of the microblogging implementation across three cases

	Participants	Front-channel learning	Microblogging tool adopted
Case 1	18	The instructor was lecturing use of social networks in education	Twiducate
Case 2	23	Students doing a teaching presentation	Twitter
Case 3	22	Students presenting online learning sites designed by themselves	Twitter

Table 2 A summary of variations in instructional guidance across three cases

	Guidance mode	Pre-class training	Prompts and cues	Tweeting time allocation	Reminders
Case 1	Guided	Yes	Yes	Yes	Yes
Case 2	Semi-guided	No	Yes	No	Yes
Case 3	Unguided	No	No	No	No

During the in-class activity, students were instructed to post questions or comments on Twiducate anytime at their own discretion while the instructor lectured. In addition, the instructor paused her lecture twice to give prompts and cues that promoted discussion to occur on the microblogging platform, thus creating a designated time interval for students to think and discuss issues around the instructor's prompts on Twiducate in the middle of the lecture. The two prompts were: (a) how can teachers integrate microblogging into their own classrooms? (b) what are the benefits and constraints of incorporating microblogging incorporation in the classroom?

Case 2: Semi-guided microblogging to support student mock teaching activity

In Case 2, microblogging was implemented to facilitate the students' mock teaching project. The primary instructional event was a mock teaching session that involved students teaching a chapter from the textbook. The chapter had to focus on a specific type of technology that can be integrated into instruction. Students were asked to set up a Twitter account early in the semester. Prior to the mock teaching, students were instructed to open their Twitter account and be prepared to tweet. During their colleague's mock teaching, the rest of the class was instructed to tweet their (a) thoughts and concerns on how they would personally integrate the tools being taught by their peers in the classroom, and (b) comments and feedback on their peers' teaching presentation. The instructor reminded students to provide feedback on Twitter a few times during the mock teaching, but no designated time period was allocated for students to use microblogging. All tweets were posted simultaneously along with the students' mock teaching session.

Case 3: Unguided microblogging to support student presentation activity

In contrast to the above two cases, the microblogging integration in Case 3 was implemented without any instructional guidance. The students' main task was to present their final project in which they had designed and created an online learning course, working in groups. Each group of students had to explain what each member did for the project and showcase the design process and final product. Like Case 2, the use of Twitter was intended to encourage instant and virtual feedback on students' presentations. Prior to the presentations, the instructor stated that students

should use Twitter for comments and feedback. No instructions, prompts, or reminders were given to guide students' writing on Twitter during the session.

Participants

Participants were students (age range 18–22 years) enrolled in an undergraduate course on educational technology. The number of participants in each case varied depending on the attendance of that particular face-to-face class. Table 3 presents students' demographic information, self-rated technological literacy level, and their prior experience with the microblogging tool, Twitter. Students' self-rated technological literacy level was assessed by asking students to rate on a scale from 1 to 5 their own familiarity level with technology by answering the question, "How quickly can you learn a piece of online tools or a piece of software/online program?" Students' Twitter profile information was accessed from their Twitter accounts. Overall, characteristics of participants across the three cases on all the above-mentioned levels were homogenous. ANOVA was used to test the mean difference of all the parametric parameters (age, technological literacy, average # of tweets per student, average # of followers, average # of people followed) and no significant differences were found among the participants in the three cases ($p > .05$).

Data collection and analysis

The major data sources include students' tweets, blog reflections, and survey responses. Students' tweets were collected immediately after the completion of the activities. Tweets on Twiducate were copied and pasted using the print function in Twiducate, whereas tweets on Twitter were collected using hashtags edct2030 and ct2030. Students filled out a pre-course survey listing their demographic, technological literacy level and prior experience with microblogging tools at the beginning of the course, and an end-of-course survey of their perceptions about their

Table 3 Participants' demographic information, technological literacy level and Twitter profile

	Gender		Age	Techno-logical literacy	Having a Twitter account prior to course?		Average # of tweets per student	Average # of followers	Average # of people followed
	F	M			Yes	No			
Case 1	12	6	20.33	2.61	13	5	1083	82	98
Case 2	14	9	20.41	3.22	17	6	1113	106	150
Case 3	14	8	20.13	3.19	16	6	1108	102	139

microblogging experience. In the blog reflection assignment after each microblogging activity, students were instructed to answer the following questions: (a) How was your in-class microblogging learning experience? (b) Have the incorporation of microblogging helped you learn? Please provide detailed rationales to your answers. (c) Do you have any suggestions to improve the incorporation of microblogging? If yes, please state them in detail. All data were collected to answer the research questions.

Amount of participation

The number of tweets posted has been one of the critical criteria and a logical indicator to evaluate participation in microblogging-based learning activities across various studies (Ebner and Maurer 2009; Elavsky et al. 2011; Junco et al. 2011; Kop et al. 2011; Wright 2010). Therefore, the following were calculated for analysis: (a) total number of tweets, (b) total number of characters (not including spaces), and (c) average number of characters in each tweet. Given the difference in the number of participants across the three cases, the researcher also added the (e) number of tweets posted per person and (f) the number of characters tweeted per person.

Content analysis of tweets

A content analysis was conducted to compare students' focus on tasks and depth of thinking across the three cases. A review of coding schemes used by previous researchers suggested that there has not been a commonly adopted instrument to evaluate microblogging-based learning in that researchers have developed different coding schemes to fit the purpose of the study and activities examined. For example, students' tweets in Elavsky et al.'s (2011) study were coded into 11 categories, including type of tweet, (i.e., original post, retweet, or direct reply), aim at whom the tweet was directed, construction (whether and how the tweet was related to class and its discourse, and more. Ross et al. (2011) coded the tweets from a professional conference into seven categories: comments on presentations, sharing resources, discussion and conversations, jotting down notes, establishing an online presence, and asking organizational questions. They further split them into two larger groups: "information providers" indicating people who provide comments on presentations, share resources, jot down notes, and "whispering in class" denoting people who did not provide useful information about the conference or its themes but tweet to establish their own identity, show their online presence, or to network with other members of the community. Naaman et al. (2010) found that when no specific purpose was provided, Twitter users typically were engrossed in (a) posting messages about themselves or (b) more informative, conversational engagement with their followers. Specific categories in their coding scheme were: information sharing (IS), self-promotion (SP), opinions/complaints (OP), statements and random thoughts (RT), me now (ME), question to followers (QF), presence maintenance (PM), anecdote me (AM) and anecdote other (AO).

Therefore, due to the lack of universal content analysis framework, the researcher employed the open coding analysis approach (Corbin and Strauss 2008), a

methodology that mainly relies on grounded theory (Charmaz 2006; Glaser and Strauss 1967), while more specific pre-established coding schemes as mentioned above also shed light for this study. The researcher first read and reread all of the tweets and coded them into different categories and sub-categories aimed at exploring students' focus on task and depth of thinking, per the first research question. Based on these categories, about one-third of the tweets (N = 70) were randomly selected and coded by an external researcher to determine intercoder reliability. Both the categories on focus on task categories (Cohen's Kappa = .88) and the categories on depth of thinking (Cohen's Kappa = .74) turned out to have good level of agreement, according to Landis and Koch's (1977) benchmarks. Any disagreement was later resolved through discussion.

To evaluate whether or not microblogging helped students to *focus on tasks*, all tweets were coded as being either "on-task" or "off-task." Tweets that directly answered questions or contributed to the conversation of front-channel communication (lecture or student presentation) were coded as on-task, whereas the

Table 4 Rationales and examples of on- and off-tasks tweets

Categories	Rationales	Tweet examples
Off-task	Tweets that are not pertinent to the lecture, student teaching or presentation topic	Love knowing how plants grow #edct2030 last class of the semester!!!!! where did the time go?!
		Last #EDCT2030 class of the semester!!!
	Tweets that are not thoughts, feedback or comment, but only self-expressions of feelings	#edct2030 presentation complete! WABAM!
		I can't sit still
		Takes me back to high school Spanish. #edct2030
	Tweets that do not serve audience of the class	In my technology class so ignore my tweeeeeeeets pweeeeease tweeting for my tech class…it's required. Just ignore them
On-task	Tweets that respond to the questions or prompts	Students can use it to post questions they have on homework or projects on twiducate and other students can respond and help them out
		In a history class setting, it could be possible to use twiducate to answer pop quiz questions
	Tweets that reflect a certain level of thinking on the discussion topic	I think the virtual world thing would be really neat for kids who have to miss class. It's like being there without being there. #ct2030
		I dont mind Wikki, but it should be monitored…but since its a non profit org no one will get paid. Leads to false information #ct2030
	Tweets that are comment or feedback to the presenters	It's very creative #edct2030
		Text is very hard to see on this slide #ct2030
		Topic might be too advanced for 5th graders #edct2030

remainders were all considered off-task. The categories and example tweets are shown in Table 4.

Regarding *depth of thinking*, on-task tweets were teased out and classified into sub-categories. An initial set of categories were created by examining the tweets one by one (Strauss and Corbin 1998) and then reassessments and revisions were made until further analysis did not provide any new information or insights. All tweets were classified into three levels of depth as evidenced in the microblog posts: Level 1 were brief comments or responses that contained less than ten words and reflected little or no thinking; Level 2 were elaborated comments that were longer in length, pertained to specific content, and reflected some level of thinking; Level 3 were critiques that involved identifying problems, brought up in-depth thoughts and

Table 5 Classification of on-task tweets

Levels of thinking	Category of on-task tweets	Tweet examples
1	Brief comments or responses to prompts	Great job group 2! #ct2030
		Cool prezi = D #edct2030
		I like your topic #edct2030
		So that groups can work together
		Work together in order to succeed in this class
		To learn what assignments are due that day
2	Elaborated comments and responses	The video example you used was really good and helpful to understanding wikis and how students are using wikis! #ct2030 #edct2030
		Excellent topic, very interesting and seems like a very fun way to learn the information! #GoodJob #edct2030
		I thought the video was interesting and I think it's a great way for kids to communicate with others and be involved with all the discussions
		Twitter in the classroom allows students to voice their opinion without having to speak in front of the class
3	Identifies problems	Having some issues reading your slides #blindasabat #ct2030
		The text was extremely difficult to read on some of the slides, ex: using black text and dark background. #ct2030 #edct2030
3	In-depth thoughts and concerns	Shy kids may feel more comfortable about talking via Twitter/twiducate/etc. but they need to break out of their comfort zones and learn how to actually have a face to face discussion, or they are going to be stunned by their lack of social skills when they get out into the real world
3	Questions raised	Can wikipedia shut down your wiki site that you created? If so, what do they see as requirements for termination? #ct2030 #edct2030
		How can Wiki's restrict the editing on the content area to make sure that all information presented is factual? #ct2030
		What happens if the students start using it inappropriately and it is blamed on the teacher?

concerns, or raised questions, which reflected critical thinking. The categories and example tweets are shown in Table 5.

Student perceptions

An end-of-course survey was used to examine students' perceptions about their microblogging experience in each microblogging-based learning case. The survey consisted of four Likert-scale items on students' in-class experience and four items on the effectiveness of microblogging-supported learning on varying dimensions, including knowledge construction, focus on task, and classroom interactivity. Student experiences in three activities with variations in instructional guidance were measured independently. A six-point Likert scale ranging from strongly disagree to strongly agree was used purposefully to force orientation of students' perspectives. In addition, follow-up open-ended questions asked students to explain their responses to the Likert-scale survey questions and describe in detail how they participated in the in-class activities. Students' blog reflections were collected at the end of the course, which were read closely and triangulated with responses to the open-ended questions in the end-of-course surveys to provide a deeper understanding of students' perceptions of the pedagogical effects of microblogging tools and how instructional guidance made a difference to their learning experiences. Some additional quotes in student blogs were used to provide further insights on student perceptions.

Results

Amount of participation

Table 6 presents data on the number of tweets in differently guided modes as the indicator of student participation. Students in the fully guided mode tweeted fewer times than those in the semi-guided and unguided modes. However, when guided, the number of characters that each student wrote was much higher as compared to the unguided mode. In the semi-guided mode, the number of student tweets was similar to the unguided mode, but students wrote more characters in the semi-guided mode as compared to the unguided mode. It seems that, as the level of instructional

Table 6 Number of tweets and length of tweets

	N	# of Tweets	# of Posts per person	Total # of characters	# of Characters per post	# of Characters tweeted per person
Guided	18	55	3.05	5132	93	285
Semi-guided	23	86	3.74	5689	66	247
Unguided	22	81	3.68	3746	46	170

guidance increases, students tend to write more characters, but with less frequency. According to results from Chi square tests, there is strong statistical evidence of a relationship between instructional guidance mode and the number of tweets ($\chi^2 = 7.49$, df = 2, $p < .05$), number of characters per post ($\chi^2 = 16.28$, df = 2, $p < .05$), and number of characters per person ($\chi^2 = 80.56$, df = 2, $p < .05$).

Focus on task

Table 7 displays the number of on-task and off-task tweets across the three instructional modes. The results of a Chi square test indicated that instructional mode made a difference on the focus of students' tweets ($\chi^2 = 37.88$, df = 2, $p < .001$). As more instructional guidance was provided, the number of on-task tweets increased dramatically. In fully guided mode, all tweets were focused on the learning task. In other words, when instructional guidance was supplied students tended to focus more on their learning tasks, in this case, posting more course-related tweets.

When instructional guidance was lacking, almost half of students turned to tweet about irrelevant topics, as is seen in the unguided mode. This result is similar to previous studies, indicating that a large portion of learners tend to "whisper in class" in unguided, free learning environments (Ross et al. 2011). Among these off-task tweets, a majority of tweets were students' expressions about their feelings and random thoughts that were not relevant to the learning topic, similar to Naaman et al. findings (2010). Interestingly, a few students intentionally tweeted to warn their followers to ignore the tweets posted for the class. Excerpts from students' off-task tweets are provided in Table 4.

Depth of thinking

A Chi square test showed that there was also a relationship between type of guidance mode and the depth of thinking ($\chi^2 = 88.11$, df = 6, $p < .001$). As illustrated in Table 8, students in the guided mode produced tweets that reflected deeper thinking than those in the unguided mode. The amount of shallow thought, represented as small bursts of information, was considerably higher when little guidance was supplied. Students were much more inclined to tweet only a few words such as *good job, well-done, or I like your presentation*. Unfortunately, this type of comment hardly involves any deep thinking but only a manner of showing support or agreement. It seems that as the provision of guidance increases, so did the levels of student thinking.

Table 7 A distribution of on- and off-task tweets across three instructional guidance modes

	On-task	Off-task	Total
Guided	55 (100 %)	0	55
Semi-guided	62 (72 %)	24 (28 %)	86
Unguided	42 (52 %)	39 (48 %)	81

Table 8 Depth of thinking across three instructional guidance modes

	Level 1	Level 2	Level 3	Total
Guided	11 (20 %)	36 (65 %)	8 (15 %)	55
Semi-guided	20 (32 %)	20 (32 %)	22 (36 %)	62
Unguided	31 (74 %)	9 (21 %)	2 (5 %)	42

What is equally worth noting is that, in fully guided mode, the proportion of students' tweets that revealed the depth of thinking was lower compared to the semi-guided mode. With moderate guidance, the number of posts was almost evenly distributed across all three levels of depth of thinking. However, with full guidance, the number of critiques, concerns, and questions that reflect higher-level thinking were unexpectedly much lower than the elaborated comments and responses types of tweets. As illustrated in the Level 3 column of Table 8, the semi-guided mode generated the largest proportion of high-level tweets that represent the highest level of learning. Noticeably, among the Level 3 tweets, many were written in the form of a question.

In summary, the findings reveal that student learning with regard to the amount of participation, degree of focus-on-task, and depth of thinking vary significantly across the three cases. Overall, students in the fully guided modes were more likely to engage in deeper levels of learning. Figure 1 graphically illustrates the variation between the three cases.

Student perceptions

Survey results

Given the small sample size in each case, data were only examined using descriptive analysis. Means and standard deviations of the Likert-scale survey items are presented in Table 9. Overall, it appears from the self-report data that students had a

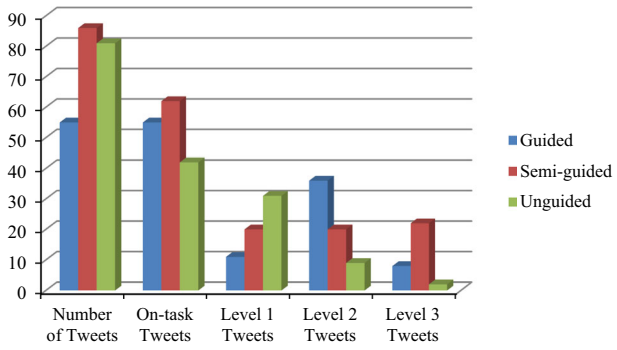

Fig. 1 A summary of student tweets across three cases

Table 9 Student ratings on perceptions of using microblogging tools on a scale of 1 to 6

Survey items	Guided Mean (SD) N = 18	Semi-guided Mean (SD) N = 23	Unguided Mean (SD) N = 22
My overall microblogging experience was bad.	2.75 (0.85)	**2.31** (1.03)	2.71 (1.12)
I was highly involved in the class	**3.60** (0.94)	3.54 (1.04)	3.21 (1.33)
My critical thinking was enhanced	3.70 (1.08)	**3. 89** (0.83)	2. 91 (0.96)
I had a lot of fun participating in microblogging-supported activities	**4.41** (1.02)	4.20 (1.00)	4.36 (0.89)
The microblogging integration helped me to effectively construct my own learning	**4.43** (1.67)	3.63 (1.37)	3.60 (1.24)
The microblogging integration helped to effectively focus on learning the topic	4.28 (0.89)	**4.53** (1.08)	3.23 (1.26)
The microblogging integration helped me to effectively express my own understanding	4.54 (1.21)	**4.79** (1.28)	4.63 (1.05)
The microblogging integration helped me to effectively interact with my classmates	3.95 (1.04)	4.54 (1.19)	**4.74** (0.92)

1 = strongly disagree; 2 = disagree; 3 = slightly disagree; 4 = slightly agree; 5 = agree; 6 = strongly agree

pleasant experience in the microblogging-supported learning. The majority of them reported being highly involved in the tweeting activities, practiced a certain level of critical thinking, and had fun tweeting. The survey results also revealed that students believed that microblogging integration helped them learn. Students reported that they were able to focus on the learning topic, construct their own learning, express their own understanding, and interact with their classmates.

Student ratings were relatively homogenous across the three instructional guidance modes. The most consistently-rated items were "I was highly involved in the class," "I had a lot of fun participating in microblogging-supported activities," and "The microblogging integration helped me to effectively-express my own understanding." Surprisingly, when comparing ratings in the guided mode versus semi-guided mode, students rated the semi-guided microblogging activity higher than the guided microblogging activity on half of the items, including critical thinking, focus on learning the topic, and expressing understanding. The students' ratings of the unguided microblogging activity were almost the lowest on all the items. However, during the unguided session, students tended to interact more with their peers as also indicated by the last item, which was rated the highest by students in relation to the no instructional guidance activity. The highest rating for each item is highlighted in bold in Table 9.

Results from open-ended questions and blog reflections

Students' responses to open-ended questions and blog reflections also provided insights into their perception of the microblogging-based learning experience. First,

more than half of the students commented that the microblogging integration had multiple educational benefits. Students recognized the considerable potential of using Twiducate, especially in guided environments. For example, one student commented, "It is a great way for students to communicate with each other and their teachers whether they are at school or at home. It provides many new ways of learning and allows students to use technology that they might not have an opportunity to use otherwise." More than half of the students noted the benefits of microblogging to encourage participation from reticent students: "I think that it can easily increase social presence for a class because shy students who usually don't enjoy speaking in front of the class can voice their opinion without actually speaking. People can also post as many ideas as they wish without interrupting other peers." During the time when guidance was absent, there were fewer positive comments, but many students recognized that Twitter holds promise for keeping them engaged, enabling more interaction with the instructor and peers, and receiving feedback. For example, one student stated, "I felt very involved and interactive with my classmates, I was able to view their opinions of the activities and what not we were going over. I enjoy Twitter and think that it gives students and opportunity to express their opinions." Several students also stated that using Twitter is particularly well suited to an online class since it can help students maintain contact virtually: "I think it is most useful because we are able to communicate with peers using Twitter even when not seeing them on a daily or even weekly basis."

Students also reported concerns and challenges they encountered when using microblogging for learning, which were found more often in the semi-guided and unguided cases. The most commonly noticed issue was distraction. Although many students stated that microblogging was engaging and helped them to stay focused on the class discussion, five students pointed out the problem of distraction, in either blog reflections or surveys. Without guidance, most students also perceived the utilization of Twitter as lacking "salient learning purposes and justification." A few students attributed the reason they did not enjoy tweeting in class to their belief that Twitter should be used only for social interaction and communication. For instance, one student commented, "I only use Twitter to talk to friends and I don't want it to be used elsewhere. It should only be used socially rather than for academic purposes." Another student commented, "I knew how to use Twitter and I'd like to stick to the way I use it." Students reported that they sometimes also found it difficult to view all the tweets as feedback coming in all at one time in the presentation. "It was overwhelming and difficult to read." Additionally, the 140 characters limit restricted the number of words students were able to write, thereby "interrupt[ing] the flow of thoughts."

Students' suggestions for improving the activity reinforced the need to provide instructional guidance. One student suggested allowing a certain amount of time to tweet after the presentations concluded, which is exactly how the instructor implemented the Twiducate activities in the guided mode. Several students also suggested that being grouped into smaller units and limiting the duration of microblogging-supported activities may help them learn better in the microblogging-environments. As one student suggested, "I would split the classes up and

shorten the time, that way people are more attentive and more productive." All these suggestions aiming to improve the effectiveness of microblogging integration from students' perspectives seem to indicate that at least some of the students wanted more instructional guidance embedded as part of microblogging-based learning.

Limitations

This study had several limitations. First, results from classroom research are often confounded by multiple external factors. Although the researcher strived to maintain equivalence across three cases, such as ensuring a comparable level of individual difference among students and keeping a consistency in the specificities of Twitter implementation, the variations across three cases still may have influenced the findings. Differences in student samples, choice of microblogging tools, purposes of adopting microblogging, and implementation details may yield different findings. Additionally, a *history threat* and *novelty effect* might have occurred during the research implementation. Other historical or external factors may be responsible for the difference in student tweeting behavior and perception, instead of the guidance as an intervention itself. As the same sample was used across three activities at staggered times during the semester, students might have tended to be less likely to stay on task after the initial motivation and enthusiasm faded out.

Discussion

As Web 2.0 tools are becoming increasingly common in educational settings – especially in higher education—questions on how to guide, monitor, and optimize their use effectively have become more pertinent (Davis et al. 2013). The current study aimed to take an initial step toward answering the question of how instructional guidance influences the success of microblogging-supported learning activities. Although the three cases were not parallel on all dimensions, findings from this multiple-case study nevertheless offer unique insights. Compared to an unguided mode, students in the guided environments appear to have been more focused on learning topics and engaged in course-relevant discussion. The depth of thinking that occurred in guided environments was also far deeper than in the unguided mode. From the findings of this study, it appears that if educators utilize the tools in an adequately guided manner, microblogging can be a fun, meaningful, and engaging experience for students.

The important role that guidance plays in microblogging-based learning may be explained primarily from two perspectives. First, instructional guidance helps to eliminate distractions, and reduces extraneous cognitive load. Since learners' working memory is easily overloaded in computer-assisted multimedia learning environments, instructional guidance can be of exceptional help to reduce cognitive overload (Mayer 2004). Similarly, while microblogging is a new type of media that

has not been extensively studied with regard to instructional guidance, results from this study suggest that the presence of instructional guidance helped students stay focused on tasks. These findings are similar to prior studies that found other forms of distraction from microblogging (such as irrelevant noise or initiating conversations with people outside of class) could largely be reduced with the aid of instructional guidance (Dunlap and Lowenthal 2009; Holotescu and Grosseck 2009; Luo and Gao 2012). Second, instructional guidance is important for microblogging-based learning because the way microblogging tools like Twitter are employed in the classroom is rather different from the way students use it on a daily basis. When unguided, almost half of the students chose to use Twitter to post content unrelated to the course; and among the on-task tweets, about two-thirds were simply small bursts of emotional support and agreement. None of those two types of tweets is indicative of particularly deep thinking about the task at hand. Ito et al. (2010) have suggested that engaging with these tools has become an integral part of youth's social and recreational lives; they provide a way for the younger generations to craft and display their unique social identities and they do not want to be observed by their instructor or interrupted. Repurposing these social networking tools for the classroom requires instructional guidance in order for any learning to occur in such microblogging-supported environments.

The type, amount, and duration of instructional guidance provided also matters. Students seemed to engage in a deeper-level thinking in the semi-guided environment (only prompts and a reminder) than in the fully guided one (including pre-course training, prompts and cues, timed activity, and reminders). A large proportion of Level 3 tweets from students in the semi-guided mode took the form of probing questions, which is a representation of higher-order learning (McGlathery 1978; Redfield and Rousseau 1981). In contrast, in the guided modes students tended to tweet supportive statements rather than provide a conflicting or alternative view. This finding is analogous to what Wu and Tsai (2011) discovered about guidance in online searching tasks. They found that guided instruction is more helpful to transfer lower-level reasoning skills such as constructing supportive arguments, instead of skills with higher complexity like rebuttal construction. Early studies indicated that excessive directions and control can sometimes work against advanced learners (Deci and Ryan 1987; Ryan and Grolnick 1986), which may explain the findings of the current study as most students considered themselves to be advanced in their technological literacy. Without more information about the students and accurate measures of guidance, it is unwise to make any conclusions about why the semi-guided mode seems to be more effective than the fully guided one in this study. Future research may alter these variables in a precise and measurable manner and investigate their effects on student learning.

This study offers pedagogical implications for practice in microblogging-supported learning. It appears that instructional guidance should always be provided with salience, explicitness, and consistency. As has been found in other research, this study again shows that students need to be guided or otherwise they will easily switch to their habitual ways of using microblogging tools. For example, students should be clearly informed of the purposes of using microblogging and guided through a progressive ongoing process. Advanced training of microblogging use for

learning may be needed prior to the class in order to educate students and transform their habitual use, especially for those with existing usage patterns. Small-group collaborative microblogging activities will allow more opportunities for personal and specific feedback as well as reduce the amount of distraction. Timing tweeting tasks and allowing intervals for students to tweet between each activity can help students stay more focused on the learning tasks. Lastly, instructional prompts and cues should be given explicitly and repeatedly in microblogging-based learning. Diversification in forms of prompts and cues including verbal, visual, and textual may also be considered in order to accommodate individual differences.

Conclusions

Improving learning in Web 2.0 environments has been highlighted in contemporary education (Greenhow et al. 2009). The current study chose to explore microblogging as a subset of Web 2.0 tools and investigated changes in student learning experiences given different instructional guidance modes. This study confirms the importance of instructional guidance, as students in guided environments were more involved, focused on task, and engaged in deeper thinking. However, it is premature to determine the adequacy of type, quantity, or duration of learning ideal for microblogging-based learning as these factors were not measured in the current study. Future studies may advance research in microblogging integration with respect to further examining these variables. Other factors, including the setting (such as face-to-face vs. an online class), goal of the learning activity (such as to learn argumentation skills vs. to improve English writing), and selection of microblogging tool (Twitter vs. Tumblr) could all be of potential interest for future research.

Given the limitations of the study, future researchers should be cautioned when making generalizations of the findings from this study to other settings and populations. It is also notable that the duration of each microblogging implementation was only an hour. A longitudinal study that involves a long-term integration process may lead to different conclusions. Third, the limited sample size in each case also restricts the generalizability of results. Future studies with a larger sample size may provide further insights on the role of instructional guidance in microblogging-based learning. Last but not least, student tweets as an indicator for learning does not fully capture all important dimensions of student learning. Identifying new methods to measure student learning through microblogging may be worthwhile to pursue for future researchers.

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