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Incorporating microblogging (“tweeting”) in higher education: Lessons learnt in a knowledge management course

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A B S T R A C T

This paper features a competency-enhancing social networking application which provides a solution for the dilemma of non-participating (non-engaged) students in class: ‘pedagogical tweeting’. Twitter’s micro-blogging service enables both instructors and students to send and read messages (tweets) of up to 140 characters, incl. links to blogs, web pages, photos, videos, etc. As Twitter can be accessed from a website, via applications on PC/Mac, iPhone, Android phones, etc., it represents an effective tool to engage students, e.g. by taking up questions during in-class and out-of-class discussions or by providing advice on assignments etc. Students in turn can generate their own learning context and benefit from collaborative knowledge creation. We share respective tweeting experiences made during a course on Knowledge Management (KM) taught at Singapore Management University (SMU) backed up by exploratory research on students’ micro-blogging activities. We discuss challenges ahead and propose four hypotheses about the effective deployment of social awareness streams such as Twitter in higher education.

Keywords:

Twitter (micro-blogging)
Higher education
Blended learning
Singapore

1. Introduction

One of the latest Web 2.0 technologies which can support learning is microblogging (Arnold & Paulus, 2010; Ebner, Lienhardt, Rohs, & Meyer, 2010; Elavsky, Mislan, & Elavsky, 2011; Leaver, 2011; Savage, 2011). Micro-blogging via Twitter represents a new form of classroom communication, enabling both instructors and students to send and read messages (tweets) of up to 140 characters to each other. The application works as follows: (i) every member of the class (including the instructor) creates a new Twitter account or use their existing Twitter account; (ii) the instructor designates a hashtag (e.g. #kmclass) and informs the students accordingly; (iii) students subscribe or search for Tweets corresponding to the hashtag; (iv) the instructor shows the stream of Tweets in class with the hashtag from his/her Twitter account, and (v) students can ask questions, raise concerns and/or seek

clarifications. Twitter can be accessed from a website, via applications on PC/Mac, Iphone, Android phones, etc.

In the context of higher education, pedagogical tweeting represents an effective tool for instructors to find out, in a non-threatening way, what students are thinking while they are in the classroom. We argue that tweeting makes learning (more) meaningful, fun and effective (Wankel, 2009).

In this paper, we share tweeting experiences made during a course on Knowledge Management taught at the Singapore Management University (SMU) in Singapore by addressing the following research questions: 1. How can social media such as twitter enrich blended learning in order to engage Gen Y students in institutions of higher learning? 2. How can twitter be effectively integrated into course designs? 3. Besides the opportunities which twitter offers for both instructors and students, what are the key challenges when it comes to implementing respective initiatives in the classroom?

The Twitter project itself was inspired by a twitter study conducted by Professor Rey Junco (Associate Professor and Director of Disability Services in the Department of Academic Development and Counseling at Lock Haven University) aimed at examining its engagement power in the classroom. In his research published in 2010 by the Journal of Computer Assisted Learning, Junco and

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colleagues concluded that it “provides the first piece of controlled experimental evidence that using Twitter in educationally relevant ways can increase student engagement and improve grades, and thus, that social media can be used as an educational tool to help students reach desired college outcomes” (Junco, Heiberger, & Loken, 2010). While Junco used Twitter quite extensively in the context of course-related communication and collaboration activities such as book discussions or service learning projects, we tried to harness the power of tweeting for rather straightforward class activities such as commentaries and discussions of in-class project presentations.

2. Conceptual framework, method and application framework

Representative studies about tweeting in higher education are still rare despite the increasing popularity of microblogging in business and society. Studies conducted by Lee and Kim (2014), Ebner et al. (2010), Dunlap and Lowenthal (2009) and Java, Song, Finin, and Tseng (2007), have put emphasis on the communication enhancing benefits of microblogging which enables learners to share and seek information as well as nurturing relationships with their peers. From a constructivist learning perspective, Web 2.0 applications such as tweeting are suitable means to empower learners within the confines of the respective course objectives to take the initiative for self-directed learning. Strategically embedded into blended learning approaches (McCarthy, 2010; Menkhoff, Thang, Chay, & Wong, 2011), microblogging can help technology-savvy Gen Y students to create meaningful learning outcomes by reflectively communicating with both students and instructor within or outside the confines of the classroom provided there is a stimulating (web-based) learning environment, quality interaction and a strong sense of belonging (Arbaugh, 2005; Baker, Boggs, & Arabasz, 2003; Lombard & Ditton, 1997; Picciano, 2002; Swan, 2001).

Methodologically this study is inspired by the tradition of interpretative case study and exploratory research (Eisenhardt, 1989; Stebbins, 2001; Yin, 1994). Key data collection methods include the analysis of relevant secondary literature, feedback from course participants, colleagues and mobile learning experts, a quantitative student twitter survey as well as observations during students' learning activities. Based on these sources and insights, the paper develops several implicit evaluative arguments about tweeting in higher education and four explicit hypotheses about tweeting in the context of blended learning to be tested in a survey with a bigger sampling frame (Klein & Myers, 1999). A key concern of the authors is to share their experiences with twitter in the classroom so that other higher education instructors can also leverage such tools (Menkhoff & Bengtsson, 2012). As part of our triangulated research strategy (Stake, 1995), multiple sources and methods of data collection were utilized such as expert interviews (e.g. other Web 2.0 savvy instructors), consultations with professional mobile learning specialists, and narratives to add value to the paper. Both validity and inter-subject reliability were enhanced by sharing data/text interpretations with teaching assistants, teaching colleagues and students (Miles & Huberman, 1994). While certainly not generalizable, we believe that our research approach is value added because of the innovative nature of the research topic and the scarcity of sufficiently tested theoretical frameworks.

It has always been a challenge for educators to encourage participation from students in order to increase the quality of discussions in the classroom. More and more universities proactively support innovative teaching methods and encourage instructors to bring social media into the classroom as a platform for student discussions, project works and assessment (Morgado, 2011; Saeed, Yun, & Sinnappan, 2009). While laptops are a common sight in the classrooms of the Singapore Management University (SMU), which serves as the backdrop for this paper, the open use of Twitter for

conversations among students with a focus on the respective subject matter taught in class is still rare. This essay reports experiences made during the introduction of Twitter in two undergraduate Knowledge Management (KM) classes with 45 students each during Academic Year 2010–11 (“class 1”) and Academic Year 2011–12 (“class 2”). Key course objectives include enabling students to:

- Explain what knowledge management is, why it has become an organisational challenge in business and society and how it adds value to both for-profit and not-for-profit organizations.
- Define what knowledge is and the various modi of knowledge creation in organizational contexts.
- Explain how selected knowledge management tools add value to three strategic knowledge processes in organisations: capturing, sharing and creating knowledge.
- Know how to create smart organisations with strategic knowledge management systems and robust cultures of k-sharing/k-creation in areas such as consulting, finance, education, public sector, manufacturing, network alliances, and IT.
- Assess the HR, managerial, infrastructural and societal implications of the ongoing transition of Asian countries such as Singapore in moving towards a knowledge society.

Students were encouraged to send in their views, comments and questions through Twitter during normal class proceedings. The content of the live Twitter conversation was projected onto one of the two available projector screens in the seminar room in real time (the other one was used to display the instructor's lesson slides) so that the students could see one another's inputs and contributions.

A teaching assistant sat in to regularly refresh and update the twitter feed. Sometimes the instructor would pause during class to take note of tweets and to follow-up on them or he would systematically review the tweets after class in preparation for the next class session. Towards the end of the term, “class 1” was invited to reflect about the usefulness of Twitter based on simple, evaluative tweets as exemplified below. Questions included: What did you like or dislike about tweeting in OBHR211? In what ways can tweeting facilitate and enhance learning? Where do you see potential problems? During the following academic year, “class 2” was surveyed to examine how students perceived the micro-blogging activities and to generate hypotheses to be tested in a future survey with a wider empirical basis. The twitter survey was small and comprised 41 undergraduate students of which 8 (20%) were males and 33 (80%) females.

3. Results and discussion

From an instructor's point of view there is evidence that tweeting helps to monitor whether students have fully understood the content taught in class. It also encourages the reticent students to voice out their thoughts and to articulate their queries. In that way, the instructor can identify knowledge gaps and address them on the spot. While students were rewarded for their pioneering and anonymous tweeting works with a certain percentage of their class participation grade, other instructors require students to use their real online identities while participating in Twitter discussions. Some go so far as to monitor and assess the progress and contents of students' tweets and to award classroom participation scores based on the quality of the students' contribution. Whether graded or not, pilots conducted by the authors indicate that the use of social media can promote interaction among students and learning among peers (Menkhoff et al., 2011). General observations made by the instructor during tweeting classes 1 and 2 of the Knowledge Management course include:

- Students are quick in deploying the twitter platform (no tech-nophobic issues).
- Tweets are used to cheer presenting student groups.
- Evaluative comments are forthcoming and very frank (sometimes a bit cynical).
- Indirect concerns regarding 'fair grading issues' are openly expressed and respective comments suggest that students expect immediate clarification/rectification by the instructor.
- Tweeting allows absent students (e.g. due to sickness) to participate in commentary flows.
- Students use twitter to contribute content-related knowledge.
- Questions by students can be used by peers to further enhance their content depth/presentation.
- Students use twitter to raise issues and content-related questions to be addressed in class.
- Micro-blogging helps students to generate new knowledge.

3.1. Reflections about tweeting in "class 1"

The following, admittedly rather simple categorisation of students' tweets is based on one course session during which the tweeting option was first introduced and applied. It indicates the potential range of benefits of tweeting in terms of stimulating students' reflection and learning processes through what we have categorised as 'evaluative comments', 'somewhat cynical/critical comments', 'knowledge-related questions' and 'knowledge-enhancing comments' by students. The tweets originated during a topical student presentation (via video format) on knowledge management-enabled firms, namely Wipro, a global IT consulting firm headquartered in Bangalore, India ([Mayansandra & Pan, 2010](#)), and Qian Hu Corp, a Singapore-based integrated ornamental fish service provider ([Menkhoff, 2008](#)). They also reflect in part students' perception and feelings towards the presenting group as well as the anticipation of Chinese New Year 2011 celebrations (and the end of class!).

Concluding comments by student presenters:

"On behalf of group 2, we hope that you have learnt something new about Wipro Technologies. Thank you all for your attention".

Generally positive comments by students:

"Whatever it is, the video definitely left an impression!"

"The advantage of video presentation: we can constantly tweet questions and the team has ample time to think about the answers".

"Good luck friends!"

Evaluative comments by students:

"This group has set the benchmark!"

"The video is very informative, but I feel it could be more engaging".

"Singapore is a great place for SMEs such as this. Transparent cultures like Qian Hu should be used as examples in case studies!"

"The social network analysis exercise was quite interesting! Makes us realize the need to be more PROACTIVE".

Somewhat cynical/critical comments by students:

"Brilliant. So we have 5 more slides till 11.45am? Can't wait".

"The video is presenting for the group! How convenient!"

"Very comprehensive analysis of Wipro's KM practices, but aren't we limited to 6 slides?"

"The video was impressive don't get me wrong. But it still doesn't tell me what they do".

"If we showed a video about Qian Hu, it would be like finding nemo. Wipro's video is pretty attractive".

Knowledge-related questions by students:

"They employ special knowledge managers? Interesting ...what do they do exactly?"

"Any idea if they patent their designs? Can they even do it?"

"How does Qian Hu share their strategies with their employees?"

"I wonder whether mutated fish can be bred".

Knowledge-enhancing comments by students:

"This is Qian Hu's Arowana Pond (in reference to what was shown in the video)".

"Can I share photos here? I can show class a few photos?".

Unrelated comments by students:

"Anybody craving *yusheng* and *lo hei*?"

"I can't wait for 11.45 to come!"

"Happy CNY in advance!"

"Hello everyone ... Twitter ROCKs!"

"I still think Prof is the undisputed champion as a knowledge guru".

Comment by student absent due to illness:

"I think my KM class has hopped on the twitter bandwagon. Sorry to be missing out, following tweets though!"

As a student remarked during a conversation, "Personally, I love the idea of tweeting in class as I think it has helped create a safe environment for introverted students to participate in the class discussion. However, in order to promote a greater sense of community and to avoid a week of silence bringing twitter discussions outside of the 3 h class context would be necessary. Twitter could also be used as a platform to make class announcements which would provide greater flexibility to both students and instructor". This is certainly a valuable piece of advice for tweeting novices interested in building electronic learning communities where students generate knowledge and learn ([Dascalua, Bodea, Lytras, Ordoñez de Pablos, & Burlacua, 2014](#)).

3.2. Results of "class 2" tweeting survey

"Class 2" survey participants rated tweeting as the 2nd most useful mode of information and communication utilized to interact with instructor and classmates. Email topped the list (38), followed by twitter (34), course outline (32), online library resources (28) and telephone (16). On an average, 27% of the survey participants had tweeted four times during each session, 24% twice, 22% once, 17% five times or more and 10% three times. The majority (30) of respondents (73%) surveyed in "class 2" rated their computer expertise as intermediate in contrast to 4 students (10%) who saw themselves as novices and 7 others (17%) who categorized themselves as experts.

Asked whether the tweeting option had helped to make the course more interesting, 95% of all respondents (39) agreed. The vast majority (36/88%) rated their overall educational experience

in taking the course as good (22%), very good (46%) or excellent (20%). 5 students (12%) classified their experience as satisfactory. 44% of the respondents (18) pointed out that they would definitely take another course with tweeting facilities if offered while 51% (21) students replied 'maybe'. 2 students (5%) were not in favor at all. In comparison with traditional information and communication avenues, most students stressed that tweeting had clearly increased the amount of interaction with other students (38), their motivation to participate in class activities (36), the quality of interaction with other students (33) and the quality of their learning experience (33).

Participating students were more critical with regard to the amount and quality of their twitter-enabled interaction with the instructor, suggesting the need for an active involvement of the instructor during in-class tweeting activities (5 students felt that there had been a decreasing effect of twitter on the amount of interaction between them and the instructor and its quality).

How did students use tweeting in the course? Most learners (40/98%) stressed that they had tweeted in order to voice out their opinion about the subject matter; 28 students (68%) tweeted because they wanted to post questions related to the subject matter online while 16 participants (39%) micro-blogged to clarify certain issues in relation to the subject matter. Other usages included 'demonstrating that I understand concepts and applications related to the subject matter' as highlighted (12/29%), 'provoking a class discussion' (12/29%) and 'challenging what the instructor said' (3/7%).

As indicated above, the majority of respondents (35/85%) rated their experiences with tweeting in the KM course as successful. Only 6 students (15%) rated it as not successful. Asked what aspect of tweeting students perceived as the most successful, a diverse picture of opinions emerged as shown in Table 1 below. As one student stressed, "It allows me to have an alternative platform to voice my opinions and questions. Sometimes I've issues to raise in class but I might withhold them because it may seem disruptive

or interruptive. Hence, twitter allows me to class participate freely whenever I've a point to make or question to ask". The comment points towards the pedagogical usefulness of micro-blogging in higher education (Junco et al., 2010).

As Table 1 suggests, students' comments underline the benefits of tweeting as a sort of empowerment tool which enables learners to have a voice, to be (more) engaged and to interact (more) freely with both their peers and the instructor via knowledge sharing and twitter discussions. As one student stressed, "It gave me a chance to know what my classmates were thinking about and the opportunities to interact with them even though I do not know them personally. Furthermore, during presentations, it helps to engage with the class and discuss the presentation". Others argued that tweeting is truly enriching because it allows students to build upon each other's ideas and come up with new insights. As another student pointed out, "I think it is effective in allowing us to clarify questions without being embarrassed and also get a reply very quickly. It breaks the intimidating factor that is involved in the usual classroom class participation." What aspects did students perceive as not successful (Table 2)?

The comments suggest that it is important to have a system which allows students to track tweet discussions easily (and without technical glitches) and that the instructor needs to play a proactive leadership role as a sort of 'technologically inclined master twitter' cum facilitator. The latter arguably also necessitates to know more about the personality traits of students which might hinder (e.g. in the case of high levels of anxiety) or promote (e.g. the case of high levels of friendliness) collaborative tweeting.

Overall, 93% of all respondents (38) said that the university should offer more courses with tweeting activities for various reasons as listed below (see Fig. 1). Students' comments show that tweeting is regarded as a more interactive and exciting way of learning compared to traditional knowledge transfer tools such as lectures. As one student reported, "University students like unconventional ways of learning". It seems that utilizing twitter

Table 1
Successful aspects of tweeting.

<p>If successful, which aspect of tweeting did you perceive as successful?</p> <p>Being able to post questions while others were presenting</p> <p>I get to air out my opinions on the web instead of voicing it out. Hence, I am able to make my comments as constructive and coherent as possible</p> <p>The ability to view different perspectives and chains of thoughts on the same subject matter</p> <p>Sharing of information and invoking discussion among peers. Getting insights related to subject matter</p> <p>It makes the lessons more interactive</p> <p>Share information that is in the web but not in the presentation with my classmates</p> <p>It helps students who do not prefer to speak out in class to have an addition avenue to voice out their opinion</p> <p>It was interactive, allowing me to voice out my thoughts and respond to the comments of others</p> <p>To be able to view other people's comments, engage with classmates and share useful materials (E.g. articles to read, software they use for their video etc.)</p> <p>More class engagement and participation from all</p> <p>It provides real-time update and allows a multiplicity of views to be expressed concurrently</p> <p>It kept me focused throughout the class, gave me inputs from fellow peers, additional information on the subject being discussed such as related web articles posted by classmates</p> <p>Students' discussion still carries on even though prof is not addressing the issues in class. Students also bring in knowledge that they have learn from other courses to answer other students question. Helpful for students who are afraid of voicing out in class as well</p> <p>Exchange of knowledge that was not taught in class</p> <p>Tweeting helps to answer certain doubts that I have or even to share with the class how I feel about the subject topic</p> <p>Tweeting helps to have a better understanding for the course to be discussed in class</p> <p>It gives me the ability to voice out opinions and comment on other's opinions without the need to interrupt people who are doing their presentations. Also, I am able to understand the viewpoint of others while presentations are being given</p> <p>The ability to capture each tweeter's opinion and/or question and ensure that instructor and students are able to recognize each tweet as a contribution to learning</p> <p>I can share my opinions as and when I want without having to interrupt the instructor. And the instructor and class will decide whether to discuss what I have shared in my tweets</p> <p>There are more interactions and discussions with a new way of doing them</p> <p>Sharing of common questions and different perspectives of the topic in question. Sharing external resources with the class while the prof is using his own resources to teach</p> <p>Because we are a big class and because we cannot express all of our opinions I think it is a good idea to have a place where we can have all the voices, discussions, etc. and it also helps to see different points of views of the same topic very easily</p> <p>I feel that a lot more students voiced out their opinions, and their knowledge on the subject, and I learned so much more from them</p> <p>Not having to wait to be picked by the teacher to voice an opinion</p>

Table 2
Unsuccessful aspects of tweeting.

<p>If not successful, what aspects of tweeting did you perceive as unsuccessful?</p> <p>I think the opportunities to use twitter were too few. I was not able to voice my opinions frequently enough</p> <p>It was quite difficult to track what were the topics/areas that we can discuss about. Often we got lost in the lists of tweets coming in</p> <p>I think that it is making the class distracting as people are busy tweeting and no one is listening to the presentation in some sense. Eventually some tweets are still chosen to be discussed in class, which makes tweeting a little redundant. There are also the same few people tweeting and some people tweet for the sake of tweeting. The whole list becomes too long to be read. Overall I would still prefer the discussions to be conducted in class. Some people who do not voice out their opinions in class will still not voice them out in twitter</p> <p>My Internet connection was bad at times. The tweets could not get through or the pages would not load. Quite frustrating</p>

as an education tool can help institutions to better engage young learners. Asked why the university should offer more courses with tweeting activities, respondents came up with a long list of arguments as summarized below (see Table 3):

Students' respondents mirror earlier comments that tweeting increases participation, interaction, sharing and engagement. As one student remarked: "It's innovative and helpful for participation especially when our class size is getting bigger and bigger. This allows more opportunity to share our thoughts and views. Also, it allows us to link and share websites that are useful to expand our knowledge about the topic with real life news". Those who did not feel the need for more courses with tweeting activities pointed out that they found it hard to multitask within the class, i.e. paying attention to the presentation/lecture and tweeting simultaneously. As one course participant remarked, "it would perhaps be better if there was adequate time for the tweets to be consolidated and then bring out some key issues to be discussed." It was stressed that tweeting can be incorporated into existing courses as it enhances the learning experience because more knowledge is being shared among students. However, the tweeting discourse must be moderated by instructors to ensure that the comments posted are relevant. Also, to attain assurance of learning, instructors must discuss the comments posted.

In sum, the survey results underline the advantages of micro-blogging in higher education. Asked whether they had enjoyed tweeting in the course, 36 students (88%) agreed while 3 (7%) had no opinion and 2 students disagreed (5%). The majority of students (33/80%) felt that the tweeting option had stimulated their desire to learn more about the subject matter of the course: Knowledge Management. 12% had no opinion (5) while 7% (3) disagreed (see Fig. 2).

Almost all students (39/95%) agreed that the tweeting option had helped them to effectively communicate certain thoughts and ideas about the subject matter in a non-threatening way. The majority of respondents (38/93%) felt that the micro-blogging option had enhanced social interaction amongst class participants. A very large number of students (34/83%) said that the tweeting option had allowed them to post urgent questions and seek answers in relation to the subject matter. The rest of the students (3/7%) had no opinion about this or disagreed (4/10%). All students (41/100%) reported that tweeting had enabled them to communicate with other students in class and to learn more about what they are thinking.

Our study suggests that the micro-blogging behavior of the instructor is arguably a critical enabler of students' engagement as learners expect the instructor to be actively involved in the tweeting process in order to be perceived as credible. The urgency of the issue is perhaps best illustrated by the following quote from a student who was skeptical with regard to the value-added of twitter:

"Firstly, the instructor was not familiar with twitter himself. Hence, I was not motivated to use it as I don't know how to use it myself. If my Prof doesn't know how to use it and he wants me to use it – that does not make sense. It's not exactly

fair to judge a student's class participation based on tweets as not all students know how to use twitter. The tweets are also not archived and it takes really long to scroll down and read ALL the tweets."

It was stressed that the instructor could also have tweeted comments and questions during students' presentations and that "a live feed of the tweets should be displayed on the slides at all times" to ensure students' full attention.

While the instructor did actually tweet contrary to the perceptions of some of the students (albeit under a pseudonym), students' comments underline the need 'to be visible' in order to enhance both communication and learning effectiveness. Possibly as a result of 'the invisible tweeting instructor', just about 54% of all respondents (22) felt that tweeting is an effective means of communicating with the instructor while 20% (8) had no opinion or disagreed (11/27%). Respondents were clear about the value added of tweeting with regard to knowledge transfer amongst their peers. The majority of students (36/88%) surveyed felt that they had learned a great deal about other students in the course during the tweeting activities. Merely 10% (4) had no opinion while just 1 student (2%) disagreed.

Students had several suggestions for improving the tweeting experience in the course. It was proposed to evaluate e-tweeting discussions with metrics to minimize irrelevant comments/tweets. Other students stressed that it is important to ensure that the tweets relate back to the subject topics/key discussion points which could be achieved by organizing, tracking and categorizing them so that it is easier to make comments and tweet replies. Finally, students reiterated that the instructor should be more actively (meaning: visibly) involved during the tweeting activities.

To examine the collaborative nature of micro-blogging twitter and to establish if there is a case for collaborative wisdom extraction requires a closer analysis of "e-learning communities" (Dascalua et al., 2014) forged through tweets, re-tweets, etc. This was not done in the context of this study but we are planning to

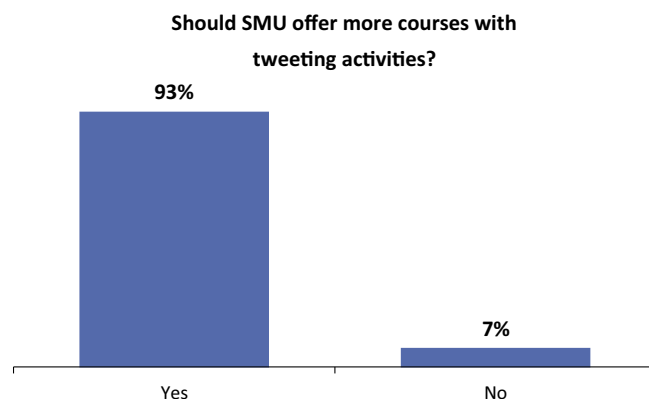


Fig. 1. Percentage of respondents in favor of more course offerings with tweeting activities.

Table 3
Reasons why SMU should offer more courses with tweeting activities.

It promotes active participation even during presentations
 This will allow more reserved students to participate in class discussions as well
 Another way to engage learning and ensuring class participation. Greatly helped students who are introverted or shy to participate to participate more during tweeting sessions
 It is engaging and interactive. It encourages more class participation
 It is more engaging as compared to posting our comments on forum. Less formal
 Encourages students to speak up, especially when class size has increased drastically. and it makes the class much more interesting
 It will be favorable as social media such as twitter are vastly used by Gen-Y
 Because it is a good tool to communicate and share ideas
 It allows soft-spoken students an avenue to share their thoughts
 Tweeting allows students to class participate freely and also, professors can read the tweets even after class and address the questions raised when they are free. Hence class participation is not limited to only class time
 It provides an opportunity for students who are generally shy to participate in class discussion
 Provide a new platform for students to interact as well as share knowledge with each other
 Tweeting gives students another avenue to participate in class, especially for those who may feel uncomfortable speaking up in class
 It is innovative and an interesting learning method
 Traditionally, students only share when prof asks a question; however tweeting provides more opportunities for students to share anytime during the class
 Encourage student to discuss actively in regards to the issues. We can also learn new knowledge from our classmates
 Encourages sharing
 Increased interaction with the class and more motivation for people to participate as they are hidden behind the laptop. Live feed also makes participation dynamic and simultaneous, even during ongoing presentations
 Allowing students who do not feel comfortable talking in class to do their class participation using twitter
 It enhances classroom interaction virtually and allows people who are less vocal to participate in a more comfortable platform
 It helps students to take part in discussions and post ideas or supplementary materials (links, pictures, articles, videos, etc.) that may help others in class
 It will help students who are more introverts to participate more. And it will also help to screen out comments/opinions that are of no substance
 More interactive and exciting way of learning. University students like unconventional ways of learning. Accepting twitter as an education tool speaks the language of the young students institutions are trying to engage
 Adds variety and interest for students. Students would compete to class part. for the sake of the grade, it adds quality to the discussion
 It is more interesting than without and there are avenues for discussion and learning
 It really rejuvenates the idea of class participation-where class participation is no longer just about receiving marks, but about interacting with other students. Also, tweeting helps break the barrier of group think and general shyness
 It enhances knowledge and learning and interaction. Even the quiet ones can finally speak

do so in a follow-up study. One promising approach would be to leverage natural language processing tools (in combination with knowledge management approaches) such as sentiment analyses to explore the possible emotional effect of students' tweets on others in a learning group (Gurevych & Kim, 2013; Hellmann & Auer, 2013; Lytras, Sakkopoulos, & Ordóñez de Pablos, 2009) An alternative way to find evidence for learning effectiveness triggered through Twitter would be to conduct social network analyses of tweeted words and components to shed light on affiliative trends amongst learners and to establish whether they predict positive learning outcomes (Lee & Kim, 2014). This could also entail identifying 'central figures' amongst students in a class who manage to nurture 'real' synergetic e-learning communities defined as "two or more discrete learning agents acting together (that) will create a learning result greater than that obtained by acting individual" (Dascalua et al., 2014:362).

4. Conclusions

Both face-to-face and online classroom discourses have been recognized as important in enhancing the educational experience of students and their learning curve (Junco et al., 2010). Increasingly, user-generated learning content is revolutionizing traditional learning and teaching approaches as evidenced by the rise of microblogging, wikis, Google Doc and other types of social media (Stern, 2011). While representative studies about the effectiveness of tweeting are still rare, we argue based on our own data and prior pedagogical research (Menkhoff et al., 2011) that such tools are useful in the context of mobile learning for the following reasons: (i) they supplement blended learning approaches and help students to create positive, contextual learning outcomes in relation to pedagogical objectives; (ii) they enable students to engage in meaningful, collaborative learning and to tackle existing knowledge and competency gaps either individually or in a team with the help of their peers; (iii) they motivate students to tweet any question they might have about the respective subject matter which can then be addressed by the instructor and (iv) they support assurance of learning as they appeal to Gen Y's technological know how and learning cultures.

Our findings echo the need for a stimulating (web-based) learning environment as stressed by e-learning researchers. To avoid that learners are "drifting" while tweeting in both class and cyberspace, quality interaction between them, the instructor and their peers (Baker et al., 2003, p. 8) has to be ensured, which includes strong intellectual stimuli such as problem-based learning stimuli, regular 'online Professor office hours' after class and reference to students' study/career aspirations (Arbaugh, 2005). To be effective, course participants active in tweeting must feel a strong sense of class belonging. Picciano (2002) and others such as Lombard and Ditton (1997), Swan and Shih (2005) or Dunlap and Lowenthal (2009). refer to this quality as social presence, described as the communitarian embeddedness of virtual learners in web-based

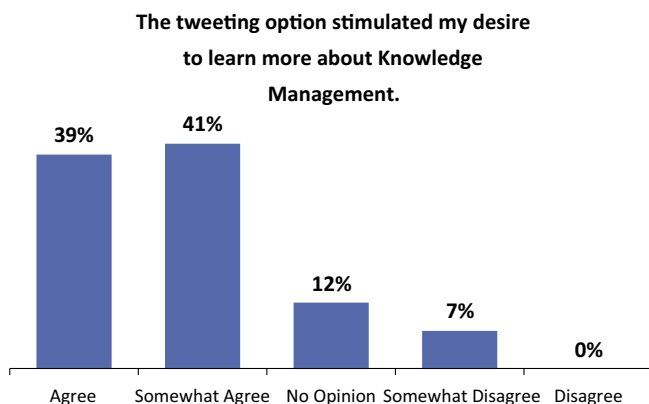


Fig. 2. Percentage of respondents who felt that the tweeting option had stimulated their desire to learn more about Knowledge Management.

learning environments and their dependence upon instructors and other students sharing ideas and knowledge. All this will increase the likelihood that the instructor is able to stimulate students' desire to learn more about the respective subject matter, i.e. in our case: knowledge management.

One way of coping with issues such as cognitive overload which is caused by the large number of tweets learners have to deal with, is to develop and integrate a dedicated tracking application into the tweeting system. This would enable users to organize (Twitter) discussions more effectively by archiving/prioritizing those tweets worthy of further in-depth discussions with the help of specific tabs. It would also equip users with useful analytics to focus class discussions on essential topics (e.g. via the use of word clouds), supplemented by a participation index to assess students' participation levels.

Based on our exploratory study about the tweeting behavior of undergraduate students compiled in Singapore, we hypothesize the following:

Hypothesis 1. The degree to which the tweeting experience stimulates students' desire to learn more about the respective subject matter is positively related to the frequency of tweeting.

Hypothesis 2. Social presence is positively related to the degree to which the tweeting experience stimulates students' desire to learn more about the respective subject matter.

Hypothesis 3. A blended learning course with tweeting elements that offers rich interaction experiences with other students and the instructor stimulates the desire to learn more about the respective subject matter.

Hypothesis 4. A system which organizes and categorizes the tweeting stream and allows students to rank/track discussion points easily helps to improve students' motivation to learn more about the respective subject matter.

While our conclusions and hypotheses are drawn from the small sample study reported in this paper, more representative empirical research is necessary to systematically track and analyse tweets (Naaman, Becker, & Gravano, 2011) to provide more evidence that microblogging is indeed a powerful learning enabler for university students. An important research question which we intend to explore in a follow-up study is whether tweeting in Southeast Asian nations such as Singapore also boosts grades as documented in US studies. In terms of future research, the usefulness of pedagogical analytics needs to be further established. Interesting approaches include Twitter's potential for collaborative wisdom extraction via e-learning communities (Dascalua et al., 2014), the utilization of natural language processing tools such as sentiment analyses to explore the possible emotional effect of students' tweets on others in a learning group (Gurevych & Kim eds., 2013; Hellmann, 2013), social network analyses of tweets based on word clouds to examine the effect of affiliative trends amongst learners on positive learning outcomes (Lee & Kim, 2014) or best practice research. Another promising research angle would be to study how students' personality dispositions such as open-mindedness or anxiety promote or hinder the development of interpersonal, collaborative learning networks on Twitter (Correra, Hinsley, & de Zúñiga, 2010; Davenport, Bergman, Bergman, & Fearington, 2014).

Practical challenges ahead for teaching staff belonging to the baby boomer generation include questions such as: How to acquire the required technical competencies to create and manage microblogs (tweets)? How to ensure pedagogical tweeting excellence during mobile learning journeys such as class excursions or

learning trails? How to monitor and assess students' micro-blogging performance adequately and fairly? How to provide timely and valuable feedback for students' tweets? How to obtain adequate technical support for setting up microblogging solutions in class? How to manage the (additional) time when tweeting solutions are deployed in class? Finally, it is of utmost importance to determine the pedagogical underpinnings and usefulness of microblogging initiatives before Twitter is deployed in the classroom to ensure learning with impact.

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