Using Microblogging to facilitate Community of Inquiry: An Australian tertiary experience

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Abstract

The usage of Twitter as part of tertiary learning is growing and is increasingly a common scene. However, most institutions use Twitter for social information exchange rather than deep pedagogical use. Here we experiment with Twitter based on the Community of Inquiry (CoI) approach using two undergraduate cohorts from Australia and America. Both cohorts were asked to exchange messages and discuss on a given topic for three weeks via Twitter. Our findings show that all three types of presence from the CoI model, viz. cognitive, social and teaching, can be facilitated by the use of Twitter in teaching. This demonstration of the use of microblogging for pedagogical use is a significant contribution to the higher education literature since previous studies' findings are largely limited to aspects of social presence.

Keywords: Microblogging, Community of Inquiry, Twitter, Tertiary Education

Introduction

In this paper we explore the use of Microblogging, one of the social media, in conjunction with a traditional Learning Management System (LMS) for students in a second year undergraduate eBusiness face-to-face course at an Australian university.

From a number of perspectives, including in particular the social constructivist one, interaction and community can be considered fundamental to the learning experience. This position can be seen in the educational literature as far back as in the work of Dewey, who maintained that both the psychological and sociological aspects of the educational process were equally important (Dewey, 1959 cited by Garrison, Anderson & Archer, 2000). Taking such a position leads to the notion that, rather than conventional conception of a class as a group of students enrolled in a unit being taught by a teacher, it is desirable to conceive of a community of learners who are

engaged in the purposeful, mutual construction of knowledge facilitated by staff member(s) (Ebner, Lienhardt, Rohs & Meyer, 2010). A widely used model to describe this kind of learning community is the Community of Inquiry (CoI) model developed by Garrison et al. (2000).

The study was motivated by anecdotal evidence and observation that students were spending less time interacting with each other outside of class. This meant that student interaction could be limited to the class time in their specific tutorial groups. Possible explanations for this phenomenon could include changing lifestyles, increased pressure to work and long commutes to and from campus. While the LMS based discussion forums were available to the students to allow them to interact outside of class hours, these boards were hardly used at all. The LMS is a website that requires students to go to the website and log in to see whether there has been any activity (as opposed to "pushing" information out to them). Further, the design of the LMS precludes students from interacting with other students not enrolled in the same unit through it. We consider both of these facts subtle but significant barriers to their widespread use for the kind of informal, spontaneous interaction we considered was missing.

Background

In this section, we provide a brief background regarding the use of microblogging for education. We also introduce the CoI framework and discuss our rationale for adopting microblogging as a tool to facilitate CoI.

Microblogging and Twitter

A microblogging platform allows users to post brief messages for public view. The messages appear in reverse chronological order. Microblogging combines aspects of blogging and social networking and as such is considered one of the "social media". Users can "follow" other microbloggers so that they have access to a "feed" of posts with recent posts appearing at the top. Microblogging has become very popular since the inception of Twitter in 2007. Despite several other microblogging platforms having become available, Twitter remains the most popular and in the literature reference is often made directly to the use of Twitter for education rather than to the use of microblogging (e.g. Ling 2007, Dunlap & Lowenthal 2009a, Dunlap & Lowenthal 2009b, Rodens 2011). Although the microblogging platform used in this study was Twitter, it is worth noting that other platforms can also be used depending on student/instructor familiarity, linguistic and cultural preferences, availability, etc.

The key features of microblogging are the ability to publish posts that are very brief (up to 140 characters in the case of Twitter), the ability to include abbreviated hypertext links and the ease and mobility with which such posts can be made. Twitter, for instance, allows posting via Short Messaging Service (SMS); mobile computing devices such as mobile phones and tablets; instant messaging (IM) services, email, etc. These are all in addition to a conventional web-based interface and custom application software.

The pragmatic implication of the multiple channels of accessibility is that the flexibility thus afforded may be well suited to any scenario where a diverse group of people with differing levels of technological equipment and ability can all interact in a common forum. This flexibility can be particularly powerful, we argue, in online and blended education, where in our view the ideal is to have the technology be adaptable to the needs of the learner rather than vice versa.

The preliminary studies in the education literature on the use of microblogging in education suggest that it has significant potential, despite some drawbacks. For example, a report describing the use of Twitter to complement a traditional LMS found that it encouraged free-flowing, just-in-time social interactions between

students and staff (Dunlap & Lowenthal, 2009). Ebner et al. (2010) studied the use of Twitter by Masters' students at an Austrian University. They concluded that there was great potential for microblogging as a tool to support informal learning and collaboration by students. It also allowed for the staff to provide feedback to students and get a feel for the overall "learning climate." Badge, Johnson, Moseley and Cann (2011) studied the networks that emerged between students using twitter and concluded that there were a number of potential applications for it as an educational tool, such as as a peer-to-peer support tool, an administrative tool (e.g. to broadcast announcements), and adding an "extra dimension" (p. 97) to time and location sensitive events.

However educators have recognised some drawbacks in the use of Twitter, such as the possibility of it being distracting and addictive (Grosseck & Holotescu, 2008, cited by Dunlap & Lowenthal, 2009a). This may be related to findings around Twitter usage generally (i.e. outside the tertiary education context) such as Java et al. (2007) and Krishnamurthy et al. (2008), which emphasised the social aspects of Twitter usage. The latter, claimed that the frequency of updates correlates directly to the number of followers if they were also friends. Huberman et al. (2005) on the other hand studied the activeness of a user based on individual's social circle and concluded that there are three types of distinct user activities; information seeking, information sharing and social activity. However, most of these studies report the social presence within twitter. Other studies focused relied content analysis on the '@' reply/mention function in Twitter such as Honeycutt and Herring (2009) which lead to categorisation of tweets. Similarly, Naaman et al. (2010) analysed a random sample of 3379 tweets and produced nine message categories by extending work done by Java et al. (2007) to evaluate message content. The categories 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). The study found that typically there are two types of Twitter users. Users in the first group (80% of all users) are engrossed in disseminating messages about themselves, while the second group (20% of all users) are far more informative, conversational and more involved with their followers. The latter proved to be more interesting thus attracted more followers given the benefits of information sharing, chance of discussion and chances of being heard by a larger crowd. These findings suggest that much twitter traffic is non-factual. Educators acknowledge the possibility that Twitter usage could potentially suffer from such drawbacks, however in general their findings suggest that the potential benefits outweigh the drawbacks, e.g. Dunlap & Lowenthal (2009a, 2009b) and Junco et al. (2011) report improved student engagement and a positive effect on grades from Twitter usage in conjunction with an LMS.

An interesting aspect of using microblogging to complement a traditional LMS is the fact that students can take the discussion beyond the barriers of the traditional classroom. Most LMSs allow access to the discussion only to fellow students in the course. For many discussions, this is perfectly appropriate. However, topical discussions and debates can benefit from more open discussion, e.g. with students from other courses and institutions or by tapping into discussions and debates in the wider society. Being able to participate in such discussion may also be a possible contemporary alternative to the kind of social, free-flowing, informal interaction that used to take place between students on-campus outside of formal classes. Such interaction may be limited due to altered student lifestyles, as students often have more demands on their time, meaning they spend less time on campus outside of class (Dunlap & Lowenthal, 2009a; Dunlap & Lowenthal, 2009b; Ebner et al., 2010).

The Community of Inquiry Model

The Community of Inquiry (CoI) model proposed by Garrison, Anderson and Archer (2000) provides a conceptual framework for characterising the overall higher education experience in terms of the interaction between three elements: cognitive presence, social presence and teaching presence (see Figure 1).

Figure 1: Elements of the Educational Experience (Garrison et al. 2000).

CoI has been used extensively in research about Computer-Mediated Communication (CMC) in education (Garrison et al., 2009).

The CoI model proposes that learning occurs through the interaction of three elements, viz. cognitive presence, social presence and teaching presence. Cognitive presence refers to the extent to which the participants in the community are able to construct meaning through their communication. Social presence is the extent to which participants in the CoI project their personal characteristics to the community. This goes beyond a simple notion of a sense of belonging that previous work had focused on (Garrison et al., 2009). The teaching presence refers to the dual functions of educational experience design and facilitation. While the educational experience design is largely within the purview of the staff in the higher education context, the facilitation function can be shared by the staff and students.

In principle, social media applications, such as microblogging, could be leveraged to enhance all three types of presence in an educational setting. Cognitive presence can be enhanced through social media based on students' ability to build meaning through ongoing communication involving individual and social exploration of ideas to develop understanding of a particular issue. Social presence is significantly enriched based on students' capability to present their ideas and identity while developing valuable links with the community for socio-emotional support for learning. Finally, teaching presence, involving the design and facilitation of the educational experience, can be facilitated to allow "natural", informal and personal expression by staff and students. Further, it is desirable that students can also exhibit teaching presence for instance by guiding and advising others in their cohort.

CoI and Microblogging

Garrison et al. (2000) originally proposed the CoI framework in the context of ensuring that the critical components of higher education identified were in fact carried over to distance and online courses using computer-mediated communication (CMC), primarily in the form of asynchronous discussion boards. However,

the framework of the higher education experience is fundamentally independent of the mode(s) of communication employed. Furthermore, subsequent work has adapted the framework for use in "blended learning" i.e. courses where a significant degree of CMC complements face-to-face communication in the community of learners and teachers (Garrison & Vaughan, 2008). For example, a report describing the use of Twitter to complement a traditional Learning Management System (LMS) found that it encouraged free-flowing, just-in-time social interactions between students and staff, thus enhancing the social presence aspect of the CoI (Dunlap and Lowenthal, 2009a). Microblogging, while having what is sometimes referred to as a "real-time" characteristic, i.e., a user receives updates almost at the same time as they are posted and are often responded to very shortly afterward, still remains asynchronous and thus is compatible with the original CoI principles. The fundamental differences from "classical" asynchronous interaction include much briefer messages and less explicit "thread" structures in most user interfaces used.

Methodology

The experimental setting was a second-year, undergraduate unit on eBusiness delivered primarily in a face-to-face mode with some online support (i.e. Blackboard LMS for materials availability). Twitter was used as the microblogging platform due to its popularity and the instructors' familiarity with the platform. The basic experiment involved setting up in-class tutorial activities that were suitable as the basis of students posting their thoughts and questions as tweets. They were encouraged by lecturers both in class and via twitter to further their discussions and share information. The purpose of doing so was to encourage student interaction across the traditional tutorial-based boundaries. In-class activities included scaffolding in the use of twitter and appropriately tagging tweets using "hashtags." Also, collaboration was undertaken with an American instructor running a similar unit to ensure that there were periods of overlap where both the Australian and the American cohorts were covering similar topics in the curriculum. They were therefore able to interact with each other using microblogging in an ad-hoc, real-time manner. The purpose of doing so was to enrich the student learning through exploring a wider spectrum of perspectives than they would otherwise. It also harnessed the power of microblogging to take the discussion outside of the conventional "classroom" boundaries. The curriculum topics around which microblogging was encouraged included privacy, ethics and censorship; these were topics common to the curricula of both cohorts.

The data set analysed for this study is the list of tweets tagged as being relevant to the curriculum-related discussions over a four-week period. The four-week period corresponds to a three week overlap in teaching times when discussion activities were scheduled for both cohorts and one following week. This is because, while the learning activities were scheduled for three weeks, the discussions continued for an extra week. The tweets studied here are those posted by students and staff over the four-week period of interest that met at least one of two criteria. The first criterion is that the tweet was annotated with at least one of the hashtags "#leb215" and "#cse2642" (corresponding to the two unit codes). The second criterion is that the tweet included at least one of the participants' twitter username in an @ mention. Satisfaction of either one of these criteria was deemed sufficient to identify the tweet as relevant to the experiment. The dataset includes tweets by both the American students and staff (referred to hereafter as Cohort 1) and the Australian students and staff (Cohort 2). Note that this is a subset of tweets posted by the cohorts during this period; other discussion took place, which was tagged differently. Such discussion would not be related to the scheduled teaching activities and is therefore not included in the analysis here.

A content-analysis approach using a coding scheme adopted is adapted from Garrison et al. (2006) was used to analyse the tweets. The coding scheme used is shown in Table 1, which uses the elements and indicators from Garrison et al. (2006). Our adaptation of the coding scheme for the microblogging environment is illustrated via the examples and coding guidelines in the same table.

In the initial attempt at coding, each tweet was to be assigned the single category that it was deemed to fit best into. This would parallel the message level coding discussed in Garrison et al. (2006). To increase reliability of the results, two coders were used. The initial level of agreement between the coders was approximately 77%. As part of the negotiation process, both coders (two of the authors) decided that many of the tweets were rich

enough to satisfy multiple categories. So the two coders agreed to assign up to two categories to each tweet; a "primary" category which seemed most applicable and, where necessary, a "secondary" category was also assigned. Not all tweets were assigned a "secondary" category. This form of categorization is comparable to other tweet analysis research such as Naaman et al. (2010) and Sinnappan et al. (2010). While Garrison et al. (2006) advise caution in using this approach, they acknowledge that the nature of the research and the purpose of the discourse may warrant its use. Given the exploratory nature of this study, in the breadth versus depth dilemma described by Garrison et al. (2006), we have chosen to focus on the depth of analysis with a view to gaining greater insight (Morse 1997 cited by Garrison et al. 2006). After negotiation and the use of secondary category, negotiated coder agreement was 98.5%.

Table 1: Coding Scheme adopted, after Garrison et al. (2006)

Element	Category (Code)	Indicator	Brief coding guidelines	Example Tweet
Cognitive presence	Triggering event (CTP)	New topic introduced, Sense of puzzlement	Includes new resource and opinion or ask for comment	I found an article about WikiLeaks http://yhoo.it/hrJ6dN #cse2642
	Exploration (CEX)	Information exchange	Comments on previously raised resource, expresses an opinion on a previous tweet, expression of opinion with no linked resource	Some peoples in the government want to get WikiLeaks branded as a terrorist organization #cse2642
	Integration (CIN)	Connecting ideas	Draws connections from multiple tweets, multiple @s AND multiple URLs, multiple hashtags and multiple URLS	@Iserguy @VickyBlueWoody Do AUS parents need edu on how2censor??? http://tinyurl.com/25dd66w http://tinyurl.com/2g529bx #cse2642 #leb215
	Resolution (CRE)	Apply new ideas	Resolves an issue, brings a discussion to a close, uses ideas from learning material to settle an argument.	N/A
Social presence	Affective (SAF)	Expressing emotions	Emoticons, text-based expressions of humour eg LOL, LMAO, emotionally loaded words like ridiculous, includes emotionally laden value judgements e.g fantastic, brilliant	http://bit.ly/99BFZo This my not be ethical but I still LOL'ed so hard over the ignorance contained in this article #cse2642

	Open communication (SOC)	Risk-free expression	Bold statements, controversial statements (indicates a level of comfort making them), personal confessions	@dr_at_work the theory "never against a government" seems perfect in China. lol
	Group cohesion (SGC)	Encouraging collaboration	Replies with an opinion, or asks for clarification, e.g. RT with agreement, RT with disagreement, @mention, multiple @mentions, reply with URL	@Iserguy I think it does, it doesn't allow for every side to freely express themselves #cse2642 #leb215
Teaching presence	Design and organization (TDO)	Setting curriculum and methods	Communication on the units, methods, etc Typically staff-staff communication.	@stefaniemarkham saying hi from down under. looks like #cse2642 is going well. we #LEB215 will soon participate in your discussions.
	Facilitating discourse (TFD)	Sharing personal meaning	typically retweet or reply with extra/counter resources, soliciting clatrification, asking for explanation	RT @Reeseandchips:@Armein78 violent video gmes make children mre aggrssive #leb215 #cse2642 -what does this say..http://bit.ly/9IFcgW
	Direct instruction (TDI)	Focusing discussion	Provides guidelines on topic and/or format of discussion	@waacyweng can you retweet and add #leb215 in all ur tweets with #cse2642 students

Results

In this section we describe the results of the experiment while the detailed analysis and key findings are presented in the next section. Table 1 shows the general breakdown of tweets for both cohorts according to CoI elements. Given that this experiment was a non-assessable component, the response was considered encouraging from both cohorts as approximately 57% from Cohort 1(20 from 35 students) and 60% from Cohort 2 (27 of 45 students) participated in the experiment. In total there were 324 tweets; 163 tweets made by local students (Cohort 2) and 161 tweets by American students (Cohort 1). On average per person Cohort 1 has just over 8 tweets while Cohort 2 had 6 tweets for Category 1. For Category 2, Cohort 1 had more than 4 tweets while Cohort 2 had over 3 tweets.

As shown in Table 2, Cohort 1 had 161 tweets in Category 1 and 88 for Category 2 while Cohort 2 had 163 tweets for Category 1 and 98 for Category 2. Thus on average each tweet represented 1.57 codes though Cohort 2 (1.6 codes) had marginally "richer" tweets than Cohort 1 (1.55 codes). On the whole, a significant proportion of the tweets were defined by codes such as CEX, SGC, CTP and TDC. Other codes were not expressed and

were found to be less significant as a consequent researchers decided not to report these. One such code in particular was CRE, which was not accounted due to fact that there were no arguments or conflict in information shared between the cohorts.

Table 2: Breakdown of tweets by CoI element code for both cohorts

Code	Cohort 1, n = 20(of 35)		Cohort 2, n = 27(of 45)		Total, n = 47(of 80)		Total (%)	
	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2	Category 1	Category 2
CTP	78	2	4	0	82	2	25.3	1.1
CEX	72	1	122	2	194	3	59.9	1.6
CIN	3	0	0	0	3	0	0.9	0.0
CRE	0	0	0	0	0	0	0.0	0.0
SAF	1	2	3	2	4	4	1.2	2.2
SOC	0	1	1	2	1	3	0.3	1.6
SGC	4	82	4	92	8	174	2.5	93.5
TDO	3	0	5	0	8	0	2.5	0.0
TFD	0	0	22	0	22	0	6.8	0.0
TDI	0	0	2	0	2	0	0.6	0.0
Total Tweets	161	88	163	98	324	186	100.0	100.0
Average Tweets	8.05	4.40	6.04	3.63	6.89	3.96		

As mentioned in the methodology section, certain tweets were agreed to warrant a secondary category, which, while important, would not be a fair standalone characterization of the tweet. Consider, for example "*@Rin789 I agree that people should know the real facts, not filtered information from censoring through the internet #cse2642 #leb215*". Both coders agreed that the primary category (Category 1) for this tweet was CEX, as it clearly responds to a previous tweet but doesn't contain an additional linked resource. However, as it had an @mention, there is an element of the SGC category present too. The interpretation here is that this tweet is primarily taken as indicator that information exchange is taking place. However, the manner of the information exchange is such that collaboration is being encouraged. To reflect this phenomenon, we agreed that the secondary category (Category 2) should be weighted half that of the first. This would mean that two tweets of a certain code in Category 2 would equate to 1 tweet from Category 1. The weighted average thus calculated for both cohorts is presented in Table 2.

It can be seen that CEX was almost 50% of the total weighted average which indicated the nature of the whole experiment which was to exchange information between two cohorts. For example "*@ebzero89 adults should*

be able to view any content. But when it comes to kids there should be some form of censorship #cse2642 #leb215". In this tweet a student is extending the discussion on censorship by including another student using the @ symbol to further the discussions. Further the student has directed the discussion to both cohorts by using the hashtag #cse2642#leb215. Both, @ mention and hastag have been crucial in driving student discussion in this experiment. It is noted that both SGC and CTP had almost similar percentages at 23 and 20 respectively. This shows that 1 in every 5 tweets was seeking support and collaboration while also initiating a new dialogue either by posting a new resource, seeking opinions or asking for comment. For example "Should *the ACMA blacklist be public? http://goo.gl/kbg0 #cse2642 #leb215"*. Here a student is asking a question directing it to both cohorts with regard to the *Australian Communications and Media Authority's (*ACMA) blacklist and whether it should be made public.

A small percentage of students were found to post comparatively more CTP coded tweets in attempt to initiate new topics of discussion. Though this is encouraged however this behaviour should be monitored as too many questions would initiate many threads of dialogue thus diluting depth of the discussion. It would be advisable for a student to have 20% CTP overall and this would be taken into consideration when this experiment is conducted next. Though this was not monitored in this experiment the exact ratio was reflected in Table 3 coincidently. A typical example of SGC tweet would be "*How easy or difficult is piracy in Australia? #cse2642 #leb215"*. Here a student is clearly asking a question about privacy in Australia to both cohorts without any other link to other information resource or citing a previous tweet. Similar SGC tweets were accounted for more than 93.5% on average in Category 2. It was also noticed that Cohort 1 had only 3 teaching related codes (TDO, TFD or TDI) as compared to Cohort 2 of 29 of which was mostly made up of TFD (22) aimed at facilitating the course. For example *"RT @Rin789: Would u create open srce sftware n why #cse2642 #leb215 yes & reason is tht the revenue means has changed, it's no more strategic".* Here the instructor is answering a post from a student in connection with open source software linking it to revenue models. The instructor also cites the tweet in the process of answering by linking both cohorts using the hashtags #cse2642 and #leb215.

Analysis and Discussion

Beyond Social Presence

The first finding we draw from the data is that the Twitter usage considered through the CoI lens strongly indicated a cognitive presence, over and above the social presence. This can be seen in the aggregates shown in Table 5, where cognitive components (67%) outweighed the social components (25%).

This may seem to contradict the descriptive statistics from previous studies on Twitter messages, such as Java et al. (2007), Krishnamurthy et al. (2008) and Naaman et al. (2010) which emphasised the social aspects of Twitter usage. In particular, Naaman et al. (2010) concluded that 80% of the tweets were personal, random notes about the posters, while only 20% were genuine information sharing. These findings suggest that most tweets are non-factual. However, this was contrary to our findings in this experiment. Collected messages as shown in Table 3 clearly demonstrate the existence of not only social components (SAF, SOC, SGC) but more so cognitive components (CTP,CEX, CIN) and teaching components (TDO, TFD, TDI). This clearly shows that Twitter as a platform offers more than just social interaction. The primary reason our findings differ from that of Naaman et al. (2010) is that our dataset is drawn from a particular context, whereas that study looked at an arbitrary set of tweets which could have been from varying contexts. Our findings are consistent with previous work such as Sinnappan et al. (2010). While Dunlap & Lowenthal (2009a) largely focus on social presence in a tertiary education setting, they reflect on the potential of Twitter usage contributing to the cognitive and teaching presences. Our findings, although preliminary, support their reflection.

Despite the importance of deep discussion which is often highlighted by the code CRE, it was found that the code was not expressed throughout this experiment from either cohort. This could be attributed to the short duration of time in which the experiment was conducted and also to the design of the learning activities. Both cohorts were more inclined to share information and to argue factual details. In future, appropriate learning tasks could be designed with appropriate time to get students to discuss and engage in deeper discussions.

Table 3: Weighted Average Tweets by CoI element code for both cohorts

Code	Weighted Aggregate (Cohort 1)	Weighted Aggregate (Cohort 2)	Weighted Aggregate (both cohort)	(%)*
CTP	79.00	4.00	83.00	20
CEX	72.50	123.00	195.50	47
CIN	3.00	0.00	3.00	1
CRE	0.00	0.00	0.00	0
SAF	2.00	4.00	6.00	1
SOC	0.50	2.00	2.50	1
SGC	45.00	50.00	95.00	23
TDO	3.00	5.00	8.00	2
TFD	0.00	22.00	22.00	5
TDI	0.00	2.00	2.00	0
Total	205	212	417	100

* Percentages were rounded to the nearest figure

Encouraging levels of Participation

On average this experiment had almost 60% participation from both cohorts and the findings demonstrate a healthy composition of CoI components across both cohorts. Though this was not an assessable component of their study, the number of tweets and the richness of each tweet suggest that students were keen to participate and contribute. Another factor supporting this is the fact that the discussion continued for a longer period than the duration of the assigned learning activities.

Limited Teaching Presence exhibited by students

Although there was 7.6% teaching presence as shown in Table 5, most of the tweets corresponding to teaching instructions were made by the instructors. This suggests that a low teaching presence from students was exhibited in the tweets. In a more mature CoI, we would expect that a larger number of participants could potentially contribute to the discussion in a manner that would indicate teaching presence. This could be facilitated in the future by designing learning activities that encourage selected students take lead in class discussions and activities for a stipulated time, and in duration of the sequence of activities, every student has the opportunity to participate in an instructor role.

Comparison between cohort characteristics

From the results in Table 2 it could be noted that on average both Cohorts made a comparable number of tweets. However, on a per student basis, cohort 2 was less prolific than cohort 1 by two tweets. However, further analysis (Table 4) shows that on average the number of links introduced per tweet was equal across both cohorts. Cohort 2 used direct mentions using the @ symbol slightly more frequently than cohort 1. These additional @ mentions are also reflected in the higher proportion of tweets labeled SGC in Table 2 for cohort 2.

Table 4: Average number links and direct mentions

	Cohort 1	Cohort 2
No of urls per tweet	0.15	0.15
No. of direct mentions per tweet	0.51	0.78

As the students were engaged with the same learning activities, we conjecture that the slight difference in the usage levels and patterns may be attributed to differing levels of comfort with Twitter prior to the start of the experiment. The instructors of both cohorts noted that not all students had pre-existing Twitter accounts, and those who had accounts had not necessarily engaged in academic use of Twitter. This was also evident in the style of tweets that were made by both cohorts at the start of the activity. The constraint of communicating in Twitter requires modification to normal sentences to embed more flesh in the message in one attempt. It is understood that familiar Twitter users converse and interact in a lingo specific to Twitter unlike normal written sentences. Here, parallels could be drawn with the short messaging service (SMS) texts that are laden with abbreviations and emoticons. A polished Twitter post requires compromised spelling conventions, removal of vowels, violation of grammar, eschewing prepositions and heavy usage of internet jargon and acronyms. Though Twitter has recently allowed users to post more than 140 characters per message with the "long update" feature, most messages are still less than 140 characters. Further, to communicate efficiently, twitter users need to be conversant in using symbols @ (to include and mention other users), re-tweeting (RT), sending a private message (D) and using hashtags and shortened urls.

The scaffolding materials for the learning activities in the study did include methods of effective communicating using Twitter and using client-side software (e.g. Tweetdeck) to manage tweets. If this is to be investigated more thoroughly, student levels of familiarity with and perceived ease of use of twitter will need to be measured pre- and post-participation in the learning activity.

Limitations

There were several limitations to this experiment. First, we had a small sample size of 47 participants across both cohorts. This could have introduced some bias to the study, as more students would have resorted to more 'noise' and non-class discussion eventuating in a different composition of CoI components. Second, though both cohorts were using Twitter independently throughout the semester this experiment only ran for 4 weeks where they were asked to collaborate and exchange messages. A longer experiment would have yielded more representative data on both the cohorts and their progress throughout the semester.

Table 5: Aggregated Percentage of tweets for each CoI element

CoI Element	Aggregate(%) Cohort 1	Aggregate(%) Cohort 2	Aggregate(%) Both cohorts
Cognitive Presence	37.05	30.46	67.51
Social Presence	11.39	13.43	24.82
Teaching Presence	0.00	6.95	7.67
Total	48.44	50.84	100

Conclusion and Future Work

This experiment supports and extends research done by Junco et al. (2011) (cited by Rodens 2011), Ebner et al. (2010) and Dunlap Lowenthal (2009) showing that Twitter has potential for pedagogical use. However, unlike these studies our work goes beyond demonstrating only social presence. We demonstrate that Twitter can be used to enhance and complement all "presences" in CoI. Though the experiment was conducted in a short period of time the findings are significant towards extending the research done on Twitter within the tertiary education space. This is especially true when many tertiary institutions that currently use Twitter limit their usage to mere social activities (Faculty Focus, 2010). Further, this also encourages other educators who are intending to adopt Twitter to facilitate their teaching and learning activities as it was reported that many educators shy away from Twitter when it comes to classroom activities (Faculty Focus, 2010).

We are the first known study to have used Twitter to form CoI between an Australian and American tertiary institution. Though both cohorts were only engaged in exchange of information and discussion only for four weeks the experiment demonstrates that outside class learning is feasible and better still as it involves peers from other institution. This has paved the way to engage with other tertiary institutions in future for real time and asynchronous discussion. In future, authors might extend the idea of CoI to include other higher education institutions over a longer period of time.

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