Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2010 Proceedings

Americas Conference on Information Systems (AMCIS)

8-2010

Collaborative Learning with Web 2.0 Technology: Synchronicity Dimension

Hwee-Joo Kam
North Central Michigan College, hkam@ncmich.edu

Pairin Katerattanakul
Western Michigan University, p.katerattanakul@wmich.edu

Collaborative Learning with Web 2.0 Technology: Synchronicity Dimension

Hwee-Joo Kam
North Central Michigan College
hkam@ncmich.edu

Pairin Katerattanakul
Western Michigan University
p.katerattanakul@wmich.edu

ABSTRACT

Web 2.0 technology provides an open platform to promote active users' interaction and participation in anytime and anyplace, enabling knowledge creation, sharing, and transfer. Using grounded theory approach, this study examines how effective the online collaboration tool that employs Web 2.0 technology could enhance collaborative learning in a team-based environment in higher education. The study results discover that Web 2.0 collaboration tool lacks high synchronicity dimension. High synchronicity dimension of a communication channel is characterized by immediacy of feedback in support of attaining shared understanding, focus, and trust in team interaction. As learning is an outcome of interaction among team members who exchange ideas and share experiences to attain group solutions and bring about knowledge construction, the study suggests that Web 2.0 collaboration tool should include features supporting high synchronicity dimension.

Keywords

Web 2.0 Technology, Grounded Theory, Online Collaboration Tool, Collaborative Learning

INTRODUCTION

Web 2.0 technology is defined by Wikipedia as the Web development and Web design that "*facilitates interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web. Examples of Web 2.0 include Web-based communities, hosted services, Web applications, social-networking sites, video-sharing sites, wikis, blogs, mashups, and floksonomies. A Web 2.0 site allows its users to interact with other users or to change Website content, in contrast to non-interactive Websites where users are limited to the passive viewing of information that is provided to them*" (http://en.wikipedia.org/wiki/Web_2.9).

Web 2.0 technology is not a new version of the Web, but rather, is the realization of the Web's potential. Web 2.0 technology does not really constitute any new technical standards but it indicates new ways of using the Internet as a platform for interactive applications (McLean, Richards, and Wardman, 2007). Musser and O'Reilly (2007, p.13) posited that Web 2.0 technology "*harnesses collective intelligence through an architecture of participation*", which is attained by "*actively involving users both explicitly and implicitly, minimizing the barriers to product adoption and use, and by designing products that encourage viral network-driven growth*". In short, the architecture of participation establishes a user-focus platform that maximizes the value of user involvement by allowing users to add value (e.g., creating new content) and thereby enrich the Web.

With the available open platform supporting users' interaction and participation in anytime and anyplace, Web 2.0 technology could be used to enable collaborative learning as well as knowledge dissemination. By allowing users to add values to the content, Web 2.0 technology could harness collective intelligence to enable knowledge construction, knowledge sharing, and knowledge transfer (Rollet et al., 2007). Additionally, Web 2.0 technology may produce powerful learning experience when it serves as cognitive reflection and amplification tools (i.e., mind tools) that assist users to establish meaning through the act of self-design of knowledge databases (Boulos, Maramba, and Wheeler, 2006).

However, there is limited research pertaining to how effective Web 2.0 technology could be used to support collaborative learning. Thus, this research project focuses on using Web 2.0 technology in higher education and investigates how effective this technology could enhance collaborative learning in team-based environment.

Google Docs & Spreadsheet

Based on Web 2.0 technology, over 150 of free or low-cost collaboration tools have been developed (www.mindmeister.com). For example, developed by Google and launched in 2006, Google Docs & Spreadsheet (GDS) is a collaborative writing tool that contains word processing, spreadsheet, and presentation. GDS allows users in different locations to share and collaboratively edit the same document (e.g., report, presentation).

To share documents and collaborate online, a user can assign other users as either the collaborators or the viewers by selecting "Collaborator" or "Viewer" radio buttons respectively. GDS application incorporates some features found in traditional office applications as well as features that support collaborative work (e.g., archive history). Archival documents are listed so that users can easily restore previous draft of the document. All revisions are saved and recoverable (www.google.com).

GDS is a free Web 2.0 collaboration tool and requires virtually no technical settings. Users of GDS need only Internet connection and a Google account. Thus, GDS is an attractive Web 2.0 collaboration tool to be used for collaborative learning in higher education. Examples of how students have used GDS to support their learning are provided in the "Rear user examples" section of Google Docs Tour (http://www.google.com/google-d-s/tour5.html).

RESEARCH METHODOLOGY

Data Collection

During Spring 2008 and Fall 2009, totally 96 undergraduate and 124 graduate students in Introduction to Information Systems class were arranged into 55 groups to work in group projects entailing case studies and research papers. Every group had to submit the final electronic version of each project's report and presentation using GDS. Every group was also encouraged, but not required, to use GDS for the collaboration within the group; thus, students could use other tools (e.g., e-mail, phone, other collaboration tools) to support their group communication and collaboration. At the end of the semester, upon completing all group projects, students were required to provide their feedbacks, in written text format, about the Web 2.0 collaboration tool (i.e., GDS) that students had used during the semester. At the end of Fall 2009, totally there were 216 transcripts (i.e., four students did not submit their feedbacks). These transcripts provided more than 400 pages containing students' feedbacks. According to Hiraki (1992), all human experiences can be interpreted and understood as text. Therefore, data collected in written text format in this study are a good representation of students' perspectives on using Web 2.0 collaboration tool in support of collaborative learning (the Web 2.0 collaboration tool mentioned in this study refers to the collaboration tool that employs Web 2.0 technology).

Data Analysis

To analyze students' feedback, the grounded theory paradigm postulated by Strauss and Corbin (1990) was employed. Given that, this research paper applied open coding, axial coding, and selective coding procedures. The major reasons to adopt grounded theory approach is that this paper serves to conduct an in-depth study on using Web 2.0 collaboration tool to support collaborative learning, and thus, the research question is broad (Niederman, 2009).

This paper, a research-in-progress, analyzed the first 80 transcripts of students' feedbacks from 20 groups. Within these 80 transcripts, 32 of them were from undergraduate students in one class section and 48 of them were from graduate students in two class sections. These students were studying in one university in Midwest region and another university in Northeast region. To reduce biases in coding procedures, both researchers began with a broad research topic in mind, that was, collaborative learning using Web 2.0 technology in higher education. Next, the researchers started out by reading the transcripts together to collect data before venturing into literature reviews. Essentially, literature reviews were conducted after the discovery of key concepts. Then, the researchers narrowed down the research topic. This was consistent with the notion of theoretical sensitivity highlighted by Urquhart (2001), postulating that the researchers should enter the fields without preconceived views to prevent the researchers from imposing predetermined core categories during coding procedures. Literature review, in this study, was applied to help build the theory after the discovery of key concepts.

During the open coding procedure, sentences were analyzed line by line by both researchers in a face-to-face manner. Differences in coding arose among the researchers and this was resolved by finding a common ground. Hermeneutic circle approach was applied during open coding procedure to written feedback gathered from the students. The hermeneutic circle approach proposes *"that we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships*" (Klein and Myers, 1999, p.71). With that, the sentences written in the feedbacks are parts that serve to shape an understanding on students' perspectives regarding using online collaboration tool in support of collaborative learning as a whole; conversely, the global understanding of students' perspectives regarding collaborative learning improves the understanding on each part.

Open coding procedure, therefore, was an iterative process that iterated between concepts, incidents, and sentences. The researchers kept a "code book" using a spreadsheet, which outlined the specific transcript number, narrative or the line number of a sentence, and incident. The incidents generated were then classified into concepts, which were later grouped into categories. Next, the researchers proceeded to axial coding procedure to group the categories from the open coding procedure into causal conditions, contexts, intervening conditions, action/interaction strategies, and consequences (Strauss and Corbin,

1990). Finally, in the selective coding procedure, the causal conditions, the contexts, the intervening conditions, the action/interaction strategies, and the consequences from the axial coding procedure were linked to describe how effective Web 2.0 collaboration tool could enhance collaborative learning. Figure 1 illustrates the results of open coding, axial coding, and selective coding procedures.

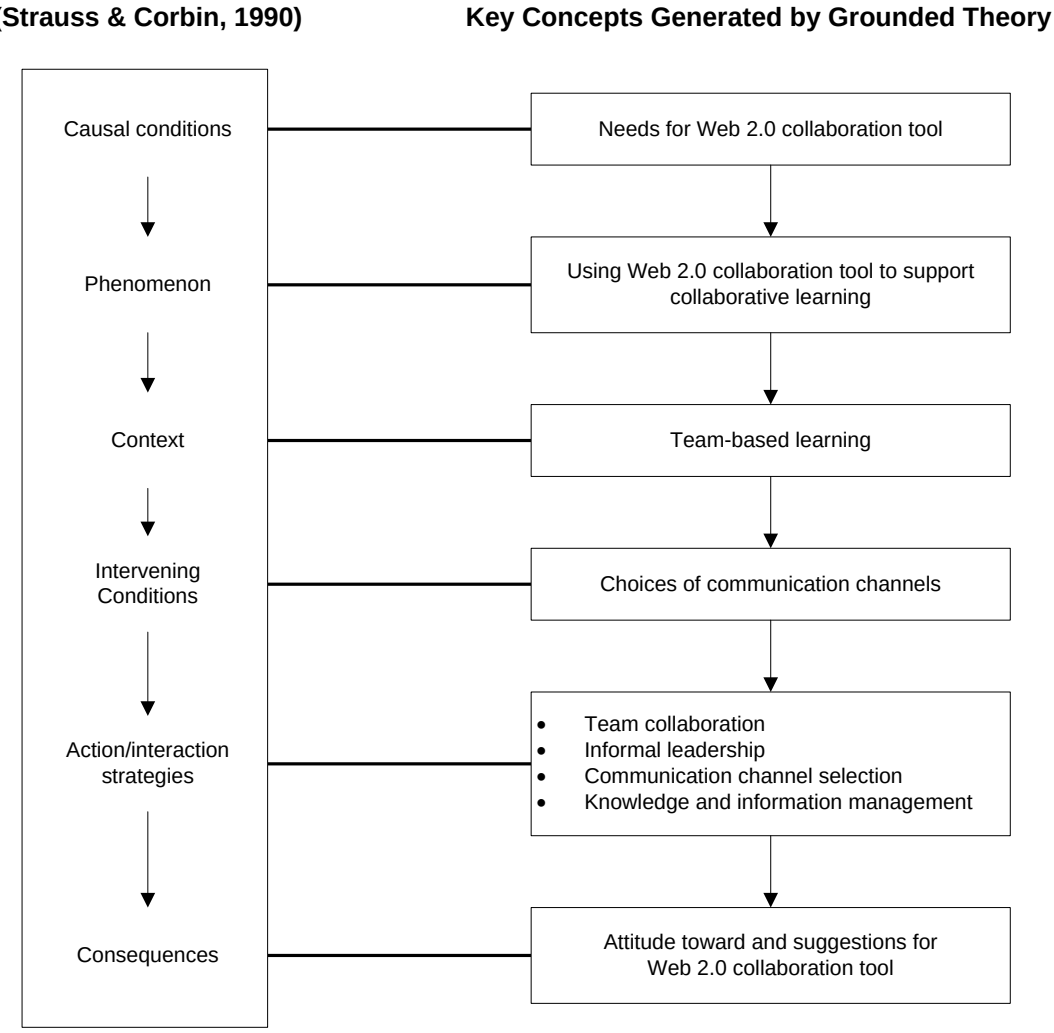

Figure 1. Research Results

RESEARCH RESULTS

In this study, we examined the phenomenon of using Web 2.0 collaboration tool to support collaborative learning, in the context of team-based learning, while focusing on choices of communication channels as an intervening condition along with students' action/interaction strategies in using Web 2.0 collaboration tool. The consequences of this phenomenon include students' attitude toward and suggestions for Web 2.0 collaboration tool.

Causal Conditions: Needs for Web 2.0 Collaboration Tool

Web 2.0 collaboration tool could be useful for collaborative learning. The need to adopt GDS mainly stemmed from the team members' requirements to collaborate with time and geographical flexibility. In this respect, team members expressed their views about having a system that achieved the aforementioned needs:

> *... I worried about the amount of group meetings that I had to attend. I thought that GDS would be useful because of the lack of time available to meet outside of class (having in mind that some students work and have families to take care of).*

Context: Team-based Learning

The results reveal that students appreciated the value of group assignments and team-based learning.

> *... With being from different backgrounds and having different jobs and job titles along with being at different stages in our careers and life, it gave us that much more diversity that we were able to learn from each other.*
>
> *...the ability of each student brought something different to the table ...allowed each group member to learn from each other*
>
> *...groups allow students to work together with different people and allow them to learn so much more*

Team-based learning involves small groups of students working together to solve a particular problem and is based on the following two important attributes of effective learning (Alavi, 1994).

(1) *cooperation and teamwork in learning :*
Learning could be attained by the social processes that monitor individual thinking, belief, and opinion while challenging individual viewpoints by exposing the individual to alternative viewpoints.
(2) *learning via problem solving:*
Learning is accomplished in problem-solving situation in which mental models are tested, extended, and refined until they are effective and reliable in solving that problem.

Group assignments promote team-based learning through collaborative activities that encourage individuals to exercise, verify, solidify, and improve their mental models during discussions and information sharing (Alavi, 1994). In team-based learning, learning is an outcome of interaction among team members who exchange ideas and share experiences to attain group solutions (Shen, Hiltz, and Bieber, 2006), bringing about knowledge construction (Michinov and Michinov, 2008).

Intervening Conditions: Choices of Communication Channels

Team members realized that they had multiple choices of communication channels to choose from - synchronous vs. asynchronous communication. However, the results reveal somewhat conflicting views. Some of the team members stated that they preferred to have minimum synchronous communication (i.e., face-to-face contact) as one team member put it:

> *...Finding time when everybody is available for group meetings is very difficult. The work system allowed me to lessen my travel expenses and saved me stress from scheduling time for meeting by not needing to meet up with group members excessively.*

On the other hand, there were expressions of dislike for less frequent face-to-face communication. GDS does not transmit any non-verbal clues; thus, according to the social presence theory (Short, Williams, and Christie, 1976), it is perceived as having low social presence, inferring impersonal communication. Some of the team members claimed that the online asynchronous communication had created impersonal communication that may have caused the rest of the team to take the projects less seriously. For example, a team member stated:

> *...The fact that we never met created some distance between us where people did not feel personally responsible because we were not communicating on a face-to-face basis...People were a lot more willing to disappoint when there is no face-to-face communication.*

Action/Interaction Strategies: Team Collaboration, Informal Leadership, Communication Channel Selection, and Knowledge and Information Management

Team Collaboration

Team members made efforts to collaborate by delegating task, contributing to the work of their teams, initiating meetings for team discussion, and managing the projects. A team member mentioned that:

> *... we met before the project was started and divided the project into sections for individual completion*
>
> *...The whole group was involved in the setting-up process of the collaboration systems....*
>
> *...Each member was responsible to check the communication log regularly to be updated about any progress or inquires.*

Informal Leadership

Informal leadership manifested in group collaboration. Generally, this informal leadership belongs to the distributed-coordinated model (Mehra et al., 2006), in which an informal team leader perceives other team members as peers. Informal leaders encourage other team members to share their insights and give each member a sense of autonomy, enhancing team-based learning. A team member shared his or her thought about team leadership:

> *…Each of us took a lead role for an article analysis. The person who took the lead role for the week summarized the article and posted it on GDS.*
>
> *…We divided up the articles each week by assigning one editor to the article and the other four individuals would write different sections.*

Communication Channel Selection

Regarding the choices of communication channels, team members picked either synchronous or asynchronous communication channels based on the message content. Face-to-face contact and some other forms of synchronous communication, such as phone and instant messaging, were employed to solve more complex problems with ambivalent content. Asynchronous communication, such as email, on the other hand, served the purpose of coordinating less ambivalent content. Since asynchronous communication offers less information per exchange than synchronous communication does (Walther, 1995), team members preferred face-to-face communication to exchange information for solving complex problem. This finding is consistent with the media richness theory (Daft and Lengel, 1984), which suggests that users adopt rich communication channel, such as face-to-face, to communicate ambivalent content while employing leaner communication channels, such as email, for less ambivalent information exchanges (Walther, 1995). A team member put it:

> *…When preparing the projects, if we had information exchange, we would interact via email and the GDS. But in cases when we had a problem understanding a difficult question or situation, we would communicate via phone.*

Limited time seemed to be another factor. As team members were well aware of the project deadlines, they wanted to focus on completing the task on hand. Under this circumstance, the communication among team members was more task-oriented rather than socio-emotional oriented (Walther, 1992). Additionally, confronting other team members is not only unpleasant but also requires time and energy, which can thwart the project progress given the time limitation. Thus, team members selected asynchronous communication channels or "lean" media channel due to conflict avoidance and preference over task-oriented communication. A team member stated that:

> *…GDS allows for everyone to check each other's work and make changes without having to confront the person, which can be tricky.*

On the other hand, rich media, such as face-to-face communication, was used to build relationships. Team members invested their time to meet face-to-face to get to know other team members. A team member shared the story:

> *…We met at coffee works just off the campus…On top of working together on article analysis, research projects, and presentations we talked with each other about work, and how to deal with different issues we ran into.*

Knowledge and Information Management

Finally, knowledge and information management arose. Nonaka (1994, p.15) posited that *"information is a flow of messages, while knowledge is created and organized by the very flow of information"* and that *"information initiates and formalizes knowledge"*. In this regard, team members made sense of the information presented by other team members. Team members made efforts to review, edit, and verify other members' works and to piece things together so that all of the available information was integrated and organized to produce one cohesive flow, resulting in knowledge construction. As a result, knowledge sharing took place. For example, a team member revealed that:

> *…Everyone started writing his part, posting comments, or suggestions to the whole document using the note feature on GDS. While we have shared all the references, if a member finds information related to a section other than the one available, this member usually adds this information as a note on the appropriate section. After posting everything on GDS, we met and discussed the details of the paper to make sure everything is clear, and there is no information overlapped.*

Consequences: Attitude toward and suggestions for Web 2.0 collaboration tool

With the available open platform in support of users' interaction and participation, online collaboration tool could enhance the knowledge and information management in team-based learning and, subsequently, enable collaborative learning as well as knowledge dissemination and sharing. This would add a new learning dimension to traditional classroom settings and supplement traditional teaching methods. Specifically, Web 2.0 collaboration tool supports anytime and anyplace learning as compared to traditional teaching methods. In this research, team members perceived the aforementioned value of GDS.

> *…We found GDS to be a great tool because on more than one occasion only three of four members could meet, so the fourth member had to use GDS to stay up to date with what the group accomplished. This in the end saved time…*

> *…It's a great way for group to work together without have to meet… It's so easy and convenient for the group to share information spontaneously… It makes group work much more efficient and time-saving*

Additionally, students appreciated the centralized repository feature of GDS. This feature allowed students to effectively create streamlined documents to establish group collective memory.

> *… I liked the fact that we all had one place to put our finished products and could see what others had written.*

However, students were concerned about some drawbacks of using GDS in their group projects.

> *… I worry about that - I could misinterpret what is being stated and change a meaning.*

> *… It leads to not knowing exactly who completed what part of the project, which would lead to people relying on other group member to do the bulk of the work.*

These drawbacks may be attributed to a lack of rich communication channels with high synchronicity in GDS. Based upon the above comments, worrying about misinterpreting meanings implies a lack of shared understanding among team members; and not knowing who was responsible for which part of the project also inferred a lack of team coordination due to limited shared focus and understanding. To improve the current system, team members provided the following suggestions:

> *…A chat feature would be nice so that we could talk to each other through the site and discuss things while they were happening in real time …*

> *….use the chat function to communicate any inquiry or idea in real time and start a discussion*

> *…There is a need for instance messenger system so in order for it to be used as a communication system*

DISCUSSION

According to the analysis results, team members appreciated the existing functionalities in Web 2.0 collaboration tool mainly because they have benefited from streamlined document management and group work facilitation with the flexibility of anytime and anywhere participation. Web 2.0 collaboration tool establishes centralized repository to streamline document management and provide collective memory in support of better team coordination. In addition, since Web 2.0 technology transcends spatial and temporal boundary, it provides flexibility to team members with busy schedule and allows these team members to collaborate anytime and from anywhere.

However, in any technology-assisted learning, learners evaluate their learning through social interactions and psychological processes, rather than through the objectivity of the technology employed (Fulk et al., 1987). Similarly, drawing from Social Information Processing theory (Salancik and Pfeffer, 1978), learning occurs in the social context where learners interact to share knowledge, value, and intention. That is, learning is an outcome of interaction among team members who exchange ideas and share experiences to attain group solutions (Shen et al., 2006), bringing about knowledge construction (Michinov and Michinov, 2008).

In this study, team members had the opportunities to arrange the traditional face-to-face meeting. Despite that, team members expressed the needs of incorporating high synchronicity dimension (e.g., videoconference, chat room) into Web 2.0 collaboration tool to enhance team interaction. That is, team members wanted to see an integrated, open platform of both asynchronous and synchronous media implemented in Web 2.0 collaboration tool.

Synchronicity refers to a condition where individuals work together concurrently with a shared focus and understanding; however, using electronic media synchronously is necessary but not sufficient for synchronicity (Dennis, Fuller, and Valacich, 2008). Although individuals may use Web 2.0 technology to work simultaneously, they may not achieve

synchronicity. Media synchronicity is defined as "*the extent to which the capabilities of a communication medium enable individuals to achieve synchronicity*" (Dennis et al., 2008, p.581).

Asynchronous media is characterized by low synchronicity with high parallelism, low immediacy of feedback, high rehearsability, and high reprocessability (Munzer and Borg, 2008). In regard to high parallelism, Web 2.0 technology plays an important role to facilitate team communication by supporting parallel communication; that is, simultaneous information transmission. For instance, team members can use Web 2.0 collaboration tool and start posting their comments concurrently. The parallel communication has enhanced information sharing by facilitating simultaneous participation. With low synchronicity, team members do not face the pressure of providing immediate feedback and therefore they have a chance to rehearse and reexamine their messages before posting, creating well-shaped information. In other words, Web 2.0 technology supports high rehearsability, high reprocessability, and high parallelism given the low synchronicity dimension, resulting in good information transmission and sharing (conveyance).

On the other hand, media with high synchronicity has low parallelism, low rehearsability, low reprocessability, but high immediacy of feedback and high shared focus (Munzer and Borg, 2008). In collaborative learning, generating idea equates to information transmission. However, deciding on the best idea involves information processing and integration (convergence) in which "*pieces of information have to be related to each other and conclusions have to be drawn from patterns of relations*" (Munzer and Borg, 2008, p.666). Effective information processing and integration would require team interaction with shared focus and understanding. Thus, high synchronicity also emerges as a requirement for effective learning using Web 2.0 collaboration tool.

Both low and high synchronicity dimensions would enhance collaborative learning. Low synchronicity dimension, associated with high parallelism, high rehearsability, and high reprocessability, enables users to generate ideas in a timely manner. On the other hand, high synchronicity dimension, characterized by immediacy of feedback and sequential communication, promotes team interaction with shared understanding, focus, and trust to support information integration and processing.

Web 2.0 collaboration tool has the capacity to effectively facilitate asynchronous information transmission and sharing (conveyance). However, what is lacking is the high synchronicity dimension to support information processing and integration (convergence) that requires team interaction with shared focus and understanding. Thus, team members suggested incorporating features such as videoconference, chat room, and instant messaging into Web 2.0 collaboration tool. Additionally, to implement high synchronicity dimension, Web 2.0 collaboration tool may also include (1) auditory and visual transmission and (2) high transmission velocity.

High synchronicity dimension could emulate face-to-face communication, bolstering high social presence in an effort of trust building. Dennis et al. (2008), while extending the Media Synchronicity Theory (MST), posited that media associated with more natural symbol sets (i.e., physical, visual, and verbal) attain high synchronicity. Web 2.0 technology will not be able to transmit physical cues such as hand shake and gentle touch but it can send out visual cues (e.g., facial expression) and verbal cues (e.g., vocal tone). Transmitting visual and verbal cues will increase social presence (Short et al., 1976), fostering trust among team members. Trust building is essential to establish shared understanding for information processing and integration (Scott, 2000).

In addition, high transmission velocity alludes to speedy delivery of message to the recipient, and therefore, it facilitates immediate feedback, improving shared focus for information integration (Dennis et al., 2008). Thus, Web 2.0 collaboration tool with high transmission velocity will enhance team coordination, promoting understanding among team members.

Furthermore, Web 2.0 collaboration tool may also include features supporting sequential communication. Sequential communication, with low parallelism, will facilitate not only team interaction but also informal leadership, an emerging action/interaction strategy in collaborative learning. Informal leadership falls under distributed-coordinated model (Mehra et al., 2006) where an informal team leader views other team members as equal, and therefore, interacts with other team members as peers in the social context. Sequential communication would allow team members to take turn to speak up and promote an egalitarian atmosphere. These circumstances would foster open communication, contributing to good knowledge sharing.

CONCLUSION

This study investigated how a Web 2.0 collaboration tool (i.e., GDS) could enhance collaborative learning in team-based environment. We collected students' feedbacks regarding the Web 2.0 collaboration tool that they had used during the semester to prepare their group projects. We employed grounded theory paradigm to analyze these students' feedbacks that were written in text. The results shown that students were aware of the needs to adopt Web 2.0 collaboration tool to help them prepare their group projects. Students also appreciated the value of group assignments and team-based learning.

Additionally, with Web 2.0 collaboration tool and other media choices such as face-to-face meeting and phone, students had choices of communication channels. Students may communicate with their team members either via asynchronous communication channel (e.g., e-mail) or synchronous communication channel (e.g., face-to-face meeting, phone). In addition to communication channel selection, knowledge and information management emerged. As team members reviewed, edited, and verified other members' work in order to integrate, organize, and produce one cohesive flow for their project reports, knowledge construction and sharing took place.

Although students perceived the value of Web 2.0 collaboration tool, students were also concerned about some drawbacks. For example, the system lacked rich communication channels with high synchronicity. To enhance collaborative learning, low synchronicity dimension of communication channels enables team members to generate ideas anytime; on the other hand, high synchronicity dimension of communication channels promotes team interaction, shared understanding, focus, and trust to support information integration and processing. The shared understanding and focus are important because learning occurs in the social context where learners interact to share knowledge, value, and intention (Salancik and Pfeffer, 1978). Additionally, in any technology-assisted learning, learners evaluate their learning not through the functionalities of the technology employed, but through the social interactions and psychological processes that occur (Fulk et al., 1987).

Web 2.0 collaboration tool lacked high synchronicity dimension. Therefore, when a team needed to develop shared focus and understanding on message content (e.g., on the content of team's project report), team members had to employ other communication channels (e.g., face-to-face meeting, phone) that provided high synchronicity dimension. Some other criteria for selecting asynchronous vs. synchronous communication channels included conflict avoidance and preference over task-oriented communication (rather than socio-emotional oriented).

Based on these findings, this study suggests that Web 2.0 collaboration tool implements high synchronicity dimension with high immediacy of feedback and sequential communication. Web 2.0 collaboration tool may also include the capability to provide auditory and visual transmission and high transmission velocity. Transmitting visual and verbal cues would increase social presence and foster shared focus, understanding, and trust among team members. Similarly, high transmission velocity would allow speedy delivery of information, facilitate immediate feedback, and improve shared focus for information integration.

Given that this study is currently a research-in-progress, more data analysis needs to be carried out to strengthen the research findings. We have applied grounded theory paradigm to analyze less than half of the collected students' feedback. Through further data analysis and coding, more noteworthy incidents and concepts may emerge. For example, some students mentioned that they had concerns over the quality of their project reports and the effect on their final grades. More in-depth analysis and coding will possibly uncover an interaction.

Finally, similar to any other empirical studies, this study has certain limitations. This study was conducted in and the students' feedbacks were collected from only two universities. Additionally, this study employed only one Web 2.0 collaboration tool (i.e., the GDS). Thus, the findings of this study may represent the perceptions of the students in these two universities and the particular characteristics of the Web 2.0 collaboration tool employed in this study. Researchers should exercise caution and judgment in extrapolating the findings of this study from the responding sample to the broader population.

REFERENCES

1. Alavi, M. (1994) "Computer-Mediated Collaborative Learning: An Empirical Evaluation," *MIS Quarterly*, 18 (2), p.159–174.
2. Boulos, M. N. K., Maramba, I., and Wheeler, S. (2006) "Wikis, Blogs and Podcasts: a New Generation of Web-Based Tools for Virtual Collaborative Clinical Practice and Education," *BMC Medical Education*, 6 (41), p.1472–1480.
3. Daft, R. L. and Lengel, R.H. (1984) "Information Richness: A New Approach to Managerial Behavior and Organization Design," *Research Organizational Behavior*, 6, p.191-233.
4. Dennis, A.R., Fuller, R.M., and Valacich, J.S. (2008) "Media, Tasks, and Communication Processes: A Theory of Media Synchronicity," *MIS Quarterly*, 32 (3), p.575-600.
5. Fulk, J., Steinfeild, C.W., Schmitz, J., and Power, J.G. (1987) "A Social Information-Processing Model of Media Use in Organizations," *Communication Research*, 14 (5), p.529-552.
6. Hiraki, A. (1992) "Tradition, Rationality, and Power in Introductory Nursing Textbooks: A Critical Hermeneutics Study," *Advanced Nursing Science*, 14 (3), p.1 – 12.

7. Klein, H. K. and Myers, M. D. (1999) "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly*, 23 (1), p.67 – 93.
8. McLean, R., Richards, B.H., and Wardman, J.I. (2007) "The Effect of Web 2.0 on the Future of Medical Practice and Education: Darwikinian Evolution or Folksonomic Revolution?" *Medical Journal of Australia*, 187 (3), p.174-177.
9. Mehra, A., Smith, B. R., Dixon, A. L., and Robertson, B. (2006) "Distributed Leadership in Teams: The Network of Leadership Perceptions and Team Performance," *The Leadership Quarterly*, 17 (3), p.232-245.
10. Michinov N. and Michinov E. (2008) "Face-to-face contact at the Midpoint of an Online Collaboration: Its Impact on the Patterns of Participation, Interaction, Affect, and Behavior over Time," *Computers & Education*, 50 (4), p.1540-1557.
11. Munzer, S. and Borg, A. (2008) "Computer-Mediated Communication: Synchronicity and Compensatory Effort," *Applied Cognitive Psychology*, 22 (5), p.663 -683.
12. Musser, J. and O'reilly, T. (2007) *Web 2.0 Principles and Best Practices*, San Francisco, CA: O'reilly Media.
13. Niederman, F. (2009) "Using Grounded Theory to Generate Indigenous MIS Theory," *Proceedings of the 15th Americas Conference on Information Systems*, San Francisco, CA, August 6-9, 2009.
14. Nonaka, I. (1994) "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science*, 5 (1), p.14-37.
15. Rollett, H., Lux, M., Strohmaier, M., Dosinger, G., and Tochtermann, K. (2007) "The Web 2.0 Way of Learning with Technologies", *International Journal of Learning Technology*, 3 (1), p.87-107.
16. Salancik, G. R. and Pfeffer, J. (1978) "A Social Information Processing Approach to Job Attitudes and Task Design," *Administrative Science Quarterly*, 23 (2), p.224-253.
17. Scott, J.E. (2000) "Facilitating Interorganizational Learning with Information Technology," *Journal of Management Information Systems*, 17 (2), p.81-113.
18. Shen, J., Hiltz, S. R., and Bieber, M. (2006) "Collaborative Online Examinations: Impacts on Interaction, Learning, and Student Satisfaction," *IEEE Transactions on Systems, Man, and Cybernetics—Part A: Systems and Humans*, 36 (6), p.1045–1053.
19. Short, J., Williams, E., and Christie, B. (1976), *The Social Psychology of Telecommunication*, London: Wiley.
20. Strauss, A. and Corbin, J. (1990) *Basics of Qualitative Research: Grounded Theory, Procedures, and Techniques*, Newbury Park, CA: Sage.
21. Urquhart, C. (2001) "An Encounter with Grounded Theory: Tackling the Practical and Philosophical Issues," In E. M. Trauth (Ed.), *Qualitative Research in IS: Issues and Trends* (p.104-140), Hershey, PA: Idea Group.
22. Walther, J. B. (1992) "Interpersonal Effects in Computer-Mediated Interaction: a Relational Perspective," *Communication Research*, 19 (1), p.52-90.
23. Walther, J.B. (1995) "Relational Aspects of Computer-Mediated Communication: Experimental Observations over Time," *Organization Science*, 6 (2), p.186-203.