

Singapore Management University

## Institutional Knowledge at Singapore Management University

---

Research Collection Lee Kong Chian School Of  
Business

Lee Kong Chian School of Business

---

9-2015

### Computer supported collaborative learning: A business simulation activity using social media

Siyong CHUNG

*Singapore Management University, sychung@smu.edu.sg*

Hichang CHO

*National University of Singapore*

Follow this and additional works at: [https://ink.library.smu.edu.sg/lkcsb\\_research](https://ink.library.smu.edu.sg/lkcsb_research)



Part of the [Higher Education Commons](#), [Social Media Commons](#), and the [Technology and Innovation Commons](#)

---

#### Citation

CHUNG, Siyoung and CHO, Hichang. Computer supported collaborative learning: A business simulation activity using social media. (2015). *2015 International Conference on Interactive Collaborative Learning (ICL): 20-24 Sept. 2015, Firenze, Italy: Proceedings*. 809-814.

Available at: [https://ink.library.smu.edu.sg/lkcsb\\_research/5120](https://ink.library.smu.edu.sg/lkcsb_research/5120)

This Conference Proceeding Article is brought to you for free and open access by the Lee Kong Chian School of Business at Institutional Knowledge at Singapore Management University. It has been accepted for inclusion in Research Collection Lee Kong Chian School Of Business by an authorized administrator of Institutional Knowledge at Singapore Management University. For more information, please email [cherylds@smu.edu.sg](mailto:cherylds@smu.edu.sg).

# Computer Supported Collaborative Learning: A Business Simulation Activity using Social Media

Siyoung Chung

Lee Kong Chian School of Business  
Singapore Management University  
Singapore  
sychung@smu.edu.sg

Hichang Cho

Department of Communications and New Media  
National University of Singapore  
Singapore  
cnmch@nus.edu.sg

**Abstract**—Social media are dramatically changing the way we live and make social relationships with others. While students are so immersed in social media in their daily life, social media adoption in classroom has been slow. Educators who wish to experiment with social media for CSCL struggle to find ways to incorporate the expected benefits and advantages of social media to teaching lessons. This paper reports on the experiences of using social media for a business case simulation activity in a higher learning context. Drawing on a qualitative feedback and social media log data of 27 teams of 135 undergraduate students, this paper discusses the advantages and disadvantages of social media as a CSCL tool in classroom, especially in the areas of information sharing and social interaction.

**Keywords**—computer supported collaborative learning (CSCL); social media; Facebook; Google Docs; information sharing; social interaction; simulation activity

## I. INTRODUCTION

Social media are dramatically changing lives of everyone. From photos of food on Instagram (so called food porn), to a YouTube video of a police shooting an unarmed man (South Carolina cop shooting, 2015), to tweets of an airplane crash (a plane crash in the Hudson River, 2009), to a Facebook page of humanitarian aid to Nepal (International Medical Corps, 2015), social media penetrated to every facet of individual life. No other media was so rapidly changing the way people communicate with others.

Social media are different from other media in that participation and sharing is a norm. On social media, the way people consume media is no longer one way or linear. Unlike traditional media which provide media contents to people to consume (reading or watching), social media require active participation from users such as creating, commenting, editing, and sharing contents. Even though passive use of social media is possible, anyone on social media soon realizes that active participation is the only way to make his/her “social” ties with others bigger and stronger. For example, on Twitter, people stop following Twitter accounts if updates are not done regularly or the tweets from those accounts are not interesting. Furthermore, people feel that they get to know others “better” on social media than on offline. By looking at slice of life of someone, people feel more intimately related to others. This

sense of intimacy leads them to “friend” (i.e., Facebook) and to “follow” (i.e., Twitter) others.

In recent years, educators have started to use social media for computer supported collaborative learning (CSCL) which is considered as more conducive to collaborative learning thanks to their capability to facilitate real-time, social, and collaborative interaction among participants [1]. CSCL using social media can enhance learning experience and outcomes, by enabling educators to create learner-centered learning environments where learners initiate, explore, share, and find answers and solutions. Much research supports that such a proactive approach to learning boosts confidence and interest among learners. However, little is known as to how social media aid collaborative learning for learners, what benefits and drawbacks they engender, and lastly, what challenges they pose to learners. Using a business simulation activity, this study will examine the benefits and drawbacks that social media may create for learners. In specific, this paper focuses on information sharing and social interaction of CSCL.

## II. LITERATURE REVIEW

Collaborative learning promotes higher-level thinking, communication skills (verbal and non-verbal), self-management, and leadership skills. Some studies further suggest that CL engenders students to become more social and collaborative members of the society.

Collaborative learning is applied in a group-based educational approach that involves problem solving, creative idea generation, new product and/brand development [2], and critical thinking [3]. With the advent of computers and educational technologies, computer supported collaborative learning has become a fact or a norm in classroom. Educators and schools have implemented computing systems in learning to promote collaborative, cooperative learning among learners who are either in the same physical place or dispersed in different geographical locations. Equipped with various tools and platforms, CSCL aids learners to build knowledge and expertise, support student-centered learning, and facilitate group learning. As a result, student engagement and achievement are likely to be enhanced (see Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999, for a comprehensive review of benefits of CSCL) [4].

While the application of computers to collaborative learning has been considered as a new opportunity for effective learning experience and outcomes, it also presents new challenges to learners due to different environment created by computer mediated communication. Computer mediated communication (CMC) is known to lack in bandwidth and capacity to convey various cues such as non-verbal cue (i.e., voice tone, pitch, body language, and facial expressions), spatial information (i.e., distance), and other social and relationship cues (i.e., ranks and intimacy). The lack of these cues delays or impedes the social exchanges and interactions, and further hinders development of social and interpersonal relationships among communicators. To this, Walther [5] argues that with enough time and interaction, people in a CMC environment can and will build substantial and quality interpersonal and social relationships. However, that requires sufficient time of interaction and exchange among communicators. Lessons or courses using CSCL often are not long enough to offer such opportunities to learners. Hence, learners in CSCL are expected to face challenges in communication from the cue-filtered out [6] environment. Information sharing and social interaction among learners are expected to face challenge in CSCL as these require continuous interactive exchanges. This paper will discuss how information sharing and social interaction are influenced in CSCL using social media.

#### A. Information Sharing

Collaboration is a process by which individuals negotiate and share meanings relevant to the task at hand [7] and this process inevitably encompasses information sharing. Scholars in CSCL have identified information sharing as an essential component for successful collaborative learning [8][9]. Before a group starts a task, pre-existing information should be shared among the learners so as to build knowledge repositories for the group and to create shared understanding. Therefore, the amount, diversity, and quality of information shared among learners have substantial impacts on learning outcomes [10][11][12]. In fact, one of the benefits of CSCL is to provide learners the opportunity to share resources and knowledge [13]. Learners in a CSCL environment are equipped with means and tools to connect with other learners and with the knowledge resources and are able to create bigger knowledge repositories. However, it is important to understand that technology alone does not guarantee successful information and knowledge sharing among learners. Studies found that learners are more motivated to share information when they feel the information is timely and relevant, and when they are given with enough opportunity to clarification and elaboration [14][15]. This requires systems and programs in CSCL to provide two-way, synchronous communication through which learners can engage in discussion, negation, elaboration, and meaning creation at any time.

On social media, learners can choose various tools for their purpose, convenience, and preference. The vast options for learners include instant messaging, sharing of photo, video, screenshot, microblogging, co-creation of documents, digital

bookmarking, collaborative mind mapping and brainstorming, collaborative editing and creating, and so on. The endless of choice of social media will facilitate information sharing among learners.

#### B. Social Interaction

Learning is a social construct [16]. This basic premise signifies the importance of social interaction in learning. Social interaction is a pre-requisite for collaborative process as it promotes flow of information, exchange of ideas and feedback, and co-creation of mutual understanding [17][18][19]. Social interaction takes place in constant and continuous communication and exchange among learners. One of the most notable characteristics of social media is continuous feedback they enable users to provide to others. Social media users give and take feedback to and from one another in the form of comments, posts, tweets, symbols and signs (i.e., “Like” button in Facebook and stars in recommendation systems) and learn about others’ thoughts and feelings, their relationships with others, and reputations about themselves and others. This social interaction will deepen understanding about themselves and others and promote more collegial and collaborative behaviors among learners. The friendly and favorable climate will ease tension and conflicts that learners in CSCL often face, helping them overcome social and emotional challenges throughout the learning process..

Second, social media are more suitable to create social presence of learners. Social presence is the awareness of others in communication combined with an appreciation of the interpersonal aspects of that interaction [20] and is considered important in creating successful communication. Social Presence theory posits that, due to limited bandwidth, communication in a mediated environment like CSCL lacks in non-verbal cues such as facial expressions, posture, gaze, gesture, voice tone and inflection. Other social information such as spatial (i.e., how closely people stand or sit) or relationship (i.e., ranks, titles) is also omitted in communication. The absence of non-verbal cues and social information impedes the development of interpersonal and affective relationship among people. However, some social media, by offering communication in various forms such as video, audio, visual, and text, can enhance social presence of learners while they are working on a task.

### III. COLLABORATIVE LEARNING CLASS ACTIVITY-SIMULATION

#### A. Design rationale of the activity

For successful CSCL processes and outcomes, several key elements have been proposed [21], including individual accountability and personal responsibility, interdependence among learners, and substantial of social interaction and social skills. Based on this recommendation, this study carefully designed a simulation-based activity to create a collaborative learning environment and experience to the learners.

First, individual accountability and personal responsibility is embedded in the activity so that each learner is fully aware of their role and responsibility to the task. Individual student receives information regarding his or her role and the information pertaining to that role. This information is not shared with the others in the group, so individual contribution is a key to successful task completion. Second, interdependence is essential part of the activity. The information is needed to be shared among other members for quality decision making and learners are dependent upon one another. Third, this activity prescribes student-student interaction rather than teacher-student interaction. As pointed out by Johnson, Johnson, Stanne, and Garibaldi [21], social information and skills obtained through social interaction would increase the possibility for collaborative and cooperative learning process. Selection of CSCL tools, rules and procedures of use of tools, information sharing, communication, and decision making will be jointly decided among the learners.

#### *B. Description of the activity.*

The activity involving collaborative learning and communication technologies was used for an undergraduate course in a university. This activity was carefully designed to create conditions similar to real-life situations and contexts where collaborative group process inevitably involves the use of communication technology. Instead of face-to-face, all interactions and communication needed to take place in a computer mediated communication, especially via social media for the purpose of this research.

A total of 135 students were randomly assigned to groups of five, creating a total of 27 teams. This criterion for group formation was adopted to reproduce working conditions similar to real-life teams where there is a varying degree of intimacy and familiarity among members. The task given to students was to make a decision, as a team, for a hypothetical manufacturing company that faced a serious business challenge. They had to decide whether the company should change their business model to online business, abandoning their 80-years long traditional brick-and-mortar approach. Each team was comprised of five roles; team leader, business analyst, market and consumer researcher, implementer, and technical expert. Once again, this design was introduced to create similar condition to real-life project teams, taskforce, or committees that rely on expertise and special talents of each member.

When the activity started, all communication and information given to students were done by electronically, via the school email system. All students received the basic information about the business objective, the situation analysis, and the team information (names and emails of the teammates). In addition to that, each team member received unique, unshared information and data pertaining to their roles. For example, if a student role was the market and consumer researcher, he or she received the data about a recent consumer lifestyle survey and the sales data for the last 5 years, while a student with technical expert role was given the

information about the technical feasibility study and budget of an online shopping mall system. No prior information was given to students as to who played what roles and what kind of information each person possessed; students initially assumed that everyone had the same information. This design was to ensure that only through interaction and communication could they obtain all necessary information to make a rational decision for the company.

To reinforce the use of social media for this activity, students were told 1) not to engage in face-to-face interactions during the activity, 2) to scatter and go anywhere they wanted to go while maintaining their access to the Internet, and 3) to submit the log data or screenshots of their social media communication after the activity. Some students remained in classrooms but a majority of them went to libraries, cafes, study lounges, benches, and even home. Instructors remained electronically available throughout the activity for any technical problems. However, no intervention, instruction, or advice was given to students as to media choice, conflicts and communication problems, free-rider issues, and so on. Students were given with most liberty in all aspects of this activity.

After the two-hour simulation activity, qualitative feedback based on a set of questions was collected along with their social media log data.

#### IV. RESULTS AND DISCUSSION

Different forms of social media were tried and used by students for this activity. Students were freely experimenting with social media and comparing them for the fitness to the task. Common rules for selecting the media for the activity were communication with multiple users, good interface designs, and ability to co-create the documents. Most preferred media, after trials and discussion, were Facebook and Google Docs, followed by Skype and WhatsApp. The choice of media is well supported by Media Richness Theory [22] which posits that media choice based on the match between the task complexity and richness of the media (lean vs. rich) would yield better communication outcomes.

The two most used social media platforms, Facebook and Google Docs, have clear advantages and disadvantages. Students used Facebook reported the familiarity with and competency of using the platform was very helpful, enabling them to start the activity immediately. Facebook also offers instant chat function in a private setting, enabling the groups to have undisturbed discussion. However, the poor interface design (i.e., small fonts and screen) and constant distraction from their other Facebook friends popping up to chat were major disadvantages.

On the contrary, unfamiliarity with the interface and the platform was the most challenging part for first time users of Google Docs. Experienced users had to teach them, so even only one first time user delayed the activity for the entire group. Many students found technical proficiency would be critical for CSCL. Lack of personification caused some confusion as guest users were denoted as "Anonymous User 1"

and “Anonymous User 2” (see Fig. 2) so the members constantly struggled to identify who they were talking to. Its function to assist collaborative group work was, however, highly positively evaluated. The screenshots of log data of the two social media are shown in Fig. 1 and Fig. 2, respectively.

#### A. Information sharing

Students engaged in active information sharing regardless of the types of social media platforms they used. Groups reported that “everyone took the initiative to create an online presence and showed engagement in the discussion” and “there were no ‘Shrinking Violets’ that failed to contribute.” A student reported that he was “forced to become more active than [his] usual self because [he] knew that “that was expected on social media.” This may be due to the nature of social media that requires instant feedback in order to stay connected. On social media, users are continuously approached, invited, replied, and commented by other users. Unexpectedly long time lapse for interaction, though it varies from media to media, will create perception of lack of interest or sociability and may result in decrease in contacts or even cut-out from others’ personal networks (like “unfriend” in Facebook or “unfollow” in Twitter, Pinterest, or blogs). This normative pressure motivates learners to become more active and visual during collaboration. Example 1 shows information sharing behaviors among students.

#### Example 1

[Log]Student 1: Let's put in all the information first before reading it through together at 240PM

[Log] Student 2: i think maybe we can share some information from the document our TA sent us

However, as learners shared the information they received, so-called raw information, they began to feel overwhelmed and discouraged by the amount of information they had to process. This created a problem of information overload. One student commented that “it was an information ‘dumping’ session with everyone speaking at the same time” and another student stated “The sheer amount of information being rallied back and forth and shared on the document eventually became disorientating, requiring a high level of concentration and cognitive ability to work.” This called for rules and agreement on information sharing such as turn-taking, reply time, summarizing, new coordinating roles assigned, and adding signs and symbols. Below is an example of students negotiating on rules to cope with the information overload issue.

#### Example2

[Log]Student 4: instead of sharing all the information we have. why not we first decide on the areas that we want to talk about in the report first.

[Log]Student 5: ok give me sometime to read and digest all the information.

[Log]Student 6: we give ourselves... 5 mins? 10 mins??? 15????

Fig. 1. Screenshot of Facebook Chat Log

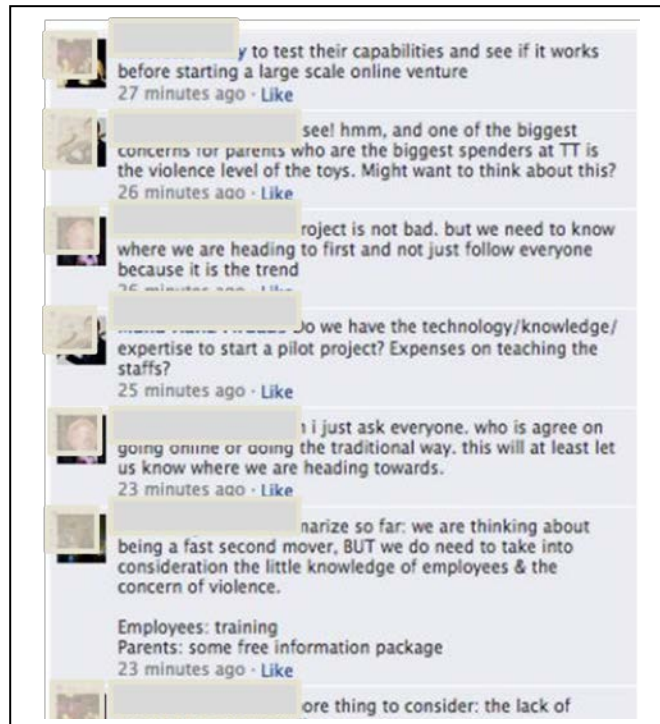
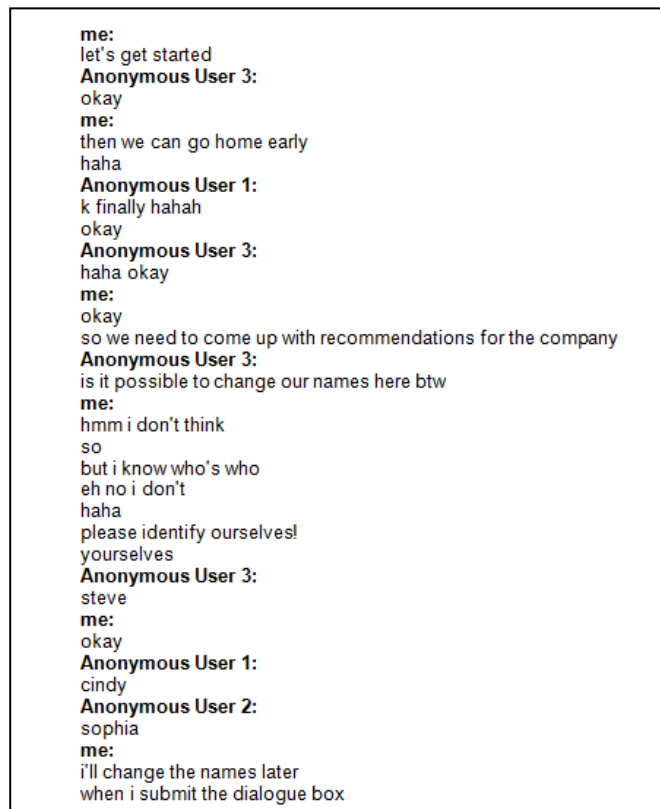


Fig. 2. Screenshot of Google Docs Chat Log



[Log]Student 7: Pls stop sending new info for 5 mins from now.

[Log]Student4: then, I am creating skeleton of the report.  
.....[time lapse].....

[Log]Student4: ok, guys, time is up. Lets shre your summary.btw, let's do our answers in a different color or font then the questions.

Information overload also challenged information processing. A student stated that “*ironically, [they] were so focused on ‘sharing’ information, [they] did not have enough time to absorb information shared by others.*” Many groups tended to “trade-off” with the quality for speedy decision as information overload hindered “deep discussion” and scrutinize all the information.

Interestingly, implementation of rules made a big difference in group process and decision making. Those who created the rules early on progressed faster and collaborated with less friction while groups without these rules were delayed in information processing and decision making, and was subject to much conflicts and emotional stress. Below are comments from three students regarding this issue.

*“I wish we had some rules about turn taking. Instead of working on the task, we wasted our time on figuring out who says what. Everyone got so pissed up towards the end of the activity”*

*“I feel that the team leader could have facilitated a short interaction at the beginning of the exercise, to establishing rules, build relationships, and forge a certain degree of common understanding.”*

*“My teammates all started the “discussion” by rapidly regurgitating the data they received without much deliberation over what were the crucial or relevant information for the decision to be achieved. They also automatically adopted a typical [school name] “divide and conquer” project-work style ..... without consideration that the task at hand requires much more collaborative effort”*

## B. Social Interaction

Despite the time constraint, substantial social interaction was found during the activity. The types of social interaction included sharing emotions, support and encouragement, and jokes. Students reported that their teams used motivating comments like “*good job*”, “*good idea*”, and “*nice*”.

Language used in exchange and discussion was short, common and Internet lingos were used in an attempt to shorten the communication. Some may argue that this may impede the development of collegiality and social relationship as it may breeds misunderstanding such as being abrupt or even rude. But the result showed that such use of language was a norm. Students frequently used smileys and Internet jargons to compensate for the lack of non-verbal and social cues. Example 3 shows the use of lingos in students’ dialogue.

### Example 3

[Log]Student 8: eh sorry ah.. why got like economical viability technical feasibility all that...hahahaha...sooo im doing economical viability i guess?

[Log]Student 9: haha cause you're supposed to convince the bosses

[Log]Student 8 : uh huh uh huh... hahaha

[Log]Student 10: hmm

[Log]Student 8: you're supposed to convince the senior management you have to show them that you have thought about it

[Log]Student 11: Sorry let's shift the recommendation to the top i think management all want to know the decision first

[Log]Student 8 : yah yah i get it hahahaha my only concern is... so im doing the economical viability part right? lol

Social presence was perceived relatively higher on Facebook than on other social media such as Google Docs, Skype, or WhatsApp. Groups using Facebook added their group members to the friends list of their Facebook. Students reported that “*the moment [their] teammates sent a friend request, [they] could see their profile pictures and have more information about them.*” Groups that adopted Facebook obtained some personal information about each other such as photos and events from timeline, which helped create a friendlier climate.

### Example 4

[Log]Student #5: Wow. Sam, nice photo, where did you take it?

[Log]Student #6: Tnx. That was from my BSM to newyork

[Log]Student #7: FRZN.

Proactive offer to help and friendly gestures were considered important and valuable. Students believed that those were essential to create friendly and trusting atmosphere, ease the tensions, and coalesce distant members together as a working group. A student highly praised a group member as “*he was also quick to offer assistance when technology failed, and was organized in sharing his information.*” It was found that students valued small friendly gestures and helps highly, believing that those were essential

Conflict and misunderstanding was more frequently witnessed and experienced in groups using lean media such as Google Docs and WhatsApp. For example, one foreign exchange student was upset when the other group members addressed her as “exchange student” instead of her name. She complained to the instructor that she felt insulted. A face-to-face meeting after the activity revealed, interestingly, that the group chose to call her as exchange student because they were afraid that they might misspell her rather unfamiliar foreign name. This incident indicates that collegiality and friendly climate requires substantial social presence. Regarding this, one student noted that “*what [they] faced as a team was the*

lack of collegiality. [She] would opt to integrate other forms of new media (e.g. Facebook, Google Docs) to know one another better and facilitate rapport building for a more optimal team performance.”

Students reported that this simulation activity was overall “highly engaging”, “educational” and “useful for future career”.

## V. CONCLUSION

In this paper, we discussed the results of the implementation of a collaborative activity in CSCL using social media as a way to increase motivation in undergraduate students. We discovered through the analysis of the self-reported feedback and social media log data, that despite widespread adoption of CSCL in classrooms in higher education, social media have proven to be an effective tool to engage students in a task. Learners were instantly engaged in the role playing simulation activity that required the use of social media through which students were able to share, negotiate, and discuss with their peers to create meaningful outcomes.

Information sharing occurred voluntarily and proactively from the beginning of the activity. With minimal instruction, through active participation, engagement, and joint group decision making, students exchanged information and opinions. This is an encouraging finding for teachers and educational researchers because motivating to students to take voluntary actions and initiatives is one of the most challenging tasks in any learning contexts and social loafing, free loader and suckers effects are all detrimental to collaborative learning.

High engagement also induced voluntary problem solving for technical and social challenges. New rules and roles were jointly decided to facilitate the group process.

Consistent with Social Presence Theory [20] and Media Richness Theory [22], rich media were considered to provide more social presence, conducive to cultivating a more social and collegial climate among students. Lean media were found to offer low social presence, more prone to create conflicts and miscommunication.

Social media have made students active participants of learning process; voluntary information seeking and sharing, and actively engaging in discussion and problem solving. The current generation is more acceptable to and explorative with new technologies, which has affected their thinking and learning styles [23]. A more interactive and participatory learning environment, enabled by social media, will make students self-motivated, inquisitive, and collaborative learners in classrooms.

## REFERENCES

- [1] S. Lewis, P. Roy, and J. Rosen, "Beyond participation to co-creation of meaning: mobile social media in generative learning communities," *Social Science Information*, 49.3, pp. 351-369, 2010.
- [2] K.A. Bruffee " Collaborative learning: Higher education, interdependence, and the authority of knowledge," Johns Hopkins University Press, Academic, pp. 271-350. 1999.
- [3] A.A. Gokhale, "Collaborative learning enhances critical thinking." *Journal of Technology Education*, 7.1, pp. 22-30, 1995.
- [4] E. Lehtinen, K. Hakkarainen, L. Lipponen, M. Rahikainen, and H. Muukkonen, "Computer-supported collaborative learning: A review of research and development" (The J.H.G.I Giesbers Reports on Education, 10). Netherlands: University of Nijmegen, Department of Educational Sciences, 1999.
- [5] J.B. Walther, "Computer-mediated communication impersonal, interpersonal, and hyperpersonal interaction," *Communication Research*, 23. pp. 3-43, 1996.
- [6] J.B. Walther and M.R. Parks. "Cues filtered out, cues filtered in," *Handbook of Interpersonal Communication*, pp. 529-563, 2002.
- [7] J. Roschelle and S. D. Teasley, "The construction of shared knowledge in collaborative problem solving," *Computer Supported Collaborative Learning*. Springer Berlin Heidelberg, 1995.
- [8] D.D. Suthers, N. Dwyer, R. Medina, and R. Vatrappu, "A framework for conceptualizing, representing, and analyzing distributed interaction," *International Journal of Computer-Supported Collaborative Learning* 5.1, pp. 5-42, 2010.
- [9] H.R. Pfister, "How to support synchronous net-based learning discourses: Principles and perspectives," In R. Bromme, F. Hesse and H. Spada (Eds.), "Barriers and Biases in Computer-Mediated Knowledge Communication-- And How They May be Overcome," Dordrecht: Kluwer. 2005.
- [10] M. Alavi and D.E. Leidner, "Research commentary: Technology-mediated learning—A call for greater depth and breadth of research," *Information Systems Research* 12.1, pp. 1-10, 2001.
- [11] D.D. Curtis and M. J. Lawson, "Exploring collaborative online learning," *Journal of Asynchronous Learning Networks*, 5.1, pp. 21-34, 2000.
- [12] E. Lehtinen. "Computer-supported collaborative learning: An approach to powerful learning environments." *Powerful learning environments: Unravelling basic components and dimensions*. pp. 35-54. 2003.
- [13] H. Cho, G. Gay, B. Davidson, and A. Ingrassia, "Social networks, communication styles, and learning performance in a CSCL community." *Computers & Education* 49.2 pp. 309-329. 2007.
- [14] P. Vedder, *Cooperative learning: A study on processes and effects of cooperation between primary school children*, Westernhaven Croningen, Netherlands: Rijkuniversiteit Groningen. 1985.
- [15] N. M. Webb, " Peer interaction and learning in small groups," *International Journal of Educational Research*, 13, pp. 21-39, 1989.
- [16] M. Rorty, J. Yager, M.A. and E. Rossotto, "Childhood sexual, physical and psychological abuse in bulimia nervosa," *American Journal of Psychiatry*, 151, pp. 1122-1126, 1994.
- [17] B. Barron, "When smart groups fail," *The Journal of the Learning Sciences*, 12, pp. 307-359, 2003.
- [18] K. Kreijns, P.A. Kirschner, and W. Jochems, "Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research," *Computers in Human Behavior*, 19.3, pp.335-353, 2000.
- [19] S. Liaw and H. Huang, "Enhancing Interactivity in Web-based Instruction: A Review of the Literature," *Educational Technology*, 40.3, pp. 41-45, 2000.
- [20] J. Short, E. Williams, and B. Christie, *The social psychology of telecommunications*. London: John Wiley & Sons, 1976.
- [21] D.W. Johnson, R.T. Johnson, M.B. Stanne, and A. Garibaldi, "Impact of group processing on achievement in cooperative groups. *The Journal of Social Psychology*," 130 (4), pp.507-516, 1991.
- [22] R.L. Daft, and R.H. Lengel, "Organizational information requirements, media richness and structural design. *Management science*," 32.5 pp.554-571. 1986.
- [23] D. Tapscott, "Growing Up Digital: The Rise of the Net Generation," New York: McGraw-Hill. 1998.