Student Awareness Change in Computer Supported Collaborative Learning (CSCL) Environment

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Abstract—**Computer Supported Collaborative Learning (CSCL) is considered to be helpful in fostering collaborative and computer skills. CSCL is also thought to contribute to higher order thinking. In this study, CSCL was conducted to a total of 480 students enrolled in a prerequisite course in a Japanese higher education setting. A groupware that allowed synchronous group work was integrated and used. Pre and post surveys were delivered to analyze students` awareness of collaborative skills. Confidence level of computer skills was also investigated. The study showed that administering CSCL improves students` awareness in collaborative skills such as interpersonal skills, inquiry skills and group management skills, as well as raise the students` confidence level of computer skills.**

Index Terms—**Collaborative learning, ICT, student awareness, computer skills.**

I. INTRODUCTION

The Partnership for 21st Century Skills names collaborative skill as an important 21st Century skill, defining collaboration as working effectively and respectfully with diverse teams, working flexible to accomplish a common goal. Collaborative learning in higher education is also increasingly promoted worldwide including Asia Pacific Region [1], [2].

Collaborative learning has been around for many years before the use of technology became a norm in classroom. This is also the case in university settings. Bosworth [3] described collaborative skill taxonomy relevant to higher education students two decades ago. According to Bosworth, collaborative skills that are prerequisite for good collaborative work include; interpersonal skills, group management skills, inquiry skills, conflict resolution skills and synthesis and presentation skills [3]. In many cases, successful collaborative learning does not occur without carefully planned design of curriculum, and an instructor who is able to become the facilitator of the class. Bosworth also mentions that it is important for the students to be aware of the collaborative skills before the collaboration begins as well as during the collaboration for successful collaborative learning experience [3].

II. COMPUTER SUPPORTED COLLABORATIVE LEARNING

The advancement of technology along with the attention on collaborative skills, led to studies on Computer Supported Collaborative Learning (CSCL) [4]. CSCL examines how to use technology as a scaffolding tool to support collaboration and higher order thinking.

Many studies are done on how CSCL fosters higher order thinking by focusing of argumentation, such as drawing reasons to support idea, finding evidence, and drawing a valid conclusion. For example, one study looked at historical reasoning of 20 middle school students in a CSCL environment and conducted a microgenetic analysis of participation, and type and quality of participation [5]. Another study looked at effects of collaboration and argumentation on learning forum where eight undergraduate students participated in the study. They were put into pairs, and each pair was given a writing task. Their interaction was video recorded and the discourse was analyzed [6].

These studies consider that cultural tools, including technology mediate cognitive process, which is based on social constructivist theory. Also, social constructivist theory is one theory that was the basis for most modern work on using technology to scaffold learning in schools and colleges [7]. The focus on scaffolding is based on social constructivist notion that learning, or development of higher order thinking occur in social relationships, especially when the learner work with a more competent other persons [8]. The notion of scaffolding is important in collaborative learning. It is considered that adequate scaffolding is needed for students who are not necessarily very confident in their collaborative skills. CSCL considers that computer act as the scaffolding for learners.

The frequent tendency to use social constructivist theory is apparent especially in the studies of CSCL. De LiSi summarized main ideas that many research on CSCL explicitly adopted [7]. They are the following six ideas regarding technology and learning: 1) constructivism: students are active learners 2) higher form of thinking develops from experiences with more competent other persons who serves as scaffolds for learning 3) cultural tools and artifacts play a formative role in learning process 5) the quality of discourse is an important factor in the quality of learning 6) modern technology is an important example of a cultural tool that can be used to support learning in both scaffolding & co-constructing relationships.

Although many studies adapt social constructivist theory to analyze how technology mediates construction of knowledge through collaboration, it is difficult to draw any firm conclusion about how modern technology influences the development of higher cognitive process [7]. De Lisi argued that it is difficult to draw any firm conclusion as there are many uncontrollable variables operating, and a much larger corpus of data is needed in each area studies [7].

While it may be difficult to control various variables of how technology may influence development of higher order thinking or higher cognitive process in collaborative learning settings, this study bases its premise on Bosworth`s understanding that students` awareness of collaborative skills lead to successful collaborative learning experience. Based on this premise, we believe that improvement of the students` awareness of collaborative skills along with the improvement of computer skills is a sign of successful collaborative learning taking place in CSCL environment. This study focuses on how students` awareness of importance and self-achievement of collaborative skills change before and after the CSCL experience. This study also looks at how students` perception of their confidence level of PC skills may relate to the improvement of collaborative skills. This may lead to a better understanding of the relationship between the use of technology and collaborative learning.

Also, Sullivan warned that software and courseware are designed for individual learners; therefore, conducting CSCL using software or system in market is difficult [9]. However, there are many systems that are designed for collaboration readily available in market today that can easily be utilized in school with careful tuning and minor change in design.

In this study, we set up and used a groupware that allows students to engage in synchronous collaborative work. The study was conducted in a Japanese university setting. The study looked at under a CSCL environment, how the students perception of their PC skills change as well as how it may influence their awareness of the collaborative skills such as interpersonal skills, inquiry skills and group management skills. The purpose of the study is to investigate how in the process of CSCL, students` awareness regarding collaborative skills as well as their perception on PC skills may change.

III. METHODS OF STUDY

The objective of the study is to see how the use of ICT affects the students` awareness of PC skills as well as collaborative skills. The study was conducted to 480 undergraduate students enrolled at a university in Japan.

A. Objective of the Curriculum

The study was done during spring semester 2014. The study was administered to 16 classes, with one class consisting of 30 students, who are enrolled in a course entitled "Social Design". This course is a requisite course for the second year students at Tokyo University of Technology, Department of Media Sciences. The course consisted of nine sessions with one session being 90 minutes.

The objective of the course was for the students to learn about social issues that deal on both global and national levels and to think about the solutions to these issues using social design methods. Another objective of the course is for the students to gain the following competencies; 1) information literacy skills 2) collaborative skills.

B. Use of Groupware

For this study, we used Microsoft Sharepoint (SP) as the groupware. Each student was given a login and password to access the groupware. For this study, we utilized shared editing functions to facilitate student/student interaction. Using Microsoft Sharepoint function, a group of students are able to edit one Power Point Slide (PPT) simultaneously.

For this study, students were put into group of four and were asked to create a PPT for collaborative assignment. Fig. 1 shows how the students are working collaboratively on one PPT in a group.

Fig. 1. Group work.

For this study, we developed a new function that can be added to the system that also encourages communication between different groups. We developed a system in which each groups' PPT can be extracted into one large file. Fig. 2 is the example of how we used this system to extract all group`s PPT slides into one file. This file was projected in front of the classroom by the instructors. In this fashion the instructor commented on each group`s work and students were able to see what other groups are doing while they work on their own.
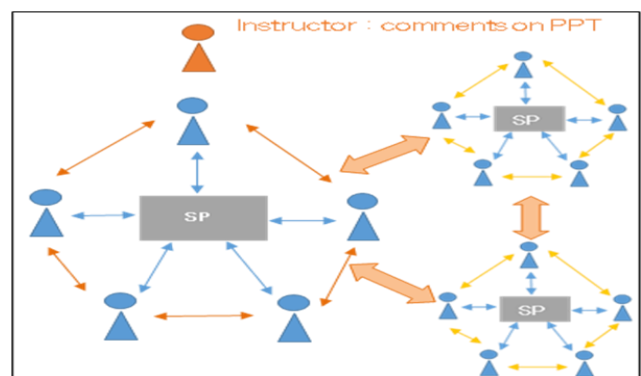

Fig. 2. Shared PPT file.

Fig. 3. Collaboration and interaction in groups.

This system allowed students not only to collaboratively work within the group, but it allowed the students to see what the other groups are doing. The instructor, by commenting on the works of all the groups, facilitated a more successful collaboration. This acted as interpersonal scaffolding by a more competent other. Fig. 3 is a diagram that shows how SP and groupware worked within this environment.

IV. EVALUATION

In order to look at how students` awareness with regard to collaborative learning skills and computer skills changed by participating in the course, we administered two surveys; one before the first session started, and another at the end of the last session of the course.

The first survey administered at the beginning of the first session, consisted of 25 questions. The questions were categorized into 5 topics; 1) interest in the course content, 2) confidence in computer skills, 3) awareness of importance of collaborative learning, 4) awareness of achieved collaborative skills, 5) awareness of the importance of collaborative learning and the use of ICT. The questions were evaluated based on four point Likert – scale.

For the second survey, we asked the same questions as the first survey. There are four patterns to the choice of answer.

For example, for the first topic which asked about the interest of the course content, the answer choices were; very interested/ interested/ not so interested/ not interested at all. For questions that asked about students awareness, the four answer choices were; very aware/ aware/ not so aware/ not aware at all. In these cases, for analysis purposes, we scored 3 for "very aware", 2 for "aware", 1 for "not so aware" and 0 for not aware at all. The surveys administered before and after the course were given to all the students who took the course.

Fig. 3 shows and example questions asked for the first survey.

V. DATA ANALYSIS

Total of 329 students answered both pre and post surveys. The result of the two surveys were compared. For analysis purpose, here we will share the data sets in which changes were observed. First, improvement in computer skill confidence was observed. Change of confidence in computer skill between pre and post survey is shown in Table I. The data shows that student who answered not confident/not confident at all on the pre-survey decreased to 4% and 29%. Also, students who answered confident/very confident increased to 49% and 19%.

Second, comparing the pre and post survey result, improvement of awareness and acquired skills in collaborative skills was observed. Table II shows the descriptive statistics of variables related to collaborative skills in pre and post surveys. The questions asked about collaborative skills such as interpersonal skill, group management, and inquiry skills. The data shows that in most questions, between pre and post survey, improvement could be seen in the average point differences. Especially, students` awareness of achievement in collaborative skills improved.

For instance, on average, students` awareness of their sense of achievement to comment of others work constructively to improve group work, and to inquire on what other members are doing to improve group work improved.

TABLE I: CONFIDENCE OF COMPUTER SKILL

	Pre survey		Post survey	
	N	%	n	%
Not confident at all	33	10%	12	4 %
Not confident	138	42%	94	29%
Confident	122	37%	160	49%
Very confident	36	11%	63	19%

No significant changes were seen in awareness of the importance of collaborative learning. For example, compared to the pre survey, students on average, felt that it is less important to inquire on what other members are doing for better understanding, and to think of one`s role in group work as not as important. This maybe because the students were already aware of the importance of collaborative learning before they participated in the course. On the other hand, awareness of achieved collaborative skills improved. This may show that students who were not confident in their collaborative skills, by participating in this course were able to feel that they improved in their collaborative skills.

TABLE II: DESCRIPTIVE STATISTICS OF DIFFERENCE BETWEEN PRE AND POST SURVEYS ON STUDENTS' AWARENESS CHANGE OF COLLABORATIVE SKILLS N=329

Obs		Mean	SD	MIN	MAX
To discuss about the content and topic with other members	importance	0.01	0.53	-2	2
	achievement	0.30	0.71	-2	3
To inquire on what other members are doing for better understanding	importance	-0.02	0.70	-2	3
	achievement	0.29	0.79	-2	3
To inquire on what other members are doing to improve group work	importance	0.02	0.72	-2	3
	achievement	0.33	0.88	-2	3
To think of one`s role in group work and make contribution	importance	-0.08	0.53	-2	1
	achievement	0.26	0.73	-2	3
To comment on others work constructively to improve group work	importance	0.14	0.67	-2	2
	achievement	0.41	0.91	-2	3

VI. RESULT OF DATA ANALYSIS

We have further analyzed the correlation between computer confidence level of the pre survey and differences in data from the pre and post survey on collaborative skills. Table III describes the data of 173 students who answered not confident/not confident at all on computer skills in pre survey. The data shows that with the increase of computer skill confidence level, their awareness of self-achievement of collaborative skills also improved. Especially on collaborative skills that deal with interpersonal skills and

group management skills, such as discussing about the topic and thinking of one`s role in making contribution to the group, this tendency can be seen very strongly with correlation of $p<0.01$.

TABLE III: CORRELATION OF COMPUTER AND COLLABORATIVE SKILLS
$N=173$

	computer skills confidence (Difference from pre/post survey)	
To discuss about the content and topic with other members	0.27	**
To inquire on what other members are doing for better understanding	0.09	
To inquire on what other members are doing to improve group work	0.07	
To think of one`s role in group work and make contribution	0.21	**
To comment on others work constructively to improve group work	0.05	

**$p<0.01$

VII. CONCLUSION

In this study, we designed and implemented a CSCL curriculum in a Japanese university setting. While many studies on CSCL base their foundation on social constructivist theory which supports the idea that technology can act as scaffolding for collaboration, we based our premise on the argument that changes in students` awareness indicate learning. The study looked at students` change of awareness of confidence in computer skills, awareness of importance and self-achievement of collaborative skills, and how improvement of confidence in computer skills may correlate to students` awareness of collaborative skills in a CSCL environment.

The study showed that student who considered that their computer skill improved also felt that their collaborative skills improved as well. In particular, students with improved level of computer skills confidence in the post survey tended to also score higher on collaborative skills self achievement score of the post survey. These students whose confidence improved in post survey compared to the pre survey tended to also improve their score on whether they are able to discuss about the content and topic with other groups members. They also tended to have better score on the post survey on group management. For instance, they were better able to think of one`s role and contribute to group work.

The study shows that students` confidence in computer skills and awareness of achievement in collaborative skills are correlated. The result of the study may indicate that by using collaborative functions of the groupware, students simultaneously improved their computer skills as well as their collaborative skills. This may indicate that in a successful CSCL learning environment, students` improvement of computer skills and collaborative skills should go hand in hand.

The result of the study also showed that simultaneous on-line collaboration opens new possibilities to different form of collaboration in classrooms. In this instance, it may be more adequate to define the role of computer not so much as a scaffolding tool for higher thinking process, but to look at the role of computer as intrinsic element embedded in the activity. Although computer can act as scaffolding for collaboration in the classroom, the role of computer should depends on the characteristic and learning objective of the designed activity. It may be helpful for educators to realize that when incorporating computers in collaborative learning setting, it is important to see it not only as a tool that helps the activity but to design its role more as integral part of the learning activity at hand.

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