Collaborative Learning Using Integrated Groupware: A Case Study in a Higher Education Setting

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***Abstract*—Collaboration is considered to be a key learning skill essential for success in the new global economy. Collaboration is labeled as a 21st Century skill among Critical thinking, Creativity, and Information Literacy. Collaboration is also indicated as an important skill in Japanese Higher education. In this case study, an integrated groupware is applied to a higher education setting to a total of 480 students enrolled in a course entitled "Basic Seminar: Social Design". In the study, students utilized the groupware for class interaction and group work. Questionnaire evaluated the usage of the groupware and the perception of the students on collaborative learning. The study suggest for a solution for scaffolding system to further collaborative learning.**

***Index Terms*—Collaboration, groupware, classroom interaction, higher education.**

I. Introduction

Today, we live in a rapidly changing society driven by technology and marked by an access to abundance of information. The ability to collaborate and make individual contributions has become essential in an unprecedented scale. In recent years, integrating what is commonly referred to as 21st Century Skills in education has become a prominent global trend. The Partnership for 21st Century Skills, a national organization of the U.S.A and UNESCO promote a framework for student success in the new global economy[1]-[3].The framework shows that students must learn the essential skills for success in today's world, such as critical thinking, problem solving, communication and collaboration. These learning and innovative skills are labeled as 4Cs-Critical thinking, Communication, Collaboration and Creativity. In addition to such skills, the Partnership for 21st Century Skills and UNESCO argue that effective citizens and workers must be able to exhibit a range of skills such as: Information Literacy, Media Literacy and ICT (Information, Communications and Technology) Literacy.

This framework and idea is now widely promoted in Asia and Pacific Region [3], [4]. For example, the Ministry of Education, Culture, Sports, Science & Technology in Japan indicated the importance of teaching the 21st Century Skills skills such as critical thinking, collaboration, communication and creativity as well as, and Information Literacy in the classrooms, often using the term "Active Learning" [4].

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II. Collaboration and Technology

The use of technology may influence many aspects of learning and instruction. For example, the report by the National Center for Post-secondary Education [5] described that technology may impact teaching and learning in higher education, including the nature of knowledge, the relationship among participants in the learning and teaching process, the content of courses, and the use of time in teaching. Knowledge students can acquire may be different, since multiple resources can be easily located using the Internet. The relationship among participants may change due from those typically found in most college classrooms [6]. Students may have more equal access to opportunities to participate in on-line discussion than in a face-to-face class. In face-to face groups students may feel intimidated to participate with other students but may feel less so using online tools.

Also, many of the justifications for the use of technology in education are made on the basis that higher order of thinking is possible with the support by various applications [6]. Collaboration among peers is generally considered to be an important contributor to students` higher order of thinking [6]. A widely used definition of collaboration states that it is "a construction of shared knowledge through activities with others, where the participants are committed to or engaged in shared goals and problem solving" [7]. Collaboration, development of higher order skills, and engagement in authentic tasks are some of the important key ideas in constructivist learning theory which bases its philosophy on the idea that knowledge is constructed by the learner through activity [8]. According to this theory, collaboration fosters deep learning by exposing students to different perspectives and allowing opportunity for negotiation to occur [9], [10].

Collaboration has the potential to increase the quality of discourse, provide alternative explanation, generate multiple solutions to problems, and allow for the inclusion of many different kinds of skills. However, successful collaboration is not easy to create [6]. Since it is widely accepted today that learning takes place in social interaction, integrating collaboration in learning contexts is especially important for designing learning environment using technology.

Research on collaborative learning and the use of ICT has been integrated in the area called Computer Supported Collaborative Learning (CSCL) [11], [12]. Koschmann defines CSCL as "a field centrally concerned with meaning and practices of meaning-making in the context of joint activity and the ways in which these practices are mediated through designed artifacts" [12]. Koschmann suggests that technology such as computer can play an important role in

mediating interaction among participants in the process of meaning making through a joint activity [11]. According to Koschmann, collaboration intrinsically requires a mediating tool to foster practices of meaning-making though joint activity, therefore; technology can act as a medium which support collaborative work.

Many studies exist today on CSCL. There are instances in which scripted collaboration and group based learning are applied in higher education in CSCL. For example, in one study, well defined scripts are used to foster collaborative activity to understand the process of collaborative learning in CSCL contexts [7]. There are also studies that look at social learning networks which occur in a mobile learning environment as well as in distance learning [8]-[13]. Also, there are recent studies that look at patterns in social interaction for effective learning in a CSCL [14]. The emphasis of such research is to understand the process of meaning making when computer is used as the mediated artifacts for collaborative activity. In the past, because CSCL was relatively new, it often provided tools for collaboration but it did not always provide an integrated environment for the use of these tools [15]. With today`s technology as this case study shows, it is possible to provide an integrated learning environment for students to collaborate easily in classrooms.

III. Method of the Study

In this case study, we used a groupware to enhance group work activities in a higher education setting. The purpose of this study is to conduct collaborative learning using ICT for college students and to evaluate its usage. To facilitate students` activities, we designed the platform so that it is catered to individual profiling, classroom interaction and group activities.

A. Content of the Curriculum

Fig. 1. Students working in a group.

The course is a prerequisite course called "Social Design: Basic Seminar" offered to the 2nd year students enrolled in the Department of Media Studies, Tokyo University of Technology. The seminar consists of 9sessions and is 90 minutes per session. The objectives of the course were to enhance global awareness, learn the current social issues and to design solutions to the problems through collaborative learning. There were total of 16 classes with approximately 30 students. Total of 480 students enrolled in the course. In each class, the students were divided into eight groups. The students were evaluated based on 6 group assignments and 3 individual assignments. Group assignment consisted of creating group posters, power point slides, and presentation files.

The classes were held in a computer equipped classroom. Each group of students worked on a large desk with four computers stationed on each desk. Fig. 1 shows a picture of how the students worked in groups. This group is using Google Earth to research on a given topic and is discussing how to create a poster.

B. Groupware

For this study, we used Microsoft Sharepoint as a platform for the class groupware. We prepared a web-server for the platform, and created a login and password for 480 students taking the course. Microsoft Sharepoint 2013 is supported by cloud computing and therefore; we used this feature to our advantage. For instance, Power Point Presentation files, Word Document, and Excel documents can be edited on-line without downloading the files to local computers. Using this feature, we had students simultaneously create and co-edit documents. We integrated necessary worksheets for every student and all groups on to the system and created a groupware catered to the classes.

For group work, students created PPT poster slides and presentation documents in class using the computers. Students would login to the groupware and open a common PPT file with other group members. For example, the student can add an image to the PPT slide while other group members write a summary of research. Fig. 2 shows an example PPT Poster slide students created using this co-editing feature. The instructor can also look at the version history to check which students participated in creating the file.

Fig. 2. PPT group worksheet.

The groupware can be used for class interaction. For instance, in this study, using the co-editing feature, instructor asked all class members, in this case, approximately 30 students to simultaneously co-write one Excel file. The instructor asked questions and students wrote their answers in one Excel file. The instructor then shared the file with the class using a projector. This feature is similar to Twitter, or Facebook, however has the merit of saving the content for documentation purposes. Fig. 3 is a sample image of how Microsoft Excel was used to promote class interaction.

We have found that by using Excel worksheet in this fashion, the instructor can look at all the students` responses simultaneously as the students write. This procedure allows

students to read other students` comments as well. The instructor can use the file as an interactive tool to start a discussion with the class. This seems to have positively influenced students` motivation to participate, for most of the students decided to edit or add more sentences to the response one wrote earlier, after the interaction has taken place.

Fig. 3. Excel worksheet used for class interaction.

TABLE I: CONTENT OF THE QUESTIONNAIRE

Q1	Have you used Microsoft Sharepoint before?
Q2	I was able to use the class groupware easily of the first class.
Q3	I understood how to use the individual and group worksheet.
Q4	The class groupware was easy to use.
Q5	The class groupware was very useful.
Q6	Excel Worksheet activity was easy to use.
Q7	Excel Worksheet activity was useful for learning.
Q8	It was good that we used Excel Wowksheet activity in class.
Q9	It was good that we shared Excel Wowksheet activity in class.
Q10	PPT Group Worksheet was useful.
Q11	PPT Group Worksheet was useful for learning.
Q12	It was good that we used PPT Group Worksheet in using class groupware.
Q13	It was good that we shared PPT Group Worksheet in class.
Q14	I participated in class with interest in the content of the course.
Q15	I learned something new in class.
Q16	I was able to participatein group activities without any problems.
Q17	I learned collaborative skills through groupwork in this class.
Q18	I learned something new through groupwork in this class.
Q19	I was able to use my leadership skill through groupwork in this class.

C. Evaluation

At the end of the last session, we conducted a survey to evaluate the use of the groupware as well as the content of the course. The evaluation was done using four point Likert-scale. Each score corresponded as follows; 3 strongly agree, 2 agree, 1 do not agree, 0 disagree. Total average of 400 students answered the questionnaire. The questionnaire consisted of ten questions. The questions asked about the students` perceptions of the curriculum including technology used in class. The questionnaire consisted of 19 questions and one comment section. Table I shows the list of questions that were asked in the questionnaire.

The questionnaire asked about the usefulness of the groupware, group work activity using the groupware and perception of the students toward collaborative learning.

IV. RESULT

The result of the questionnaire showed that overall, the students answered positively to most of the questions asked.

Table II shows the average score, standard deviation and number of students who answered the questions.

TABLE II: MEAN AND SD OF QUESTIONNAIRE

	Average (0,1,2,3) Disagree, Strongly agree	SD	N
Q1	0.49	0.86	401
Q2	1.75	0.65	402
Q3	1.85	0.65	401
Q4	1.46	0.77	402
Q5	1.71	0.67	403
Q6	1.8	0.69	403
Q7	1.81	0.61	402
Q8	1.87	0.6	402
Q9	1.93	0.63	401
Q10	1.24	0.86	401
Q11	1.65	0.69	400
Q12	1.63	0.76	398
Q13	1.76	0.66	402
Q14	1.74	0.68	403
Q15	1.99	0.68	401
Q16	1.8	0.71	401
Q17	1.86	0.69	402
Q18	1.8	0.68	398
Q19	1.39	0.82	384

The result showed that students answered most positively to Q15 “I learned something new in class” with average score of 1.99 and Q9 “It was good that we shared Excel Worksheet activity in class” with average score of 1.93. Also, Q6 “It was good that we used Excel Worksheet activity in class” scored 1.8, a high score among other questions. Q17”I learned collaborative skill through group work in this class” also scored 1.86 which is one of the higher scores among the questions.

TABLE III: CONTENT OF FREE WRITING COMMENTS

1. Positive comments of class content	10
2. Problem with PPT Group Worksheet	9
3. Poblem with Groupware login	7
4. Suggestions to improve class content	6
5 Enjoyed groupwork	5
6. Enjoyed communication with Excel worksheet	5
7. Enjoyed the class	4
8 Others(one`s attituted toward class)	2
Total	**48**

The result also showed that Q10”PPT Group Worksheet was useful” scored lowest among the questions with 1.24. Also Q19 “I was able to show some leadership through group work in this class” scored low point of 1.39.

From the questionnaire, the result showed that classroom activity using Excel Worksheet where all members of the class co-write one Excel Worksheet simultaneously and share the file using a projector was a very popular activity. The questionnaire also showed that students had a perception that their collaborative skill developed.

However, use of PPT Group worksheet scored lower than expected. Also, the result showed that not all students felt they were able to lead the group work.

Q20 was a free writing space for student comments. The following comments are some examples of what the students wrote. Table III shows the content of the free writing section.

The result shows that 48 students wrote comments of the free writing section of the questionnaire. Out of 48 students,

ten students commented positively on class. However, nine students commented that they had technical difficulty with PPT Group worksheet. Most of them commented that they were not able to co-edit the files. Also seven students commented that they had initial problems with groupware login.

We believe that technical problems was the cause of the low score of 1.24 for Q10, which was "PPT Group Worksheet was useful".

V. Conclusion

In this case study, we used a groupware for class interaction and group work. For the class interaction, students wrote responses to questions shared on one Excel file, which enabled students not only to write their comments synchronously but to compare the responses with others, allowing students to improve what they wrote. For the group work, using the co-editing feature, group members were able to edit a common PPT slide, allowing students to simultaneously improve the quality of the files. In a common group work, students would have to merge the files they created individually before they create a final product; however in this study, students created a common PPT from the beginning. In the process, students could pay attention to detail of other members` work as well as check one`s work progress. However, adequate scaffolding is still needed for students to collaborate successfully and to come up with high quality end products. This could be done by instructors` guidance, but the alternative solution to this problem using technology may be to prepare certain sets of guidelines available for students to follow and check as they collaborate. Another solution maybe to have students actively assess other students` products so that they become aware of high quality work. This case study shows that with the use of carefully planned and designed groupware, a common college seminar could be transformed into a highly interactive and collaborative environment. Further research is needed to design effective scaffolding solution; both human and technological, and be provided to all students in such contexts.

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