

Facilitated Collaboration in CSCL based University Course

--A Longitudinal Case Study in China

Xusen Cheng

University of International Business and Economics, Beijing, China
Email: xusen.cheng@uibe.edu.cn

Yuanyuan Yu

University of International Business and Economics, Beijing, China
Email: uheisy@sina.com

Zhao Li

University of International Business and Economics, Beijing, China
Email: dennislee2010@gmail.com

Abstract—With the rapid development of Facilitated Collaboration in Collaboration Engineering field, there are more and more applications of Computer Supported Collaborative Learning (CSCL) in the university undergraduate education worldwide. Collaborative team realized the significance of using collaborative technology and Facilitated Collaboration methods to improve working efficiency. In this paper, we propose a collaboration process for undergraduate teaching based on CSCL environment by means of Design Science Research, Case Study and the application of thinkLets method - which is an important theory of Facilitated Collaboration, aiming at providing an advanced and efficient method to improve the collaboration process for undergraduate teaching and student teams. We have taken a two-stage questionnaire and interviews to the case of undergraduate participants in a China university. The results validated the designed process. We also have many findings such as it helps improving working efficiency, achieving learning goals and building trust.

Index Terms—CSCL; Facilitated Collaboration; thinkLets; Design Science Research; Case Study

I. INTRODUCTION

Under the influence of the rapid development of emerging technologies and their wide application in various fields, both business units and education field are continuing to pursue more advanced, efficient and collaborative model. Especially, the interest in discussion on collaborative method is increasing especially when it comes to the problem of undergraduate teaching. How to improve the learning efficiency of student teams and optimize the student collaboration process with limited teaching resources and time has become more and more significant.

Nowadays, undergraduate education has been impacted gradually with the increasing requirement for participants to join in collaborative teams to complete subjects together, especially through online methods.

More and more teachers prefer to set collaborative tasks which require students to have relevant collaboration skills. Generally speaking, online technical support for collaboration is predominantly task-based rather than team interaction for personal and social aspects. However Computer Supported Collaborative Learning is actively researching team interaction. Facilitated CSCL is that we use computer as the main learning tools to assist the collaborative teams, and use Facilitated Collaboration methods to optimize the learning efficiency. This burgeoning idea will always provide a hand for Collaborative teams.

Nevertheless, how to design an effective collaboration process that could be repeatable for the collaboration tasks for the undergraduate students in the CSCL based teaching process seem to be a question to be explored.

In this paper, we are aiming to solve the mentioned problems in the Undergraduate Teaching through the application of Facilitated Collaboration in the Computer Supported Collaborative Learning background. In the following parts, we are going to talk about Facilitation in CSCL, including CSCL, Facilitated Collaboration and thinkLets. The third part will talk about the research methods and design which we will use the combined method of Design Science Research and Case Study to design our research based on an undergraduate course. Then, a real case study of an undergraduate teaching case will be discussed to evaluate the collaboration process. The results of the surveys and interviews will be revealed in the fifth part following by a conclusion of the case study and future work.

II. FACILITATION IN CSCL

A. Computer Supported Collaborative Learning

Computer Supported Collaborative Learning (CSCL) is a significant current discussion, it refers to establish collaborative learning environment by using information

technique, multimedia technology and other assistant tools to improve learning ability and efficiency of the collaborative teams. However, in a perspective of sociology, CSCL is a scientific community with plentiful journals, conferences, educational programs and so on [1]. It attaches great importance to emphasize what are likely to do and what types of research should be executed with the assistance of computer techniques, rather than just as a widely accepted concept or a science branch that could only be applied to classroom experiment [2]. With the rapid development of information technology, more and more emerging technologies are applied to the traditional education field. Compared to traditional learning methods, CSCL has more complex principle and system. It focuses not only on basic skills, such as how to learn or how to use, but also pays more attention to inspiring students to develop abilities of dealing with complex issues [3].

The past several years have witnessed CSCL move along from a time when the Web was only an emerging modality and the Internet a minority concern to a situation in which the Web is a basic platform and the Internet is becoming immanent. In the generation of Web 2.0, CSCL is widely used in the project-based collaborative teams [4]. It is reported by Amponash that collaborative learning activities using cooperative task structures and based on active learner participation, and also aiming to help the collaborative teams to achieve their common goals of completing subjects for the course [5].

In today's undergraduate education, many teaching methods and goals have begun to turn to the use of computer technology and Web-based communication tools. CSCL can not only take advantage of time and space, but also ensure the flexibility of instant messaging and improve the efficiency of collaborative teams. So it is of great significance to use CSCL as a technology platform that complemented with advanced concept of Facilitated Collaboration and design collaboration process appropriately for collaborative team.

B. Facilitated Collaboration

Facilitation is a developing area of group support system research and it is an advanced and complex collaborative skills and its effective use can make teams finish their tasks more rapidly and effectively [6] [7]. As an important theory in the field of Collaboration Engineering, Facilitated Collaboration is the emerging research point of the Information System and Management field. Briggs, Vreede and Nunamaker have even formally proposed the concept of Collaboration Engineering in the top journals in the field of Information Systems [8].

Ackermann thinks that the purpose of facilitator is to substantially increase the effectiveness of team working, and make meetings more productive and efficient through the management of both process and content [9]. In Facilitated Collaboration, the function of facilitator is to strengthen the decision-making ability rather than making decisions for teams [10]. Schwarz has proposed that professional facilitator means great help to optimize the collaboration process [11]. Some scholars think that an

optimized collaboration process could still be conducted smoothly even without guidance of professional facilitators.

Facilitation technology has also played a significant role in collaboration process and been used as collaboration support. Many methods such as group session, presentation, description and questionnaire are used by facilitators. The choice criteria for facilitation technology are established by interviews and analyzed in terms of task requirements, context and future steps, facilitators' preference and pleasant process, effectiveness and efficiency [12].

Nowadays, in the world, many universities have undertaken the research platform based on information technology. For instance, GroupSystem™ (ThinkTank), which was co-developed by Nunamaker, has a successful application in many universities such as Manchester University in the UK and Delft University of Technology in Netherland. In China, although the development of professional Facilitated Collaboration platform is slow, the frequency of using virtual communities, such as QQ group, Weibo, RenRen and other SNS communication tools is indeed increasing so as to achieve better communications among collaborative teams. Obviously, Facilitated Collaboration has not only played a significant role in Collaboration Engineering, but also in modern teams of many other fields such as student teams.

C. ThinkLets

As one of the most important concept in CE, thinkLets is a technique which could be used to create a various collaboration models, is the core theory of Facilitated Collaboration. There are more than 70 different thinkLets, such as Brainstorm, PopcornSort, BucketWalk, StrawPoll etc., and they could be formed as various different models. The research and exploration of thinkLets have attracted many scholars' interest and will attract more and more attentions in the future [13].

According to Briggs and Vreede[14] thinkLets has been divided into five parts which are diverge, converge, organize, evaluate and build consensus. In the following studies, it has been identified as the general pattern of six: generate, reduce, clarify, organize, evaluate and build consensus [15]. Any thinkLets methods will change more or less according to these patterns [16]. ThinkLets is often used as a pattern language to describe and design complex cooperation process by facilitator, in order to provide predictable, portable and reusable cooperation modules to achieve the team's goal. In the international level, GroupSystem™ (ThinkTank), which has been widely used by many colleges and universities, is developed on team collaboration model proposed by Briggs and used to enhance efficiency of the team through related collaboration process design.

III. RESEARCH METHODS AND DESIGN

A. Rresearch Methods

This research adopted the combined method of Design Science Research and Case Study. In the preliminary

stage, we have designed a Computer Supported Collaborative Learning model based on Facilitated Collaboration. In the stage of model evaluation, we have adopted the research method of Case Study and undertaken the questionnaire and interview as data collection method to verify and evaluate the collaboration process we proposed.

1) *Design Science Research*

Recently, there are more and more scholars are using design approach to conduct a research [17] [18] [19]. Design Science Research (DSR) whose name has been changed from Design Research (DR) in quite short time is a rapidly developing knowledge system in the area of Information System. The difference between DR and DSR lies in that DR is about or belongs to the research of designing, while DSR is a method of research which regards designing as a means or technology [20]. DSR helps design corresponding process programmers for the subjects requiring research and verify or evaluate by using some case. Moreover, the application of this method could also promote the study and exploration in other areas. So far more and more scholars have showed great interest to DSR and begun to use it in research. It is objective and rational to adopt DSR because of its three main stages: problem identification, solution design and conformation between scheme evaluation and research model [21].

Kolfschoten and Vreede had design a collaboration process model for teams by means of DSR [22]. The model consists of five parts: Task Diagnosis, Activity Decomposition, Task-thinkLets Choice, Agenda Building and Design Validation. All the parts are closely related and the result of each part is the basis of the next one. The Task-thinkLets Choice is the core part of the collaboration process design model and it aims to match appropriate thinkLets method with the tasks and activities. The collaboration process design model is showed in “Fig. 1”.

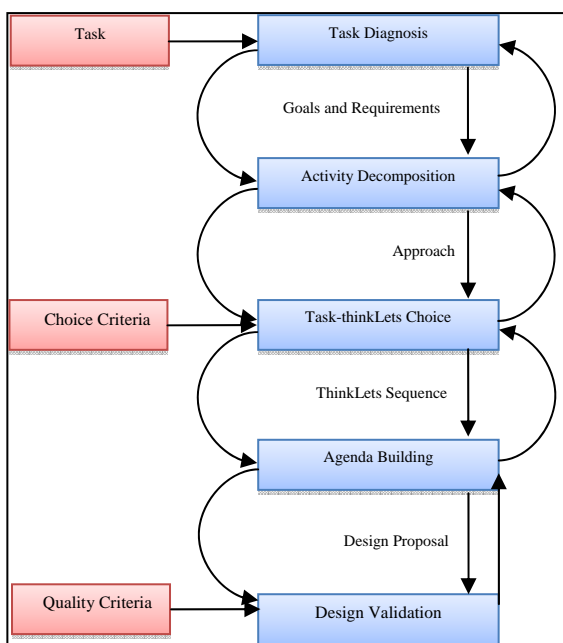


Figure 1. Collaboration Process Design Model

2) *Case Study*

Yin proposed a classic definition of Case Study [23]. He thinks that Case Study is an empirical research directed towards a temporary phenomenon under the background of the current situation. In this background, the boundary between the phenomenon and the environment is not very obvious, so the researchers could only use case to continue their study. Tellis believes that the credibility of conclusions in Case Study can be strengthened by copying matched models [24]. Some previous researchers have also chosen case study as a research method in the facilitated collaboration research [25]. In comparison with other methods of research, Case Study is adopted not only to verify those original theories or emerging theories, but also to better explain the causal association among incidents by analyzing the current condition with the requirement of normative in description and complete in explanation. No matter an experimental research or a quasi-experimental research, the data collection and analysis methods are known to hide the details which case study could bring to the forefront [26].

As a supportive research method for Case Study, the combined use of observation, questionnaire and interview could make up the deficiency brought by the indistinct boundary between phenomena and environment in detail information.

B. *Research Design*

On the basis of undergraduate teaching and the important theory of Facilitated Collaboration, this research is designed on Computer Supported Collaborative Learning and the collaborative process proposes aim to help the collaborative teams achieve their learning goals with high efficiency.

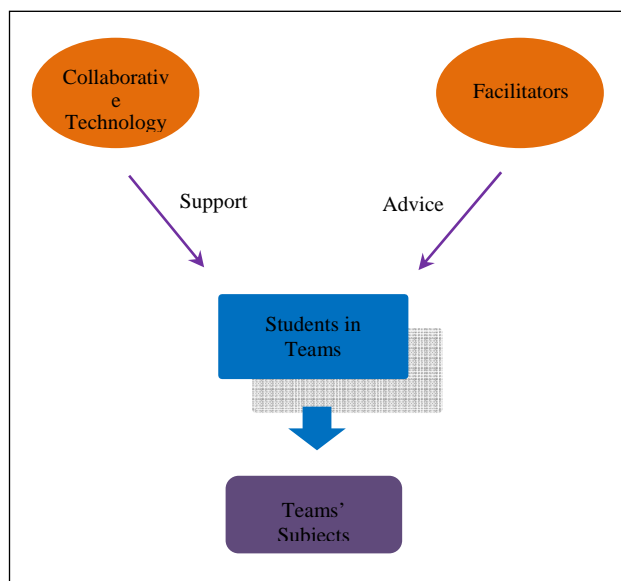


Figure 2. Collaboration Teams Interaction

In order to complete the collaborative teams’ subjects, we can figure out from “Fig. 2” that the students in teams need facilitators to provide advice and lead them to conduct the collaborative process. Relevant collaborative

technology can also support teams to communicate with each other conveniently and efficiently.

The concrete collaboration should set the target on teaching goals as the basic one, should integrate several procedures including the distribution of collaborative teams, specific subjects of each team, collaborative technology, thinkLets method and teaching process. At the same time, appoint teachers who master thinkLets as facilitators to lead the teams to implement the collaboration process. Among these points, thought silk sequence consists of six parts: Brainstorm, FastFocus, PopcornSort, BucketWalk, StrawPoll and CrowBar. The thinkLets method in collaboration process is shown in the following “Fig. 3”.

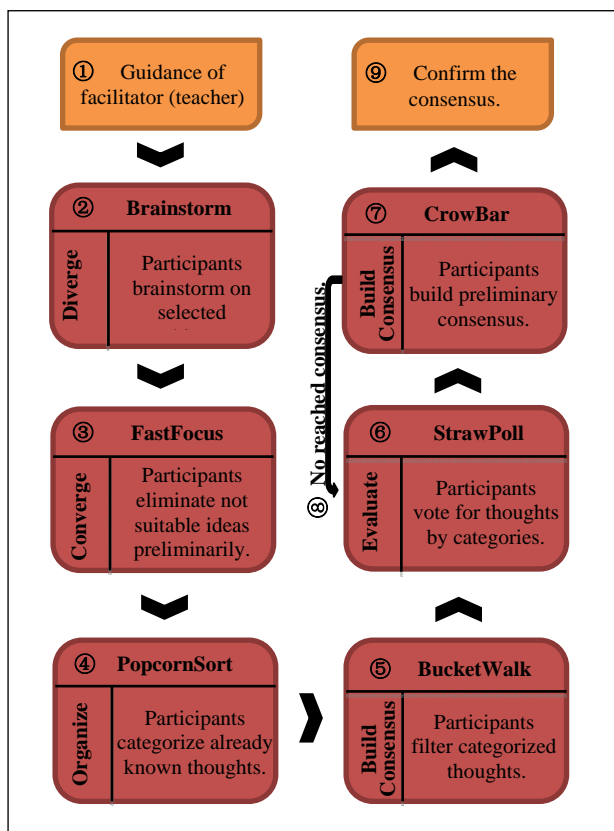


Figure 3. Facilitated Collaboration Process

The analysis of the “Fig. 3” is as follows:

- **① Guidance of facilitator(teacher):** The facilitator should make the goal of the course clear and allocate the collaborative team members at random in accordance with the number of classes and the number of members in each group. He or she should also give each group a subject task and the corresponding requirements, such as course plan, content which should be completed before the mid-term teaching inspection, approaches to final evaluation and so on. The collaborative team should make its task clear and selected a group leader. The leader should take advantage of the collaborative means of communication required by the facilitator and independently organize team members to finish each step.

- **② Brainstorm:** According to the goal, team members should work together and use Brainstorm to propose their own ideas as many as possible. These ideas could be irrelevant in content, but they must be rational. They can be called the outputting result in the current phase as long as they are not obviously wrong.
- **③ FastFocus:** It means the members should have a discussion about the course analysis and task definitions to reach a basic thinking consensus about the task recognized by the whole and make the general research direction clear. This process could be connected with Brainstorm.
- **④ PopcornSort:** Classify the ideas generated in Brainstorm by using PopcornSort. The aim in this phase is to find different aspects of problems clearly. It is beneficial for the members to sort their thought and continue their following work.
- **⑤ BucketWalk:** Using BucketWalk to filter the assorted results above, finding one or some important, relevant, practical problems from each classification, ensuring these problems and get a simple plan at last.
- **⑥ StrawPoll:** Using StrawPoll to vote for the sorted plans. It aims to helping the collaborative teams to select the final decision-making. Teams’ members can use ballots or marks to complete the vote.
- **⑦ CrowBar:** In this phase, the members should make choice on the outcome of the vote, find out the highest ballot or marks and build preliminary consensus on the final decision-making.
- **⑧ No reached consensus:** Taking the possibility that too many problems and disagreement among members in the process of implementation could affect the final consensus into consideration, the facilitator could guide the teams to go back to StrawPoll to revote and choose again to get a generally accepted choice.
- **⑨ Confirm the consensus:** After reaching a consensus, it comes to the last stage - the announcement of the consensus. Henceforward, the members could have a further research and discussion about this course based on the result of thinkLets.

In the actual application of thinkLets method collaborative teams could adjust the process according to the specific tasks, which just shows the predictable, transplantable and reusable features of thinkLets. Such flexible usage and dispatch will make the range of application wider.

IV. CASE STUDY

A. Case Description

In order to evaluate the Facilitated Collaboration process in CSCL in undergraduate teaching, we have selected a course filled of junior students in a China university to carry out a longitudinal case study for one semester.

The selected course module is Logistics Management in E-commerce, which is a key module in the undergraduate program in the university. There are 60 students in the module. The 60 students have been divided into 12 collaborative teams randomly. Each team will have a collaboration project to complete throughout the semester. Each team mainly use QQ group as the collaborative technology. They also exchange views and contact each other via E-mail, msn, skype and weibo after class. The facilitator could effectively control the process according to collaborative teams' chatting records in QQ groups throughout the semester.

Considering the objective arrangement of the school's teaching activities, researchers and facilitator confirm the teaching process as "Fig. 4". The collaborative teams have to finish the related contents in accordance with it and show their project outcomes with report and presentation at the end of the semester.

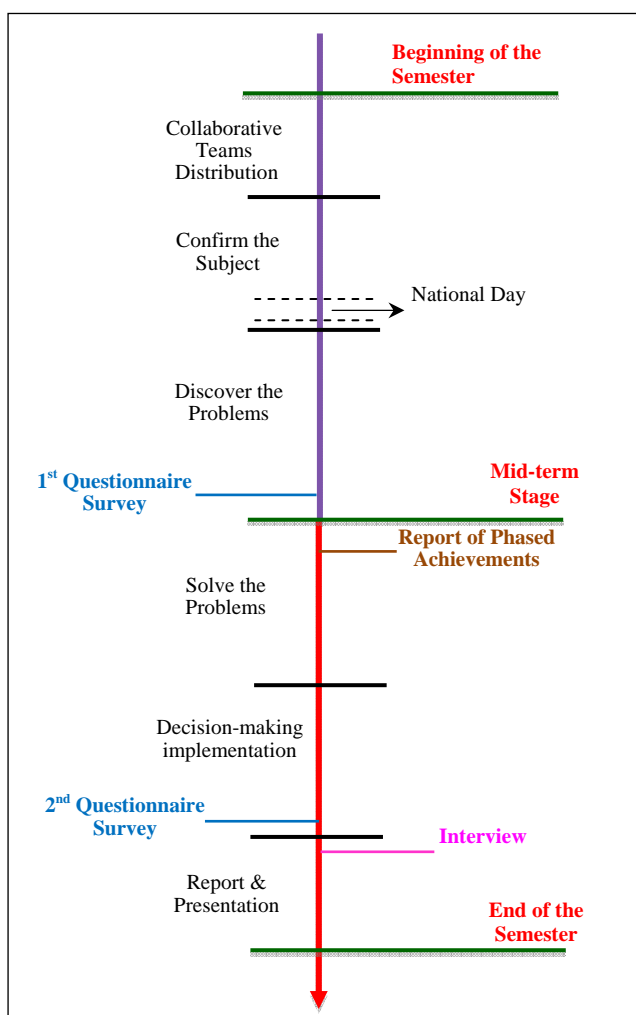


Figure 4. Teaching Process in the Case Study

B. Verification of Case

In the case above, each collaborative team has a project to be finished. In the course of Logistics Management in E-commerce, this subject aims to settle the problems in E-commerce logistics operating. Each team could choose their own logistic case as a project to

be finished and this is just the first application of thinkLets. Each group should analyze the current situation of the logistic market, select cases to be studied and make use of Brainstorm, PopcornSort and StrawPoll to consume CSCL under the guidance of their facilitator. After selecting the subject, the team leader could continue the learning flow independently in accordance with the teaching program of Logistics Management in E-commerce. In this period of time, team members should use at least Brainstorm, PopcornSort, BucketWalk and StrawPoll methods to build consensus on massive thoughts and determine what the most important problems that should be solved is. When it comes to the mid-term teaching inspection, each team should finish all the requested content and report their phased achievements. And then, the collaborative teams should keep on settling the most important problems which will call the collaboration process to run another time. Team members need to brainstorm lots of solutions, do the PopcornSort to sort them out in different categories, and conduct the StrawPoll to vote for the sorted solutions. Finally, team members should build consensus on the chosen solution. After that collaborative teams have to take the decision-making into implement. What's more, they should also get affirmation from the facilitator and other teams in the final report and subject presentation.

V. DISCUSSION

According to the arrangement of the course offering and the arrangement of the teaching schedule we can find that in the part of case verification, we adopted questionnaire survey and interview as our data collection method to test our facilitated collaboration process.

The first questionnaire survey is conducted at the mid-term stage and the second is before the end of the semester. An interview is held between the second questionnaire survey and the final report and presentation. The questions set for the questionnaire surveys and the interview are mainly focus on the following points: the practical applicability of the collaboration process, the trust between team members, the collaborative working efficiency, the advantages of thinkLets methods and so on.

A. Questionnaire Survey

At the mid-term stage and the end of the semester we take our questionnaire surveys for twice. After analyzing the questionnaires data, we list partial result in the following tables.

TABLE I.
PARTIAL FEEDBACK OF THE 1ST QUESTIONNAIRE SURVEY

Questions	Degree of Agreement (1 to 5)
1. I'm willing to work with my team members.	3.7
2. We trust each other in our collaborative team.	3.3

3. Others' lack of ability limits the performance of our team.	3.2
4. The efficiency of our team has been improved.	3.6
5. I have gained a lot of knowledge by using thinkLets.	3.5
6. I'll use facilitated collaboration process in other collaborative teams.	2.9

TABLE II.

PARTIAL FEEDBACK OF THE 2ND QUESTIONNAIRE SURVEY

Questions	Degree of Agreement (1 to 5)
1. I'm willing to work with my team members.	4.1
2. We trust each other in our collaborative team.	3.9
3. Others' lack of ability limits the performance of our team.	2.5
4. The efficiency of our team has been improved.	4.3
5. I have gained a lot of knowledge by using thinkLets.	3.8
6. I'll use facilitated collaboration process in other collaborative teams.	3.4

We can see from the "TABLE I" that the degree of agreement of collaborative team members on the given questions is beyond the average level. Question One shows that till the end of the semester, more students have gained the willingness to work with their team members. From the result of the second one we can see that the trust has been increased during a semester's cooperation. About the Question Three, the average degree is 3.2 at the mid-term stage and 2.5 at the end of the semester which means that the application of the collaboration process and the usage of thinkLets method can avoid the weakness of ability on a certain extent. Since the most significant function of thinkLets method is to increase the working efficiency we can see from the Question Four that most of the students think so. By using this emerging method students have gained more knowledge through the semester. And from the increasing of degree on Question Six, we can find that many students recognize the practical applicability of facilitated collaboration process.

"Fig. 5" is a comparison of the result of the two questionnaire surveys. The red columns show an increase of the degree of agreement at the end of the semester. And we believe the approbation of the using of Facilitated Collaboration in CSCL will always be

improved and more and more optimized collaboration processes will be taken into practice.

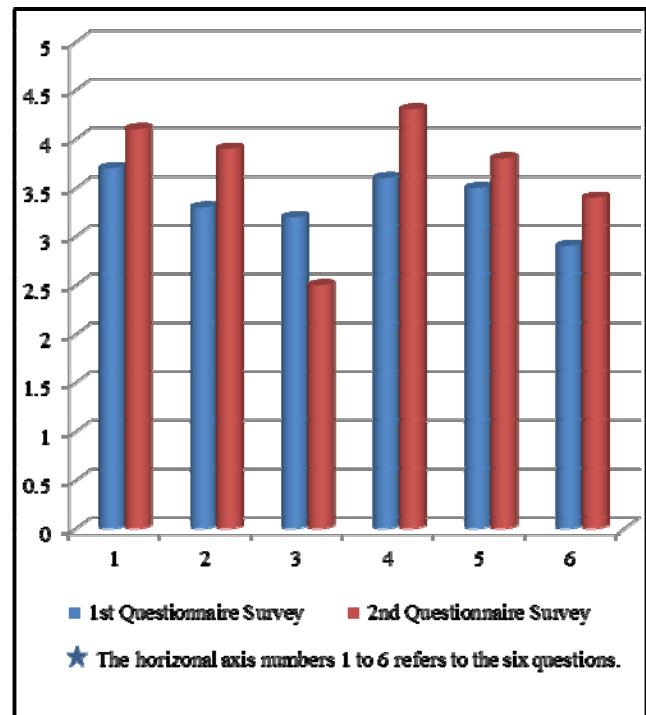


Figure 5. Comparison of the Questionnaire Survey Result

B. Interview

In order to get the specific information of individuals, we conduct an interview at the end of the semester, just after the data collection of the second questionnaire survey. From the feedbacks of the voluntary interviewees, we summarize our findings as follows:

1) *Facilitated collaboration in CSCL is practical, flexible and operable in undergraduate teaching.*

Many voluntary interviewees think that the basic theories of facilitation are easy to be grasped. With the guidance of facilitator, students can conduct the collaboration process and thinkLets method at any time they want in different kinds of collaboration projects especially when enough resources and suitable conditions are offered. Some interviewees express that it is bound to increase the efficiency and operability if GroupSystem™ (ThinkTank) is to be collaborated. We get some feedbacks of the voluntary interviewees such as "Facilitated Collaboration is easy to understand", "ThinkLets is very practical and useful" and "I had used Facilitated Collaboration in another course because it has fine applicability". All these feedbacks show that Facilitated Collaboration is highly recognized by the collaborative team members. Besides, according to the specific problems, team members can use the six parts flexibly rather than just copy them.

2) *Facilitation Collaboration has positive function towards increasing working efficiency and achieving the learning goals.*

When facing with the complicated and wide-ranged subjects, participants of Facilitated Collaboration in

CSCL can not only figure out the main stream of the research, but also improve their activeness and passion in participation. It is undeniable that collaboration process plays an anxo-action in improving the whole working efficiency. Some students said that “the result of the first Brainstorm is really amazing” and “We proposed more than 50 ideas easily, this method could really avoid needless wasting of time”. From these comments we can figure out that the meaning of thinkLets lies in improving working efficiency.

3) *The usage of collaboration process plays a proactive role in enhancing the trust between the team members.*

Since Facilitated Collaboration in CSCL has no insistent demands for the capabilities of the members, the participants can take the mainstream of thinkLets as a standard and think freely. We get some feedbacks like “Our team members trust each other” and “At first the ability of the others would be questioned, but now we are very sure of the common progress”. Fewer limitations in knowledge and high participation improved the friendliness and passionate atmosphere in team cooperation in this collaborative circumstance. And trust between members is bound to strengthen their sense of responsibility. While achieving the goal effectively, they could also strengthen their ability to collaborate and team spirit.

VI. CONCLUSION AND FUTURE WORK

The rapidly development of the Internet and emerging information technologies make Facilitated Collaboration get spread widely in collaboration engineering field and information system research. Since more and more foreign universities such as Manchester University in the UK, Delft University of Technology in Netherland, University of California and Johns Hopkins University in America have already taken application of Facilitated Collaboration into teaching, how to suit the characteristics in domestic undergraduate teaching by using thinkLets method and operating Facilitated Collaboration in CSCL get increasing practical significance.

This research takes an undergraduate course in a Chinese university as a case study and adopts the combined research method of DSR and Case Study. On the basis of thinkLets method, collaboration process is designed with Brainstorm, FastFocus, PopcornSort, BucketWalk, StrawPoll and CrowBar six parts. Within a semester’s teaching, verification and evaluation have been achieved by follow-up investigation of the courses.

Compared with traditional teaching methods, Facilitated Collaboration can not only increase students’ ability in learning and exploring, but also increase trust between team members. Therefore, students can achieve their learning goals better on the basis of the improved learning efficiency, team spirit and their creativity.

Nevertheless, the Facilitated Collaboration we proposed here still has some limitations. Firstly according to the objective requirements of university’s teaching arrangement we have to adjust our case study process.

Secondly a highly skilled facilitator and a good course design are also requires. Moreover, we meet higher demand for means of computer mediated communication, such as in QQ group, E-mail, weibo and other social network tools. All of these have restricted our research on a certain extent.

In the future, we are going to develop more cases on other courses, and apply the thinkLets based collaboration process in the postgraduate teaching, international students teaching and even in Sino-foreign teaching so as to make the model more applicable and explore more findings in education field. More cases and cross case cross culture studies will be analyzed in future research. At the same time, this article also serves as a modest spur to induce more scholars to come forward with their valuable contributions in information system research and Collaboration Engineering field.

ACKNOWLEDGMENT

This work was supported in part by National Natural Science Foundation of China (Grant No. 71150110170, 71101029) and Postgraduate Teaching and Research Project of University of International Business and Economics (Grant No. X11029). We also thank the ICMAIE12.

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Xusen Cheng received his Ph.D degree in Informatics in Manchester Business School, The University of Manchester in the UK in 2010. He is currently an assistant professor in the School of Information Technology and Management, University of International Business and Economics. His research interest focuses on facilitation and collaboration, service science and engineering, trust development in computer supported teams, social and organizational issues of IS. He has published many papers internationally.

Yuanyuan Yu is currently a junior student and research assistant in the School of Information Technology and Management, University of International Business and Economics.

Zhao Li is currently a postgraduate student of University of International Business and Economics and is majoring in Industrial Economics.