

Understanding Collaboration Process Design in CSCL: A Case Study in a PG Environment

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Abstract—Information technology and Computer Supported Collaborative Learning (CSCL) has been applied into postgraduate teaching by many researchers. The sense of student teamwork and the quality of teaching are enhanced rapidly. In this study, we have applied facilitated collaboration methods into the CSCL education field to solve problems occurring in the teamwork of postgraduate students' computer supported collaborative learning. We have designed a collaboration process for postgraduates for their collaborative work. A longitudinal case study has also been conducted in a China university with the application of our designed process. Our aim is to provide a more efficient method of collaboration that helps improve teaching quality, the efficiency of postgraduate student teamwork and motivate the students to convert their knowledge.

Index Terms—Teamwork, Postgraduate, Collaboration, CSCL, Process Design

I. INTRODUCTION

With the sharp enrollment expansion of postgraduates, the features of postgraduate teaching are approaching to the undergraduate's, which influences the interaction between teachers and students inevitably [1]. Although teachers try their best to arrange for students to archive teaching objectives in the form of group collaboration, students couldn't collaborate smoothly to accomplish a task or a subject. Facilitated Collaboration could help design and apply a collaborative process for various kinds of teamwork by helping teams to collaborate flexibly and effectively in order to reach the success of the collaboration. For instance, a facilitated collaboration could dramatically reduce the decision making time, improve the collaboration efficiency, and also could

enhance the collaboration results. Facilitated collaboration could be applied in many areas. Therefore, by applying facilitation methods and processes into the postgraduate teaching, it is also possible to facilitate the postgraduates' collaboration and improve their learning efficiency.

Recently, Computer Supported Collaborative Learning (CSCL) has gradually become the main method of collaborative learning. In addition, facilitation collaboration is normally supported by information technology. At present, a growing number of Europe and USA universities have begun to use IS platform embedded with facilitation technology (e.g. Group System™) [2] to guide their collaboration. In Asia, there are also some scholars also began to study the correlation between facilitation and teaching in order to make up the deficiencies of the traditional teaching [3].

Postgraduate (PG) students who have more knowledge, skills and social perception are different with undergraduate students. Nonetheless, there is little research about what kind of facilitation process would benefit the postgraduate students' collaboration in their course especially in the background of CSCL in China. Therefore, our research question is what kind of collaboration process could help the postgraduate students' collaboration within CSCL environment. In order to answer the research question, this paper aims to design a facilitation process in CSCL based postgraduate teaching context and evaluate the process in a longitudinal case study of a China university.

This paper is consisted of four main parts: the first part will introduce the theoretical background, followed by the second part which will show the research method and

design. The third part will talk about the facilitated collaboration process in the case study. The conclusion and future work will be given in the final section.

II. THEORY AND BACKGROUND

A. CSCL

CSCL (Computer Supported Collaborative Learning), as a significant research field, has been studied by many scholars for several decades [4][5][6][7][8][9][10]. CSCL refers to create a collaborative learning environment by using computer technology, especially multimedia technology and Internet technology, to facilitate and support collaborative learning. According to Cho et al. [11], CSCL is deeply based on communicative acts such as conversation, collaboration, and social exchanges. It is also reported by Dimitracopoulou[9] that it can stimulate students to discuss information and problems from different perspectives, to elaborate and refine these in order to reconstruct and co-construct knowledge or to solve problems. Compared with traditional teaching technology, CSCL pays less attention to basic skills, such as reading and computing, but is more concerned about the advanced thinking and abilities, such as the ability to debate and self-management, with particular emphasis on non-confirmed knowledge sharing [12]. It is undoubtedly in line with the teaching objectives of postgraduates that emphasizes on study and research capabilities. Nevertheless, CSCL also faced with some problems frequently, such as inefficiency, team cohesion shortcomings, even though it can overcome some constraints on time and area to provide learners with more flexible, democratic and learning environment. To a certain extent, these risks can be mitigated by introducing some new collaborative methods, such as facilitation, to build an appropriate collaborative process which can improve the participation and interest of the learners.

B. Facilitation and Technique

Facilitation is a complex skill which can help teams complete a task promptly [13], and it can make the collaboration more effective and efficient. The nature of facilitation is a process which could intervene and guide a team, the purpose is to encourage all team members to participate in the activities and reach a consensus at last [14]. The facilitation technique can support the collaboration and play a significant role in collaboration [15]. According to Kolfschoten et al. [16], a successfully facilitated collaboration process can help people finish a collaborative task without the instruction given by the professional facilitator. Nevertheless, if we do it with the help of the facilitator, it will make the teamwork more smoothly [17][18]. By optimizing and instructing the collaborative process, the facilitator can help the team work better. It is reported by Griffith et al. [19] that, facilitator can enhance the way when the team makes decisions and the influence of facilitators is very important to generate effective facilitation [19]. The aim of facilitator is to increase the effectiveness of teamwork,

and make meetings more productive by the content and process management [20].

According to Briggs and Vreede[27], there are five general patterns in facilitated collaboration, which include diverge, converge, organize, evaluate and build consensus. It is further developed to six patterns, which include generate, reduce, clarify, organize, evaluate and build consensus [28].

There are various facilitation techniques which could be widely applied in different areas. Nevertheless, in the computer supported collaboration area, thinkLets is a newly merged but widely used facilitation technique which could help to establish a required model of collaboration [21]. It also provides a portable, reusable and predictable building block for the design of collaboration process [22]. Presently, thinkLets is used by facilitators as a pattern language to describe and devise a complex process design [23][24]. ThinkLets describes the way people perform tasks, they may use lots of them to complete a task actually [25]. ThinkLet is a basic collaborative activity, it can create predictable, repeatable model of collaboration for people to achieve a goal [26]. There are various kinds of thinklets, such as brainstorming, popcorn sort, bucketwalk, and strawpoll. By combining different thinkLets together, we can design various kinds of collaboration process which may be suitable for different collaboration due to their requirements and context.

III. RESEARCH METHODS AND MODELS

A. Method

Nowadays, more and more scholars begin to use design approach to conduct the research [29][30]. In this study, firstly, we use Design Science Research (DSR) approach to design the collaboration process for postgraduate students' collaboration in CSCL. After that, we evaluate, validate and improve the process by Case Study of which the main technique we have used is In-depth interview. DSR was early proposed in the design methods Conference held in London in 1962. In the early 1990s, information systems (IS) researchers began to show strong interests in DSR and used widely in their research [31]. It is mainly used to analyze problems, design appropriate solutions and give the validation and evaluation [32]. Here we have chosen DSR to design the collaboration process. However, Case Study is also a common research method used under a real-life condition, especially the boundary between the phenomenon and the situation is not particularly clear [33]. It is always used to answer how and why the problem is [34]. It also can explain some problems combined with other research methods by making up for each other's deficiencies. In this study, our case study aims to answer the sub research question which is whether the designed collaboration process is useful for the postgraduates. Finally, a longitudinal case study is used to give a comprehensive evaluation of the process and plays a guiding role in validating and improving the process.

B. The Theoretical Model of Process Design

The general model of design collaboration process in teamwork, which is designed by Kolfshotens and Vreede[16], is the theoretical model for process design in this paper. The general model is consisted of five parts. They are Task Diagnosis, Activity Decomposition, Task-thinkLets Choice, Agenda Building and Design Validation. They are connected each other closely and the result of the previous step are the basis for the next step.

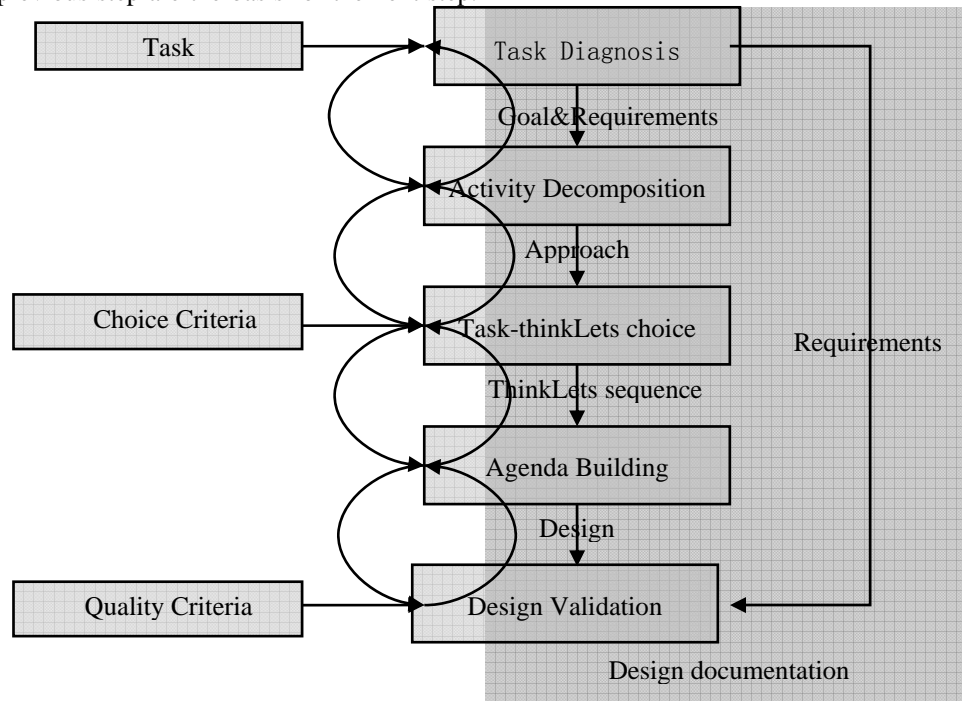


Figure 1. The Diagram of Collaboration Process Design [16]

IV. CASE DESIGN AND STUDY

A. Case Background

Considering many of the postgraduate courses divide them students into groups and encourage the students to do teamwork throughout the semester, this case study used a group project based module which is selected from a Chinese university' postgraduate course. The module has taken "Supply Chain and Logistic Management" as the research object throughout a semester. This group project required the team of students to analyze the problems of logistic business informatization and give the appropriate solutions of the identified problem in the business. In total, we have 15 participants in this Postgraduate module and they are divided into 3 groups randomly. The students will use this process to fulfill this collaborative work, and there will be a facilitator (teachers who received the professional facilitation training) in this process to organize and guide the process. The feature of this process is ordinary, as it is not only applied to certain courses but may also extend to the similar CSCL courses. The students are using GroupSystem™ and Blackboard to do the on class team collaboration. They also communicate with each other

using social networking platforms such as RenRen and QQ.

The core of the collaboration model is based on the actual situation analysis, and then gets the appropriate "ThinkLets sequence" to guide the process of teamwork. This study is mainly based on the above model to design the collaboration process for the team of students who need to complete the module, in order to help them achieve the team goals more effectively.

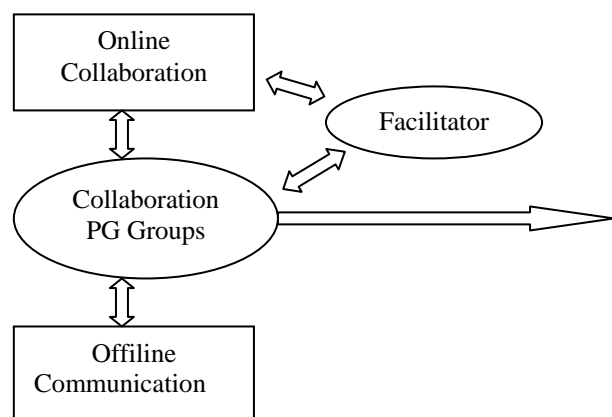


Figure 2. PG Case Study

B. Collaboration Process Design

This paper adopts six thinkLets units to design the collaboration process. They are OnePage (brainstorming ideas freely, but in 5 or fewer people group, and less than 80 ideas), PopcornSort (categorize ideas), BucketWalk (discuss and filter ideas), StrawPoll (voting ideas), CrowBar (discuss and build consensus) and WrapUp (reach satisfaction). Every thinkLet in the process is a main segment (each box of Figure 3). Every

segment includes the method of thinkLets, specific activities of student team members, patterns of collaboration and the duration of each activity. Our designed specific process has been shown in Figure 3. In the model, 1 stands for the first part of the collaboration task which is to find out the problem, and 2 stands for the second part of the collaboration task which is to solve the problem.

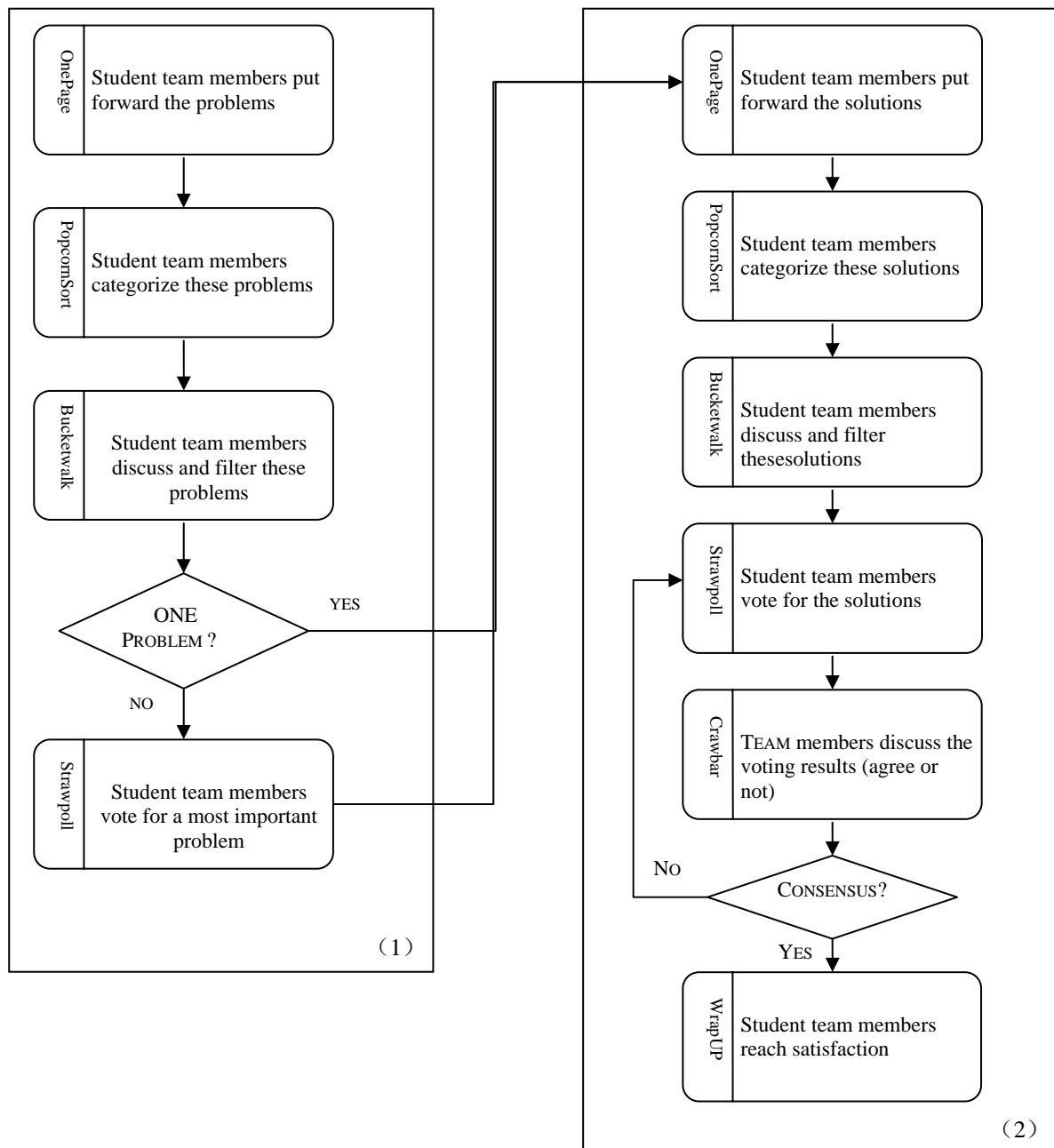


Figure 3. ThinkLets Design Process for Postgraduate Collaboration

Based on the consideration of the actual research questions, student groups would use two main rounds of discussions in this process. The Arabic numerals in the figure 3 represent the timeline of thinkLets process (i.e. the round of discussion).

The first time, the team members need to discuss problems of business, in order to find out the problems of business in the implementation of information technology. The study use OnePage, PopcornSort and BucketWalk thinkLets segment to complete this process of collaboration. Brainstorming is used to encourage

participants to find out problems as many as possible. This stage is limited to 15 minutes. In the next stage, these problems can be classified and more clearly by PopcornSort method. This stage will last for 10 minutes. BucketWalk can filter results after the classification and abandon the unimportant or wrong problems. This stage will last for 15 minutes. Furthermore, if there is more than one problem that still exists, students can enter further discussion to find the most urgent problem by voting in StrawPoll session.

Next, the task is trying to get the solutions to solve the problems identified in the previous task through using the process again. In this round, OnePage, PopcornSort, BucketWalk and StrawPoll are similar with those in the first round. Then team members use CrowBar to show their opinion that whether to agree or not and if not agree, then give some arguments to the voting results in 5 minutes. StrawPoll should be conducted again if there's someone hold different opinion. If not, the WrapUp stage will inform all team members the final result in 3 minutes.

In fact, a new round should be conducted in consideration of some unforeseen problems, such as deadlock in the voting stage. Using StrawPoll and Crowbar again can ensure a relatively consistent choice. The process could be repeatable according to the results. Adjustments are necessary in actual process according to

the task, for example, only one part maybe used in the whole process. Thus, the process could be run flexibly for the specific issues.

C. Validation and Evaluation of the Process

We decided to run our collaboration process design for three times in three semesters as three longitudinal case studies. Nevertheless, in this paper, we have only collected data for the first case study. In this case, these students were divided into three groups randomized by the facilitator at the beginning. Each group has five members. As we can see in fig.4, each group collaborated using the process with the guiding and supervising of the facilitator. In this process, every group adopted the communication method that combine face-to-face and on-line communication organized by some collaboration or communication tools such as ThinkTank, BlackBoard, QQ, MSN, Weibo to accomplish the learning task that evaluating the design and implication of a company's logistic project and resolving the problems. Among those tools, ThinkTank is a kind of specialized software for the facilitated collaboration on class. Blackboard and QQ are the main platforms for the students communicate with each other after class.

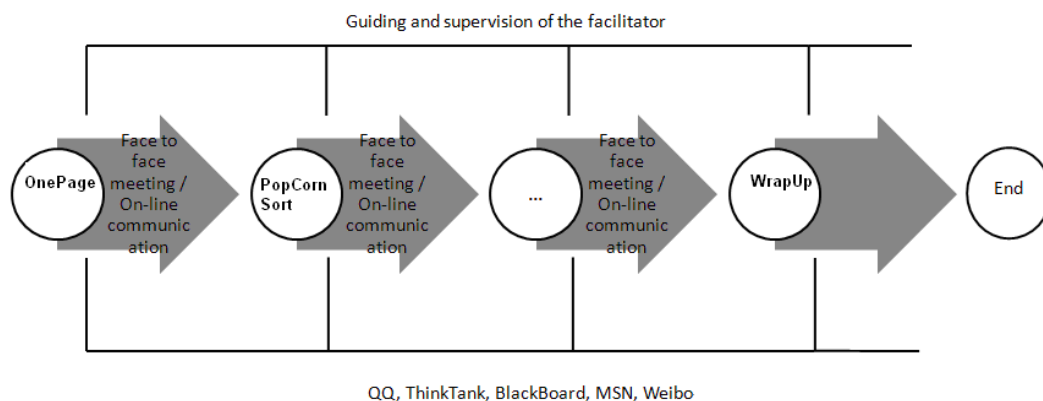


Figure 4. The description of the facilitator role

In the case, the process needed to be used twice to finish the core part of the task. In the first time, every group analyzed the status of the project company's logistic system and took the company's product categories, business condition, operating processes and so on into consideration to find out the main problems of the company's supply chain management and informatization. The first three parts were used instead of the whole process under the guidance of the facilitator in this time due to the particularity of the task that required everyone to present their own options. In the second time, the process was used to find out the best solutions to resolve the problems worked out in the last stage. Every group reached the final consensus by further analyzing the company's present situation. In this stage, all group members shared information and ideas with each other by the whole process. In addition, the process was also used

to resolve some small problems which should be chosen by company. In this case, all group members gave their own opinion in OnePage. And they focused on key points quickly in PopcornSort and BucketWalk. StrawPoll and WrapUp were used to achieve the best answer. At last, every group wrote a report that recorded the collaboration processes and collaboration contents and handed the report to the related company.

In this paper, in-depth interviews were conducted in our research. Volunteered participants are interviewed. We finally get 12 in-depth interviews for this first case. We collected data in the end of the semester. In the handling of the interview data, we gave each dialogue of each student a detailed number first. After that, we extracted critical statements of the interview as well as keywords of each statement. Then we classified these

keywords and draw the conclusion. Due to space limitation, Table I shows a part of the analysis process.

TABLE I.
A PART OF THE ANALYSIS PROCESS

Interviewee ID	Coding Key Words	Conclusion	Examples of Comments
5	solve the problem quickly	Collaborative learning time is significantly reduced and the efficiency is upgraded through the teaching process.	I think it is easier to resolve conflict of opinion between us.
1	reach a consensus soon		Well, for us, learning time was reduced a lot. And each module has its time limitation.
2	time limitation		Yup, the software it helped us to reach a consensus soon.
3	own advantages		Well, our group collaborated though the Web and also the face-to-face method, however, I think they both have their own advantages.
4:	learning time was decreased		The traditional discussion way, you know, is always a time-consuming job. But the new method is good at solving the problem quickly.
6	in a short time		PopcornSort is good; it helps us to focus on the key point in a very short time.
8	achieve the outcome quickly		The voting helps us to achieve the outcome quickly.
7	so many ideas	Through the teaching process, students' interest in learning has improved, the leaning quality was in a higher level and the quality of learning was upgraded substantially.	It's so unbelievable. We have got so many ideas in such a short time.
3	new		It is a new collaboration process rather than what we have done before, it is cool.
9	good quality		The process of collaboration let us reach a good quality of the learning results
11	like to participate		During the collaboration, I learned some from other guys. Because I'm not good at summary, but he is good at that, so he always told me what should I do
12	learned more		It looks like we all team leaders. And we'd like to participate.
6	Interesting		Well, it is a interesting process, very good.
10	guild us		The process is a good guideline, it can guild us to reach a good outcome.
1	reduce	The facilitated teaching process is more flexible for those facilitators can adjust the process according to the task.	Yes, we use the first three stages of the first round to catch the main problems of Amazon.com, and we reduced the results in the third stage.
3	flexible		I think, the process is really flexible.
5	repeat		Unfortunately We didn't reach unanimous consent after first voting, so we repeat again.

We draw some conclusions during the analysis of the interview data:

- The time of collaborative learning is significantly reduced and the efficiency is improved through the teaching process.
The teaching process is based on facilitated method, group tasks are divided into six stages: OnePage, popcornSort, BucketWalk, StrawPoll, CrowBar and WrapUp. Combined with advanced collaboration tools, such as ThinkTank, controlling the time of every link, ensure to draw the various strands together, realize the problems focusing quickly and effectively, and reach a consensus at last. Compared to traditional postgraduate teaching, especially inquiry-based teaching, the facilitated teaching process works with high efficiency.
Conclusion can be made through analysis of interview data, through the postgraduate student facilitated teaching process, the conflict of

opinion can be resolved quickly, collaborative learning time is significantly shortened and the leaning efficiency is upgraded.

- Through the collaboration process, students' interest in learning has improved, the leaning quality was in a higher level and the quality of learning was improved substantially.
Postgraduate teaching is often different from the undergraduate teaching. Teachers often give students more inspiration and then to train the students' abilities to solve the problems in the process of postgraduate teaching. The facilitated teaching process can make students to think completely and make the conclusion combined with everyone's views to ensure that the final result is reasonable. Moreover, the facilitated teaching process is a good way to help students develop the characteristic of self-initiative, and reduces the collaboration risks such as confliction of views, confliction of time. Students also can

broaden their thinking, acquire more knowledge as well as increase capacity through collaborating with others. In addition, if the collaboration tool such as ThinkTank is used, anonymity can be set, which can ensure the result of the task is reasonable and accurate better. Thus, compared to traditional postgraduate teaching, the postgraduate teaching based on facilitation is more efficient. During the interview process, we draw the following conclusion: through the postgraduate student facilitated teaching process, students' interest in learning has improved, the quality of learning is improved greatly, and they also got better learning outcomes.

- The facilitated collaboration process is more flexible for those facilitators can adjust the process according to the task.

The task and time of all stages during the process are limited. Limitations are proposed on the basis of previous researches. However, these limitations are not in line with all kinds of problems. The process and the learning time can be adjusted flexibly according to the task by some collaboration tools such as ThinkTank. Compared to traditional teaching methods, the postgraduate teaching process shows some benefits. The process introduced new facilitated methods into collaborative postgraduate teaching to improve the quality of teaching and enhance students' abilities of problem-solving.

V. CONCLUSION AND FUTURE WORK

Facilitation and collaboration techniques have already been adopted in IS higher education undergraduate subjects by some universities worldwide. This research investigates a case of postgraduate students in China who use facilitated collaboration process in CSCL based teaching module within a IS project teamwork background. In this research, we have designed a two round collaboration process for the postgraduate students to finish their module project. The thinkLets units such as OnePage, PopcornSort, BucketWalk, StrawPoll, CrowBar and WrapUp has been embedded into the collaboration process. Interviews results show that the process could decrease the learning time, increase the efficiency of teaching, improve the students' interest and learning quality, as well as enhance flexibility for the course facilitator to do the control.

On one hand, this research will contribute to the collaboration process design, the research in the CSCL and also the case study of the postgraduates in higher education. On the other hand, it will also provide clues for the teachers in the CSCL teaching process for postgraduates and also software and system development.

Nevertheless, there are also some limitations, such as the process not only requires the postgraduate students to have computer skills on selected tools but also the hardware and software requirements for teaching and learning environment. Nevertheless, with the dramatically adopted technology and increasing hardware level, we believe that the process will be more widely applied in the

teaching. Moreover, this is only a single case study which may not be enough to have the conclusion. The case is also set in the particular context of CSCL background of postgraduates in China. As this is only a research in progress, in the future, we will continue to finish our case studies for another two postgraduate cases in order to evaluate our designed collaboration process by collecting more data evidence for this research. Furthermore, we will also conduct some comparative analysis such as investigating the differences and similarities among postgraduate teaching, undergraduate teaching and international students in our future research. This designed process which has a strong theoretical and practical implication could be encouraged to other universities to enhance the quality of postgraduate education and train more talents in future.

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