‘Many to one’ mode of CSCL and further discussion

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Abstract: This study is an experiment of a new instructional model in classroom of higher education. Quantitative research methodology is employed in this study. Data are collected from 22 college students in the school of educational technology of a university. Findings indicate that ‘many to one’ mode participated by two to three students sharing one computer has a positive effect on the quality of learning. This contributes to the improvement in instructional quality of the college. As a result of this study, this paper advocates for an emphasis on experience-based computer-supported cooperative learning (ECSCL) in F2F classroom to facilitate the reform in higher education.

Keywords: cooperative learning; lifelong learning; computer-mediated communication; improving classroom learning.

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1 Introduction

As technology becomes more available, the development of e-learning for classroom instruction in higher education is essential. Kinuthia and Dagada (2008) thought the
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Development of e-learning in higher education would help to improve the flexibility of instruction and provide learners with the opportunity to adjust their learning interests, needs and learning styles under different learning environments. Meanwhile, he also believed that large class capacity, limited bandwidth, time and financial resources would hamper the integration of information technology into instruction in college. As he has stated, the above four issues have almost become insurmountable obstacles to the integration of ICT into instruction in higher education. However, with the popularity of one to one learning and the cost-effective optimisation of IT hardware products, the proportion of learners with laptops in college has gradually increased. Requirement for low cost and large student-computer ratio have driven the emergence of handheld technology use which is frequent, integral in everyday classroom routines (Roschelle and Pea, 2002; Soloway et al., 2001). If learners are allowed to bring their laptops into the classroom, other learners without laptops can share with them, thus, to some extent, it alleviate the problem of shortage of public computers caused by factors such as a large class capacity. As a result, this may lead to the experiment of a new way to change the leaning mode.

2 An overview of related research

Computer-supported cooperative learning (CSCL), as the name suggests, is an emerging branch in computer-assisted education concerned about a way for learners learn together with the help of computers (Huang, 2003; Stahl et al., 2006). According to this definition, CSCL has two features: 'computer supported' and 'learn together'. The former indicates the facilitating role of technology such as local area network, Internet, distance learning platform, certain software, mobile technology, etc. The latter puts emphasis on cooperation which is the foundation of CSCL.

However, cooperation do not always happen in groups thus resulting in students not being able to complete their learning tasks in time (Dehler et al., In press; Morris et al., 2010; Wang, 2010) despite some students participate in group activities.

Various interactive strategies have been used to prompt effective cooperation (Wang, 2010). Wang proposes that online shared workspace has the potential of supporting group cooperation. Chen et al. (2010) suggest that groupscribbles-based cooperative learning strengthens student-domination of discourse thus contributes to their cognitive development.

After studying various types of web-based cooperative learning in higher education, Zhao and Akahori (2001) lists ten strategies and analyses in detail their features and usage. Strategies such as student team-achievement divisions, cooperative integrated reading and composition, JigsawII, learning together and group investigation are typical for F2F cooperative learning (Peng, 2010). Especially, group investigation (Sharan and Sharan, 1992), also known as collaborative inquiry (Smith, 1999), was regarded as an effective approach to promote collaboration in classrooms.

There are also studies that concentrate on the creation of multi-user environment to support cooperative learning in classroom activities. Pal et al. (2006) create a multi-users-based hardware environment to share resources and work better together with minimal increment. Järvelä et al. (2007) build a mobile tools-based wireless environment to scaffold cooperative learning and support a shared understanding. Dufresne et al. (1996) have stated that classtalk offered an interactive learning environment for active
learning and overall communication. To improve traditional teaching and learning method, a system named computer supported for face-to face teaching (COSOFT) was developed to support cooperative activities inside and outside classroom (Baloian et al., 2000). The system has a key scenario computer-integrated classroom (CiC) which integrates computer technology into traditional classroom to form a mixed environment to enhance instruction.

In summary, the general claim has been that interactive strategy and corresponding learning environment have been regarded as two key factors. However, these two factors have often been regarded as independent paths to cooperative learning. There will lead to an obvious gap between cooperative strategy and learning environment so that group cooperation can’t take place naturally. The final outcome is to have a passive influence on learning quality.

Effective CSCL requires the combination between factors to enhance positive interdependence. Just as Dillenbourg and Fischer (2007) mentioned that “collaborative learning per se is not effective since productive social interactions often do not occur spontaneously” and suggested “CSCL environments must purposely be designed to trigger interactions that produce positive learning outcomes”.

In this study, we will attempt to integrate interactive strategy into learning environment and form an interactive, student-centred mode which can provide an alternative mode to CSCL in F2F classroom environment where the ratio of student-computer is not large. This mode is often referred to as the ‘many to one’ mode of CSCL, as compare to the ‘one to one’ mode (Chan et al., 2006). This ‘many to one’ mode is a relatively new approach which has been attracting more and more attention in area of computer-assisted education in recent years.

3 Research question

This research aims to ascertain whether a new cooperative learning mode can enhance the quality of learning in F2F environment in classroom. The following question guides this research:

Can ‘many to one’ mode of CSCL improve quality of learning if two to three students use one laptop together in F2F classroom in college?

4 Research design

Ledlow (1999) clearly pointed out that a successful cooperative learning consists of six factors, including the balance of class atmosphere, group composition, team building, cooperative skills, teaching design and classroom management. Kaufman et al. (1997) investigated some teachers and students from medicine, dentistry and mathematics fields and concluded that cooperative learning was a very useful for learners, and learners’ response to cooperative learning is positive. To exert the benefits, learning groups, case preparation, proper classrooms and a comparatively devoted group of teachers were indispensable. Neo (2005) thought that through mutual cooperation and interaction, learners could take the initiative to participate in the process of group learning. The relationship between the cooperative learning structure, teachers, learners, technology,
technical support, and cooperative learning framework provided an active and constructive guidance and support for learning.

Though these studies enable us to understand the essential factors for establishing a cooperative activity, it is still not clear how a cooperative environment can be organised to complete an instructional task in a particular situation.

For CSCL in F2F classroom, the way to produce messages for student has been regarded as a core topic. Wong and Looi (2010) proposed that the messages in online discussion should originate from task, student-initiated learning, peer help and thought. In these factors, student-initiated learning is an active process for participants in learning activity (Singh and Carr, 1992). Meanwhile, Johnson et al. (1981) have suggested that “educators may wish to considerably increase the use of small group learning procedures to promote higher student achievement” (p.58).

In this study, we design the ‘many to one’ mode based on results of Wong and Looi et al. This mode consists of learning environment, inquiry-based interactive strategy, learning task and learning activity. Activities-based group investigations (Sharan and Sharan, 1992) are designed to motivate every student into an active participant. Small fixed group (Dillenbourg and Fischer, 2007; Johnson and Johnson, 1974) share information and resolve problem to gain the help from others through using one computer together.

4.1 Learning environment building

The first step is to build a simple, mobile learning environment in F2F classroom where two to three students use one laptop. The laptops are from students themselves and there are only nine in this study. There is no connection between laptops either by internet or wireless networks. Data sharing depends on USB flash disks.

4.2 Inquiry-based interactive strategy

Two key aspects are taken into account for inquiry-based interactive strategy in CSCL. One is inquired task (also known as learning task) and the other is assisted tool. Compare to traditional cooperative learning, assisted tool is additional but typical cognitive tool to help students complete inquired task, such as software, rating scales, etc. Multi-student cooperative use and inquiry support are two distinct features for assisted tool. In this study, an assisted tool named learning and study strategies inventory (LASSI) (Weinstein, 1987) is used to help student learn theme complete their assigned learning task.

4.3 Learning tasks

Students were asked to study Chapter 3 of their textbook (Research Methods in Educational Technology) and concentrated on the survey research methodology. This is a required content in their coursework. There are three tasks assigned to every student:

Task 1 after having finished the learning activities, every student has to submit a learning strategy level analysis report of the whole class.

Task 2 after having finished the learning activities, every student has to submit an individual reflection report about the learning strategy.
Task 3 Each student is to complete a set of questionnaire about satisfaction level of students.

4.4 Learning activity design

There are seven activities designed in this study. Each activity is to be completed with the 40-minute slot given.

A1 students fill out the LASSI Independently
A2 students input raw score under guidance of teachers
A3 students use SPSS and EXCEL to sum scale score of LASSI
A4 students gather data from other groups with the flash disks, in accordance with standard score of LASSI calculated 0%–50%, 50%–75%, above 75% of the number of the three intervals, generating columnar charts
A5 teachers and students discuss the difference between the questionnaires and rating scale methodology
A6 students discuss the overall level of learning strategies of the class in groups; understand the methods and significance of the scale data analysis under the guidance of the teacher
A7 students calculate structured items in questionnaires and show the results with pie charts or in bar graph form. In order to avoid statistical tendencies appearing subjective, the teacher has already shielded the characteristics information of all individuals before the survey.

5 Research method

5.1 Participants

Participants are recruited from a university in Qinhuangdao of China. The university is selected because it has limited number of public computers for student use which makes it very difficult to organise one computer to one college student learning environment.

A total of 22 students major is educational technology was recruited for this study. The sample includes an equal number of male and female students. The mean age is 21.6 years (SD = 0.99). The sample has diverse ethnic background including 4.55% Yi nationality, 4.55% Manchu, and 90.90% Han nationality.

5.2 Participants grouping

Only nine students in the group own laptops. The students are divided into nine groups on a voluntary basis. Groups 1, 3, 6 and 9 have three students sharing one laptop while the remaining five groups have two students sharing one laptop. Grouping was voluntary rather than assigned Students from each group are mostly from the same dormitory, thus their group cooperation will be more harmonious. The owner of each laptop is responsible for group coordination and monitoring.
5.3 Data collection

Data collection is in two parts: Part one consists of two sets of 22 individual reports collected from all participants. These reports are divided into two genres, one is the learning strategy level analysis report of the whole class submitted by every student; the other is a self-reflection report about learning strategy also submitted by every student.

To exactly evaluate level of learning quality of the participants according to learning task, a coding system is designed by the first author based on a five point scale, ranging from 1 = Poor, 2 = Fair, 3 = good, 4 = very good and 5 = excellent (see Table 1).

Table 1  Scoring criteria for analysis reports submitted by every student

<table>
<thead>
<tr>
<th>Points</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 point</td>
<td>Unclear framing, unemphasised statement, no logical reasoning, no conclusion</td>
</tr>
<tr>
<td>2 points</td>
<td>List some items, a little bit focus, weak logical reasoning, random conclusion</td>
</tr>
<tr>
<td>3 points</td>
<td>Clear framing, statement involved with key point, good logical reasoning, narrow conclusion</td>
</tr>
<tr>
<td>4 points</td>
<td>Clear framing, highlighting statement, complete argument clue, conclusion based on data and facts</td>
</tr>
<tr>
<td>5 points</td>
<td>Extremely clear framing, highlighting key point, forceful argumentative process, conclusion based on data and facts completely</td>
</tr>
</tbody>
</table>

Both sets of reports adopt the same scoring criteria as due to their similarities on discourse framing, standpoint statement, logical reasoning and reliable conclusion. In addition, the two set of reports also belong to expository text structure which explains some results by means of graphs or charts.

Part 2 is the questionnaire which has two main purposes. It reflects individual learner’s satisfaction level with classroom instruction and record their suggestions and recommendations. In addition, by experiencing the completion of the questionnaire, learners can understand the role that the questionnaire plays in the instruction and get to know how to develop questionnaires to achieve learning goal and induce opinions from interviewee. The process of statistical data analysis for the questionnaires was performed using SPSS 11.5.

Twenty-two sets of responses were collected from the participants. The likert rating scale was adopted for the questionnaire. There are six structured items covering the aspects of teaching method, learning method, cooperative strategy, learning environment, evaluation methods and overall attitude to reflect students’ evaluation on the efficiency of the instruction (see the Appendix).

5.4 Assessment of reliability

For assessing inter-rater reliability for coding system, 20% of the samples are usually selected for the assessment (Puranik et al., 2008). However, in this study, all of the samples have been used because the number of participant is small. The first author and the corresponding author code the reports according to the coding guidelines. Spearman’s rho is used to measure correlation coefficient between scores of the two raters. The following are correlation coefficient for each of report genre: For the first genre, \( r = 0.767, p < 0.01 \); the second genre, \( r = 0.692, p < 0.01 \).
For assessing reliability for structured questionnaire, the Cronbach’s alpha coefficient is adopted. The alpha coefficient is 0.6627.

6 Results

As mentioned above, this study places emphasis on level of learning quality which is reflect in the students’ report and questionnaire.

6.1 The quality level of the analysis reports of whole class

The quality level of the reports of whole class has a mean of 3.05 (SD = 0.79) which exceeded the ‘3’ which is the minimum score required by the college for students to pass the course. There is a significant different between students who scored ‘below 3’ and ‘above 3’, \( \chi^2 \) (df = 1, N = 22) = 1.485, \( p = 0.223 > 0.05 \) for 2:3 which required by the college for students to pass the course. This shows that the experiment has reached its desired objective of raising students’ learning quality.

For example, the report from one of the student’s states:

“We can find that our classmates have greater advantages in study aids. They are also good at time management, anxiety treatment, concentration and information processing skill. However, their utilisation in selection of main ideas, test strategy, attitude and self-test scale shows low performance, especially in the motivation scale.”

6.2 The quality level of reflection reports

The quality level of the reflection reports has a mean of 3.23(SD=0.87) which also exceeded ‘3’ which is the minimum score required by the college for students to pass the course. There is also a significant different between students who scored ‘below 3’ and ‘above 3’: \( \chi^2 \) (df = 1, N = 22) = 2.735, \( p = 0.098 > 0.05 \) for 2:3 which required by the college for students to pass the course. This shows that the experiment has reached its desired objective of raising students’ learning quality.

For example, one student describes his reflection report of individual learning strategy as follows:

“Through inventory testing and data processing, I have got a better understanding of my learning status. According to Table 3, compared to the average score of the whole class, many scale scores in my testing are quite low, especially in selecting main ideas. This indicates that I should work on making improvement in it in the future. Compared to the average score of boys, many item scores of my scale are higher. However, my scale scores of information processing, selecting main ideas and self testing are lower than the average score of the boys. This implies that I should make improvement in them as well.”

6.3 Satisfaction level of students

As is shown in Figure 1, we can find that learners are very sensitive to changes in the teacher’s instruction and that they show great curiosity and interests in them. 68.2% of the learners are satisfied with these changes (including the very satisfied option and the
satisfied option). 32.8% of the learners think it is fair, neither better nor worse. No learner shows dissatisfaction or feels very dissatisfied.

**Figure 1** The statistic data of structured item in questionnaire (see online version for colours)

![Data Chart](image)

Some learners expressed that it was very enjoyable that they could complete the cooperation task with their classmates who had never worked with them before. Most of the learners think LASSI accurately describe their learning strategies and provide the basis for their improvement in learning strategy.

7 Discussion

7.1 Improvement for learning quality

From the above analysis of the results we find that the quality level of learning reports, both whole reports and individual reflection, have already exceeded the minimum standards of three points which required by the college for students to pass the course and the number of students below and above minimum standards have shown significant different. Meanwhile, the degree of satisfaction of students is close to 70%. More students are more interested in learning method in classroom environment with two or three students sharing one laptop. There are also enough evidences to indicate a distinct improvement of learning quality in F2F classroom with two or three students sharing one laptop. This result is consistent with findings of Johnson et al. (1981). And what’s more, this study provides a possibility for initially alleviating the structural problem of shortage of public computers due to the low student to computer ratio in college and makes a preliminary exploration to find a new way to utilise existing conditions to improve teaching and learning method.
Nevertheless, it is more important to discuss ‘why it happened’ rather than ‘what happened’ to the increase in learning quality. The following discussion will be based on two areas: changing of teaching method and changing of learning method.

Changing in teaching method mainly involve which methods the teacher uses to teach and how to teach in the process. The 2 ~ 3-learner-cooperative learning environment promotes some significant changes in teaching method which are mainly shown in the following five aspects:

1. the analysis of learners’ characteristics in a particular phase not only focuses on a comprehensive analysis of their existing knowledge base, but also whether a learner is willing to be involved in learning with emotional participation
2. besides the middle ability group, individuals with either weak or strong information technology application abilities were also paid attention to so that they can take the initiative in the group cooperation and complete the given tasks
3. time and space for self-regulated learning were set aside in instructional design so as to give equal emphasis on both teaching and learning
4. attention was paid not only to the availability of information technology resources and learning tools but also the minimisation of the threshold of technology learning difficulties for students
5. the tasks, mode, and evaluation were inline with each other.

Changing in learning method mainly refer to how to learn in the instruction process, namely, through which method learners succeed in learning a certain topics. The 2 ~ 3-learner-cooperative learning environment also promotes some significant changes in learners’ learning method which are mainly shown in the following four areas:

1. through cooperative learning, learners gradually complete the construction of knowledge instead of using the traditional ‘listening to a teacher and reciting notes’ method
2. by self-reflection learners obviously realise that their leaning strategy have changed with the support of the computer
3. learners transfer and apply what they have learned into different scenarios in the learning process
4. learners shift their focus from the content learning to comprehension, feeling, experience and practice of knowledge of issues.

7.2 Further findings

For college education, choice of successful cooperative learning, which has to be both appropriate and easy to use, should be based on the principle of how to optimise the learning performance to improve student achievement (Cook, 1991; Zhao and Akahori, 2001). Having proposed some possible reasons for the improvement in the learning quality, we would like to explore further other possible reason to explain the improvement found in the quality of learning.

In the study, we find learners’ personal experience and group experience based on and generated by LASSI have fostered their learning interests and improved their
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learning quality. What’s more, computer-supported group cooperative learning supports the process calculation of LASSI. As a result, the accurate diagnostic results of LASSI promote the experience and reflection of individuals and groups, the insight of which further lets them have some degree of dependency and trust towards cooperative learning. This phenomenon is called ‘cooperation – experience – cooperation – experience’ spiral cycle.

Based on the study of Piaget, Dewey and Lewin, David A. Kolb proposed an experiential circle including four components: ‘concrete experience – observation and reflection – formation of abstract concepts – test in new scenarios’. On the basis of Kolb, Peter Jarvis created a model containing “non-learning, some non-reflective learning and some reflective learning” three components (Smith, 1996). The third component ‘some reflective learning’ describes the stages of experience-based learning from the knowledge perspective. The core of experience-based learning lies in learners’ reflection and how they do it. That’s to say, to keep repeated reasoning, reflection and evaluation on the basis of practice and experiments according to scenarios and experience, learners change their learning states and gain more experience. In this process, learners’ practical knowledge has been developed and their problem-solving ability in the new scenarios is also improved.

Previous studies show that cooperative learning emphasises learning objective orientation and overall performance incentives (Huang, 2003). While in this study the particular experience stimulated by LASSI also has become a guide and inspiration for successful cooperative learning. The difference between this kind of experience and previous orientation and incentives rests with its emphasis on the insight and reflection related to individual’s success in solving practical problems in a particular situation.

Based on the above analysis, we would like to advocate the ‘experience-based computer-supported cooperative learning’ (ECSCL). The so-called ECSCL means that with the support of certain cooperative tool, learners can complete the cooperation task and gain a cooperative learning experience associated with solving practical problems successfully.

- Experience-based CSCL extends the connotation of cooperative learning as well as closely combines cooperative learning and individual experience in solving practical problems. It is more suitable for solving some specific problems encountered in some particular situations.
- Experience-based CSCL not only pays attention to the influence the process of cooperative learning has on individuals’ knowledge construction and emotional factors, but also emphasises what kind of opportunities for improvement and learning strategies to individuals to solve practical problems the cooperative learning results could bring about.
- Experience-based CSCL combines individual performance and group performance, involving individual’s participation and utilising cooperative tools to guide a learner’s practical mode of thinking.
- Experience-based CSCL allows learners to experience certain a social role and individual competence so as to enable learners to transfer knowledge in solving different practical problems to gain experience for working independently in future work.
For the design of experience-based cooperative learning, the important points lie in the selection of cooperative learning tools and how to motivate learners to reflect. Selecting cooperative learning tools aims to involve all group members to participate in the activities in a computer-supported environment. At the same time, there are some potential strategies or methods within the tool itself, guiding learners to solve practical problems. The practical effects resulted from these strategies or methods become one of the reasons to stimulate learners to reflect and produce experience. In this study, LASSI has the function of diagnosing individual strategies, as well as using computer to collect data which requires the participation of all group members. If LASSI is replaced by blog, forum or other tools, they can also use the computer and everyone can participate. However, these tools themselves do not have a diagnosis function of learning development. They can only support general cooperative learning, but not for effective experience-based cooperative learning.

8 Conclusions

‘Many to one’ mode of CSCL can have a positive effect on quality of learning in F2F classroom in college. As a result, it can initially alleviate the structural problem of shortage of public computers and help to enable a new way to explore alternative instructional model based on existing conditions. According to the result of this study, this paper advocates that the experience-based CSCL should be emphasised in classroom teaching and learning in higher education environment.

9 Implications and limitations

Some implications from our research are worth mentioning here:

a for teaching and learning in F2F classroom in college, experience-based CSCL not only applies to courses of educational technology programs, but also to science, physics and chemistry, and even engineering. As long as a cognitive tool such as LASSI is available to arouse individual experience, it would be possible to design experience-based CSCL with students sharing laptop.

b the experience-based CSCL provides possibility to look for a low-cost, high-efficiency, high-quality approach for teaching and learning in F2F classroom. It is especially useful to some colleges located in Northwest area of China. Generally, most colleges in the Northwest area have relatively low student-computer ratio. This experience-based CSCL would be an appropriate solution to address this structural disparities between ‘more students’ and ‘little computers’.

There are two possible limitations in this study. Data are only collected from a small sample of 22 college students, thus be limit its application to other situations to some extent at least. In addition, pre-test (or control group) was not included in research design due to circumstances and content of the study. All the results were based on student’s own reports which also may influence the validity of the study to some extent.
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References


