

Web-based Cooperative Learning in College Chemistry Teaching

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Abstract—With the coming of information era, information process depending on internet and multi-media technology in education becomes the new approach of present teaching model reform. Web-based cooperative learning is becoming a popular learning approach with the rapid development of web technology. The paper aims to present how to carry out the teaching strategy of web-based cooperative learning and apply it to the foundation chemistry teaching. It was shown that with the support of modern web-based teaching environment, students' cooperative learning capacity and overall competence can be better improved and the problems of interaction in large foundation chemistry classes can be solved. Web-based cooperative learning can improve learning performance of students. Moreover, web-based cooperative learning provides students with the skills of cooperation, communication, creativity, critical thinking and information technology application.

Index Terms—cooperative learning, teaching strategy, foundation chemistry, Web

I. INTRODUCTION

The idea of cooperative learning originated in the 1970s and achieved a substantial progress in the 1980s. Cooperative learning refers to the instructional use of small groups so that students work together to achieve a shared goal. These groups used a variety of learning activities to understand the meaning of a subject [1]. In cooperative learning classes, students were interdependent and individually responsible for their work. With cooperative efforts, all of the students strove for mutual benefit. Cooperative learning changed the traditional teacher-centered classroom teaching idea to student-centered model; switching from teacher's force-feeding teaching to student's self-autonomous learning. Studies showed that cooperative learning was effective in improving students' study performance, cultivating their collaboration, social skill, practical ability and creativity [2]. Therefore, it had drawn much attention by researchers and had been used widely in colleges and universities in many countries.

As the development of modern technology, computer network became more and more important for teachers and students. In this context, web-based cooperative learning was developed from cooperative learning, in which students study with computer network and multimedia to achieve a higher level in understanding and mastering of the taught subject. Network can take full advantage of cooperative learning. Some cooperative learning patterns which could not be carried out in the traditional classroom can be implemented much better with network environment [3~5]. Chemistry, as a foundation course for stu-

dents in agricultural university, still has many shortages in teaching method at present. Aiming at this kind of situation, this paper brings forward the practice that taking the theory of web-based cooperative learning in the foundation chemistry courses, such as Analytical Chemistry and Chemistry Experiment.

II. GUIDED DESIGN ON COOPERATIVE LEARNING IN WEB-BASED ENVIRONMENT

With the guide of contemporary cooperative learning theories, we implemented the new teaching mode in chemistry course teaching program in some experimental classes.

A. Building of the Online learning platform

A web-based platform named Teaching Platform of Department of Applied Chemistry was built by Department of Applied Chemistry in the author's university. The web-based platform is well open, widely ranged and interacted. It includes all the course teaching by Department of Applied Chemistry, providing necessary information and learning sources for the students. Learning resources contain electronic course materials, hyperlinks of relevant web sites, relevant knowledge base of the original database (or its hyperlink), etc. If students had any question, teachers in the online answer question room could provide necessary helps. Students could also learn from other people by browsing internet such as personal home page, links to MSN, QQ, QQ space group. If necessary, they might get help by sending email to the teachers or members in their group.

B. Practical steps

1) cooperative learning preparation

The cooperative learning preparation included two steps:

a) Grouping students into teams

Students in the whole class should be divided into several groups, who were heterogeneous in terms of primary knowledge and learning attitude. Suitable cooperative learning materials according to students' levels should be prepared by teachers at the very beginning. Generally, it was better to arrange three to five students in each group with different primary knowledge and different specialties. In such groups, they could help and learn from each other. Of course, each group should have a leader to be the coordinator.

b) Definition of learning goal and task.

Designing of the learning goal or tasks under internet environment should be based on the following principle.

The task should be clear and the results could be easily generated. The intelligence and active intelligence required to complete the tasks should be suitable to the abilities of students. The network resources and communications should be necessary for accomplishing the task. Cooperative mode should be needed to complete the tasks. Teachers should set up learning and research scene which students could be active to involve in and try to find out innovative solutions from. While students were grouped, they would analyze the learning assignments, and defined their common learning goal and evaluation criteria.

c) Supervising and instructing students' team activities

Teachers should encourage the members to do the work by themselves, but providing necessary constructive suggestions such as teamwork procedure, role-taking skills between group members, ways to communicate and compete between different groups. Students should be guided in an active dialog by acquiring, generating, analyzing, manipulating, and structuring information.

Curriculum should be planned in a spiral manner so that the student could build upon what they have already learned continually. In this way, they could finish their assignments interdependently and creatively.

2) During cooperative learning

a) Plan of Groups

As task was defined, the cooperative group would discuss and analyze the learning task. Each member should obtain relevant duties and roles in web-based cooperative learning mode.

b) Cooperative Practice

Students and teachers would implement cooperative learning in this phase. Cooperative learning might traditionally occur in or out of class. In-class activities, which might take place anywhere during an entire class period, usually consisted of answering questions, explaining observations, summarizing lecture material, trouble-shooting and brainstorming and so on. Out-of class exercises included designing projects, carrying out research studies, writing reports and preparing class presentations, etc. In our case, web-based cooperative learning mainly occurred out of class. The basic techniques in web-based cooperative learning were to solve problems and communicate with other members. The students were actors while teachers were instructors and observers in cooperative learning system. Students should try to accomplish their task depending on internet resources. They could interact with others for help. The interaction might occur between students and their group members, students and teachers, and students with other people in the form of chat room, email exchange, instant messaging software, online discussion board, etc.

c) Summary of Achievements

The cooperative groups should reveal their achievements. The summary of achievements should include exposure of team and every member's achievements, plans of team activities and cooperative implementation.

3) Post-cooperative learning

In this program, teachers should evaluate the effect of learning and get feedback from students. The evaluation of web-based cooperative learning should include: general process evaluation, general evaluation of cooperative

groups, evaluation of individual performance in cooperative groups, and evaluation of general cooperative performance in groups. Teachers should observe and record students' changes on learning process, interesting, motivation and adjust the learning groups accordingly. Considering students' regular activity records and assignments outcomes, teachers can grade their final scores from two parts: team scores and individual scores.

III. CURRENT PROBLEMS OF COOPERATIVE LEARNING BASED ON WEB

A. Students' poor ability to get efficient information

Web-based cooperative learning requires the students have a basic ability of modern information technique for gaining information, processing information and transferring information. It also requires an attitude of independent learning under the condition of information era, strong sense of duty and critical thought.

B. Students' inactivity to take part in the small group

Web-based cooperative learning needed more interaction than traditional learning. It promoted a better communication, collective building and information and resources transferring. But some researches found that some students had little interesting in group discussion. Even worse, some students would rather look through the irrelevant websites than collect correlative information. This was mainly due to the fact that the students did not know the importance of interaction, participation and cooperative learning.

C. Teachers' Lack of Identity Recognition

Web-based cooperative learning, teacher's identity is different. They may be knowledge's introducers, a provider of internet resources and sometimes organizers who lead students to discuss and then keeps an online class together. It was important for teachers to understand their new identity.

IV. EFFECTIVENESS OF WEB-BASED COOPERATIVE LEARNING

In order to evaluate the effects of web-based cooperative learning model in college chemistry learning and teaching, the author collected the final scores of the four tests of one experimental class and one non-experimental class, and analyzed with SPSS 18, as shown in table 1. Table 1 showed that students in experimental group got higher mean scores than those in traditional learning groups (Comparison Group) in all the four exams, which means web-based cooperative learning group was more effective than traditional group.

TABLE I.
COMPARISON OF MEAN SCORES OF DIFFERENT GROUPS IN EXAMS

	Experimental Group N=152; mean(SD)	Comparison Group N=124; mean(SD)
Test1	73.23(19.32)	65.35(19.57)
Test2	75.62(14.84)	68.19(14.17)
Test3	71.09(21.47)	60.26(20.09)
Test4	76.18(18.28)	62.54(16.95)

p<0.05

Differences between web-based cooperative learning and traditional learning were shown in Table 2. Compared with traditional learning, web-based cooperative learning had many advantages in participation degree, individual responsibility, diversity of knowledge, communicative skills, problem situation show, teachers' status and value.

Attitude of students towards the web-based cooperative learning mode were shown in table 3. It was shown in Table 3 that the vast majority of the students in the experimental group were willing to accept the Web-based Cooperative Learning mode.

As stated above, web-based cooperative learning brought great changes to foundation chemistry courses teaching and learning. It differentiates traditional teaching in improving students' skills of learning, enhancing students' satisfaction with learning, promoting their motivation and interests in learning. Compared with the class taught in traditional teaching mode, students in the web-based cooperative learning strategy got higher scores in exam and were more active to study. Furthermore, they also had better study performance. The web-based cooperative learning helped students a lot on improving their skills of cooperation, acquiring new knowledge, communication, computer, creativity and independent learning.

V. CONCLUSION

Web-based cooperative learning could scientifically suit college students' cognitive and psychological needs. It broke a traditional situation of teaching mode, and thus could be effectively applied to foundation chemistry classes. Cooperatively taught students tended to exhibit higher level of expression, higher self-esteem, easier to cooperate and more positive relationship with others. To students, the ability of building a positive relationship with other people was very important for their future career.

With the support of the web, which provided all our learning media, web-based cooperative learning might lead to a new teaching strategy. Web-based cooperative learning would provide students with greater flexibility in time, place and material they choose for their study. More freedom and more accomplishment might enhance students' interesting on cooperative learning. Harmonious atmosphere improved students' autonomy study mode, which was encouraged in a new round teaching reform.

However, web-based cooperative learning was not universal truth for every course. As it had never been systematically adopted in formal chemistry course before, there is no formed experience can be found concerning this area. Yet it remained to be explored on teachers' acceptability and students' adaptability, as well as the effective use of the web technology in teaching.

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TABLE II.
COMPARISON AND ANALYSIS OF WEB-BASED COOPERATIVE LEARNING AND TRADITIONAL LEARNING

Comparative Point	Web-based Cooperative Learning	Traditional Learning
participation degree	participation span more widely Participation depth deeper	participation span more limited participation depth limited
Individual responsibility	strong	weak
Diversity of knowledge	Students get more Resources through network environment and own more dissimilar knowledge	resources are limited in traditional school classroom environment and team members own similar resources
communicative skills	web-based cooperative learning provide more choice to communications, group members gain more communicative skills.	lack of communicative skills
Problem situation show	more easily to show the overall picture of the question to cooperation group	teachers feel hard to show the overall picture to the question away from life
teachers' status and value	the cooperative platform put up by computer technology ensures the reasonable distribution of teachers and Students' control right.	spatial physical environment in classroom has some unfavorable influence on the cooperation between teaches and students makes the communications hard to go on smoothly and equal.

TABLE III.
ATTITUDE OF STUDENTS TOWARDS THE WEB-BASED COOPERATIVE LEARNING MODE(N=152)

attitude	enjoy	like	common	dislike	very dislike
numbers	48	92	10	2	0
percentage	31.6	60.5	6.6	1.3	0

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