

Design and Implementation of Web-Based Cooperative Learning System Co-Net

Kyungsu WANG

(Chonbuk National University)

Abstract

This study investigated to design and implement web-based collaborative learning system Co-Net and map out students' learning procedure using the system, based upon Student Team Achievement Division (STAD Slavin, 1990, 1996). There are technical process and instructional considerations to be made during the design process. The former are those that concern equipment requirements and specifications and include Ease of Use, Speed of Access, and Flexibility. On the other hand, instructional considerations are concerned with the delivery and access of instructional materials and their outcomes on learners. They are cooperative interactions within groups and group heterogeneity, learner control, group incentives, individual accountability, equal opportunity for earning high scores and contributing to group effort, task specialization, and competition among groups. A web site for a virtual learning environment designed and built by the authors and known as Co-Net is then explained along with the whole process learners inside the environment. The main page of Co-Net consists of 15 menus to implement cooperative learning process. The cooperative learning activities using 15 menus are composed of six phases (1) preparation of the new knowledge (2) presentation of the new knowledge (3) knowledge assimilation and application (4) team and individual evaluation (5) team and individual recognition. Throughout the five phases, the appropriate use of cooperative learning techniques has been shown to have both academic and social benefits to learners.

Keywords : cooperative learning, virtual learning environment

* Department of Education, Chonbuk National University
kswang@chonbuk.ac.kr

I. Introduction

Educators are faced with a number of issues that concern ensuring that schools are “world-class” in terms of achievement and higher-level reasoning, creating positive relationships among diverse students, and promoting students' psychological well being and development(Dick & Carey, 1990). Because cooperative learning is effective in dealing with these issues, it has surfaced as one of the most important educational practices. The popularity and wide spread use of cooperative learning may be largely due to its being based on a theory validated by a great deal of research.

According to Johnson & Johnson (1993a) there are three basic types of learning that goes on in any classroom. They are Individualistic Learning, Competitive Learning, and Cooperative Learning. Cooperative learning allows students to work together in small, mixed-ability groups. The teacher's role shifts from learning disseminator to learning facilitator. The responsibility for learning shifts from the teacher to the student. Furthermore, students working in cooperative groups have an additional twist to their learning. They are not only responsible for learning the material that is presented, but also for ensuring everyone in the group knows the material as well. Usually, there is some type of group goal, either academic or some other type of extrinsic reward (Slavin, 1990).

Looking into previous studies and learning environment are full of tools that facilitate social interaction which are disproportionately text-based tools, such as web BBS type asynchronous tools, E-mail and chat room. In order to overcome these limits of method, the Co-Net were designed based upon Student Team-Achievement Division (STAD) cooperative learning environment. In this Co-Net environment teachers teach the students knowledge focusing on individual and team recognition structure. This collaborative learning system depends largely on educational environment that promote everyone to solve learning problems with common learning goal by social interaction.

Students learn learning contents with 4-5 team members following a teacher presentation and take quizzes individually to demonstrate how much they have learned. The individual quiz scores are added to form a team score, and teams are rewarded for their performance. Teams are made up of students with varying academic abilities, genders, and race. The entire cycle of activities of Co-Net, from teacher presentation to team practice to quiz, usually takes two to four class periods.

II. Design considerations

In Co-Net, the total learning processes are composed five steps (PAATI). (1) Preparation of the new knowledge and skill. (2) Presentation (3) Assimilation & Application of the acquired knowledge and skill (4) Teams evaluation and Individual evaluation. (5) Teams and Individual Recognition. Throughout these five steps there are many considerations to be made and attentions to be paid in the design and implementation process of Co-Net. They may be classified into two kinds. One is technical consideration and the other instructional consideration.

1. Technical considerations: those that concern equipment requirements and specifications

1) Ease of Use

Those systems that require no specialized training to operate are generally more comfortable and cost efficient than those where a high degree of specialization is needed.

2) Speed of Access

Real time transmission offers many advantages over delayed transmission. Most important, real time transmission supports synchronous interaction

of learner and instructor. If students are viewing prerecorded instruction or if learners at multiple sites receive delivered instruction at different times, learning is asynchronous and opportunities students and teachers have for engaging each other are diminished.

3) Flexibility

The speed at which educational technologies are advancing is fast. Ways of delivering knowledge and skills are being improved so that leading edge technologies quickly become outdated. As fast as technologies are being developed, however, web-based instructional systems can be fitted so that a school is able to grow into the technology's full capacity. Systems that provide this space for growth without replacement of expensive parts best serve educational needs.

2. Instructional considerations: Those that are concerned with the delivery and access of instructional materials and their outcomes on learners.

1) Cooperative interaction within groups and group heterogeneity

Learning is inherently a social, dialogical process (Duffy & Cunningham, 1995). Therefore, the more "social presence" (Gunawardena, 1995) established to overcome the effects of geographic proximity the better. Cooperative interaction within groups and group heterogeneity must be ensured in STAD-based Co-Net.

The size of cooperative-learning groups is relatively small and as heterogeneous as the learning environment allows. The recommended size is usually four to five learners. At the very least, groups should contain both males and females and students of different ability levels. If possible, different social economic status backgrounds and social classes should be represented as well. Students within a group are shown how to help each other overcome problems and complete whatever task has been assigned. This may involve

episodes of peer tutoring, temporary assistance, exchanges of information and material, challenging of each other's reasoning, feedback, and encouragement to keep one another highly motivated (Fantuzzo et al, 1990, 1992).

2) Learner Control

Learner control allows students to be active, collaborative, and reflective in knowledge assimilation & application on their own pace. Namely, the learner is involved in setting goals and in choosing the tasks, assessments, and standards to reach those goals (Jones, Valdez, Nowakowski, & Rasmussen, 1995). When web-based collaborative learning technologies are calibrated to support learner autonomy, students can apply unique learning strategies and intellectual processes rather than teacher prescriptions

3) Group incentives and individual accountability

Every member of a group must contribute to achieve the group's goal. This may be met by achieving a minimal score on a test, having the group's test score be the sum or average of each student's quiz scores, or having each member be responsible for a specific part of a project. Although each member works together in a cooperative group, each student is held accountable for individual learning. Individual student performance is assessed and the outcome is reported and celebrated by the individual as well as team members.

4) Equal opportunity for earning high scores and contributing to group effort

Students compete against comparable members of other teams in a game- or tournament-like atmosphere, or are given learning assignments geared to their current level of skill. And then groups are awarded points for degree of improvement over previous test scores. Because cooperative groups are heterogeneous regarding ability and their success depends on positive interdependence, promotive interaction, and individual accountability, it is demanded that steps be taken to ensure that all students have an

opportunity to contribute to their team.

5) Competition among groups

sometimes competition is ineffective. But when competition occurs between well-matched competitors, is done in the absence of a norm-referenced grading system, and is not used too frequently, it can be an effective way to motivate students to cooperate with each other.

III. Designing and Developing

The design of web-based cooperative learning environment will be based upon leading edge technology. Yet technology itself is important. Rather when and how to use is important. FLASH 5.0 and other web publishing software will be used. ASP will be used to link web pages to DATA BASE so learners will communicate with each other inside a variety of bulletin board. The board will be provided to each learner and group.

[Figure 1] is the map of the main structure. After logging into the learning

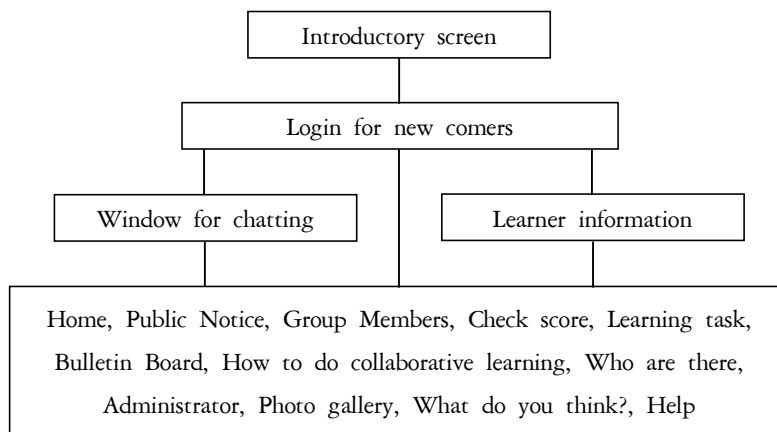


Figure 1. The structural map of cooperative learning system Co-Net

environment, are 15 submenus. They are the followings: 'home', 'public notice', 'group members', 'check score', 'learning task', 'learning resources', 'bulletin board', 'how to do collaborative learning', 'who are there', 'photo gallery', 'what do you think', 'help', and 'chatting room'.

The submenus can be subdivided into two groups. The first group is directly related to the main learning process of the learners in the cooperative learning system. The second group is indirectly related to the main learning process of the learners, for example 'photo gallery'. In the first group menus, designers made efforts to prepare the learners to know their progress and to better communicate with each other. 'Public notice', 'Learning task', 'Learning resources', 'Who are there' were made using bulletin board technology and 'Chatting room' made using real time chatting technology.

1) System environment & architecture

The server system used for his study has Pentium IV processor, 256MB Ram, 40Gb HDD and physically located in an elementary school. The software environment consists of windows 2000, Korean word processor Hangul, and Internet explorer so it enables learners to easily download, upload files they write and modify. The system was mainly designed by the collaboration of school teachers in an elementary school. In STAD-based Co-Net environment, different from other collaborative learning method, the learners know their progress and know the extent and kinds of the imminent test by teachers' uploading test results. The chatting space for inner group communication were provided for synchronous and asynchronous chatting tools

2) The structure of main page

When you log into the learning environment, you will see login menu and pop-up window for chatting. Without logging into the system, it is not

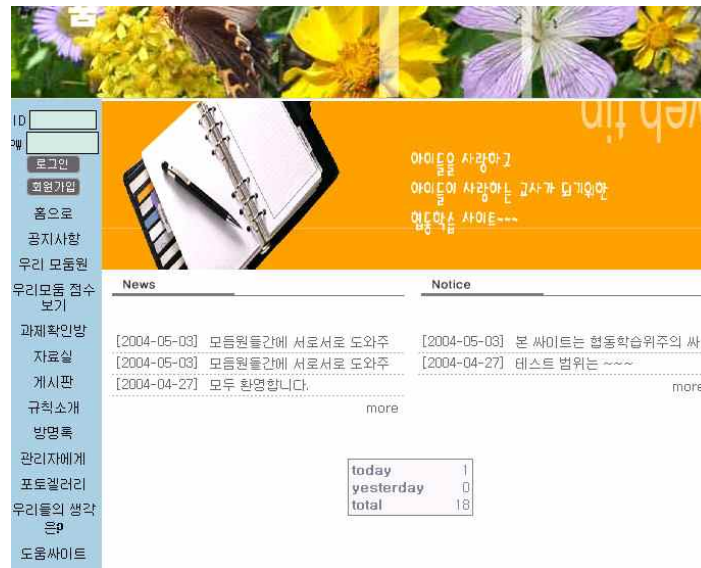


Figure 2. Main Page

allowed to participate in the learning and to know which member already got in the system. Also you can take a test and leave your output in the bulletin board with your ID. Every ID for all the users can be only given by passing this window.

Window for chatting (pop-up menu): You can mostly confirm urgent messages and notices. In addition, you can attach the rules and hints that are essential for the learning before you start learning it. Learners may read this pop-up notice as soon as they enter the site. It is for group members, who want to share their opinions, views, information together by real time dialogue. So the members can discuss given problems and their solutions beyond the limits of time and space.

Learner information: To protect your personal information, the administrator can only have access to the registered information, and it consists of essential elements for the notice of learning resources, accountability for the test and suggesting the use of real names when using the bulletin board. In

addition, the system may request your cellular phone numbers for adults.

Home: You can return to this home while using other menus in this page. You have the right to write only after logging in. Also you can contact your friends who have accessed it through various gates. The counting for the number of contacts is prepared at the bottom of the text.

Public notice: this menu, the administrator gives the notices to the users. Most messages are for conveying information. The special users who are qualified can post their thoughts for the active interaction. Main elements of this page are similar to a bulletin board system. The pop-up window should be used conveying urgent messages. Also you can mainly check the messages for guiding learners.

Group members: You can know who each member of the group is through this option. Because sometimes children of lower grades forget who the members are and also children of higher grades confuse in the case of operating many kinds of small groups belonging to one class, it is very essential.

The administrator had better suggest some notices whenever members are changed. Of course, he or she can arrange the nicknames or the role that are assigned to the members in the case of cooperative learning.

Check score: In STAD learning, the results of previous test are very important. It is also true if the rewards are given according to the score improvement. The personal score is not noticed to protect personal information, which can be exposed to others. Learners can enhance the needs for learning, by comparing their scores with others'.

Learning tasks: This is or presenting assignments beforehand. In addition, previous assignments do not have to be deleted for the final test. If it is modified before the following semester for the review purpose, it can be

utilized later

Learning resources: This space is for uploading and downloading sources and spontaneous sharing of the resources among learners.

Bulletin Board: This is for the routine activities of each group member. Because most of the students are heterogeneous in the same team, you'd better use that page for communicating with each other.

How to do collaborative learning (explaining rules): This is the menu for the students who do not know about the rules of cooperative learning methods. This also helps the learners that do not know about the objective of learning and methods for competition understand learning methods among learners. The results of learners' specific test can be scored as the degree of improvement judging from the chart presented here. You can ask group members how you think of the current issue directly or indirectly related to the learning phases. Actually the main use of this menu is to provide asynchronous free-talking cyberspace as well as to provide participants with informative feedback.

IV. Implementing steps learning phases

1. STAD (Student Teams-Achievement Divisions)

Cooperative learning structures can also be used when assigning group projects or tasks to students. In Student Team Learning developed by Slavin (1990), teams earn certificates or other team rewards if they achieve above a designated standard. Students are rewarded for improving on their own performances, and team scores are important motivators. This method includes four separate programs. Two are general cooperative-learning methods for use in most subjects and grade levels: Student Teams-

Achievement Divisions (STAD) and Teams-Games-Tournament (TGT). Two others are comprehensive curriculums: Team Assisted Individualization (TAI) for math in grades 3-6 and Cooperative Integrated Reading and Composition (CIRC) for reading and writing instruction in grades 3-5.

The Student Teams-Achievement Division (STAD: see Table 1) as a cooperative learning method is a structure in which students are given information for readings, lectures, etc. Teams of four to six are assigned to complete a worksheet or solve problem sets. Generally STADs are heterogeneous groups.

The teacher introduces the lesson, assigns students to groups (four to six members), gives students the materials they need to complete the assignment, and assigns students roles (group preparation). The teacher explains the task, teaches any concepts or procedures the students need in order to complete the assignment, and structures the cooperation among students (knowledge presentation). Students work on the assignment until all

Table 1. STAD

Model	Learning Task	Group Size	Learning	Cooperative or Competitive	Reward Structure	Characteristics Of task	Note
STAD	Present materials 2-4 lessons	4-6 Learners	Student work on worksheets to master material	Intergroup competition Innegrup competition	Individual quiz Team recognition	Basic Skills	
TGT	Present materials 2-4 lessons	4-6 Learners	Student work on worksheets to master material	Intergroup competition Innegrup competition	Students compete in academic games Team recognition	Basic Skills	Identical to STAD except for the determination for the mastery of skills

group members have successfully understood and completed it. While the students work together the teacher moves from group to group systematically monitoring their interaction. The teacher intervenes when students do not understand the academic task or when there are problems in working together (knowledge assimilation & application). After the assignment is completed and when team members feel they have reached acceptable solutions, you can give a brief oral or written quiz to the group, representative, or each member of the team to assess mastery of the material (evaluation & recognition, see Figure 3). In working cooperatively, students realize they (a) are mutually responsible for each other's learning and (b) have a stake in each other's success.

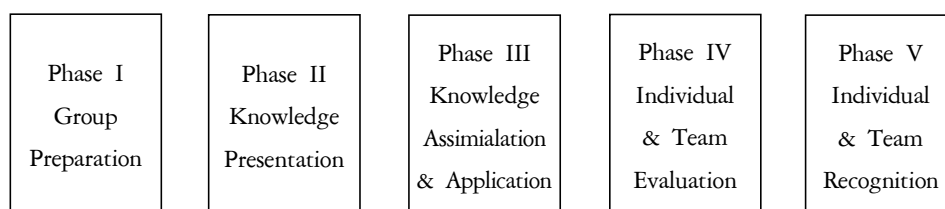


Figure 3. Learning Phases

1) Phase I. Group preparation

It is essential to explain to users the cooperative learning system, Co-Net, steps, and rules to be followed before starting a lesson. This is to make sure instructional reliability and effectiveness. In fact, collaboration is most effective when the learners have the prerequisite knowledge to collaborate. In a computer room, a teacher must show how to do the whole process and how each menu works.

2) Phase II. Knowledge presentation by teacher

This phase corresponds to the presentation of the lesson in the Co-Net. The teacher explains what they learn and why it is important. After the knowledge and skills are presented, the learners are to identify what they

must solve in the learning task menu. And the teacher must tell what kind of quizzes they will take and what are expected after the cooperative learning. In order to ensure learners understand the whole process, all the members may communicate each other inside the chatting room. For the practice purpose, the learners may try to solve sample assignments and questions.

3) Phase III. Knowledge assimilation and application by team study

While attending the knowledge presentation session, the learners try to assimilate new ideas presented by the teachers. Students work together to help each other master given contents by discussing, arguing, teaching, explaining, and elaborating, assessing one another and trying together to build an understanding of the academic content (Duffy & Cunningham, 1995). For example, they can sum up the introduced concepts and check whether they have a common understanding of these concepts, to confront different ways to solve a problem.

Within a group, there might be different roles. A learner may play a role or many roles. The roles motivator, assessor, lauder, ombudsman, leader, monitor, recorder, distributor, silencer, question raiser, and etc.

Choosing Groups for Cooperative Learning: If given the choice, students will want to choose their own group. However, when given the choice, students choose to be with their friends. There are many reasons why a teacher should be the one directing who participates in each group.

The teacher can choose group partners by ability. This allows the purposeful construction so each group will have one top level student, two middle level students and one struggling student in each group. The teacher can choose group partners by personality. This allows the purposeful construction so each group will have an outgoing student, two students who are neither outgoing nor shy and one shy student. The teacher can choose group partners

by leadership skills, communication skills, by past experiences, by gender, by strength/knowledge in a particular subject, etc.

Obviously you can split the groups to include all of the characteristics above but you can make purposeful decisions about splitting the groups to most effectively accomplish your learning objectives for the task at hand. You also want to be able to utilize the group beyond one task. A good rule of thumb is maintaining the same groups about every five to nine weeks. By the end of the year, most students have been involved with everyone else in the classroom.

The learners are given work to do as a mean to apply the knowledge they acquired. Several cooperative modes are possible. In cooperative learning, several cooperative activities enable to apply and create knowledge. Labidi & Ferreira (1998) proposed the negotiation, the competition, the coaction, the assistance, and the complement.

4) Phase IV & V. Evaluation & recognition

Assessment practices should be changed so that they are consistent with collaboration, with a new view of learning and with a thinking curriculum. In the meantime, effective ways have been developed whereby individual students can be evaluated in collaborative classrooms. For example, David Johnson and Roger Johnson (1993a), as well as Robert Slavin (1990), advise making individuals responsible for subtasks in-group work and then determining both group and individual grades.

So, two major areas may be assessed. First the teacher may assess what each individual learner accomplished. And secondly, you may assess how well the student participated as a member of the team.

If the students participated in a small group cooperative learning team, did all team members contribute equally and what were the results of their efforts? Did they have to build a project or complete an experiment? What

quality were the results? How did the written material to support the activity appear? In large group cooperative efforts, grades should be awarded toward individual member participation. If the student took part and achieved his/her role in the accomplishment of the activity, an appropriate grade should be assigned. In addition, tests could be given on the material learned or papers or student logs describing what they did could also be evaluated. Teams must earn certificates or other recognition based on the degree to which all team members have progressed over their past records.

IV. Conclusion

This study investigated to design and implement web-based collaborative learning system Co-Net and map out students' learning procedure using the system, based upon Student Team Achievement Division (Slavin, 1990). This environment provides school teachers with easily adaptable tools, which can be applied in real classrooms without any prior knowledge and experience.

We urge that educators first examine their assumptions about learning and then consider new curriculum guidelines. There is an intimate relationship among one's definition of learning, one's view of the content and scope of curricula, and instructional practices. Examining one's assumptions honestly and forthrightly, in a supportive group, often spurs educators to change. The whole process consists of group preparation, knowledge presentation, knowledge assimilation & application, evaluation, and team recognition.

Cooperative learning may take some time to get used to. A teacher who is accustomed to being the sole source of information and learning in the classroom must not only allow, but should actively encourage students to help each other and to learn from each other. The appropriate use of cooperative learning techniques has been shown to have both academic and social benefits to students, while also offering benefits to the teacher.

Technology education is especially well suited for cooperative learning

Acknowledgements

I'd like to express special thanks to Choi, Kwanglok who helped to develop the system. He is a master student at Chonbuk National University.

References

- Bard, J. H., Lazarowitz, R., & Hertz-Lazarowitz, R. (1992). Academic achievement and social gains offering status students learning science in cooperative groups. *Cooperative Learning*, 13(1), 21-23.
- Cohen, E., Lotan, R., & Catanzarite, L. (1990). Treating status problems in the cooperative classroom. In S. Sharan (Ed.), *Cooperative learning: Theory and research*. New York: Praeger.
- Dick, W., & Carey, L.(1990). *The systematic design of instruction*(3rd Ed.), Glenview, IL: Scott, Foresman and Company
- Duffy, T. M., D. C., and Cunningham. (1995). Constructivism: Implications for the design and delivery of instruction. In *Handbook for research on educational communications and technology*, edited by D. H. Jonassen, Hillsdale, NJ: Lawrence Erlbaum Associates.
- Fantuzzo; J. W., Polite, K., & Grayson, N. (1990). An evaluation of school-based reciprocal peer tutoring cross elementary school settings. *Journal of School Psychology*, 28, 309-324.
- Fantuzzo; J. W., King, J. A., & Hellre, L. R. (1992). Effects of reciprocal peer tutoring on mathematics and school adjustment: A component analysis, *Journal of Educational Psychology*, 81, 173-177.
- Jones, B. F., Valdez, G., Nowakowski, J., & Rasmussen, C. (1995). *Plugging in: Choosing and using educational technology*. Washington, DC: Council for Educational Development and Research, and North Central Regional Educational Laboratory. Available online: <http://www.ncrel.org/sdrs/edtalk/toc.htm>
- Johnson, D. W., and Johnson R. T. (1993a). Cooperative learning: where we have been, where we are going, *Cooperative Learning and College Teaching*, 3(2).
- Johnson, D. W., and Johnson R. T.(1993b). *Cooperative Learning And Social*

Interdependence Theory. <http://www.co-operation.org/pages/SIT.html>

Slavin, Robert E. (1990). Cooperative Learning: Theory, Research, and Practice. Englewood Cliffs, NJ: Prentice Hall.

Slavin, R. (1996). Education for all. Exton, PA: Swets & Zeitlinger Publishers.

Sofiane Labidi and Jeane S. F. (1998). Multi-Agent Architecture for a Cooperative Intelligent Tutoring System. In the Proceedings of the 3rd International Conference on the Design of Cooperative System, (COOP'98). May 26-29, Cannes, France.



Kyungsu WANG

Associate Professor, Dept. of Education, College of Education, Chonbuk National University. Vice President of Korean Society for Educational Technology. Interests: Web-based Education, Instructional Design, Cognitive Science, and Performance Technology
E-mail: kswang@chonbuk.ac.kr

Homepage: <http://home.chonbuk.ac.kr/pedagogy>