Development of Collaborative Learning Support System Using a Shared Whiteboard

ITO, Kiyomi*      SAKAI, Sanshiro**      AKAHORI, Kanji*

*Dept. of Human System Science, Graduate School of Decision Sciences and Technology, Tokyo Institute of Technology, Japan
<kiyo@ak.cradle.titech.ac.jp> <akahori@ak.cradle.titech.ac.jp>

**Department of Information Science, Shizuoka University, Japan  <sakai@cs.inf.shizuoka.ac.jp>

Abstract

We have developed a shared whiteboard system for collaborative learning on the Internet. The system enables learners to make diagrams of the discussion with nodes and arcs. They can put their statements and graphics on the diagrams to represent thoughts more easily. In addition, the record of operations of the shared whiteboard system helps the learners grasp the flow of the discussion. The learners can review discussion log for reflection. The log in the form of HTML is automatically generated along with the record of operations in the discussion.

The result of evaluation experiments shows that it predisposes learners to explain their thought with diagrams and makes them understand the flow of the discussion.

1. Introduction

The effect of CSCL on network is not restricted distances. Teleconference standardization has been progressed, and there are researches of the following two types which support the collaborative learning using the network: researches for a system of support for teleconference using the network, and those for using shared whiteboard and chat tool together.

The system of support for teleconference shows relationship between two or more statements by using nodes and arcs. (M. Nakamura, 2000) Therefore, a student can argue being conscious of causal relationship with other students. However the student does not use graphics to explain visually. A lot of people use them in off-line meeting and collaborative learning, because there are many cases where it is difficult for them with text only.

On the other system, the learners can draw figure on the shared whiteboard on the network. At the same time, they can argue using a chat tool. (S.Fuji, 2001) However, since the graphics in the whiteboard and the sentence of the chat part are separated, the learners tend to be absorbed only in one tool. It is hard for them to understand which graphic corresponds to a text.

Moreover, in the synchronous collaboration learning, for students who participate in the collaboration work but drop out of it, it is difficult to understand the contents of a meeting.

The purpose of the research is the development and evaluation of the system that eliminates the defect in collaborative learning support systems.

2. Shared Discussion Whiteboard System

2.1. Architecture

Figure 1 shows architecture of the shared whiteboard system.

2.2. Interface

Figure 2 shows an interface of the system.

2.2. Function of System

(1) The shared whiteboard which can treat graphics and statements together

When a learner makes a statement, it forms a statement-object which is placed on the whiteboard. The graphics drawn with “Draw tool” are not objects. Learners can make graphics in the selected domain an object using “Object-izing tool” of “Draw tool”. “Object-izing tool” change graphics in the selected domain to objects.
(2) Operation of objects
Learners can operate objects on the shared whiteboard with the mouse and “object operation tool”. Learners can make these objects move, deleted and changed to icon.

(3) Folder on the whiteboard
Learners can also make folder on the shared whiteboard. They can put related statements and graphics into it.

(4) The visual display of categories and levels of importance about statements
Learners can indicate categories and levels of importance of objects. The indicator of importance has three levels: "height", "normal", and "low". The indicator of categories has also three types: "usually", "question" and "answer". According to those, form of object, such as a color and thickness of frame, is decided. Therefore, learners are also able to understand contents of discussion visually.

(5) Indication of relationship
When a learner hopes to show the relationship between statements and graphics clearly, he can indicate with an arrow between objects. They can pull two or more arrows to some objects. So learners are able to understand the relationship between statements visually, and understand the flow of discussion easily. Learners can also indicate with an arrow in the specific portion of a graphic. This is effective when they explain a part of the graphic.

(6) Replay of record of work
This system records the work carried out on the shared whiteboard. The record of operations on the whiteboard helps the learners grasp the flow of the discussion. Learners who participate in the collaboration learning but drop out it, understands the contents of the discussion more easily.

(7) Generating log of HTML form
The tool also generates discussion log in the form of HTML automatically for reflection after the collaboration work finishes. Figure 3 shows the log of HTML form. In the log of HTML, the relation between objects is expressed with links of HTML. Therefore the learners can refer to related statements and related graphics easily to carry out reflection of collaborative learning.

3. Evaluation Experiment
We carried out evaluation experiment after developing the system. The purpose is evaluation of this system and the collaborative learning performed with it.

3.1. Method
Subjects are nine undergraduate students and graduate students familiar with operation of computers. We had them use a system about 30 minutes to work on puzzles. After experiencing the collaborative learning, subjects answered the questionnaire about their frequency of using the system. We ask the learners to evaluate from 5-point rating scale. (1: most infrequent - 5: most frequent)

3.2. Result
About the system, almost items were highly evaluated to have mean value of four or more points. Especially, the item of the whiteboard featuring graphics and statements was evaluated most. Therefore the interface, which operates graphics and statements on the same area, is very effective.

Next, we focus evaluation of the collaborative learning performed with this system. Evaluations of “Collaboration with other learners” and “Explanation about graphics” were height. For this reason, this system supported the CSCL with the method of using graphics.

Many learners who had experienced the system said that they had been able to participate in the CSCL with interest. However, some learners had been surprised because objects on the whiteboard had appeared or disappeared suddenly, so that other participants had moved objects at the same time.

4. Conclusion and Future Works
So far we have developed the shard whiteboard system for CSCL on network to evaluate the system for easy collaborative learning.

The result of our experiment clearly shows that usefulness of operating graphics and statements on the same shared whiteboard. Learners were able to perform collaborative learning interacting with other participants positively. In addition, indicating relationships with nodes and arcs had helped the learners understand the structure of discussion.

We are going to improve a system about these above problems and requests of the questionnaire. This time, we experimented for less than 1 hour. We want to evaluate this system not only at the experimented stage but also at actual seminars and at lessons in the near future.

References