Supporting Awareness for Augmenting Participation in Collaborative Learning

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Abstract: Knowledge awareness (KA) has been proposed for increasing collaboration opportunities in an open ended and collaborative learning environment. KA consists of information about up-to-minute activities of other learners. For instance, it indicates when someone is looking at the same knowledge that learners are looking at. Multiple collaboration is concurrently realized through KA. This paper describes a concurrent collaborative learning environment supported by awareness called Coconuts, toward augmenting participation in collaborative learning. We tested and verified the effectiveness of Coconuts in an experimental training.

Keywords: Educational groupware, computer supported collaborative learning, awareness, informal communication, legitimate peripheral participation.

1.Introduction

Recently, researchers in educational systems area attempt to provide technological support for cooperative and collaborative learning advocated by educational theories[12]. A number of collaborative learning environments have been built, e.g., CoVis [1], KIE [6], and CSILE [14]. CoVis focus on making a collaboration process visible. KIE succeeds by helping students link, connect, distinguish, compare, and analyze their repertoire of ideas. Moreover, CSILE supports knowledge building for the creation of knowledge. In such environments, the learner actively provides his/her own knowledge into the system.

Knowledge acquisition and open ended CAI systems[15] have been proposed to

enhance and sustain learners' motivation. Especially, when learners acquire knowledge in the context of an open-ended activities, they are more likely to use that knowledge later. Similarly, in collaborative learning, distributed expertise and multiple perspectives enable learners to accomplish tasks and develop understandings beyond what anyone could achieve alone. Lave and Wenger [5] suggested that the consideration of learning as legitimate peripheral participation (LPP) in communities of practice can be a valuable analytical perspective. Therefore, it is very important for learners to collaborate with each other. However, little attention has been given to the technical support for inducing and augmenting participation in collaboration.

In computer supported cooperative work (CSCW), a collaboration process has been described a four processes model [7] which includes the elements of co-presence, awareness, communication, and collaboration. Co-presence gives the feeling that the user is in a shared work space with someone at the same time. Awareness is a process where users recognize each other's activities on the premise of co-presence. In the next process, the user collaborates on the specific task with other users and accomplishes the task and common goals. To increase communication opportunities, awareness is one of the most interesting topics. For example, awareness informs what other users are doing, and where they are working. These information facilitates informal communication between distributed users.

We have proposed that knowledge awareness (KA) is an important factor in collaborative process and assists learners who are interested in the same knowledge and to create effective collaboration in an open ended learning environment [8-11]. KA gives the learner the information about other learners' activities in a shared knowledge space. KA encourages collaboration by exciting learner's curiosity and it fosters active learning. Sharlok (Sharing, Linking and Looking-for Knowledge) has been developed as a testbed of the KA. Sharlok is an open-ended and collaborative learning environment, and it integrates a knowledge building tool with a collaborative interface tool. Sharlok allows learners: (1) to share and explore freely their respective knowledge in its shared knowledge space, (2) to make hypertext links between relevant knowledge, and (3) to collaborate about the knowledge in an ad-hoc group in real time. The result of the evaluation of Sharlok was that active KA was very effective for inducing collaboration. However, researchers of CSCL have yet proposed awareness for assisting participation of concurrent collaboration. In this paper, we describe how concurrent collaborative learning can be supported by awareness.

Our system called **Coconuts** facilitates participation in a concurrent collaborative learning environment.

We firsts analyze multiple and concurrent collaboration in section 2. Section 3 describes awareness for CSCW and CSCL. In section 4, we propose the features and implementation of Coconuts. Moreover, we describe the experimental results of Coconuts in section 5. Finally, the concluding remarks are given in section 6.

2.Concurrent collaborative learning environment

2.1.Time dimension of concurrent collaborative learning

In the real world, people concurrently learn multiple a number of discipline and spontaneously create relationship between these knowledge domains. Figure 1 shows a time chart of concurrent collaboration. There are three parallel sessions in this situation. Learners can be classified into those who:

(1) participate at the beginning of the session;
(2) participate halfway through the session;
(3) leave halfway through the session; and
(4) leave at the end of the session.

Although the participants of discussion C did not change, participants changed during discussion A and B (see figure 1). Learner X did not understand which session to join and how to participate in the discussion. Therefore, we propose that the system should support the learner to understand the discussions.

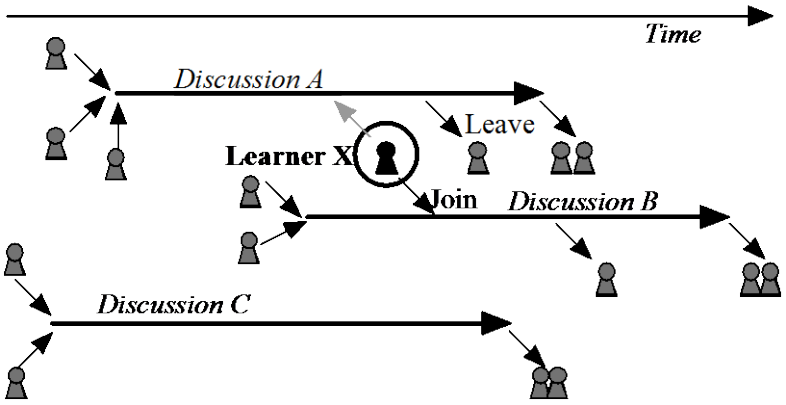

Fig. 1: Diagram of concurrent collaboration.

2.2.Taxonomy of participants

In multiple and concurrent collaboration, there can be found different kinds of participants (see fig. 2):

(1) *Observational participants (OP)*: In this case, the learner only observes discussions without utterances. Through awareness, the OP can understand the topics of the discussions and decide whether to join them or not.

(2) *Formal participants (FP)*: In this situation, a learner joins in a discussion and his/her opinions are shared and can be discussed by all of the FP of the same discussion team.

(3) *Informal participants(IP)*: In this case, an OP interacts with FPs of any discussion team. This situation can be motivated in two different ways, either the OP decides by himself/herself to give advice to a FP or any FP asks a OP to give his/her opinions. The advice from observational participants often makes the discussion active. Therefore, informal participation is very significant to argument participation in collaboration. In this context, the communication is informal because not all of the FP know about the communication in which the OP is involved. Awareness of collaboration is needed to allow users such informal communication.

The strength of the relationships between a learner and a discussion varies according with the role of the learner. Thus, one can note that in above classification (1) represent the weakest relationship, while (2) denotes the strongest. The learner may participate in concurrent collaboration by combining different kinds of participation. To augmenting participation in collaboration, educational groupware systems should provide observational, informal and formal participation.

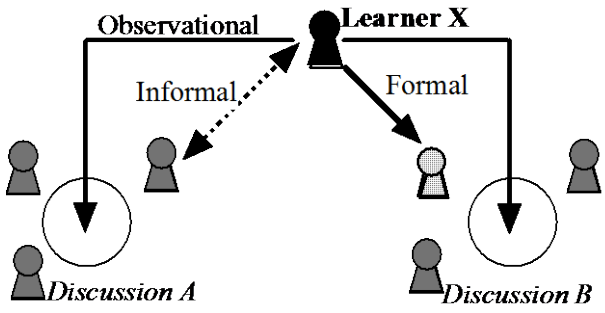

Fig. 2: Participation form of concurrent collaboration.

3.Awareness for collaborative learning

In CSCL, awareness is very important for effective collaborative learning and it plays a part

in how the learning environment creates collaboration opportunities naturally and efficiently. Awareness may lead with informal interactions, spontaneous connections, and the development of shared knowledge.

3.1.Awareness for single group collaboration

Goldman[2] identified three types of student awareness: social, task, and conceptual. Gutwin et al.[3] also proposed workspace awareness. Social awareness provides information on social relationships within the group to carry out the task, for example, the role in the group. Task awareness shows how the learners accomplish the task. Concept awareness is the awareness of how a particular activity or knowledge fits into the learner's existing knowledge or completes the task. Workspace awareness is the up-to-the-minute knowledge about other learners' interactions within shared workspace. Gutwin et al. implemented this awareness using GroupKit[13]. Although a large number of studies have been made on such awareness in single group collaborative learning, little is known about awareness for multiple and concurrent collaborative learning.

3.2.Knowledge awareness for concurrent collaboration

We assume that KA is the information for enhancing collaboration opportunities in a shared knowledge space. Its messages are about the other learners' real-time or past-time actions, that have something to do with knowledge on which a learner is doing or had already done. KA makes a learner be aware of someone: (1) has the same problem or knowledge as the learner, (2) has the different view about the problem or knowledge, and (3) has potential to assist him/her in the solution of problem. KA has a close relation with learner's curiosity. Hatano & Inagaki[4] identified two types of curiosity; convergent curiosity (CC) and divergent curiosity (DC). DC occurs because the desire of learning which makes learner's stock of knowledge well-balanced by widening learner's interests. On the other hand, CC is generated for the lack of sufficient knowledge, it is very useful so that the leaner can acquire more detailed knowledge. KA induces collaboration by exciting learner's curiosity. In this way, KA assists creating real-time collaboration. However, awareness for concurrent collaboration is not proposed.

4.Coconuts

4.1.Overview

We propose Coconuts (Concurrent Collaborative Learning Environment Supported by Awareness) for facilitating to participate collaborative group. Coconuts informs up-to-minute activities of participants of concurrent collaboration. To augmenting the participation in collaboration, Coconuts has the following features:

(1) Awareness: In order that learners can be aware about what is discussed, Coconuts allows them to peep at multiple collaboration.

(2) OP: After awareness of collaboration, the user can see the multiple discussion at the same time. Because the formal participants do not know the existence of the OP, the collaboration is not disturbed.

(3) IP: Coconuts allows the user to communicate informally in the following ways:
   (a) Communication from non-participants to participants; and
   (b) Communication from participants to non-participants.

(4) FP: Coconuts allows learners to communicate and collaborate in a collaboration object which includes a text chat tool, and a group drawing tool. In the text tool, the participants can write their ideas. Moreover, the drawing tool shows their mouse pointers and it allows them to draw figures at real time. This environment provides workspace awareness.

4.2.User interface

We developed Coconuts using Sharlok [8-11]. Figure 3 shows the screen snapshots of Coconuts in Sharlok which is used by two users: “takahasi” and “rinzu”. “Rinzu” collaborates about Japanese writers with “sharlok.” Window (A) denotes the titles of current discussions and their respective participants. If the user selects a topic and pushes the peep button, coconuts shows the user the up-to-minute snapshot of the discussion as shown in window (B). The update button allows users to see the current state of the collaboration. The user can take part in the discussion with join button. Coconuts allows users to observe multiple collaborative groups. The user can send a message by pushing the message button. In window (C), “takahasi” informally communicates with “rinzu”. Moreover, a formal participant “rinzu” can ask some question about the discussion by selecting the help button. “To list” shows who can receive the message from the user. Coconuts provides the user the message window like the window (C) and “To list” shows who to send the user’s message.

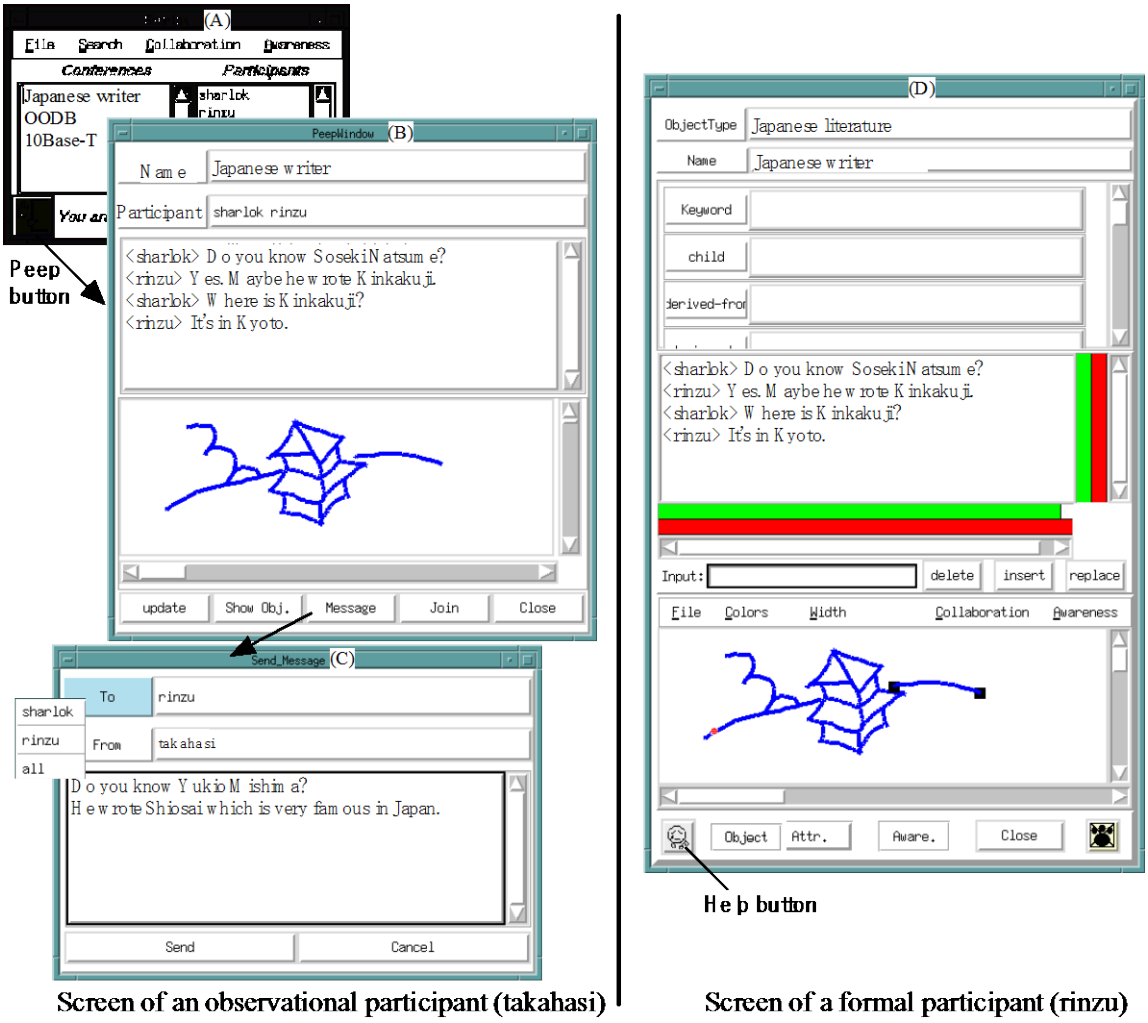

Fig. 3: Screen of Coconuts in Sharlok.

5.Experimental results

To evaluate Coconuts, we integrated a group of nine master course students. They had been using Sharlok during over 4 hours; two hours unsupported by Coconuts (group A), and another two hours supported by Coconuts (group B). The respective group explored into the shared database and discussed six times, for example, SGML, OODB and 10Base-T.

Figure 4 shows the experimental result. The total frequency of participation of group A was higher than that of group B because Coconuts provides awareness and different kinds of participation. In particular, IP was very effective for increasing participation. In group B, the provision of awareness decreased wasteful formal participation. Some users mentioned that Coconuts helps to reduce number of participants who left the discussion before it finishes. By OP, the users could understand the contents of multiple collaboration.

The learners learned actively through real-time collaboration, and they felt satisfaction and attainment of learning after the test.

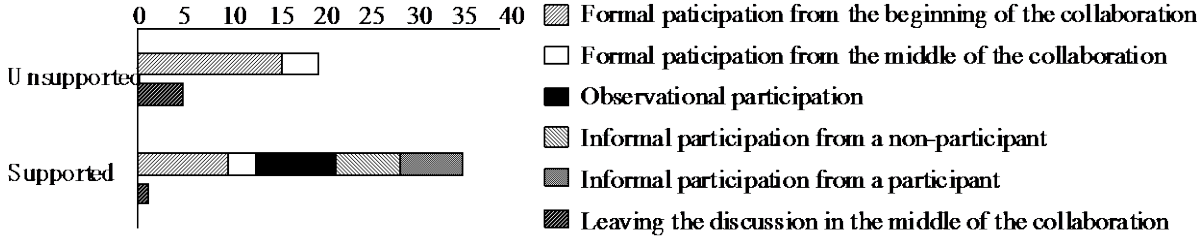

Fig. 4: Frequency of participation.

6.Conclusions

In this paper, we proposed Coconuts for supporting awareness in a concurrent collaborative learning environment. We reached the following conclusion based on the experimental result of Coconuts:

(1) The provision of awareness facilitates the participation in multiple and concurrent collaboration and it reduces wasteful formal participation.

(2) Informal communication activates collaboration.

Although this paper describes a short term experiment, we will continue using and evaluating Coconuts in the future.

Acknowledgment

This research has been supported in part by the Grant-in-Aid for Scientific Research (A) No.07308016 and the Grant-in-Aid for Scientific Research on Priority Areas No.09230214 from the Ministry of Education, Science, Sports and Culture in Japan.

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