

A CSCL Environment that Promotes Metacognition among Learners in the Community of Practice

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Abstract

This research aims at the development of a Computer-Supported Collaborative Learning (CSCL) environment that promotes learner's metacognition from the sociocultural perspective. This paper first discusses the concept of metacognitive knowledge used by the learners in the community of practice, and proposes new variables involving this concept. It also introduces a Web-based CSCL environment, the UNCHIKU (or "great erudition" in English) system, which is designed to support collaborative construction of learning materials among learners from the perspective of the proposed new variables. The system has mechanisms to enhance learners' awareness of the dynamics of the community and the structure of contents in which their activity occurs. At the end of the present paper, the author discusses results of the experimental use of the system in the classroom setting to provide a concrete example for the author's argument.

Metacognition in the community of practice

Sociocultural theory (Rogoff, 1995; Lave & Wenger, 1991), originated from L. S. Vygotsky, is one of the major contributors who put forth the concept of "collaborative learning." According to this viewpoint, learning is understood as a dynamic process of social interaction and participation. In this process, learners are first required to recognize their cognitive styles and abilities through observing capable others or a community in which the learning occurs. The learners then appropriate themselves to the community through social interaction and participation. The present research regards this self-regulative and social adjustment process as a type of metacognition required of members in the community of practice.

The concept of metacognition, however, has been limited to an individual's self-regulative knowledge and process that works during learning, problem solving, and performing tasks. Here this concept is divided into two elements: *metacognitive knowledge* and *metacognitive experience or regulation* (Brown, 1978; Flavell, 1987). Furthermore, the former is divided into knowledge about *person variables* (*intraindividual, interindividual, and universal person variables*), *task variables*, and *strategy variables* (Flavell, 1987).

To express the phenomenon of metacognition in collaborative learning from the viewpoint of sociocultural theory, however, it is important to focus on the emergent and dynamic relationship between individuals and the learning community. For instance, the individual's influence on the community and his/her perception about own place or role in the community are difficult to represent with the traditional person variables. Therefore, it is plausible that the members of the learning community are performing their metacognitive experience by negotiating their roles and social statuses in the community while updating the knowledge of those emergent, dynamic person variables.

Consequently, this paper proposes to add *community variables* to traditional person variables in order to describe the collaborative learning process in the community of practice. The variables also

consist of *intraindividual variables in the community, interindividual variables in the community, and variables of the whole community*. Intraindividual variables in the community are the knowledge about one's role or social status in the community. For instance, a social role should be recognized as the variable that will change according to the dynamics of the community. Interindividual variables in the community represent sets of information regarding the social relationships between two or more members in the community. This information is provided in the form of relative closeness or distance between particular individuals. Variables of the whole community are the knowledge about the vision or goals of the whole community.

Based on the above discussion, this study aims at promoting metacognition in the collaborative learning context from the perspective of sociocultural theory of mind.

Overview of the UNCHIKU system

We have developed the UNCHIKU system as an experimental CSCL platform to fulfill aforementioned goals. It is designed as a Web-based annotation system that allows its users to add their comments onto the learning materials. The users can post a comment onto any place there. However, before posting a comment they have to specify a word or sentence in order to let others to know the topic or issue they will discuss. The system also requires the users to select an annotation type from the predefined list. The annotation types generally include "question," "answer," "agree," "disagree," and so on. This mechanism is designed based on the idea of *mediational means* (Wertsch, 1991) that are interaction tools embedded in the social context of the community. It can also be considered as a platform for the *transactional* reading process (Rosenblatt, 1978) that emphasizes the role of writing as a meaning making activity. In addition, reading comments posted by each member may not only promote in-depth processing of the information but also allow the readers to collaboratively engage in their minds in an activity akin to semantic-mapping (Hanf, 1971).

In the UNCHIKU system, the information about the community variables is provided by the *Community Awareness* function. It visualizes the dynamism of the community with sociograms. Figure 1 shows directed and undirected sociograms. With the sociograms, the user is able to aware of his/her social status in the community (intraindividual variables in the community), relative closeness to particular users in the community (interindividual variables in the community), and activeness of members' participation in the community (variables of the whole community). In addition, the user can perform *Social Network Analysis* to obtain detail information about community variables. Figure 2 displays a result of *Centrality Analysis* among learners. The result can be used as an index of learners' influence on the whole community. Figure 2 also shows members in a *Clique*, which can be considered as a frequently interacting group. This information assists in obtaining the interindividual variables in the community.

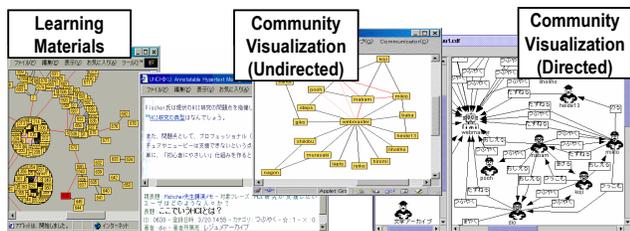


Figure 1: Learning Materials and Community Visualization

Experiment in the classroom setting

The author's research group conducted a series of experiment on the UNCHIKU system in the last three years. In the fall semester of 2003, approximately 200 undergraduates participated in the experiment. As a part of class assignments in the author's course on Theory of Network Organization, students were asked to use the UNCHIKU system in order to enhance the lecture notes posted on the Web by the author. After the semester, the author conducted a 30 minute interview session with each of the six volunteers who had taken the author's class and used the UNCHIKU system.

All interviewees reported that they were aware of the information regarding the community variables, especially the intraindividual variables in the community and the variables in the whole community. Overall, the interviewees felt the use of the system affected them and changed their participation patterns in the community one way or another. For example, active participation of other members in discussions promoted their own active participation. In addition, a discussion tone set by the whole community influenced their choosing types of comments or ways of addressing issues. However, it is also interesting to note that some interviewees pointed out that the interindividual variables in the community did not influence their activity participation patterns. In other words, the interviewees' knowledge of interpersonal relations in the community did not affect their motivation to participate in the discussion, choice of topic, or ways of addressing issues.

Another finding is that most of the interviewees felt the structure of annotated data was quite helpful in recognizing their interests, knowledge levels, and positions in the community. They also mentioned that they took careful consideration about their comments before posting them. The reason was that they became sensitive to other learners' evaluation because the basic annotation mechanism, which the users must specify the word or sentence before making a comment, promoted the users to examine others' comments carefully and to criticize when finding a mistake or a weak argument. This result suggests that the design of the UNCHIKU system may be effective to enhance learners' ability in metacognitive regulation.

Related Work

Miyake and Shirouzu (2003) have been developing a curriculum to enhance college students' meta-cognitive skills and utilizing the ReCoNote (Reflective Collaboration Note) system as a CSCL platform. It assists note sharing, concept mapping, and collaborate scrutiny of the materials among students. The CSILE/Knowledge Forum (Scardamalia, 2004) is another CSCL research that aims at enhancing self-reflection about their understanding level and thinking style through the collaborative knowledge building among learners. Those CSCL environments are focusing on the enhancement of learners' ability for problem solving and performing

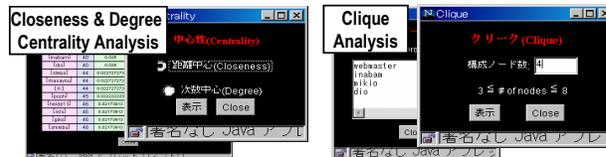


Figure 2: Results of Social Network Analysis

tasks based on the concept of the traditional metacognition. As a result, the functionality to assist learner's awareness of the aforementioned community variables is limited. Sharlock (Ogata, Matsuura & Yano,1996) is also a CSCL system that supports the *Knowledge Awareness* with visualizing how the learners access to the shared knowledge. However, the visualization is based on the structure of shared knowledge, and doesn't intend to provide the broad information regarding the community awareness.

Conclusion

Using the concept of sociocultural theory, this paper proposed the concepts of community variables vital for the successful execution of metacognition in the collaborative learning. It also introduced the UNCHIKU system that enhances metacognitive knowledge by assisting the learners to raise their awareness of the community variables. From the interviews after a classroom experiment, it was partially supported that the visualization function of the system promoted the learners' understanding of the community variables. Further efforts are needed in order to improve the visualization function of the system, and to develop a more comprehensive CSCL environment that integrates concepts of metacognition relevant for both individual and collaborative learning settings.

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