

A synchronous collaborative editing system for learning to write

Yukiko Tanikawa, Hideyuki Suzuki, and Hiroshi Kato

C&C Systems Market Development Division, NEC Corporation

Abstract: A synchronous editing system for creating a wall newspaper collaboratively by using local area networks has been developed and tested. This educational system is intended to foster writing skills through a collaborative learning process that stimulates intensive interaction among learners who edit the same document. It is designed to encourage the writer's awareness of readers and intensive interaction among learners. It has four characteristics: (1) learners are informed when someone else is following their writing process on their screen; (2) learners can instantly see what other learners are writing and revising; (3) the whole newspaper is always displayed; and (4) learners can see which parts of the newspaper other learners are writing and refer to their editing. The authors conducted experiments with the editing system in an elementary school. And the results indicate that (1) students interacted and collaborated well in the writing process; (2) they revised articles repeatedly through interacting with one another; and (3) the system supported the collaborative writing process.

Keywords: collaborative writing, document sharing, network, interaction, revision

Introduction

We have developed a synchronous editing system for creating a wall newspaper collaboratively by using local area networks. The educational system is intended to foster writing skills through a collaborative writing process that stimulates intensive interaction among learners who edit the same document.

Learning to write is important for the following two reasons: (1) writing is an essential skill required in daily life; and (2) learning to write can be a method that helps learners develop skills required in our information-oriented society, such as independently searching for information, evaluating it, creating new ideas, and presenting them to someone.

The following sections describe the reasons for focusing on the collaborative creation of a wall newspaper as an activity for learning to write and the design of the editing system we developed. It is also shown how learners interact in experiments using this system in an elementary school.

Creating a wall newspaper collaboratively

Our study of appropriate activities for learning to write focused on two of the characteristics discussed in recent research on writing and the composing process. One is that writing is an interactive medium for coherent communication between writers and readers (Nystrand, 1986). During the composing process, writers are continuously negotiating and balancing their own purpose and intentions with the expectations and needs of their intended readers, so that they can share knowledge with the readers. Reader expectations are therefore an essential factor in the composing process. The other is that the composing process is potentially recursive (Flower, et al., 1977). Writers generate ideas, write and revise in the composing process. This is not simple sequence. Writers are often prompted to generate new ideas by writing, and they revise their original ideas and texts according to these new ideas.

Taking these characteristics into consideration, activities for learning to write have the following requirements. A learners' goal of activities should not be to be judged by teachers - but to communicate with readers about what they want to say or accomplish - since one of writing's main features is that it is a medium of communication. Moreover, activities should lead learners to revise their ideas and texts repeatedly since writing is a recursive process.

Creating a wall newspaper collaboratively is an activity that meets the above demands. First, learners involved in the creating process are likely to write about information or ideas addressing and concerning particular readers, because they can clearly image the readers according to the place where the wall newspaper will be located. Second, learners who edit the same document, are expected to evaluate each other's writings (not be judged by teachers) and to intensively interact with others through exchanging views and impressions, questioning, explaining, and advising -- because they are readers as well as collaborators. This evaluation and interaction causes them to be aware of readers, to advance their own understanding (Scardamalia, et al., 1989), and to revise their writings and, thus, leads them to a collaborative learning process to write (Nystrand, 1986; Nystrand, et al., 1989).

A Synchronous Collaborative Editing System

Requirements of the design and functions to be designed

As the previous section highlighted, the important factors in learning to write through creating a wall newspaper collaboratively are awareness of the reader and intensive interaction among learners. The editing system to support this activity should be designed according to these factors as well as provide various learners with a place to edit the same document simultaneously. Thus, there are two main design requirements:

Requirement 1: Offering learners opportunities to be aware of readers, especially those involved in the writing process.

Requirement 2: Opening each learner's writing and revising process to all learners who are collaborators in order to increase awareness and foster interaction.

In order to meet these requirements, the following functions are designed into the system:

Function 1: Inform learners that someone else is following their editing process on his/her (networked) computer screen. This helps them to be aware of readers involved in the writing process and thus satisfies Requirement 1. Moreover this causes them to interact with one another.

Function 2: Show learners instantly what others are writing and revising. This meets Requirement 2. This helps them share the editing process of every article and thus causes them interaction.

Function 3: Display the whole image of the newspaper always. This satisfies Requirement 2 and helps learners understand the editing process of the whole newspaper as well as individual articles. This fosters learners' interaction.

Function 4: Show learners which part of the newspaper each learner is editing or reading and allow them to refer and follow his/her editing. This satisfies Requirement 2. This makes learners aware of other learners as collaborators and attracts their interests in other learners editing process and thus causes them to interact with one another.

Our critical concern in the design of the system is to provide awareness to other learners. There have been studies that also pointed out the importance of awareness. Fisheye views (Greenberg, et al., 1996; Gutwin, et al., 1997) are well-known as awareness tools in collaborative editing. They provide both global overview and local detail within a single window by distorting a two-dimensional space. However, they are not appropriate for editing printed matter such as a wall newspaper, because spatial layouts indicating the relationship among objects are difficult to maintain in fisheye space. Therefore we propose another solution in our editing system.

Configuration

The editing system is based on the distributed multimedia framework (Tabuchi, et al., 1998) so that it allows learners to edit the same document simultaneously.

The system consists of a server that stores shared documents and editing terminals on a TCP/IP network. The server contains a transmitting manager and a document manager. Figure 1 shows the system configuration.

Terminals open a shared document and temporarily store it on their own memory. When terminal A changes the document, this information (in Fig. 1, "Move a circle right horizontally.") is sent to every terminal and the document manager via the transmitting manager. According to this information, each terminal changes the document in its memory and the document manager changes the shared document on the server.

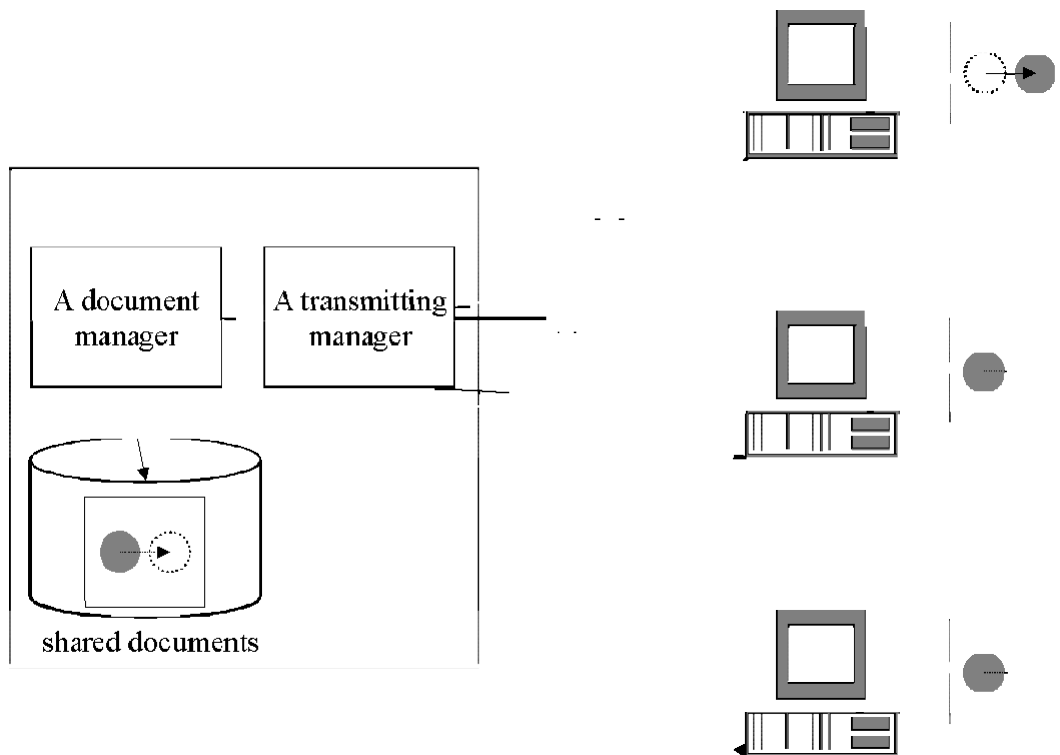


Fig. 1. System configuration.

Functions and interface

The process of creating a wall newspaper using this system is divided into four phases: Creating a shared document, which is an electronic sheet; laying out articles on it; editing articles; and printing out the document as a sheet and completing the wall newspaper. Each phase is described as follows:

Creating a shared electronic sheet

Teachers prepare a shared sheet (with optional sheet size) and register the group members who will edit the sheet.

Laying out articles on the electronic sheet

Group members make frames for articles and lay out them on the sheet as shown in Fig. 2. Then they register the editors who will edit each article. The names of the editors of each article are listed on the sheet, so that balance of work assignments can be easily seen. The layout of articles can be changed any time after editing, and a message that informs other writers of the layout change is displayed on each member's screen with a sound. This will attract member's attention and cause them to participate in this editing activity.

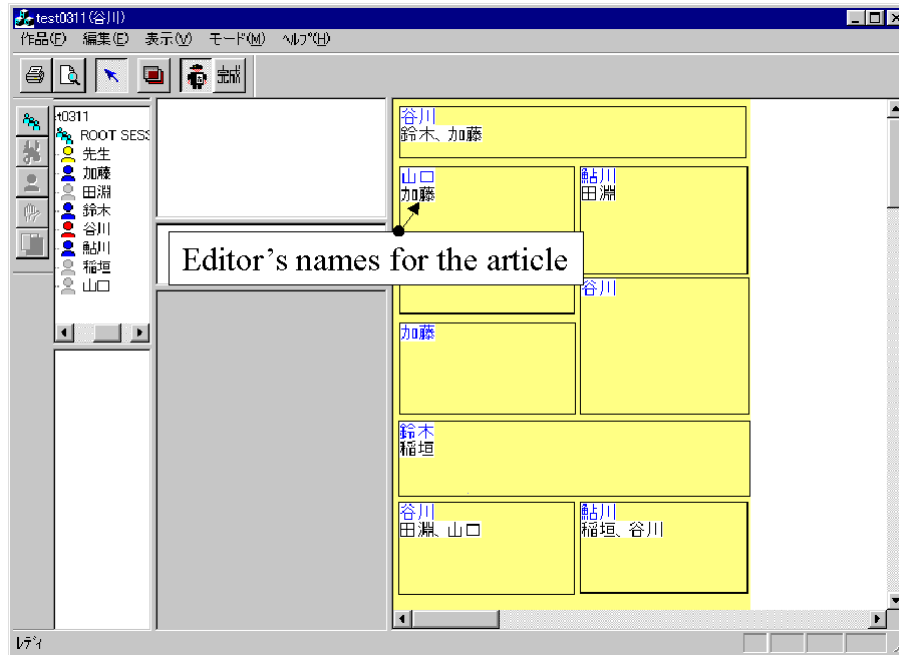


Fig. 2. A window for laying out articles on a shared sheet.

Editing articles

Each member of the group (editor) edits articles to which he/she is assigned by himself/herself or collaboratively, as shown in the window in Fig. 3. What he/she writes and revises is instantly displayed on both the editing area and the whole newspaper view, which is always displayed on that window [Functions 2 and 3]. And the particular part of the newspaper that each member is editing, called SCOPE, is always displayed on the whole newspaper view [Function 4].

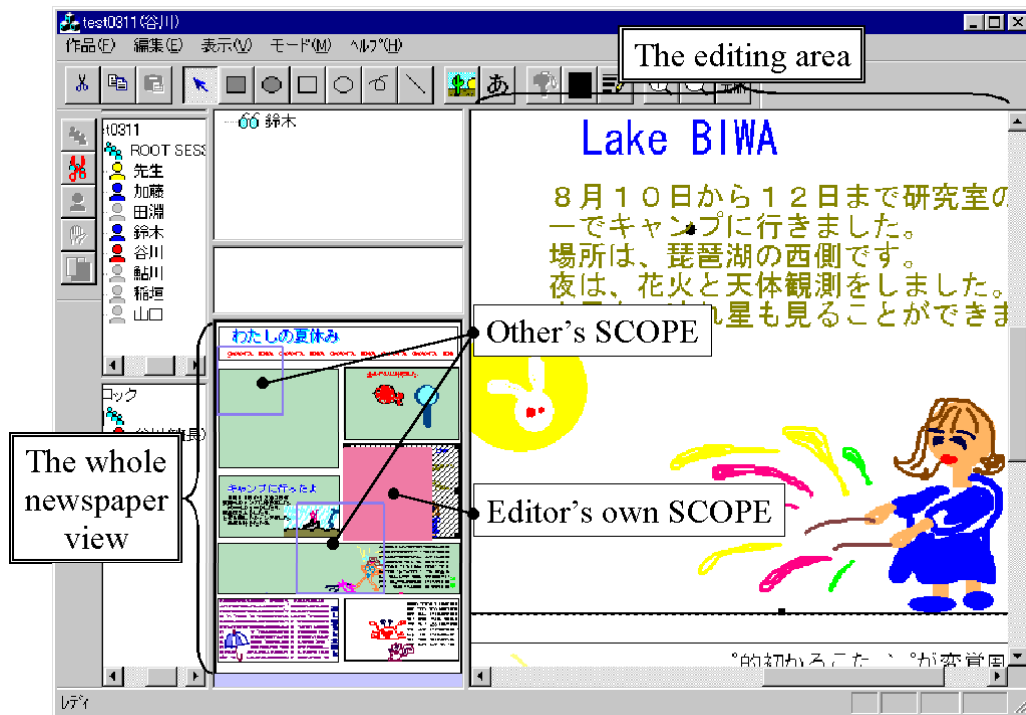


Fig. 3. A window for editing articles.

Group members cannot edit articles of other members but they can read them. They can distinguish such articles from their own articles by their color on the whole newspaper view. If they want to edit other members' articles, they send a message to its editor asking for permission for collaborative editing. They do this by pushing the button for request. These functions prevent articles from being rewritten without the permission of their editors. Members also have permission to make their own texts and drawings invisible. Therefore they can decide whether they open their editing process to other members depending on their editing stage.

In the editing process, it is important to refer to articles edited by others and to see how others edit them. A group member can read any part of the newspaper by moving their SCOPE. They can also follow someone's editing by clicking on that member's SCOPE [Function 4]. When they do this, they see a member's name on their screen (Fig. 4). Simultaneously a member who is being followed and observed sees the follower's name on their screen [Function 1].

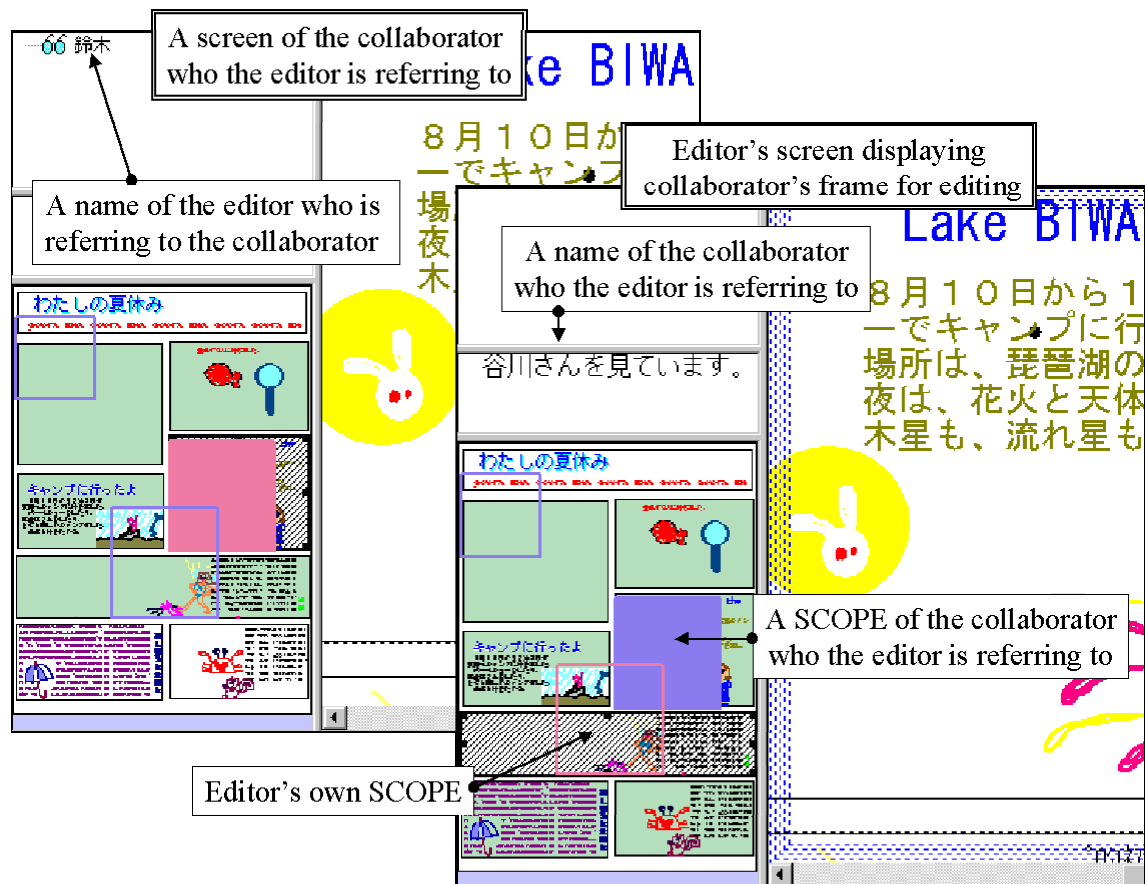


Fig. 4. Observing how another group member edits an article.

Printing out the electric sheet and completing a wall newspaper

The whole electric sheet is divided into A4-size sheets and each sheet is printed out. Group members then put the printed papers together by hand and complete the wall newspaper.

Interaction among learners during experiments

Observation in classes for creating a wall newspaper collaboratively

To see if our system supports a collaborative writing process, we observed a class of students using our system. And we focused on: (1) if the system fosters learners' awareness of readers; (2) if the system fosters interaction among learners; and (3) if this intensive interaction fosters learners to revise their writings.

The classes for creating a wall newspaper collaboratively were conducted eight times between July and October in 1998 in an elementary school. Nineteen students, who were from the 4th to 6th grades and who belonged to the school's computer club, attended the class. The theme of the wall newspaper was the school summer camp held every summer vacation. The class activities included (1) learning rules for writing articles, such as

5W1H, and ways to collect materials, (2) making a blueprint for the wall newspaper, (3) collecting materials, (4) choosing materials, (5) editing articles by following instructions about how to use the system, (6) working out a revision plan for each article and also the whole newspaper, and (7) revising the article. Activity (3) was done at summer camp or at recess. Classes for activities (5) and (7) were held five times using the system. Students were informed that the completed wall newspaper would be put up on the school bulletin board.

Students were divided into three groups, which each collaboratively created a wall newspaper. Five computers were shared by each group. And two teachers directed the class activities. Moreover, five observers from outside the school participated in each class as assistant instructors. Their role was to provide advice about editing a newspaper, as well as technical support, and to foster students' awareness that writing is the medium of communication between writers and readers.

One group, which consisted of six students: NS (6th grade), IN, ST, KN, MI (5th grade), and AK (4th grade), was chosen for observation. In this group, two male students, IN and ST, were chosen as the subjects for videotaping; their conversations and actions as well as their PC screen images, were videotaped throughout the class. IN was the group leader. AK, who moved to the school in September, did not join the summer camp and was a complete beginner at computers. The wall newspaper edited by this group had five articles, a newspaper title, and an editors' list (Fig. 5). Every student of the group, except AK, is assigned the chief editor of an article.

The following section, based on the video data, demonstrates how the group collaboratively edits two articles, A and B (Fig. 5), and how the system supports interaction among the group members during the editing process.

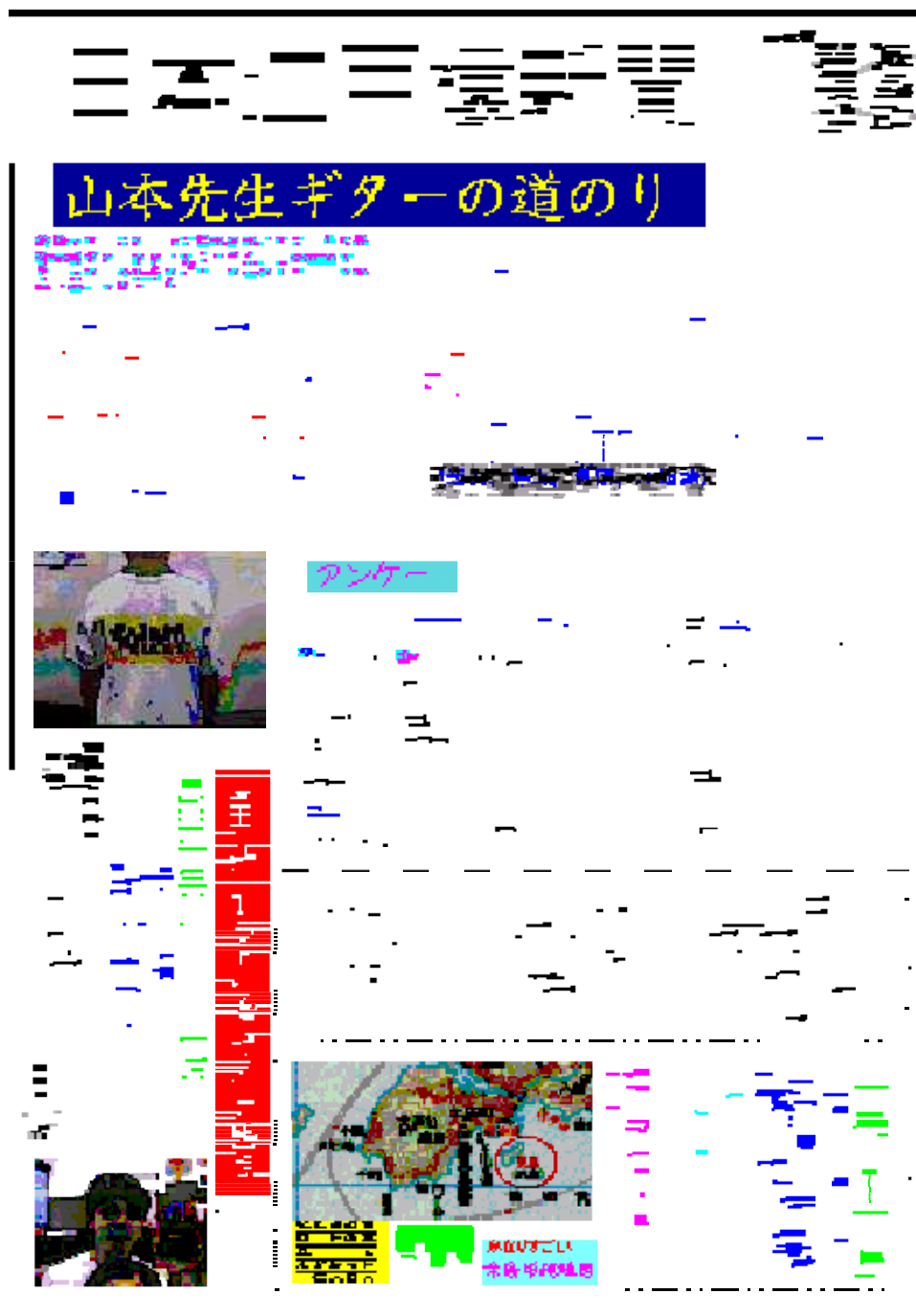


Fig. 5. A wall newspaper collaboratively edited by students.

Results and Considerations

Editing and revising article A collaboratively

The editors of article A were ST, IN, and AK. And ST was the chief editor, so he had leadership role in writing the article. After ST wrote one third of the article, IN gave his view on this writing to ST.

Fragment 1: in the 5th class, Oct. 7

[ST was editing article A at his computer. IN walked up to ST.]

IN (I-1): [standing behind ST] "I think this is only about Shodoshima island. You had better write about Yoshima island because the subject of the article is Yoshima island."

ST (S-1): "I know." [burying his head with his hands]

IN (I-2): "How about using a map of Yoshima island?"

ST (S-2): "The map?"

IN (I-3): "Yes. I saw Mr. TC-J's prepared maps."

ST (S-3): "Really?" [goes to teacher's desk]

In this fragment, watching the screen of ST's computer, IN communicated his opinion on the subject of ST's writings and he then proposed how to revise it.

ST adopted IN's proposal and informed IN during the 5th class that he would edit article A accordingly. The following fragment is from the 6th class.

Fragment 2: in the 6th class, Oct. 14

[ST edited article B, which is also assigned him, at KN's computer. IN focused on article A on his screen.]

IN (I-4): [shouting] "Hey, ST. Can I insert the map in the article?"

[Some minutes passed while an assistant instructor showed IN how to insert pictures.]

IN (I-5): "Come here, ST." [ST moves into IN's seat] "Where do you want to insert this map? Around here?"

ST (S-4): "Yes"

[Some minutes passed while IN inserted the map into article A.]

IN (I-6): "Do you like this? Or would you like me to make it bigger, as big as possible?"

ST (S-5): "Yes. Try to make bigger."

IN (I-7): "OK. Let's do that." [making the map bigger] "They may say it's too big, but it's OK. Do you get an image of Yoshima island from this map?"

ST (S-6): "Yes. It will help."

In these fragments, IN took the leadership role and, with ST, edited article A by using IN's computer. The leadership moved from ST to IN, and the computer being used changed as well. This computer change shows that IN and ST understand that their wall newspaper was shared by the group students and could be edited by using any of their five computers. This shows that the system satisfies Function 2 and this function supports interaction, collaborative editing, and revising.

After these fragments, ST became a leader again and edited article A by using his computer, and IN resumed editing the article of which he was chief editor. But IN followed ST's editing of article A, showed in the next fragment.

Fragment 3: at around the end of the 6th class, Oct. 14

[IN discusses editing an article with an assistant instructor as they both look at IN's computer. ST edits article A by using his computer.]

IN (I-8): "Which article are you editing?"

ST (S-7): "Now?"

IN (I-9): "Yes. Have you finished editing the map?"

ST (S-8): "No. A little bit more editing is needed."

IN (I-10): "I see. A little bit more editing."

This fragment shows that IN is supposed to increase his awareness of ST's activity and the awareness leads another interaction between them. And it is supposed to be done through interaction and collaboration as shown in fragments 1 and 2. This shows that Function 2 is clearly taking place in these fragments and fosters awareness and interaction.

Editors of article B were KN and ST. And the chief editor was KN who had not earnestly engaged in the activity of a wall newspaper creation since the first class. The following fragment is from the 3rd class which group students started to write articles.

Fragment 4: in the 3rd class, Sep.16

[IN sees how other members are editing articles by clicking on their SCOPE one after another. A message that he is following KN's editing and a blank image is displayed on his PC screen simultaneously.]

IN (I-11): [Shouting to KN] "Hey! You'd better write something. Everybody makes some progress in writing an article except you. "

In this fragment, IN advised KN to edit article B immediately after he saw KN's blank article on his screen. And after that, he frequently referred to KN's editing and advised him to write an article. The frequency became higher as the classes progressed and reached every ten minutes in the 5th class.

This shows that referring KN's blank image on the screen led IN to try to engage KN in editing article B. Functions 2 and 4 are clearly taking place so we can say that the system supports an increase in awareness of other students and fosters interaction.

In spite of IN's repeated advice, KN did not engage in writing and thus made little progress in article B. In the end, IN decided to leave it to ST in a short meeting held in the 5th class, whose purpose is that each group modified the work plan following the progress in its newspaper. Additionally, he asked AK, who wrote article A with ST, to assist ST.

According to IN's decision, ST, AK, and IN edited article B collaboratively in the next class. After they made some progress in it, KN began to engage in their editing willingly. The following fragments show the change of his behavior.

Fragment 5: in the 6th class, Oct. 14

[IN is editing article B.]

KN (K-1): [moves to IN's seat] "I'd like to insert a photo of the night stall."

IN (I-12): "Do you have any?" [looking in an album that KN holds]

KN (K-2): "Yes. Here they are." [showing IN photographs in the album]
"How about this one? Don't you want to insert it? We can see the night stall goods in it."

IN (I-13): "Oh, yes. Night stall goods are there."

KN (K-3): "You like photos of various goods being displayed, don't you?"

IN (I-14): "How about insert photos of various night stall scenes? I'd like to choose the liveliest one. It's not this one, nor this one. " [turning over a album page]

Fragment 6: at around the end of 6th class, Oct. 14

[IN wrote article B talking with ST who is editing article A at his computer.]

IN (I-15): "Another kind of goods is round fans, isn't it"

ST (S-9): [moves to IN's seat] "Round fans, folding fans. " [laughs]

IN (I-16): [laughs] "OK. Folding fans. Are these all? Do you think I can write all of these in this frame?"

ST (S-10): "No problem. Probably you can."

KN (K-4): [moves to IN's seat] "Can I add goods sold in the fishing club stall into this article?"

In fragment 5, KN consulted IN about his own plan for article B. And in fragment 6, he told IN and ST that he wanted to participate in the collaborative writing between them.

These fragments show that KN is supposed to increase his willingness to write an article. And it is supposed to be done because he saw that his article had been written collaboratively by other students, IN, ST, and AK. This shows the system satisfies Function 2 and this function supports engaging a student in a collaborative writing.

Summary and Future work

A synchronous collaborative editing system for learning to write was designed and tested in an elementary school. And it was shown how the learners in the experiments interact when using this system. The experiments indicate that (1) students interacted and collaborated well in the writing process; (2) they revised articles repeatedly through interacting with one another; and (3) the system supports the collaborative writing process.

In the next step of our research we plan to analyze (1) the students' use of awareness functions in detail; (2) changes in the substances of individual articles and the entire wall newspaper which was edited by students. We also plan to compare the collaborative

writing process using this system with those by hand and using other editing tools, such as word processor.

Bibliography

Nystrand, M. (1986): *The structure of written communication*. New York: Academic Press.

Flower, L. and Hayes, J. R. (1977): *Problem-solving strategies and the writing process*. College English, 1977, 39, pp. 449-461.

Scardamalia, M., Bereiter, C., McLean, R. S., Swallow J., and Woodruff, E. (1989): *Computer-supported intentional learning environments*, Journal of Educational Computing Research, 5, pp. 51-68.

Nystrand, M. and Brandt, D. (1989): *Response to writing as a context for learning to write*. In C. Anson (Ed.), *Writing in response: Theory, practice and research* (pp.209-230). Urbana, IL: National Council of Teachers of English.

Greenberg, S., Gutwin, C., and Cockburn, A. (1996): *Awareness through fisheye views in relaxed-WYSIWIS groupware*. Proceedings of Graphics Interface'96, pp. 28-38.

Gutwin, C., and Greenberg, S. (1997): *Interactive Fisheye Views for Groupware*. Short technical note, Department of Computer Science.

Tabuchi, Ayukawa, Ito, and Maeno (1998): *A compound Document Middle-ware for group-ware and a Multimedia Group Learning System based on the Middle-ware*. Transactions of Information Processing Society of Japan, Vol. 39, No. 10, (in Japanese).

Authors' addresses

Yukiko TANIKAWA (yukiko@cc.ho.nec.co.jp)

C&C Systems Marcket Development Division, NEC Corporation; 5-7-1 Shiba, Minato-ku, Tokyo 108-8001, Japan; Phone: +81-3-3798-9142. Fax: +81-3-3798-9189.

Hideyuki SUZUKI (h_suzuki@cc.ho.nec.co.jp)

C&C Systems Marcket Development Division, NEC Corporation; 5-7-1 Shiba, Minato-ku, Tokyo 108-8001, Japan; Phone: +81-3-3798-6390. Fax: +81-3-3798-6851.

Hiroshi KATO (kato@cc.ho.nec.co.jp)

C&C Systems Marcket Development Division, NEC Corporation; 5-7-1 Shiba, Minato-ku, Tokyo 108-8001, Japan; Phone: +81-3-3798-6390. Fax: +81-3-3798-6851.