

# Computer-Based Environments for Supporting Writers' Reflective Processes

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## ABSTRACT

The goals of this study were to create a writing environment with three features (recursiveness, collaboration, and authenticity) in an elementary classroom by combining a HyperCard stack "Writing Facilitator" and computer networks, and to investigate how such a writing environment can change elementary school ESL students' writing activities compared with those in a traditional writing class. The findings are: (a) in authentic writing situations, children participated in writing activities more purposefully and enthusiastically than in the traditional composition class; (b) the "Writing Facilitator" helped children move back and forth across texts and make links between ideas, through which they had a chance to have recursive processes and organize ideas, while they followed a linear writing process and paid little attention to the contents of texts in the traditional class; (c) in peer group writing with a computer, children often monitored writing processes, clarified ideas collaboratively and encouraged other children to participate in writing activities.

## INTRODUCTION

Recent research on writing has focused on reflective processes (dynamic processes in which the writer's points of view and conception of the topic develops in the course of writing) in contrast to the linear, allegorically rigid process often espoused in traditional composition textbooks (Hayes & Flower, 1980; Marder, 1982; Murray, 1978; Rose, 1981; Wason, 1980). Experts' think aloud protocols while writing and interviews with creative writers and scientists have revealed that writers do not simply express thoughts they already had but transform them (Flower, 1984; Rose, 1981; Scardamalia, Bereiter, & Steinbach, 1984; Wason, 1980).

Writers, noticing obscurity of their ideas, attempt to clarify them and to find their own distinctive points of view which provide directions for organizing ideas (Galbraith, 1992; Oe, 1989). Also they critically examine past decisions and reconcile competing ideas during writing (Flower & Hayes, 1980, 1981), through which they express their own ideas newly and differently from before (Uchida, 1989; Sugimoto, 1991). Effective writers can use language as a tool of exploration to see beyond what they know (Graves, 1978; Calkins, 1983; Murray, 1978).

Some studies, on the other hand, have pointed out that novice writers rarely have such reflective processes in writing

(Burris, Bereiter, Scardamalia, & Tetroe, 1983; Scardamalia, Bereiter, & Steinbach, 1984; Scardamalia & Bereiter, 1986). Novice writers' protocols suggested that while writing they follow a primarily linear generate-and-express procedure in which they at first explore what they know about the topic (generating relevant ideas) and then merely write it down (expressing them) without transforming their thoughts (Bereiter & Scardamalia, 1983; Flower & Hayes, 1980, 1981; Flower, 1984). Novice writers' primary concerns in this routine are "what to say next" and "how to put it into appropriate language" (Scardamalia, Bereiter, & Steinbach, 1984), and they seldom critically or globally examine their ideas. There is a variety of collateral evidence for this lack of reflective statements in the protocols of immature writers (Bereiter & Scardamalia, 1983). Novice writers tend to present ideas in the order in which the ideas occur (Flower, 1979) and start writing immediately after being given the writing task without taking time to plan (Zbrodoff, 1984). Their texts tend to lack coherence except at the sentence-to-sentence level (McCutchen & Perfetti, 1982) and to be devoid of substantive revision (Nold, 1982).

*The limitation of instructional research on reflective writing*

Why are there such differences between experts and novices? What educational support enhances novice writers' reflective processes in writing?

Current cognitive approaches to writing have tried to explain the difference between experts and novices based upon the information processing theory (Galbraith, 1992). According to Flower & Hayes (1980), Flower (1984), and Scardamalia, Bereiter, & Steinbach (1984), expert writers have inner interactive processes between a content knowledge space and a rhetorical knowledge space which become the essence of reflection, while novice writers have a typical one-way process of generating content and writing it out. Based on the writing models, Scardamalia et al. (1984) conducted an instructional experiment aimed at helping novice writers sustain such interactive processes independently. The instruction included the modeling of thinking aloud, use of cue cards on which rhetorical phrases were written during planning, and direct strategy instruction emphasizing dialectical synthesis of conflicting ideas. The result indicated that the instruction succeeded in enhancing reflection only at a local level (on individual ideas), not at a global level (on central ideas). Individual ideas were reconsidered and modified, but writers' points of view were not transformed and consciousness was not developed.

This limitation of the results is thought to be attributable to the above theory not taking into consideration the contexts of writing, focusing only on writers' inner processes (Sugimoto, 1991). Scardamalia et al. tried to help novice writers develop the inner interactive processes that experts have by instruction in rhetorical

styles. However, they did not consider why experts have the interactive processes between a content knowledge space and a rhetorical knowledge space or how they actually use rhetorical knowledge, in what situations and for what. Thus, their experimental instruction resulted in urging novices to copy superficial features of experts' inner processes without considering global writing contexts, which could not yield global reflective processes in novices. Sugimoto (1991) showed in her experimental research that junior college students, when given clear writing situations, examined, clarified and reorganized their prior knowledge at a global level using rhetorical knowledge more frequently than when given instruction in rhetorical styles without writing situations. This research suggests the importance of taking writing situations into account in studying the teaching of reflective writing.

### *Three features of writing environments for enhancing reflective processes*

What features of writing situations or writing environments help to enhance novices' reflection in writing? And why? All features of writing environments which could enhance novice writers' development of thinking will not be exhaustively listed, but instead, three features important for enhancing reflective writing --- recursiveness, collaboration and authenticity are proposed.

"Recursiveness" is proposed as an

important feature in writing environments. As mentioned above, many studies indicated that novice writers tend to have a linear writing process in which they at first generate topic-related ideas and then translate them into language and to repeat this process. They produce a text from top to bottom and rarely go across the text recursively (Flower, 1979; Nold, 1982; Bereiter & Scardamalia, 1983). However, if they can gain access to a supportive device which enables them to easily move back and forth across lines in a text, they may be able to write more flexibly and dynamically, which may yield critical and global points of view for examination and reorganization of their ideas.

"Collaboration" is also proposed as an important concept for reflective writing. Research on peer group writing has suggested the effectiveness of collaboration on writers' development of thought in writing. In collaborative peer writing, students tend to find solutions to problems by discussion with each other, with the one taking the responsibility for writing and the other taking a role of monitoring, pointing out local errors and maintaining global contexts (Levin, Riel, Rowe, & Boruta, 1985). Experience with multiple points of view makes it possible for writers to anticipate other points of view and to reflect their ideas with detachments upon the value of their own (Spear, 1984). Interactions with peers have the potential to shape and extend one another's ideas (Bruffe, 1984).

"Authenticity" is a crucial feature in

writing environments. Recent cognitive research insisted that authentic situations are invaluable to acquire knowledge and criticized the traditional classroom situation in which students are taught abstract concepts independently of authentic situations (Brown, Collins, & Duguid, 1989). Research on the teaching and learning of writing as well as other research on learning and instruction, criticizing the teaching of decontextualized and decomposed writing skills, pointed out that in authentic writing environments students can develop audience awareness which helps students learn to produce better organized, more informative and elaborate texts more efficiently than in the traditional writing classroom (Cohen & Riel, 1989). Authentic writing environments in which people can have real readers and purposes may also serve an important role for enhancing novices' reflective processes in writing. In authentic writing situations writers can gain access to a standpoint that enables them to write meaningfully and purposefully, which may make them motivated to examine what they are writing consciously and actively.

### *Computer-based writing environments*

The traditional composition class, in which each student individually writes for an artificial task given by the teacher with paper-and-pencil, not only lacks the above three writing features but also seems to have difficulty in realizing them within it. However, computers make it

possible to create the three features of writing environments (recursiveness, collaboration, and authenticity) in the traditional classroom.

Computer tools such as a word processor and HyperCard have the potential to help people write recursively. The traditional tools, paper and a pencil, with which people, especially novice writers, tend to produce texts in a linear way, from top to bottom are not effective when people want to reorganize what is already written down or to make global revision. On the other hand, a computer is effective for writers to produce and reproduce texts recursively. A word processor makes it easy for writers to at first externalize thoughts freely and then to extract the main ideas from previously written ideas or to integrate them in various ways (Galbraith, 1992; Levin et al., 1985; Sirc, 1988). With a hypertext, writers can produce texts without considering the order of contents, move back and forth across texts, and flexibly make links between ideas and texts (Glynn, Oacks, Mattocks, & Britton, 1989).

A computer also offers space for collaborative writing among pairs of children that is difficult to create in the pencil-and-paper medium (Levin et al., 1985). With the traditional pencil-and-paper medium collaborative peer writing is difficult because sharing a pencil or writing together on a small piece of paper is difficult. On the other hand, with a computer collaboration in writing is much easier because the display is more public than a piece of paper and the keyboard

extends in space more than a pencil (Levin et al., 1985). Children can easily talk about what is written on the screen seeing it together, can monitor what is being written and can help one another hit keys.

Computer networks give students and the teacher the opportunity to communicate easily with people outside of classrooms, schools, their villages or cities and countries (Goldman & Newman, 1992; Rubin & Bruce, 1990), which can create authentic writing environments in a classroom (Cohen & Riel, 1989; Rubin & Bruce, 1990). In the traditional composition class, students are forced to write even when they have neither actual purpose, ideas to write nor an intended reader. In most cases students are implicitly or explicitly expected to write to the teacher for evaluation (Cohen & Riel, 1989; Rubin & Bruce, 1990). Although recent research has repeatedly insisted on the importance of getting students to write to a specific audience, teachers find it difficult to develop audience awareness in the confines of a classroom (Cohen & Riel, 1989). It is computer networks that can break through this limitation. Computer networks can realize functional writing environments in a classroom, in which students write in order to communicate with real audiences for their own purposes (Levin et al., 1985; Rubin & Bruce, 1990).

This study investigates how a computer-based writing environment with these three features can change novice writers' attitudes toward writing,

and whether such a writing environment can enhance novice writers' reflective processes.

## METHOD

### *Students, teacher and classroom*

The subjects of this study were 17 fifth graders in an English as a Second Language (ESL) class of an elementary school in a medium-sized Midwestern city in the United States. Many of their parents were graduate students or visiting scholars at a large state university in the city. They came from various countries all over the world: Brazil, Burma, Czechoslovakia, Indonesia, Israel, Korea, Nigeria, Poland, Russia, Venezuela, and Vietnam. Some children had been in the United States for one and a half years; others had been there for only a few months. Although they could speak, read and write their own native languages well, they did not have an adequate command of English because most of them started learning English after they had come to the United States. The level of their written English was that of third or fourth graders. However, they communicated with one another actively and successfully in the classroom. The teacher, Mrs. Smith, who had learned English as a second language as a child, could understand what the children wanted to say very well.

The classroom was sunny and pretty. The walls were decorated with many colorful cards on which the names of various things such as dates, time, weather, directions were written. A

world map and pictures of children in ethnic clothes were also put on the walls. There were three big bookshelves and one small bookshelf. In those bookshelves, various kinds of books--folk tales, historical novels, books on various cultures, languages and countries, science books were stored. The children could use and read them when they needed to do so. There were two clusters of student tables, around which the students sat in Mrs. Smith's English and social science classes. The teacher's desk was located at one corner of the classroom and a Macintosh computer was put beside the desk.

### *Observation*

Mrs. Smith's class was visited once or twice a week for four months. In the first three weeks before the computer-based writing environment was created in the classroom, the whole class activities were observed and discussions took place with Mrs. Smith about how to create a computer-based writing environment in the classroom. Then, the computer-based writing environment was initiated by using computer networks and a HyperCard stack running on a Macintosh computer in the classroom. Observations were made of how children wrote using the computers and children's writing activities in the classroom were videotaped.

### *Traditional composition class*

When the class was visited for the first time, children were writing a summary of

a story individually. While writing, some children were chattering with other children and some children were walking around. It was apparent that they had little motivation to write the summary. Mrs. Smith paid more attention to spelling and grammar than the contents of their written products. Because she corrected them whenever children made mistakes in spelling and grammar, they seemed to be sensitive to such errors. On the other hand, they did not pay attention to the content of their texts. Because some of their texts did not make sense, it was difficult to figure out what they had written about. They could not express their ideas fully or organize them effectively. Neither did they develop their points of view and conceptions of the topic while writing, unlike expert writers.

### *Participation in Zero-G project*

Mrs. Smith's class started participating in Zero-G World Design Project three weeks later. The project was an educational project conducted over computer networks. Many students and teachers of K-12 classes from the United States and foreign countries, university students and faculty members, and NASA and other experts took part in the project, in which they proceeded with studies and activities on various aspects of space and weightlessness, and communicated about them with other participants on computer networks.

On the first day of their participation in the project, children of Mrs. Smith's class had a joint class with Mrs. Dickson's class

of the same school in order to watch a film on space life together. Most students of both class appeared to enjoy the video laughing at astronauts' awkward behavior in a spaceship and expressed joy and surprise at various phenomena in space. Because the children of Mrs. Dickson's class had already worked on the project activities for half a year and knew more about space life than Mrs. Smith's students, the students of Mrs. Smith's class asked questions about things they did not understand in the video and Mrs. Dickson's students answered the questions after they finished watching the video.

This experience made the students in Mrs. Smith's class very interested in space and life in a spaceship and eager to learn about them. They read books and learning materials on space Mrs. Smith prepared for them, and carefully listened to an invited speaker's story about planets and astronauts. They were motivated to communicate with other members in the project over computer networks. They were ready to participate in writing activities in the computer-based writing environment.

*Writing environment realized by computer networks and HyperCard in the classroom*

A writing environment with three features (recursiveness, collaboration, and authenticity) was created in Mrs. Smith's classroom using computer networks and a "Writing Facilitator" which is a HyperCard stack created by the author.

Computer networks became the instrument with which children could write to other participants in the Zero-G project in order to exchange information, which enabled the children to work on authentic writing activities in their classroom. Although Mrs. Smith's students were interested in writing messages on the computer networks, they had difficulty in producing comprehensible texts expressing their ideas fully and effectively. Thus they needed an instrument supporting their reflective processes in which children could have the opportunity to clarify and organize their ideas. The "Writing Facilitator" was used as a supportive device aimed at helping the children develop recursive processes in writing, with which children could easily move back and forth across lines and texts. Seventeen children in Mrs. Smith's class were divided into seven groups of two or three children. Children in each group were encouraged to write messages together using the "Writing Facilitator."

*Writing Facilitator*

The "Writing Facilitator" is designed to help children write messages on Zero-G for computer networks. It is a HyperCard stack in which children can write messages learning about writing topics, creating note cards, moving back and forth across the cards and making links among cards according to their interests and needs. This "Writing Facilitator" has two main sections; "Learning World" and "Writing World".

### <Learning World>

The "Learning World" section works as an information storage device consisting of "knowledge cards" and "note cards." From "knowledge cards," children can learn about the writing topics such as "space," "life in a spaceship" and "gravity and weightlessness." With "note cards," they can store and organize their own topic-related knowledge for later use.

Twenty-two "knowledge cards" provide children with explanations of interesting phenomena and astronauts' life in a spaceship, and the theory of gravity. For example, they can learn about astronauts' strange life styles in a spacecraft reading the explanation of "How do astronauts eat and drink?" written on a knowledge card (See Figure 1). Although some topics are related to the theory of gravity, only basic ideas are explained with simplified vocabulary and attractive pictures aimed at helping children think about the basic natural and physical laws underlying the various phenomena. Because there are several paths through the knowledge cards, children can proceed with reading cards according to their interests. The aim of providing "knowledge cards" is to offer children a springboard for starting to find interesting problems and to think about the writing topics in various ways.

On "note cards" (See Figure 2), children can write freely what comes to mind while reading the "knowledge cards." That is, writers can learn about the writing topics from the "knowledge cards," and at the same time, make "note cards" and take notes of whatever they

want to write down (e.g. what they cannot understand, what they are interested in and what they learned while reading the "knowledge cards"). The "note cards" aim at encouraging children to freely produce and combine topic-related ideas which would be useful when they write messages later.

When children want to take notes, a new "note card" is automatically created for them if they click the "note card" button on a "knowledge card." Whenever a new "note card" is made, the user's name and the card number are automatically put on the new "note card" and the user is requested to input the title of the "note card". A user can create as many "note cards" as he or she likes. Every student can store "note cards" he or she made with his or her name and card number. So when a student uses the Writing Facilitator again, he or she can add new "note cards" to the ones he or she made previously. In addition, students can see the list of "note cards" they made. If, on the "menu of note cards" (See Figure 3), they click on the line of the title of a "note card" which they want to see, the "note card" corresponding to the title appears. In this way students can read the note cards they wrote previously. Because "note cards," the menu of note cards" and "knowledge cards" are mutually connected by links, children can easily move among these cards.

### <Writing World>

The "Writing World" section is aimed



**Writing Facilitator**


## Eating and Drinking

Astronauts cannot sit down to an ordinary meal at a table, because chairs, tables, plates, and food just float away in spacecraft.

They eat food packed in cans and plastic bags that fit into cavities in food trays with enough friction to keep them from floating out.

Astronauts have to be careful that the food does not float away.

**QUIT**



Food Tray


←

**Menu of Note Cards**
→

Figure 1. An example of a "knowledge card"

**Writing Facilitator**

**TITLE:** Food and cook

**NAME:** Group 1 **No. 1**

What do astronauts eat in a space ship?

Can they cook there?

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---

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**Back to Learning World**

**One more card**

**Go to Note Card Menu**

Figure 2. An example of a "note card"

at helping children organize their ideas without difficulty in producing texts by providing them with three kinds of support ---(1) by note cards, (2) by cue questions, (3) by idea organizer.

The "support by note cards" enables children to write messages for computer networks while reading the "note cards" they made in the "Learning World." Writing while reading the "note cards" may give children the chance to view already written ideas differently and to integrate them in a new direction. The "support by cue questions" gives users cue questions designed to help them generate a coherent text while naturally answers the questions. It also gives suggestions of words and phrases when they have no idea about how to write. The "support by idea organizer" helps writers make hierarchical levels of content and text. With this support children can start writing anywhere they want without considering the order of contents and edit easily, which is helpful in organizing ideas and making the outline of a text. In this study, children were observed using only the "support by note cards" because of the limitation of time. Therefore, only the "support by note cards" will be explained here.

The "support by note cards" consists of a "text card" which has a "text field," the "list of note cards" and the field of the "content of a note card" all together (See Figure 4). The "list of note cards" on a "text card" is linked with "Learning World", and when users click on the line of the title of a "note card" shown in the

"list of note cards," the text of the corresponding note card which was written in "Learning World" appears in the field of the "content of a note card." Users can select any "note card" and read it freely while writing a text in the text field. They can make not only as long a text, but also as many "text cards" as they like. The user need only click the button "one more text," and a new text card with the user's name and text number is automatically created. The user is then prompted to input the title for the new "text card." The text card a user makes is stored with the user's name, its text number and the text title.

In the "list of texts," users can see the titles of text cards they wrote. If they click a title of a "text card" in the list, the text card which has the corresponding text title appears. Users can read and rewrite the "text card." Users can also freely move back and forth among "text cards" and the "list of texts" in this world.

#### *<Instructions on how to use the "Writing Facilitator">*

After children had been observed using the "Writing Facilitator" twice, it was realized that the students understood little about what the writing facilitator was like, how they could use it or what note taking was. Mrs. Smith said that the children could not take notes well at that time. So in the class, using an overhead projector, a presentation was given of the structure and functions of the "Writing Facilitator" and how to take notes and write messages using it. Because of the

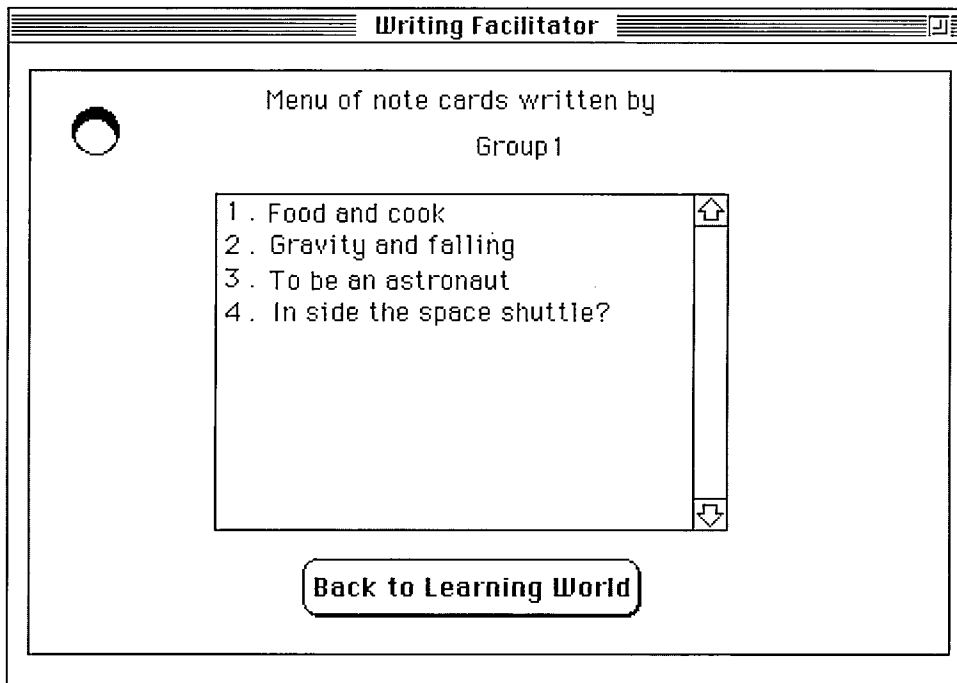


Figure 3. An example of a "menu of note cards"

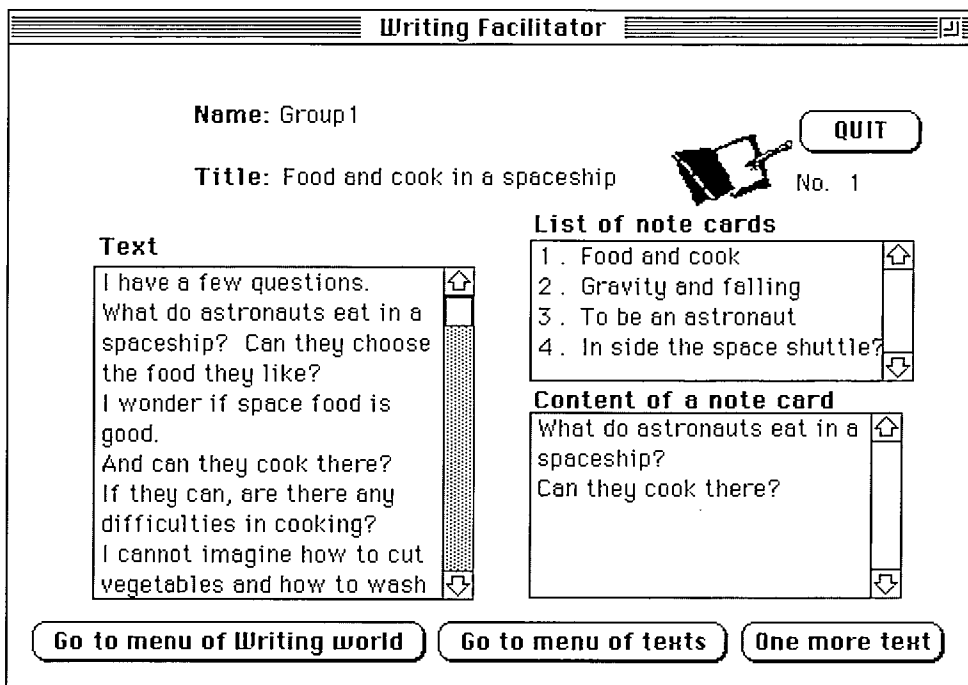


Figure 4. An example of a "text card"

presentation, children seemed to understand the usage and the functions of the writing facilitator. But they sometimes got into trouble with operating HyperCard although they seemed to be used to operating the keyboard. So when they were in trouble, they were helped. With support children were getting accustomed to use the "Writing Facilitator" and gradually came to manipulate it without support.

Every time Mrs. Smith's class was visited, one group's writing activity with the "Writing Facilitator" was observed. Each group had about thirty minutes to use it at a time. Their activities were videotaped and field notes were taken. The data was analyzed by transcribing the videotapes and taking field notes, focusing on the effects of the three features of the computer-based writing environments on children's writing activities.

## FINDINGS

### *Recursiveness*

Analysis of the data reveals that the "Writing Facilitator" served as an effective device with which children write down the ideas they are newly generating on a text while reading another text moving back and forth between those texts and by which they can make the relationships among ideas written in different texts. In example 1 below, the children wrote the ideas they generated anew on a "note card" while reading information on a "knowledge card" and made a link between the

information on a "knowledge card" and the ideas they wrote on a "note card" by crisscrossing texts. While reading a knowledge card, the children got a question, and therefore they made a new "note card" and wrote the question on it, and then went back to the "knowledge card" to continue reading it.

#### < Example 1 >

Paul, Andrew and Mark were reading knowledge card (14) (Figure 5) which explains how astronauts move and sit in a spaceship.

Andrew: What's gravity?

Paul: Oh...may be about...

Mark: I understand move.

Paul: No. How was gravity form?

How was gravity form?

Andrew clicked on the note card icon and made the note card titled "Gravity" (See Figure 6). Then Andrew went back to the knowledge card and they started reading again.

Children also tried to clarify new ideas moving among hypertexts. In the example 2, two children tried to understand fully and clearly what was written on a knowledge card by rephrasing it by their own words on a note card.

#### < Example 2 >

After she read a knowledge card which explains how astronauts eat and drink in a spaceship, Susan said as follows.

Susan: Nnn...So...This food tray keep the food not float away?

**Writing Facilitator**


## Moving and Sitting

**QUIT**

Weightlessness enables astronauts to float around and perform incredible feats of gymnastics.

They move from one position to the next by pushing against the walls and using handles. They seem to be flying.

They have to be careful to avoid damage to the spacecraft when they move around.








**Menu of Note Cards**


Figure 5. Knowledge card (14)

**TITLE:** Gravity

**NAME:** Paul, Andrew, Mark **No. 3**

How was gravity form and when?

.....

.....

.....

.....

.....

.....

**Back to Learning World**
**One more card**

**Go to Note Card Menu**

Figure 6. Note card (Example 1)

Karen: Yes. That's right.

Susan: Nnn, An...In space they are eating, they need to have food tray to keep, keep food from floating up?

Karen: Uh-huh.

Susan: Oh, great!

And Susan wrote the note card titled "Eating and drinking" (See Figure 7).

In this way, with the "Writing Facilitator" children often moved back and forth among "knowledge cards" and "note cards" following the flows of their recursive thinking processes which had hardly been seen in the traditional class. Children were also observed to write messages in the "Writing World" integrating the ideas they wrote on "note cards" in the "Learning World" by moving flexibly between the "Writing World" and the "Learning World." These instances suggest that hypertexts enhance

children's reflective processes in which they try to clarify and organize their ideas. Thus the hypertext which creates a flexible and process-oriented writing environment can be a good instrument with which children develop their ideas.

### *Collaboration*

#### Monitoring

By analyzing the data, it became evident that children spontaneously helped one another in writing. They monitored other children's mistakes in spelling, punctuation and grammar and taught other children how to correct them. Some children taught others how to use the keyboard. In addition, they monitored the contents of the texts and discussed how to write more clearly. The following are examples of these kinds of collaboration.

**TITLE:** Eating and drinking

**NAME:** Susan & Karen **No. 4**

In space people eat and drink they need food tray to keep food from floating up.

[Back to Learning World](#) [One more card](#)

[Go to Note Card Menu](#)

Figure 7. Note card (Example 2)

## Spelling

< Example 3 >

When Ralph stopped hitting keys for a while because he did not know how to spell "miss", Henry said "ss" in order to tell him the spelling.

< Example 4 >

While writing a note card, the children in a group said as follows.

Andrew: How do you spell gravity?

Paul: Ggravity? A, V, I, gravi...(while hitting keys)

Andrew: T, Y. Yes!

## Punctuation

< Example 5 >

Sandy said "OK" after she finished writing a note card. Then Judith said "point, point, point, point here." and put a period at the end of the sentence Sandy wrote.

< Example 6 >

When Daniel wrote the first word "the," John said "Hey, capital letter!" And Daniel said "Capital letter, yes." and corrected it.

< Example 7 >

Because Fredrick did not put a question mark at the end of the interrogative sentence "How many computers are in the shuttle," Edward said "Question mark!"

## Grammar

< Example 8 >

When Susan tried to write "On space" as a title of a note card, Karen mentioned

the preposition.

Susan: On space. (And began to hit keys.)

Karen: Oh, gosh! In space!

Susan: ON space. IN space?

< Example 9 >

When Scott wrote "How many computer", Philip said "s!" which meant 'computer' should be 'computers.'

## Keyboard

< Example 10 >

When Mary did not know how to make a capital letter, Janet taught her how to use a shift key.

< Example 11 >

When Carl tried to erase a few sentences using a backspace key, Henry said "Wait!" and taught an easier way of erasing it by moving the cursor.

## Content

< Example 12 >

When Matt wrote "The first bean what went to the space was dog and monkey", the other members said as follows.

Brian: That doesn't make sense.

Matt: OK.

Steve: (read the sentence Matt wrote.)

What do you mean ?

Matt: OK.

Steve: What do you mean this?

## Supplement and clarification of knowledge

Children also tried to produce sentences supplying necessary

information to each other and clarifying what they wanted to say.

< Example 13 >

After David wrote "the first man that went", Fred continuing to the phrase, wrote "to the space was" and asked "Gagarin?" "Yuri Gagarin", David replied. Then Fred wrote "Yuri Gagarin in Vostok 11." After David wrote "The first man that stepped on the moon", he asked "who?" Fred said "Armstrong and Edwin E. junior and Michael Collins." The card they made is shown in Figure 8.

< Example 14 >

Ralph and Henry were writing about space hockey. On the first note card, they described the rules of space hockey. When Ralph was writing in the middle of the second note card, he suddenly

stopped writing and erased the sentence he just wrote. The sentence was "And the goal's height is 50 m [sic] and 80 m [sic] wide and there is lot of round shape magnets pulling power and pushing power on the ground making a wide." And he said to Henry, "I don't know how to write" Then Ralph tried to explain what he wanted to write but could not express it well, drawing a picture on a piece of paper which showed the positions of a hockey goal, hockey balls and magnets. Ralph said as follows.

"Here is a hockey ball.....like this (pointing to white small circles he drew). Here is a magnet.....like this (pointing to black small circles)....This...here's....black ball (moving a pencil which demonstrated the movement of hockey balls and magnets. Hockey balls and magnets were put by turns in a circular line)...This goal

**TITLE:** Space

**NAME:** David, Fred, Kevin **No. 1**

The man started going to space in 1961. The first satellite that went to the spce was Sputnik 1, from Russia and the first man that went to the space was Yuri Gagarin in Vostok 1. The first man that stepped on the moon was Neil Armstrong in Appollo 11, with Edwin E. Junior and Michael Collins.

[Back to Learning World](#) [One more card](#)

[Go to Note Card Menu](#)

Figure 8. Note card (Example 13)



(pointing to a rectangle box he drew) .....falling.....falling.....falling.....our magnet spin.....our magnet... metal....this...so...make the same wide (pointing to the width among hockey balls and metals) yea..."

After listened to Ralph's explanation, Henry started writing mutely. Henry wrote as follows.

"The frame of goal is made of metal and under the goal are pushing magnets and pulling magnets, so the goal is always spinning slowly and you can only make goal in one side of the goal. The side of the goal is height 50cm and 80cm wide."

While Henry wrote these sentences, Ralph commented on them. When Henry wrote the first half of the first sentence, Ralph said, "Pushing?" "Of course, pushing magnets and pulling magnets.", Henry replied. In addition, after Henry wrote the word "spinning", Ralph said "Slowly" by which he insisted the word "slowly" be put after the word "spinning."

The Table 1 shows the frequencies of each category of collaboration per observation. Collaboration of spelling and punctuation occurred more frequently than other kinds of collaboration. It can

be said that the children in Mrs. Smith's class are sensitive to spelling and punctuation. However, the half of the groups also talked about the contents, which shows that children can examine, clarify and organize ideas they want to write collaboratively.

#### Scaffolding for participation in a writing activity

Besides these kinds of collaboration I mentioned above, I found another interesting collaboration in children's activities when using the writing facilitator. One student took the role of scaffolding for another student who had never written English to participate in a writing activity.

< Example 15 >

In a group of three boys, only two boys named Michael and Charles were writing on note cards. The other boy named Simon was just watching what the other two boys were doing. Simon was a shy boy who had just come to the United States. When twenty minutes had passed since they had started using the writing facilitator, Michael talked to Simon. The

Table 1. Frequencies of collaboration

|         | Spelling | Punctuation | Grammar | Keyboard | Content | Total |
|---------|----------|-------------|---------|----------|---------|-------|
| Group 1 | 0        | 2           | 0       | 1        | 0       | 3     |
| Group 2 | 4        | 1           | 1       | 0        | 0       | 6     |
| Group 3 | 3        | 2           | 1       | 1        | 0       | 7     |
| Group 4 | 4        | 3           | 1       | 1        | 3       | 12    |
| Group 5 | 4        | 0           | 0       | 1        | 1       | 6     |
| Group 6 | 2        | 1           | 0       | 0        | 1       | 4     |
| Group 7 | 0        | 1           | 1       | 1        | 1       | 4     |

protocols of the boys are as follows.

Michael: That's your turn right now.

(Put the keyboard in front of Simon.)

You can write something.

Simon: Write?

Michael: Yea.

Simon: I don't know how to write.

Michael: Yes, of course, sure.

Simon: I don't know how to write.

Charles: Oh, you can write. Write whatever you want to write.

Simon: I didn't write.

Michael: (Wrote "washing" as a title for a new note card, encouraging Simon to write.)

Simon: But what can I write?

Michael: You mean, they, they, you can just write how they shower.

Simon: How do astronaut take a shower?

Michael: Yea. How do astronauts...yea, take a shower? Shower, S, H, O, W, E, R (telling spelling).

Then Simon started hitting keys slowly with his forefinger of the right hand. Whenever Simon finished hitting a word, Michael pushed the space key for Simon. Michael watched Simon's writing intently and sometimes taught the positions of the keys Simon was seeking for.

Children actively and spontaneously monitored one another's writing processes pointing out mistakes and unclearness in the texts they produced and gave useful information other children needed. Peer group writing gave children others' points of view which enabled children to notice their own

strengths and weaknesses and to think about their own ideas objectively and newly. In collaborative writing, children had the opportunity to examine and clarify their ideas and even to gain more positive attitudes toward writing.

### *Authenticity*

The analysis of the data indicates that children were never reluctant to write when they were writing to learn about space or writing messages for computer networks. Almost all children concentrated on using the "Writing Facilitator" for about thirty minutes, while they were easily distracted in writing a summary of a story in the traditional-style composition class.

Michael, Charles and Simon enthusiastically wrote on a note card what they learned from a "knowledge card" without being distracted by the song the other students were singing. They also eagerly wanted to send e-mail to NASA people in order to ask questions of them. Linda did not want to stop writing even though the teacher urged her to go to lunch. After other students left the classroom to lunch, Linda continued to take notes and proudly reported to Mrs. Smith that she made as many as three "note cards". Paul, Andrew and Mark read a knowledge card" with one voice and spoke "Oh!" individually after they finished reading the card. They also enjoyed the picture of "space natural body posture" drawn on a "knowledge card," pointing to it. Susan and Karen clapped their hands when they made the

first "note card."

In this way children engaged in writing activities more actively and enthusiastically in the authentic writing environment computers created than in traditional writing class. Such attitudes have a great deal of potential to enhance children's conscious examination and development of ideas in writing.

However, it is interesting that some children wrote messages to be sent on the computer networks without considering the audience they would send them to. One group of three boys started writing with a sentence "The extreme temperature is the temperature that is called hot and cold." Until I asked them whom they would write to, they seemed not to understand what they should have done. They talked with one another for a while, erased what they wrote and restarted writing "Hello NASA people. We want to ask you a few question about the EXTREME TEMPERATURE in space....." This phenomenon may be attributable to their lack of audience awareness even when writing e-mail. Or they may have had audience awareness but could not write in a way that considered their audience. This kind of children's activity apparently contradicts the results presented by Cohen & Riel (1989). Why some children tend to write e-mail apparently without having audience awareness will need to be investigated.

## CONCLUSION

This paper examined how a writing

environment with three features, recursiveness, collaboration and authenticity, realized by computer-networks and HyperCard can change novice writers' attitudes toward writing and whether such a writing environment can enhance their reflective processes in writing.

Using HyperCard, children, who had written in a linear way, flexibly moved back and forth among texts, in which recursive process they had the opportunity to clarify and organize ideas. Peer groups encouraged children to write collaboratively, monitoring one another's mistakes and unclear ideas, supplying useful information to each other and clarifying ideas using others' points of view, and helping other students' participation in writing activities. In authentic writing situations created by the computer-networks-based project, children were motivated to participate in writing activities more actively and enthusiastically than in the formal writing class.

It was shown that the three features of the computer-based writing environment have a great deal of potential to produce positive effects on novice writers' attitudes and to enhance the development of their thinking in writing. However, how the environments affect their reflections has not been clarified. Further studies examining this problem will be needed.

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