Construction and evaluation of IS-BoardII to support information sharing for information education

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Abstract

Recently, by the advance of information technology, many universities come to have the information literacy education classes for freshmen. In such classes, students have various questions, because they need to learn and acquire a wide range of knowledge on the computer. Assistances for information education (e.g. arranging a teaching assistant (TA), Q&A by e-mail, e-learning systems) are done, but instructor's load is large and these supports are not enough for students. So the system which solves students' questions without requiring instructor's extra efforts has been required. In this situation, we proposed the electronic bulletin board system "IS-Board" which assists such classes. We designed IS-Board based on the normal electronic bulletin board system on WWW. In addition, IS-Board automatically extracts useful information from all utterances on the bulletin board system and provides them to students effectively. IS-Board also classifies reusable information from useful information and accumulates them as FAQ. We managed our system in some classes for two years. We showed that IS-Board could promote information sharing between students and reduce instructor's load. But we also found out that IS-Board's functions were not yet sufficient to assist information education classes. In this paper, we construct "IS-BoardII" which has the additional functions to solve the problems of IS-Board to support information education more efficiently. We also show the effectiveness of IS-BoardII by managing our system in the information literacy education classes.

Keywords: Electronic bulletin board system, CAI, CSCL, E-learning, Information sharing

1   Introduction

Recently, by the advance of information technology, the information literacy education is lectured at many universities for freshmen. For example, Senshu University (school of business

administration) has the lectures of "Information literacy" and "Computer outline", and Keio University (faculty of science and technology) has the lecture of "Information processing and training".

Each class has usually 50 to 100 students, and the lecture scenery is shown in Fig.1. In this class, a student practices to operate a computer during the lecture.
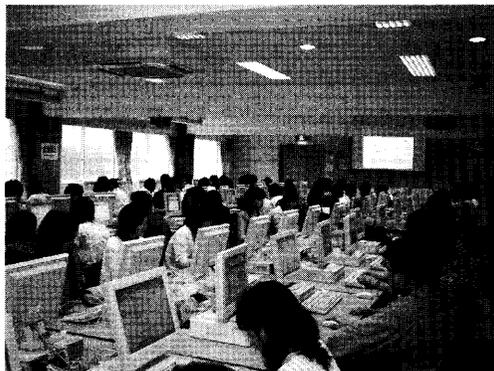

Figure 1: Lecture scenery of the information literacy education

In the information literacy education, all students have to understand a wide-range of lecture contents (e.g. the operating methods of the computer and application software, the mechanism of the computer and the internet, information ethics, etc). Moreover, the understanding level and the experience are very different among students and they often have various questions. In addition, the supporting methods in the self-study aren't sufficiently offered. So, students can't sometimes solve their questions when they study alone. As a result, it is difficult for students to solve their questions under the present conditions. To solve these problems, TA (teaching assistant) is arranged, and Q&A by E-mail is done. However, these supports are not yet sufficient to assist students and instructor's load is also very large.

Recently, the various e-learning systems which support the learning activity by using the Internet have been proposed (ALIC (ed.), 2003) (Hoppe et al., 2003) (Stahl, 2002) (Sato, 2001). But there are few systems which the student can operate easily and learn effectively. Because, many of these systems are inconvenient in the operating methods, and there are constraints in the contents of the inputs. So the system which solves students' questions without requiring instructor's extra efforts has been required.

In this situation, we proposed the electronic bulletin board system "IS-Board (Information Sharing Board)" which supports the information education (Shinozawa et al., 2003). Our system has no constraint in the operating methods and the contents of the inputs so that students can operate easily. We managed IS-Board in four classes for two years and had already confirmed the effectiveness of IS-Board (Shinozawa et al., 2004). But we also found out some problems. So, in this paper, we improve IS-Board and propose IS-BoardII which has new functions to solve the problems of IS-Board.

2 Policy of our system

We have the following two policies when we propose and design the system to support information sharing for information education.

- *Don't obstruct smooth communications*
  We expect that students utter freely their opinions and questions. We think that students' opinions should be uttered through the informal communication. Moreover, especially in Japan,

we think that it is important to construct the system which does not obstruct smooth communications among users, because Japanese students do not utter about their opinions and ask their questions positively. If the utterance contents are restricted, students hesitate to utter about their opinions.

- *Promote the voluntary learning of students*
  To solve students' questions, it is important to enhance and promote the information sharing between students. Especially we think that Q&A should be done voluntarily. It can also reduce the instructor's load. So, we promote the voluntary learning of students.

3   IS-Board

We managed the normal electronic bulletin board system (BBS) on WWW to dissolves students' questions without requiring instructor's extra efforts. And, we confirmed that the BBS could effectively support the information education. But we found the following problems (Shinozawa , Uetake and Takao, 2002).

- If the utterance content is restricted, there are few questions and useful information on the bulletin board system. Because students hesitate to utter their opinions.
- If students are allowed to utter freely, it is difficult for them to find useful information from all utterances on the bulletin board system. Because students utter a variety of utterances concerning the lecture, the operating methods of the computer, and campus life and their utterances contain the contents irrelevant to the lecture.
- The instructor's load is still large, because he/she provides most of useful information and replies to most of students' questions.

So we proposed the electronic bulletin board system "**IS-Board** (Information Sharing Board)" to solve above problems without requiring users' extra efforts.

3.1   Functions of IS-Board

IS-Board has the following functions to solve students' questions and reduce the instructor's load.

- **1st function:**
  IS-Board extracts useful information from all utterances automatically by our "Extract-Rules" and provides them to students effectively (Fig.2).
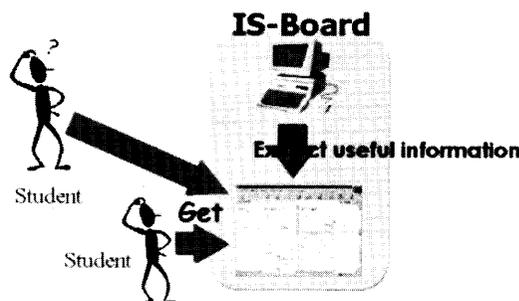

Figure 2: 1st function of IS-Board

Since IS-Board allows students to utter freely, there are a variety of utterances about the lecture contents, campus life and their recreation on the bulletin board system. So it is difficult for the students to find important information relevant to the lecture and they often overlook useful information. Useful information means important utterances for students in a specific class (e.g. the further explanations about the lecture and the reports, the messages from an instructor, the operating methods of the computer and application software, etc.). So students can get useful information easily by this function and we expect that students don't overlook useful information.

- **2nd function:**
  IS-Board extracts reusable information from useful information and accumulates them as FAQ (Fig.3).
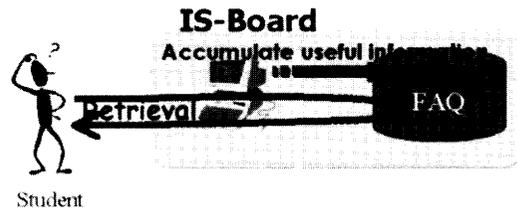

Figure 3: 2nd function of IS-Board

IS-Board classifies reusable information from useful information by using our "FAQ-Rules" and provides to students them as FAQ. Reusable information means important utterances for all students regardless of the different classes, years and includes Q&A which many students frequently need. We expect that this function can reduce the instructor's load for answering students' questions.

3.2 Overview of IS-Board

IS-Board was constructed based on the electronic bulletin board system on WWW. A student can utter about his/her questions and opinions and read his/her friends' or instructors' opinions on IS-Board with the same operation as normal electronic bulletin board system.
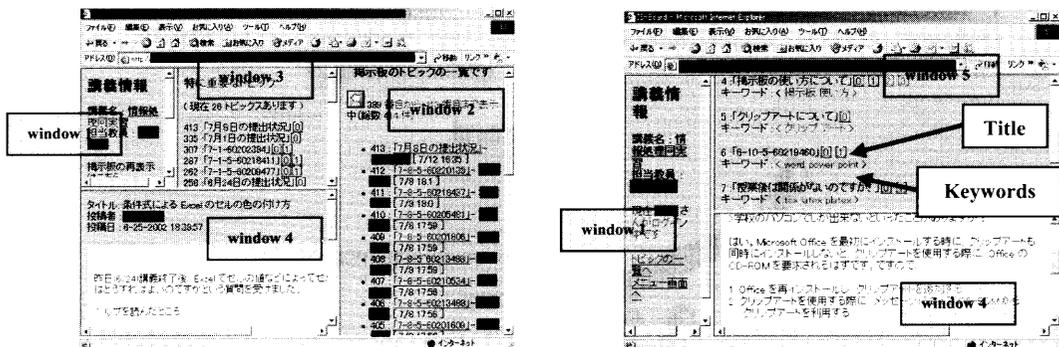
(A) Windows for lists of useful information   (B) Windows for lists of reusable information

Figure 4: Overview of IS-Board

Our system uses HTML frames and has five main windows as shown in Fig.4. The first window provides the information about the lecture and the links to other windows. The second window provides a list of all utterances. This list includes the contributor, the date and the title of an utterance. The users have to find important information from this list on the normal electronic bulletin board system. The third window provides a list of useful information extracted by "Extract-Rules" automatically. By operating this window, students can get useful information easily. The fourth window shows the content of the utterances. The fifth window provides a list of reusable information extracted by "FAQ-Rules". This list includes the title and the keywords of reusable information. By retrieving the keywords in this list, students can get reusable information and use them as FAQ. IS-Board may extract useful information and reusable information incorrectly. So our system also has the function to correct the lists manually. Instructors can correct mistakes in the lists easily by this function.

3.3 Problems of IS-Board

We managed IS-Board in four classes for two years, and we had already confirmed the effectiveness of our system (Shinozawa, Uetake and Takao, 2004). But we also found out the following problems.

- **1st problem:**
  Many students tended to get interested only in useful information extracted by IS-Board and they rarely read other utterances except for useful information.

  So, students sometimes overlooked important information[1] which our system could not extract as useful information. Because there were many utterances on IS-Board, students had to read all utterances to find out interesting utterances except for provided useful information. Moreover, there were some of students who did not pay any attention even to the messages from the instructor.

- **2nd problem:**
  If an instructor overlooked students' questions, many of them remained unanswered.

  Since there were a large number of utterances on IS-Board, an instructor sometimes overlooked questions from students. Moreover, other students, even though they could answer to the question, did not respond to it positively in many cases.

- **3rd problem:**
  It was difficult for students to use reusable information when they want to use.

  Usually, reusable information consisted of utterances of the instructor and a few students. But it sometimes contained unnecessary contents. IS-Board does not have the function to summarize reusable information. So it was difficult for students to use reusable information as FAQ.

- **4th problem:**
  IS-Board does not obstruct communications between students. But it did not activate communications enough.

  So, communication among students was not gradually activated in some of the classes. There were fewer utterances on the bulletin board in such classes. Our system needs the function to promote students to utter positively.

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[1] Information which might not have been relevant to the lecture, but actually was interesting for students (e.g. information about other lectures and campus life, the guides to the recreations, etc.).

So, the purpose of this study is to improve IS-Board to solve the problems of IS-Board, except for the 4th problem.

4   IS-BoardII

To solve the problems of IS-Board, we construct the IS-BoardII (Uetake, Shinozawa and Takao, 2005). IS-BoardII has the additional functions as follows. Each function corresponds to each problem of IS-Board.

- *Function to prevent students from overlooking important information:*
  IS-BoardII provides useful information and additionally next two types of information.
  –   Interesting utterances for students
  –   Important messages from an instructor
  This function corresponds to the 1st problem of IS-Board.

- *Function to reduce the unanswered questions:*
  IS-BoardII urges students to respond to the unanswered question and provides information related to the question.
  This function corresponds to the 2nd problem of IS-Board.

- *Function to revise FAQ easily:*
  IS-BoardII provides to the instructors the interface to revise FAQ easily.
  This function corresponds to the 3rd problem of IS-Board.

4.1   Function to prevent students from overlooking important information

IS-BoardII extracts useful information from all utterances and provides them to students as well as IS-Board does. In addition, IS-BoardII provides next two types of information which are important for students to solve the 1st problem of IS-Board.
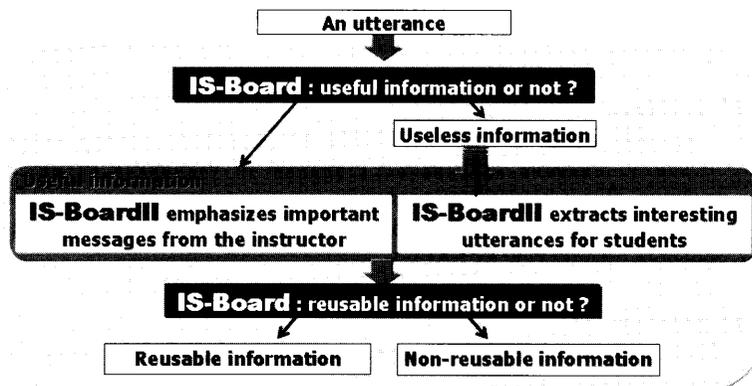The flow of each utterance on IS-BoardII is shown in Fig.5.

Figure 5: Flow of each utterance on IS-BoardII

- *Interesting utterances for students*
  IS-Board provides to students important information which are necessary for the lecture. So students rarely read other utterances except for useful information. Because it is difficult to find important information from the list of all utterances (the second window in Fig.4(A)). IS-BoardII emphasizes the important information which might

not be directly related to the lecture contents but are interesting for many students. IS-BoardII automatically classifies each utterance as shown in Fig.5 and prevents students from overlooking important information. IS-BoardII also changes the size and the color of the letters of the title of interesting information in the list of all utterances to attract attention of students (Fig.6).
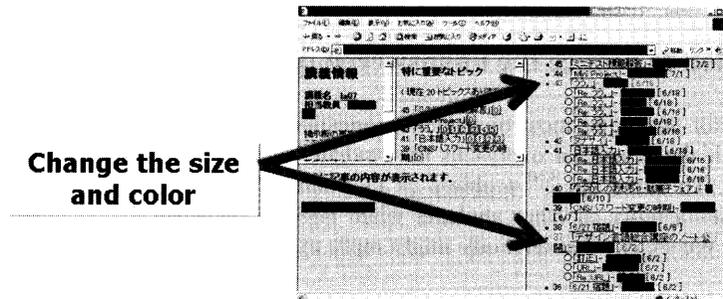

Change the size and color

Figure 6: Interesting utterances for students

We considered that more frequently students access the utterance, more interesting, more important the information could be for them. So IS-BoardII observes how frequently students read each utterance and which utterance they are interested in. In proportion to the access frequency of an utterance, IS-BoardII changes the size and the color of the letters of the title in the list of all utterances to attract attention of students. So students can recognize that the utterance, whose title is different from others in the size or the color, might be more important.

In the list of useful information (the third window in Fig.4(A)), IS-Board shows useful information in date order. IS-BoardII can arrange useful information in order of the interest of students to emphasize more important information.

- *Important messages from the instructor*
  We found out that some of students did not read even to important messages from the instructor (e.g. the message about the examination, the deadline of the report). It is absolutely necessary to prevent students from overlooking the messages from the instructor.

Messages from the instructor
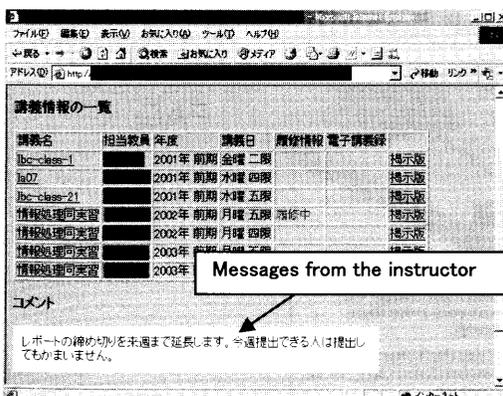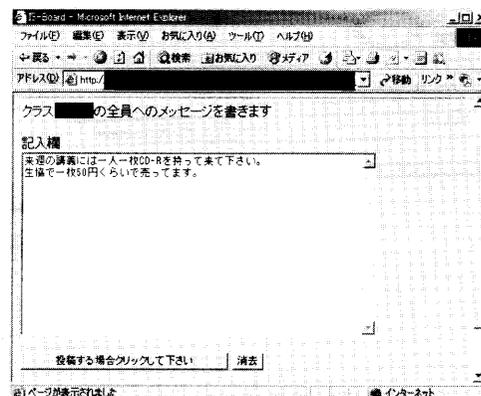
(A) Messages from an instructor   (B) A window to edit the messages to students

Figure 7: Important messages from the instructor

IS-BoardII can provide important messages from the instructor to students together with the logon messages as shown in Fig.7(A). IS-BoradII provides to the instructors the interface to edit the messages to the students easily. The window is shown in Fig.7(B). By operating this window, the instructor can edit the messages to students easily and inform to them important messages. Students can check the messages from an instructor easily and it is expected that they logon to our system more frequently.

4.2   Function to reduce the unanswered questions

The instructor answered most of students' questions and other students rarely respond to those questions. So, if the instructor overlooks the students' question, the questions remains unanswered in many cases. To solve the 2nd problem of IS-Board, IS-BoardII automatically sends a message which stimulates a reply to other students when nobody responds to the question during a fixed period (Fig.8). We expect that anybody might reply to the unanswered question if he/she notices the message.

Figure 8: Function to send a message to unanswered questions

Moreover, IS-BoardII has the function to retrieve information related to the unanswered question by using the following "Automatic-Answering-Rule".
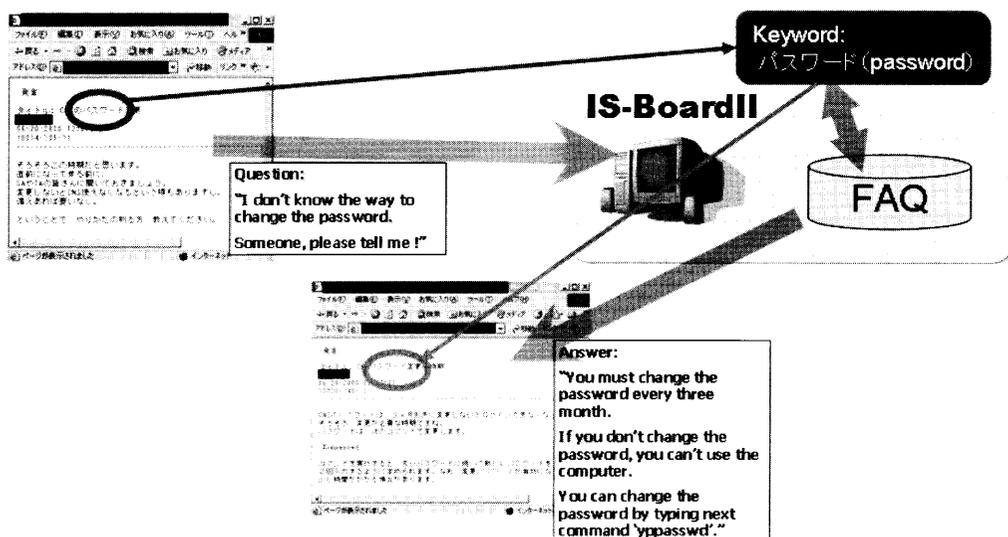

Figure 9: Automatic-Answering-Rule

- *Automatic-Answering-Rule*
  - Step1:
    IS-BoardII extracts some keywords from the student's question. The keyword is noun which is related to the lecture contents or contains both in the messages and the title of the question.
  - Step2:
    Then our system retrieves the candidates of the answer which include the keywords extracted at Step1 from reusable information database.

When a student asks his/her question on IS-BoardII, our system retrieves the candidates of the answer from reusable information database, which might not be the direct answer for the question, but is related to it, by using "Automatic-Answering-Rule" and provides them to the student (shown in Fig.9).

4.3   Interface to revise FAQ

Our system needs to have the function to summarize reusable information so that students can use them more easily (the function to solve the 3rd problem of IS-Board). But it is very difficult to summarize Japanese sentences automatically. So we provide to an instructor the interface to revise FAQ easily. The interface to revise FAQ is shown in Fig.10. By operating this interface, an instructor can revise the title, the contents and the keywords of reusable information easily and reduce his/her load. Consequently, students can use summarized reusable information as FAQ more frequently.
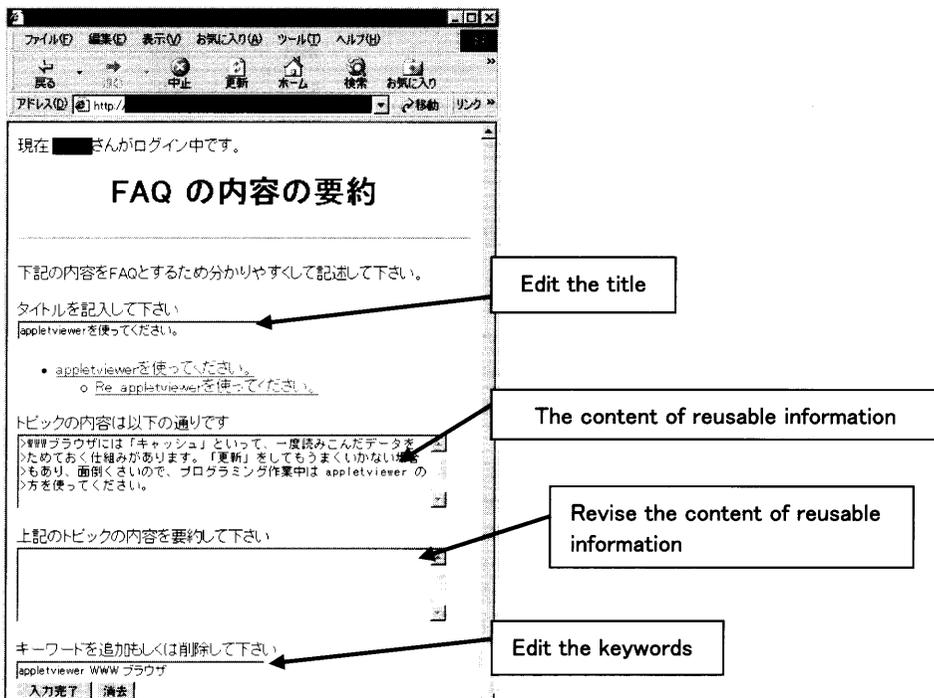

Figure 10: Function to revise reusable information

5   Evaluation of IS-BoardII

To show the effectiveness of IS-BoardII, we carried out following two evaluation experiments.

- *Evaluation of the function to prevent students from overlooking important information*
- *Evaluation of the Automatic-Answering-Rule*

5.1   Evaluation of the function to prevent students from overlooking important information

To evaluate the effectiveness of the function to prevent students from overlooking important information, we managed IS-BoardII in two classes of the information literacy education (each class had about 73 students) during three months. After three months, there were 581 utterances, 493 topics on average on IS-BoardII. There were 7 topics of useful information on average. Students logoned to IS-BoardII 10.5 times on average.

We compared the results of IS-BoardII with those of IS-Board[2] to evaluate the function to emphasize interesting utterances for students.

The results are shown in Table 1 and Table 2. Table 1 shows the number of the utterances, the topics, useful information, access frequency to all topics (per a class) and logon counts (per a student) . Table 2 shows the average access frequency (per a class).

Table 1: Evaluation of interesting utterances for students

	IS-Board	IS-BoardII
Utterances	431	581
Topics	405	493
Useful information	17.5	6.5
Access frequency to all topics	3645	5242
Logon counts	8.5	10.2

Table 2: Average access frequency (per a class)

	IS-Board	IS-BoardII
Access frequency to useful information	1994	701
Average access frequency to useful information	113	107
Access frequency to other topics	1651	4541
Average access frequency to other topics	4.26	9.33

Although in the results of IS-Board, the topics of useful information occupy only about 5% of all topics, the access frequency to useful information amounts to about 50% of all topics. This result means that on IS-Board, students are strongly interested only in useful information and they rarely read other topics except for useful information. On the other hand, there are less topics of useful information in the results of IS-BoardII. Because, although the messages from an instructor are useful information, they are not counted as useful information. The information from an instructor is provided with the login messages (See Fig.7(A)).

The average counts of the access frequency to each topic of useful information are around 110 times on both IS-Board and IS-BoardII. But on IS-BoardII, the access frequency to useful

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[2] We had managed IS-Board in four classes (each class had about 76 students) for three months in 2002, 2003 and analyzed the results (Shinozawa et al., 2004).

information occupies only about 13% of all topics. This result means that students read frequently not only useful information but also the other information.

Next, we evaluate about the students' access to our system. The result shows that by providing important messages from the instructor together with the logon messages, students logon to IS-BoardII more frequently than to IS-Board. Consequently, students did not overlook the messages from the instructor.
These results show the following effectiveness of the function the function to prevent students from overlooking important information.

- IS-BoardII can encourage students to read both useful information and other utterances and prevent students from overlooking important information.
- So, students read frequently not only useful information but also the other information.
- Moreover, IS-BoardII can also encourage students' access to our system.

5.2   Evaluation of the Automatic-Answering-Rule

To evaluate the effectiveness of the "Automatic-Answering-Rule" (the function to reduce the unanswered questions), we applied our rule to the topics of five classes[3] in which our system had been managed in 2000.

Table 3: Evaluation of the Automatic-Answering-Rule

	Class A	Class B	Class C	Class D	Class E
Topics	19	74	222	128	17
Questions	11	27	109	56	4
Extracted reusable information	1	4	13	6	1
Accuracy rate	0/1	2/4	3/13	1/6	1/1

Table 3 shows that the number of the topics, the questions, reusable information related to the question extracted by the "Automatic-Answering-Rule" and the accuracy rate on each class. These results show that our rule can provide reusable information related for about 12% (25/207) of all questions and 25% (7/25) of provided reusable information could be the direct answers. Although these results are not so good, but it was confirmed that our rule could find proper answers which are sufficiently practicable to dissolve some questions. Moreover, we think that our system functions effectively if the number of FAQ increases and reduces instructor's load. From now on, it is necessary to store FAQ and to improve the accuracy rate of our rule by analyzing questions and reusable information.

6   Conclusion

We improved IS-Board and proposed IS-BoardII which has new functions to support the information education class more effectively. IS-BoardII has the following additional functions (1) function to prevent students from overlooking important information, (2) function to reduce the unanswered questions, (3) interface to revise FAQ. We managed our system in two classes of the information literacy education to evaluate the effectiveness of IS-BoardII. The results found by the experiments are as follows.

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[3] These results were also used in Takao et al. (2000).

- IS-BoardII provides useful information and emphasizes interesting utterances from other utterances by counting the interest of students. So, our system can prevent students from overlooking both useful information and interesting utterances.

- IS-BoardII urges students to respond to questions from their friends. Moreover, "Automatic-Answering-Rule" can retrieve proper information from reusable information database. Provided information can often solve students' questions and also reduce the instructor's load.

- IS-BoardII provides the interface which supports the instructor in writing FAQ. By using this interface, the instructor can edit reusable information more easily. Revised reusable information is more easy to use for students as FAQ and to find necessary information.

7   Future Works

These results show that IS-BoardII can solve some of the problems of IS-Board and support to dissolve students' questions in the information education classes more effectively. But we also found out some problems of IS-BoardII. To support the information education further, we need to solve the following future works.

- *Activate communications between students*
- *Improve the Automatic-Answering-Rule*
- *Refine the interface*
- *Manage and evaluate our system further*
- *Analyze the interaction between on-line communication and off-line communication*

Acknowledgements

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