Proposal and Practice of Exchange Learning through Quiz Creation and Peer Review

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Abstract - In this paper, we propose a method of learning that includes interactively reviewing and taking quizzes created by learners of different classes. First, we describe a brief outline of the CollabTest system that we have developed and evaluated. Next, we describe the proposed method of learning exchange between classes, including the details of quiz creation, mutual review, and taking quizzes using the CollabTest system. We discuss the expected effects of the proposed method on learners. In addition, we implement the CollabTest system so that learners can study using the proposed learning method. A trial study was conducted in the semester beginning in April 2009, and as a result of these experiments, we determined the requirements and effectiveness of learning through collaboratively creating and taking quizzes created by learners in different classes.

Keywords: Exchange Learning, Problem Posing, Quiz Creation, Peer Review, Online Test.

1 INTRODUCTION

We studied a web-based learning system named "CollabTest" that enables learners to acquire knowledge by creating quizzes and sharing them with peers [1, 2]. The learning procedure when using CollabTest is as follows.

I. Learners in a class create multiple-choice quizzes with explanations of the content.
II. They review the quizzes collaboratively in a group.
III. They submit the quizzes to their teacher.
IV. Learners take student- or teacher-created quizzes to confirm their comprehension levels.

We have developed the CollabTest system to enable students to perform the above-mentioned tasks on the Web. Moreover, we have continually used this system since 2002 at schools of various levels, including a university, high school, elementary school, and vocational training school. In 2003, we developed a point system in which students can earn points by performing tasks such as submitting a quiz or posting a comment. Furthermore, we allowed learners to compete among individuals or among groups via a point-ranking function. We have used this system in a total of 104 classes over 6 years. As a result, 5083 learners have used the system, 14456 quizzes have been created by learners, and 40652 comments have been posted by learners. These results show that CollabTest can help resolve issues such as the lack of e-Learning materials and the lack of student-student and teacher-student interactions.

Exchange learning, which involves exchanging information between regional schools via the Internet and a video conference system, has been actively studied at junior high and elementary schools in recent years [3-9]. However, practical studies of exchange learning through quiz creation and peer review have not yet been reported. In addition, practical studies of question-posing and peer-assessment via web-based systems that facilitate learning between classes have not been reported in related studies on learning systems [10-13]. Exchange learning using a system such as CollabTest requires neither preparation of learning materials nor scheduling, as is the case when using a video conference system, as the environment of CollabTest is asynchronous. Thus, we can expect that exchange learning between classes can be conducted more easily than other methods of exchange learning. Moreover, we expect to observe considerable effects due to communicating between classes in addition to those of CollabTest [1, 2].

For these reasons, CollabTest is thought to be an effective system for exchange learning; however, we have used it only in a closed environment, for example, at a particular university. We have considered expanding the usage environment of CollabTest to include an open environment such as the World Wide Web where various learners could participate. With this in mind we apply CollabTest to exchange learning in order to expand its versatility and create new value. In this paper, we consider learning methods for exchange learning using CollabTest and their effects. We then clarify the functionality that is necessary for exchange learning and report the results of using one learning methods that we considered[1].

2 COLLABTEST

We have developed CollabTest as a Web application using JSP (Java Server Pages) and Java servlets. The system provides a group management function that can divide students into groups, a quiz entry function that is used by not only teachers but also learners, and an online test function that can deliver tests based on the quizzes created by the students and teachers [1]. A noteworthy feature of this system is the collaborative environment for quiz

[1] The work reported in the paper was supported in part by Grant-in-Aid for Young Scientists (Start-up) (No.20800055) and Grant-in-Aid for Scientific Research (B) (No.21300315) from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

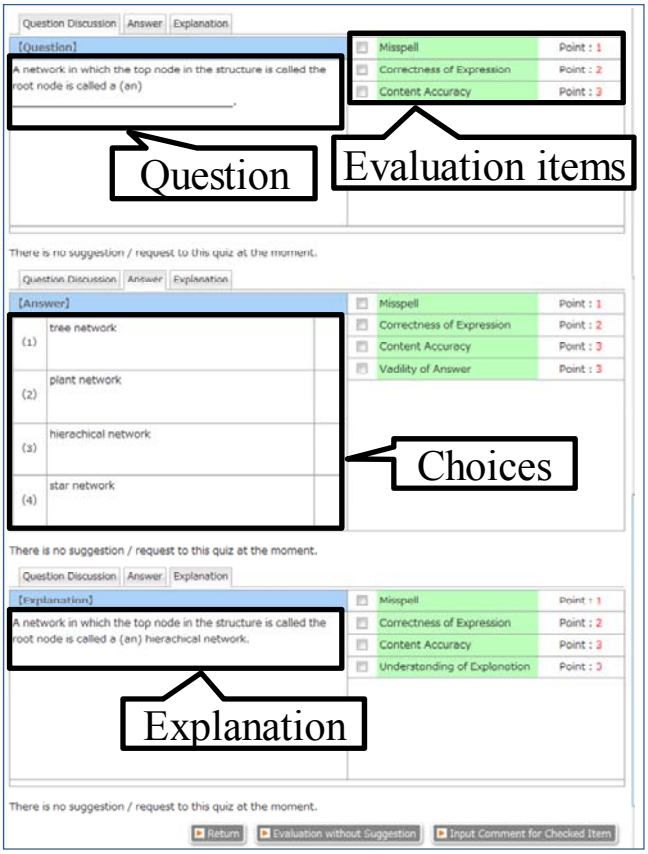

Figure 1: Review page for a quiz.

creation [14]. The environment provides a peer-review function that shares a learner's quiz with their group and allows group members to interactively assess the quiz. As shown in Figure 1, learners can assess quizzes created by group members according to review items displayed in the system. In addition to these functions, it provides a point system in which learners accumulate points through the use of the system, as well as a point-ranking function that allows competition between individual learners or groups [2].

3 EXCHANGE LEARNING USING COLLABTEST

3.1 CollabTest and Exchange Learning

Many case studies on exchange learning have been reported in recent years. Although the learning methods and contents of learning reported in these case studies were different, common points were reported regarding the information exchanged between classes. Based on these common points, exchange learning between classes is defined here as a learning method that involves sharing the knowledge of learners in different classes and exchanging comments or feedback on their respective knowledge. Since the classes are different, the learners gain access to different teachers, schools, cultures, and grade levels, as well as the different specialties, knowledge, and experiences of their peers. In CollabTest, sharing knowledge between classes occurs when taking quizzes and the exchange of information occurs when posting of comments on quizzes. In the

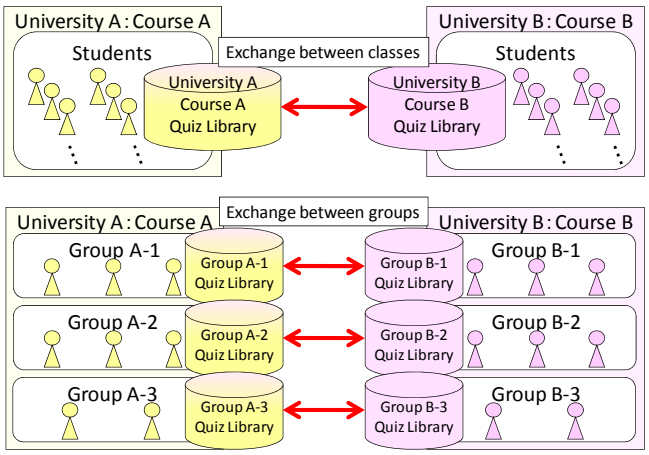

Figure 2: Methods for combining learners.

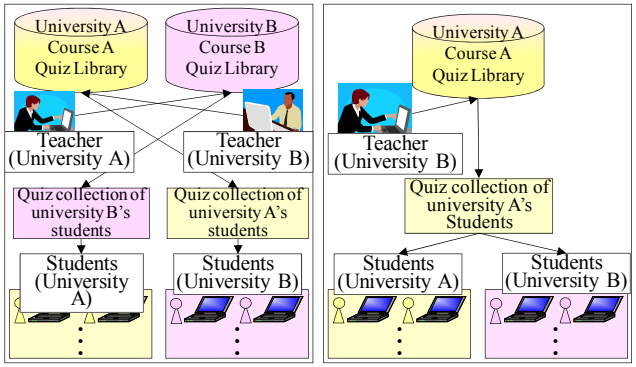

Figure 3: Method for creating a test.

following, learning is classified into two steps: evaluating quizzes interactively and taking the quizzes. Then, an example of an implementation of this learning method and the expected effects of the exchange using this system are described.

3.2 Exchange Method

(1) Learning exchange through Peer review

In one peer-review activity of CollabTest, a learner shares his/her quizzes with members of the same group. If the learners share quizzes with learners in a different class, they can share not only knowledge but also exchange comments on their quizzes.

As shown in Figure 2, we considered two methods of learning exchange through the peer review. The first method is an exchange between classes. The second method is an exchange between groups. In the case of reviewing interactively with other classes, learners can browse all quizzes created in the other class. As a result, a learner who is interested in the quizzes created in the other class has considerable opportunities for learning exchange. However, there is a possibility that an unmotivated learner who is not interested in the quizzes will not participate fully, especially if there are a large number of quizzes and the learner does not understand what should be done.

In the case of reviewing interactively between groups, a learner who is not interested in the quizzes can likely begin to learn more easily since the number of quizzes that they can browse is limited, thus making the material more

Table 1: Examples of differing class attributes.

No	Difference of class attribute (-: same, ✓: different)					Example
	Learners	Teacher	School	Grade or amount of knowledge	Specialty	
1	✓	-	-	-	-	● Exchange between classes that have the same course name and the same teacher at the same university.
2	✓	✓	-	-	-	● Exchange between classes that have the same course name and different teachers at the same university.
3	✓	✓	✓	-	-	● Exchange between classes at different universities that have the same or similar course names.
4	✓	✓	-	✓	-	● Exchange between fifth graders and sixth graders.
5	✓	✓	✓	✓	-	● Exchange between elementary school students and junior high school students. ● Exchange between junior high school students and high school students. ● Exchange between high school students and undergraduate students. ● Exchange between undergraduate students and graduate students.
6	✓	✓	- or ✓	✓	✓	● Exchange between economics class for students specializing in economics and economics class for students specializing in other fields.

accessible. On the other hand, a motivated learner will likely feel that the material is not sufficiently challenging. For these reasons, it is necessary to develop a function that enables learners to choose whether to learn between classes or groups depending on the number of learners, their motivation, and the particular circumstances of the classes.

(2) Exchange through Taking Online Tests

In online tests, learners take quizzes created by peers in the same class, quizzes created by past classes, and quizzes created by the teacher. Learners can post comments such as their questions about and impression of each quiz using the online test function of our system. If the learner takes an online quiz created a different class, the learners can mutually share knowledge and have the opportunity to post comments on the quiz after its completion.

As shown in Figure 3, we considered two methods of using quizzes created by learners in different classes. In the first method (left of Figure 3), the teacher composes the test by selecting questions from quizzes created by learners. In the second method (right of Figure 3), the teacher composes a test using quizzes created in his/her class and shares it with the other class. In the first method, the teacher can use the quizzes that he/she wants to use, although this requires a commitment of time from the teacher. In the second method, the teacher can administer the test without using a large amount of time for test preparation. However, a teacher should be able to confirm and edit the test contents before administering it to the learners as there is the possibility of including quizzes at an inappropriate level or containing inappropriate content for the class.

3.3 Expected Effects

In exchange learning using CollabTest, quizzes created by learners on the course content are used as learning materials. For this reason, different classes with similar course content can learn in collaboration. Moreover, a video conference system has been used to exchange comments in the related study on exchange learning. However, for this system, learners use a BBS (Bulletin Board System) in order to exchange comments, thereby it is not necessary to adjust the course schedules of the classes and the learning exchange can be implemented easily.

The expected effects of learning interactively between classes using CollabTest will be affected by the attributes of the classes participating in the learning exchange. These attributes include the teacher, school, and grade level, as well as the specialties, knowledge, and experiences of the learners. Table 1 shows an example of differing class attributes. The common effects of using CollabTest are expected to be as follows.

- The learners will participate in a class more actively as a result of their awareness of learners in the other class.
- The motivation for the class will improve as a result of taking quizzes created by the other class and receiving comments from learners of the other class.
- Communication skill will improve as a result of exchanging information with learners with whom they are not acquainted.

As class attributes become increasingly different, these effects are expected to become larger. Moreover, we expect that the more comments the learners exchange, the larger these effects will become. We expect the following effects when there is a difference in the grade level or amount of knowledge between classes participating in the exchange learning (Table 1, No. 4–6).

- The learners in the lower grades will be able to receive more advanced and specialized comments and suggestions.
- The learners in the higher grades or with the higher amount of knowledge will be able to improve their explanatory and descriptive skills since they must post

easy-to-understand comments for learners with incomplete understanding of the learning contents.

4 FUNCTION ENHANCEMENT

It was necessary to develop new functions to enable mutual learning between classes using CollabTest. We considered the following to be necessary functions.

- Registering courses to initiate the exchange learning.
- Reviewing quizzes interactively between classes.
- Delivering quizzes interactively between classes.

For this study, we developed the first two functions list above.

4.1 Administrative Functions for Exchange Learning

The administrative functions for the exchange learning system are provided by an administrator or teacher mode. Figure 4 shows the user interface of the function to register courses. An administrator or teacher can access the function after logging on and accessing a course page. This page displays a list of the courses that start in the same semester as the accessed course. The list displays categories describing the course content and course information such as the course name and the teacher's name. The category items correspond to the scope and learning units of quizzes. Learners consult this list when they create a quiz [2]. In CollabTest, learners must select a category item registered by their teacher when they create a quiz. Consulting this list provides the administrator or teacher with an outline of each course.

When the teacher or administrator clicks the registration button displayed next to the course information, he/she can access the initializing page where he/she can set up the start and end dates of the exchange learning. Figure 5 shows the user interface of the initializing page for exchange learning. On this page, after the teacher or administrator sets up the start and end date of the learning, he/she selects the category items that can be accessed mutually during peer review between classes from the above-mentioned category list. Learners learn collaboratively through the peer-review system using the quizzes registered in the selected category items.

4.2 Peer-review Function for Exchange Learning

We developed a function, referred to as the "interspace management function", in order to bring together learners in different classes. We developed the interspace as a space to assess quizzes between groups in different classes. Figure 6 shows the interspace management function provided in administrator or teacher mode. The left side of Figure 6 displays groups that are not assigned to the interspace among the groups that the teacher registered in the course. The right side of Figure 6 displays the groups that are being assigned to each interspace. We can assign more than one group to an interspace. Each teacher assigns groups from his/her course to any of the interspaces. If the teacher

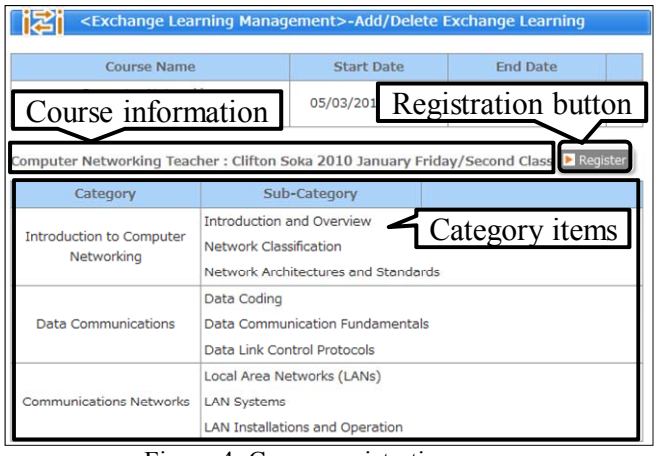

Figure 4: Course registration page.

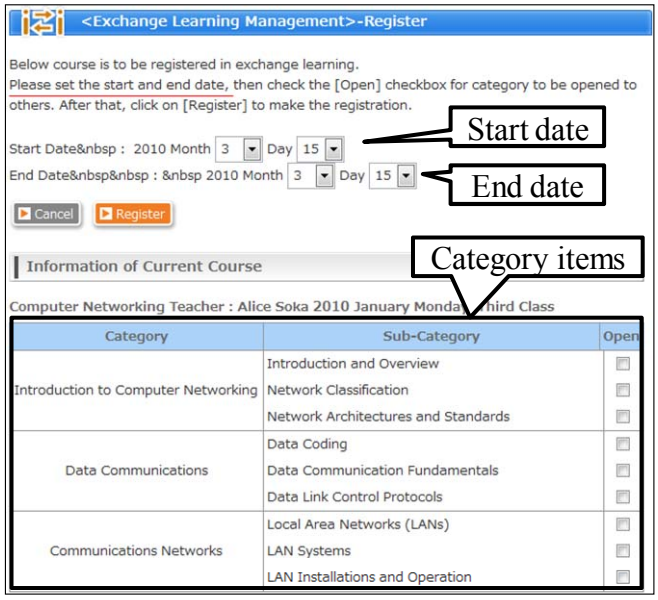

Figure 5: Initializing page for the exchange learning.

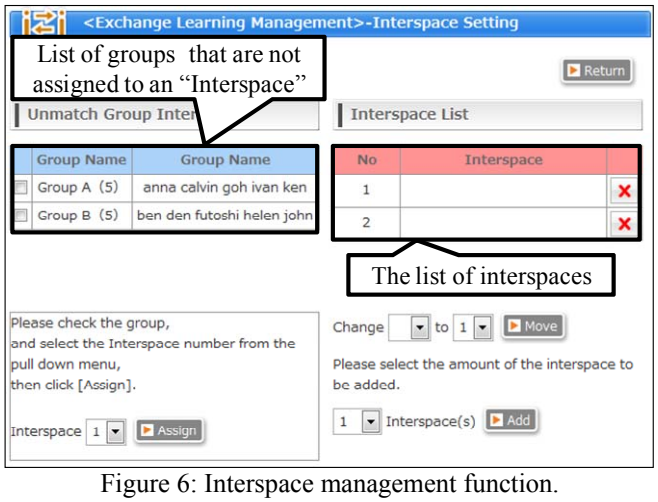

Figure 6: Interspace management function.

assigns all groups to same interspace, the learners can learn between classes as shown in Figure 2. When the teacher assigns each group to separate interspaces, the learners can access quizzes created by members of the group assigned to the same interspace and post comments on the quizzes. Figure 7 shows a function for displaying the list of quizzes

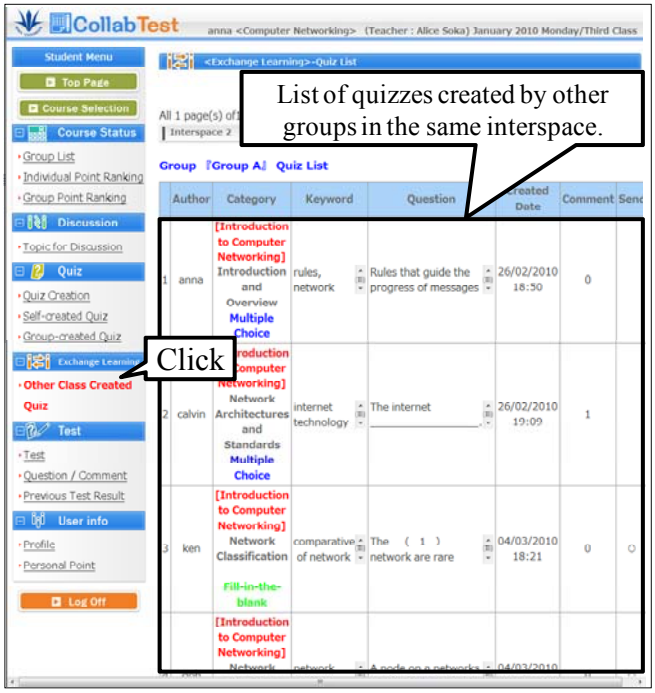

Figure 7: Function for displaying quizzes created by other class.

created by other groups assigned to the same interspace.

5 EXPERIMENTS

5.1 Overview of Experiments

We conducted two experiments in the beginning in April 2009 in order to investigate the effects of exchange learning between classes using CollabTest. Experiment 1 was conducted for two class of the same course, Programming Practice 1, which was taught by two different teachers at Soka University. In addition, Experiment 2 was conducted for two similar courses, Introduction to Computer Networks, which were taught by two different teachers at Soka University and Aichi Prefectural University. Table 2 shows an overview of these courses.

Programming Practice 1 (referred to as Prog. 1 and Prog. 2) is a beginners' class for the C programming language, and Prog. 1 and Prog. 2 (see Table 2) used the same textbook. Experiment 1 corresponds to No. 2 shown in Table 1. Introduction of Computer Networks (referred to as Network 1 and Network 2) is a course on topics such as the history of the Internet, OSI reference models, and TCP/IP. In addition, Network 1 and Network 2 (see Table 2) used the same textbook. Experiment 2 corresponds to No. 3 shown in Table 1. All teachers taught class for 90 minutes once a week.

In the first half of the semester, each teacher used CollabTest only in their class as it has been used in the past. Then, CollabTest was used for exchange learning between classes in the second half of the semester. In Experiment 1, there were two opportunities for exchange through peer review and taking quizzes, as described in Section 3.2. In the exchange through peer review, we assigned all groups to

Table 2: Course overviews.

No	Course ID	University	The number of Students	Experimental Period
1	Prog. 1	Soka University	46	2 months
	Prog. 2	Soka University	49	
2	Network 1	Soka University	102	2 weeks
	Network 2	Aichi Prefectural University	9	

Table 3: Results of exchange through peer review.

Course ID	Quizzes (*1)	Comments	Students-1 (*2)	Students-2 (*3)
Porg. 1	49	7	3	21
Prog. 2	61	33	2	4

*1: Number of shared quizzes
*2: Number of students that posted comments
*3: Number of students that received comments

Table 4: Results of exchange through taking online tests.

Course ID	Quizzes (*1)	Students-3 (*2)	Frequency (*3)		Comments
			Average	SD	
Prog-1	12	27 (58.7%)	1.4	1.4	0
Prog-2	9	25 (51.0%)	1.6	2.0	0
Network-1	7	61 (59.8%)	1.4	1.3	4
Network-2	10	5 (55.6%)	1.2	1.2	0

*1: Number of quizzes included in the online test
*2: Number of students that took the test
*3: Frequency at which students took the online test

one interspace, thereby all learners were able to access all quizzes created by the two classes. In the Experiment 2, we conducted the exchange only through taking online tests since the experimental period was short and there was a large difference in the number of students in each class.

5.2 Result of System Usage

Table 3 shows the results of exchange through peer review. Students taking Prog. 1 created 49 quizzes that were shared with students taking Prog. 2, and 61 quizzes were created by students taking Prog. 2, which were shared with students in Prog. 1. However, there were only two or three students who posted comments about quizzes created by students of the other class. Moreover, 4 out of 7 comments posted in Prog. 1 and 26 out of 33 comments posted in Prog. 2 were posted after the last class.

Table 4 shows the result for learning between classes through taking an online test. From this result we confirmed that more than half the students in each course had taken the quizzes created by learners in the other class. On the other hand, in Network 1, only four comments were posted after taking the online tests. In the other classes, there were no

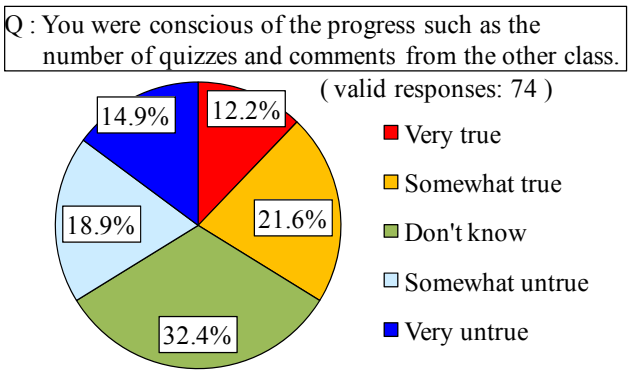

Figure 8: Results of questionnaire 1 (Experiment 1).

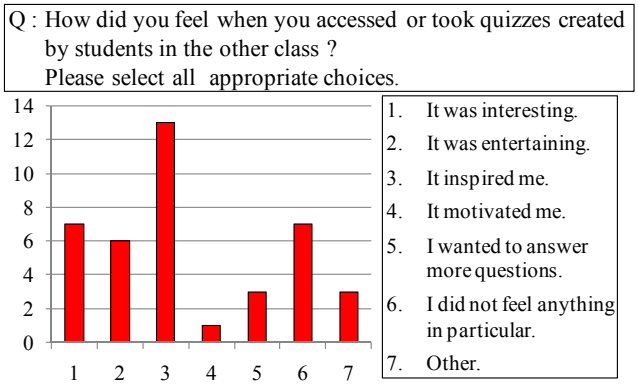

Figure 9: Results of questionnaire 2 (Experiment 1).

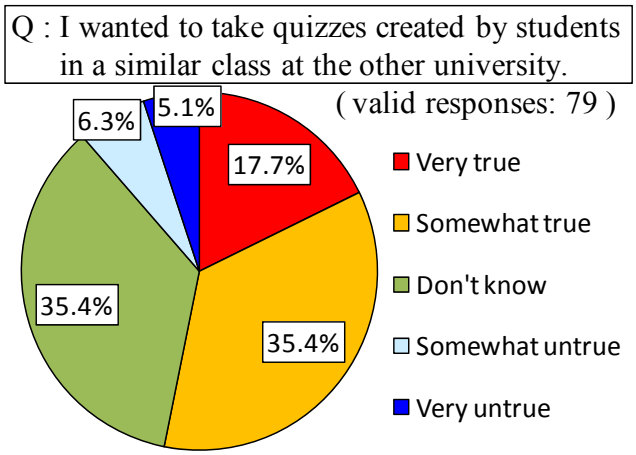

Figure 10: Results of questionnaire 3 (Experiment 1).

comments. These results show that the learners shared only their knowledge not their opinions in these experiments. This result may be due to not having sufficient time to take and assess the quizzes created by the other class during class time.

5.3 Questionnaire

(1) Experiment 1

Figures 8-10 show the results of a questionnaire given to students of Prog. 1 and Prog. 2. As shown in Figure 8, only 34% of students responded that they had been conscious of the progress of the exchange, such as the number of quizzes created and comments posted by other class. In Experiment

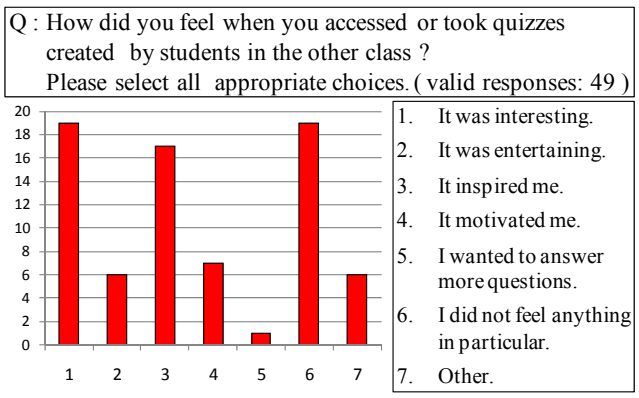

Figure 11: Questionnaire result-4 (Experiment-2).

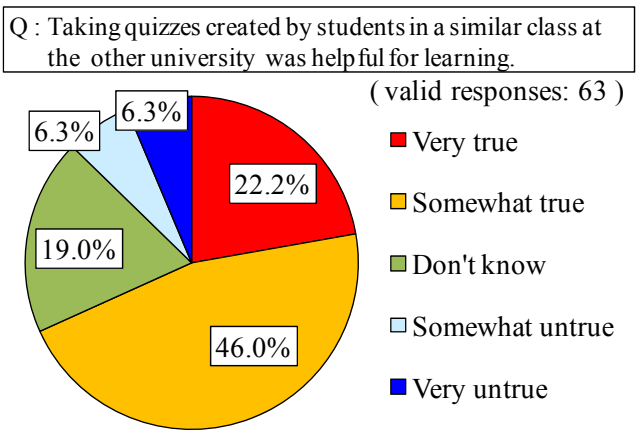

Figure 12: Results of questionnaire 5 (Experiment 2).

1, there was little opportunity to be conscious of learners in the other class since the few opinions were exchanged between the classes. It is possible that the results shown in Figure 8 are attributable to this. Figure 9 shows the results for a questionnaire given to students who had accessed or taken the quizzes created by students in the other class. As a result, 46.4% of students responded that they had been inspired by accessing or taking the quizzes. In the results of the questionnaire shown in Figure 10, more than half of the students responded that they wanted to take quizzes created by students in a similar class at another university. From these results, we confirmed the requirements for learning through mutually taking quizzes that were shared between universities for students in a related class.

(2) Experiment 2

Figures 11-12 show the results of questionnaires given to students who took Network 1 and Network 2. The questionnaire in Figure 11 was given to students who had accessed or taken the quizzes created by students in the other class. Many students responded that they had been inspired by accessing or taking the quizzes. On the other hand, there were also many students who had responded that they had not felt anything in particular when they had accessed or took the quizzes. In the result of questionnaire shown in Figure 12, 65.5% of students responded that taking the quizzes had been helpful for learning. From these results, we confirmed the effectiveness of learning through mutually taking the quizzes created by students taking similar classes at different universities.

6 CONCLUSIONS

In this study, we proposed a method of learning through mutually assessing and taking quizzes created by learners in different classes. Moreover, we defined exchange learning between classes as follows.

- Learning through sharing knowledge with learners in a different class.
- Learning through mutually exchanging opinions about their knowledge.

Furthermore, we considered a method of exchange that included peer review and a method of exchange that included taking online tests. In addition, we evaluated the effects of these methods.

In experiments conducted at two universities, more than half of the students took quizzes created by students in the other class, and knowledge was shared between classes. In the results of questionnaires, we confirmed the requirements and effectiveness of learning through mutually taking quizzes created by learners in different classes, although only 34% of students responded that they had been conscious of the progress of other class. However, there were only two or three students who exchanged comments between classes. Unless students post comments actively during peer review or after taking online test, they will not be able to achieve the expected effects described in 3.3.

Therefore, in the future, a comprehensive evaluation of the experimentation environment and manner of operation will be needed to ensure the active exchange of views between classes. For example, we will clarify the purpose or intention of the exchange learning in each class, and we will provide time to post comments and take the quizzes created by the other class during class time. If we can make them actively exchange comments between classes, we are going to evaluate how much the system can achieve the effects.

In addition, we will verify the utility of proposed methods by repeating the experiment on various cases in the future. We currently plan to conduct exchange learning between a university in Japan and a university in the United States as well as between classes with attributes other than No. 2 and No. 3 shown in Table 1.

ACKNOWLEDGMENTS

We would like to express our deepest gratitude to Prof. T. Ideguchi, Prof. S. Sakabe, Prof. Y. Sekiguchi, Associate Prof. X. Tian, and the students of Soka University and Aichi Prefectural University.

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(Received August 29, 2009)
(Revised June 23, 2010)

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