

On Class Design Using Multi-Mouse Quiz by Elementary Schoolteachers

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Abstract. Multi-Mouse Quiz System consisting of Multi Mouse Quiz (MMQ) and MMQEditor is an application set to treat quizzes in a classroom. The MMQ is an application of Single Display Groupware (SDG) which enables multiple users to answer quizzes by connecting several mice to an ordinary personal computer (PC). The MMQEditor is a PC application designed to edit quizzes for MMQ. The authors have asked several elementary schoolteachers to use the MMQ system and observe the class activities. The class practices show that the schoolteachers designed various class activities and quiz content along with the context of their school and class. This paper reports these practices from viewpoints of class design, their effectiveness and problems. We also discuss importance of collaboration among schoolteachers who design and practice class, and researchers who develop the system and analyze the class activities learnt through this study.

Keywords: Face-to-face collaborative learning, Quiz, Single Display Groupware, Elementary school, class design.

1 Introduction

Elementary education, as the formative education in the compulsory education, has special roles in teaching rudimentary knowledge and developing good study habits. Children in this period have characteristics that they prefer to pay attention only to what they are interested in. There are several studies designing practices of attracting children's attention through the collaborative learning or quiz study[1]. Many teachers also encourage children's motivation using Information and Communication Technology (ICT) environments. Nowadays, in Japan, the number of computers introduced to elementary schools has reached at one computer per 6.6 children, and 72.5% elementary school has at least one electronic blackboard (large LCD display) in the every classroom[2].

The authors focus on the collaborative learning using ICT environment, and Single Display Groupware (SDG) proposed by Stewart[3] as a candidate technology to support collaborative learning in classroom. SDG is a CSCW/CSCL

environment in which multiple users have control of a computer by using multiple input devices such as mice sharing information on a single display. Since SDG shows all of the mouse cursors on the screen, the users can see the others' behavior. This feature encourages communication among users[4]. Further, SDG can be implemented on an ordinary PC only with software and several mice connected to it. It is a big advantage in practical use in elementary schools because their budget and human resources for ICT are quite limited.

As a concreted application of SDG, the authors have developed Multi-Mouse Quiz (MMQ), a quiz software that can ask quizzes to several users simultaneously. We asked several elementary school in Kyoto, Japan to use the MMQ in their classes, discussed class design with schoolteachers, and observed the class practices. In these practices, the schoolteachers designed various class activities and quiz content along with the course subjects and other context of their school and class. In this paper, these class practices are reported and discusses them from a viewpoint of class design, their effectiveness and problems. We also discuss importance of collaboration among schoolteachers who design and practice class, and researchers who develop the system and analyze the class activities learnt through this study.

This paper is organized as follows: After introduction of this section, Section 2 gives overview of related work. Multi-Mouse Quiz System is explained in Section 3. Class practices in several elementary schools are stated in Section 4. In Section 5, these class practices are discussed from a viewpoint of class design. Section 6 gives conclusion of this paper.

2 Related Work

The Single Display Groupware (SDG) model[3] proposed by Stewart refers to systems with which each of collocating users uses an input device such as mouse sharing information shown in a display. It is shown that SDG encourage communication among collocating users[5]. The SDGtoolkit is a middle ware for Windows that provides multi-user interaction environment through multiple mice and keyboards handled independently[6]. Similar middle ware is also provided by Microsoft as Mouse Mischief based on the research for education in developing country[7]. The authors interested in SDG as tool to support collaborative learning in classroom, and studied it by developing several applications[8],[9]. Multi-Mouse Quiz (MMQ) is one of such applications.

In this paper, we report two practices of using MMQ for teaching arithmetic. There are many practices that studying mathematics through game playing on computer[10][11]. Hennessy pointed that it is helpful to children's learning objectives when teachers were developing and trialing new strategies specifically for mediating ICT supported learning[12]. Also study with quizzes provides students an opportunity to self-assess their current level of knowledge. It also provides feedback, helping students determine how to adjust their behavior to ensure acquisition of the missing knowledge. Study by quiz was wildly used with a variety of methods, such as amuse children to maintain the attention as well as to encourage the enthusiasm to learn. Pollard, J.K. used a Web-based Quiz to let

student to reflect their studies[13]. Recently, mainly in university, Clickers are often used to pose quiz in classes which encourage students' engagement.

3 Multi-Mouse Quiz System

The Multi-Mouse Quiz system is an application for treating quizzes in a classroom or other learning environment. The system consists of the Multi Mouse Quiz (MMQ), a quiz application of SDG and MMQEditor, an ordinary PC application for editing quizzes for MMQ. Figure. 1 and Figure. 2 show the screenshots of MMQ and MMQEditor.



Fig. 1. Interface of MMQ[14]

MMQ is implemented with the SDG Toolkit[6] and can be used on a Windows PC by connecting several mice to it. Currently, up to four players can answer quizzes simultaneously. In screen (a) of Figure.1, the teacher can choose the question file and other options such as number and asking order of quizzes to show, and on-off of sound. In (b), any user can start quiz by clicking the start button. In (c), users choose their own color to make registration of quiz session.



Fig. 2. Interface of MMQEditor[14]

Table 1. Class Practices using MMQ System

No.	School	Grade	Subject	Class Size
1	H	5 th	Social Study	28
2	S	6 th	Social Study	32
3	F	6 th	General Study	25, 27 (two classes)
4	T	6 th	Arithmetic	27
5	N	4 th	Arithmetic	4

Screen (d) is a screen of asking quiz where users answer the quiz by clicking an alternative within a prescribed time limit. Screen (e) shows the correct answer and commentary of the asked quiz. After answering all of the quizzes, the total score for all users is shown in (f), and the system goes back to screen (a).

MMQEditor is a quiz editor for MMQ. With this editor, users can edit quiz questions, choices, explanation and other options for MMQ. To make operation easy to understand, we designed the user interface of MMQEditor as close to MMQ as possible.

4 Studies of Using MMQ System

With assistance of the Kyoto Municipal Board of Education, we carried out five practices using MMQ System in public elementary schools in Kyoto, Japan. Table. 1 shows the list of practices. Class subjects were social studies (such as geography and history), arithmetic, and Sogo-Gakushu (general learning), and they were held in four to six grade classes.

We have reported practices No.1[15], No.2[16], No.3[17] and brief summary of them are given below. As for practices No.4 and No.5, we explain more in detail. In this paper, there are two class design with social studies, two class design

with mathematics studies, and one class design with 'Sogo- Gakushu'(general learning).

4.1 Practice in H Elementary School

In H elementary school, MMQ was used for a 5th grade class of 28 children in 'social studies'. Since two electronic blackboards were available, we used two sets of MMQ totally having 8 mice for the class. Three or four children shared one mouse as a group.

The teacher designed the class activity using MMQ aiming at enhancement of children's writing ability through discussion in group. Quiz content were created by the teacher. In the beginning, rather easy quizzes were posed so as to make children have confidence in answering, and gradually more difficult quizzes were asked. Finally children had to answer quizzes that require common sense as well as knowledge explicitly learned in classes. He also asked a quiz without choice. Then he handed worksheets to children and ask to have discussion and write descriptive answer. In this practice, children did not only remember the knowledge asked in the quizzes, but they also could write the descriptive answer. The teacher said quality of writing were better than usual.

4.2 Practice in S Elementary School

In S elementary school, MMQ was used for a 6th grade class of 32 children in 'social studies'. One MMQ set was used, and a mouse was shared by a group of 8 children. The teacher tried class management that makes children feel class was fun. Along with this policy and so as to raise concentration of children that share mice in rather larger group, he tried to ask children to make quizzes by themselves. First, after experience of answering quizzes with MMQ, the children were asked to design quizzes and write them on paper. Then the teacher collected and reviewed them before entering them into the MMQ system. Finally the children answered the quizzes made by them with MMQ. In answering quizzes they made, the children were more concentrated on the contents of quizzes keeping high motivation compared with answering quizzes made by the teacher.

4.3 Practice in F Elementary School

In F elementary school, MMQ was used for two classes of 6th grade having 25 and 27 children, in 'Sogo-Gakushu' (general learning). In this course, children studies historic places of learnt materials such as books, and later they visit the actual places. The activities were held in a computer room of the school. MMQ was used to show what they learnt to other children. Each class spent three class time of 45 minutes. First, they created quizzes personally with MMQEditor, and combined quizzes into one files in group of 3 or 4 children. Then, use MMQ they tried to answer quizzes created by other groups.

In this practice, children successfully created quiz questions with MMQEditor without special assistance of the researchers. Even children of low scholastic

ability could make at least one question. In the activity of answering quizzes with MMQ, we observed that the children not only answered the quizzes but also carefully read the explanation.

4.4 Practice in T Elementary School

In T elementary school, MMQ was used for a 6th grade class of 27 children in arithmetic. We used two MMQ sets of 8 mice in total, and children learnt in 8 group of 3 or 4 children. This class aimed at to solve difficult arithmetic problems through discussion in group as course unit of “Attempt to challenge a variety of issues”. The following are examples of the asked questions:

Question 1: How many kinds of possibility to choose 3 people from 6?
 Choices: A: 20 B: 60 C: 120 D: 18

The activity was held in one class period of 45 minutes. Eight quizzes were asked in the class. For each quiz, first the teacher showed the quiz written in a large sheet of paper on the blackboard, and let one child read it. The each group was asked to discuss how to solve in. Ideas proposed by the group members were written on a white board given to each group. Then, the question screen of MMQ was shown and the groups answered their solutions. After explanation screen was shown on MMQ, the teacher paused the MMQ and let children explain their choice using whiteboard to the whole class.

The teacher evaluated that this was a good practice, and felt the MMQ more affect to the children who didn't like arithmetic. He said that if this lesson was held in a traditional way with printed hand out, children of higher scholastic ability might achieve more, but children of lower scholastic ability children might feel difficult, and give up to work. This class was shown to other teachers in the school, one of the teachers said that he was impressed that children could concentrate in these difficult arithmetic quizzes, and all of the children didn't give up until the time limit.

4.5 Practice in N Elementary School

In N elementary school, the MMQ was used for a 4th grade class of four children in arithmetic. This school area is small, hence the class of the four grade has only a few children. The course unit was “What is the original number?”, it aims to understand the concept of relationship diagram to find the value of a variable from the given condition. An example question is as following:

Question1: I bought six notebooks of a same price. Then I also bought a bottle of juice, it cost me 100 yen. I spent 940 yen in total. So how much is the price of one notebook.

Figure 3 is a sample of the used diagram (translated in English). It shows the relationship of forward and inverse calculation to assist children to decide the asked value. This class held in connected 2 periods of 45 minutes each without break. In the first period, the teacher explained the arithmetic rules to calculate of question 1 as showing above using the relationship diagram. She gave one page

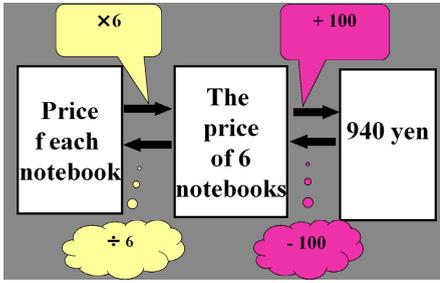


Fig. 3. Diagram

Fig. 4. Quiz on MMQ

handout to each child on which a similar question, say question 2 is printed, and give them a few minutes to let them think about how to calculate. In the 2nd period, the children wrote down the relationship diagram, arithmetic formula, and the solution of question 2. Then, the teacher started up the MMQ let every child has a mouse when they finished writing. The teacher made 5 quizzes about the relationship diagram and one quiz for arithmetic formula which treat question 2 in step-by-step manner. Figure 4 is a translated example of the question on MMQ. As well as asking children to answer in MMQ, the teacher paused the MMQ, not only let children explain the reason of their choice, but she also asked children to explain the reason of the choice they did not chose.

The teacher evaluated operation of MMQEditor was not difficult, and they used MMQ to support their pedagogical research in Arithmetic. She said that the children used the MMQ with the high motivation, because they designed this practice with two class periods, she worried about the engagement of a less able child having difficult moods in the class, but he could concentrate in this practices. Different from other practices of MMQ, we observed each child choose different choices along with their idea, while in other practices, children often follow others choices. On it, the teachers opinion was that the class size was so small, hence children might not be afraid of making mistakes in front of their classmates.

5 Discussion

In this section, we discuss the class activities from “engagement and usability”, “class subjects”, “cobination of activities”, “quiz content”, “facilitation using pause”, and “collaboration among schoolteachers and researchers” various viewpoints relating design of classes.

5.1 Engagement and Usability

In all of the practices, the teachers evaluated effectiveness of the MMQ in encouraging children’s motivation to study in class. One of the teacher mentioned

that all of the children seemed to feel happy to use the computer. Teachers and children could use MMQ without particular difficulty. As for MMQEditor, it also could be used by the teachers not difficulty. Further in F elementary school, 6 grade children could use the MMQEditor by themselves without difficulty. It is also important issue that using MMQ encourage participation of children of lower scholastic ability. Both usage of the computer for interaction and study in group may be the reason of such involvement. It also should be noted that oral communication is encouraged in these practices. This might also the effect of using the MMQ developed as an application of SDG.

5.2 Class Subjects

The teachers used the MMQ for class subjects of the social studies, arithmetic, and periods of general studies. Due to the social studies requires to remember many facts and concepts, it fits to use quiz. In the both practices for arithmetic, the teachers wanted to children could comprehend difficult contents through discussion in a group and encouraging participation using the MMQ. In F elementary school, MMQ is used for the general studies where children learn more actively along with the theme set by the teachers. The children created quiz questions with MMQEditor, and appreciate them mutually with the MMQ.

5.3 Combination of Activities

In the above practices, various activity were combined with answering quizzes with the MMQ. That is, the following activities were combined with the MMQ along with the class subject and teaching aims:

- Group discussion (all the schools)
- Oral explanation of children's ideas (H and N schools)
- Writing descriptive answer (H school)
- Quiz Creation and Mutual Appreciation (S and F schools)

It should also be noted that the teachers select media that fit for the activities. Both the teachers and children use paper as well as the computer. In these activities, quiz creation is interesting because children engaged in learning both in quiz creation phase and quiz appreciation phase. Even in answering quizzes, children concentrate more because the questions were made by their classmates.

5.4 Quiz Content

We found a common strategy from the content created by schoolteachers, that is teachers arrayed the quizzes considering difficulty level from easy ones to difficult ones in the H, N, T school. The teacher designed the quizzes in this order so as to gave children confidence in answering the questions, and gradually attack difficult ones through discussion in group.

5.5 Facilitation Using Pause

The pause function of MMQ were often used by the teachers aiming at control of the progress, giving hints, and combining other activities such as discussion in group, oral answering, and writing on paper or whiteboard.

5.6 Collaboration among Schoolteachers and Researchers

All of these practices, class plans were designed mainly by the teachers. Then, the researchers discussed with the teachers to confirm implementation of their plans, and necessary support in carrying out the classes. Then, if needed we revise the MMQ such as introducing pause function and improvement of stability of the system on computers in the schools. Further, the researchers also recorded the data of these practices using questionnaires, interview, voice, and video. And made analysis of them. We think such continuous interaction and collaboration among schoolteachers and researchers are important for both school teaching and academic research.

6 Conclusion and Future Work

We studied several class practices with the MMQ System to support collaborative learning in multiple elementary schools in Kyoto, Japan. This paper mainly focused on the class design by the teachers in these practices. These practices showed that schoolteachers could use MMQ System without difficulty, and they designed independently along with their educational aims with the MMQ System. Furthermore, the schoolteachers also felt advantages of this system in their classes. For successful use, the researchers took roles of technical support and system revision along with the teachers' class design, and recording and analysis of class practice for evaluation of their design. As a future work, the authors are planning the following:

- To encourage community of schoolteachers by gathering and sharing the cases of class design with the MMQ and quizzes for MMQ.
- To develop other applications of SDG, by exchanging opinions with schoolteachers.

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