Individual Student Support System for Teacher and TAs using Mobile Devices in Exercise Classes

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Abstract: The paper describes a student support system for a teacher and Teaching Assistants (TAs) in order to support individual students effectively and satisfactorily in computer exercise classes. In general, a teacher teaches some classes in universities and several TAs engage in the activities to support students under guidance from a teacher in charge. Introduction of a student support system for a teacher and TAs is essential in order to support all the students effectively and satisfactorily by fewer teaching staff. In this research, we develop a system which visualizes the seat location of the questioner and shares the responses of questions, in order to answer students' questions during the class effectively and satisfactorily. In this paper, we report the proposed student support system and the results of the system evaluation.

Keywords: Computer exercise classes, Mobile devices, Teacher, Student support system, Teaching assistants

1 Introduction

The paper describes a student support system for a teacher and Teaching Assistants (TAs) in order to support individual students effectively and satisfactorily in computer exercise classes. In general, a teacher teaches some classes in universities and several TAs engage in the activities to support students under guidance from teacher in charge.

Introduction of a student support system for a teacher and TAs is essential in order to support all the students effectively and satisfactorily by fewer teaching staff.

In this research, we develop a system which visualizes the seat location of the questioner and shares the responses of questions, in order to answer students' questions during the class effectively and satisfactorily. By using this system, it is expected that a teacher and TAs are able to support individual students effectively and satisfactorily.

Moreover, we develop an user-interface in which students easily ask questions for the exercise. By using this user-interface, it is expected that students are able to ask questions without hesitation.

In this paper, we report the proposed student support system and the results of the system evaluation.

In Section 2, we present some related work about education support systems. In Section 3, we describe main jobs of a teacher and TAs. In Section 4, we describe the proposed individual student support system. In Section 5, we describe the operation and the evaluation of the proposed system. Finally, Section 6 gives concluding remarks and the directions of our future work.

2 Related Work

In [1], the authors developed a system which shares the responses of questions between a teacher and TAs. In [2], the authors developed a system which visualizes the students' progresses of an exercise on tablet PCs.

By using these systems, these authors reported that students who do not have a clear understanding were founded early, and the overall level of understanding in the class was improved. Based on the result of these early researches, we develop a new system for a teacher and TAs in order to support individual students effectively and satisfactorily.

3 Main Jobs of a Teacher and TAs in Exercise Classes

In computer exercise classes (e.g., the programming and the operating system), the main jobs of teachers are as follows:

(1) Make and prepare educational materials for the class.
(2) Take students attendance in the class.
(3) Check students' exercise answers.
(4) Answer students' questions during the class.
(5) Support individual students that have insufficient understanding and have a problem about an exercise during the class.
(6) Give a grade to each student.

TAs mainly do the jobs from (2) to (5) under guidance from a teacher in charge. In particular, the above jobs from (4) to (5) are important for computer exercise classes because each student has different problems and the

feedback about mistakes must be given at the time the mistakes for exercise are made.

In this research, we focus on the jobs of (4) and (5).

The job of (4) means that when a teacher and TAs are asked a question from a student during the class, they answer the question of the student. In this job, a teacher and TAs may be not able to do this job smoothly. This is because there is the potential for an increase of students' questions. The students' questions increase when the instruction for the exercise is unclear or the understanding of students is insufficiency.

The job of (5) means that a teacher and TAs visit each student during the class and if a student has insufficient understanding and has a problem about a exercise, they support the student. In this job, a teacher and TAs are overloaded and may be not able to do this job smoothly.

In this research, we develop a student support system in order to do these above jobs smoothly.

4 Proposed Individual Student Support System

4.1 Functional Requirements

In order to do the jobs of (4) and (5) smoothly, a teacher and TAs need to understand the entire status of questions from questioners (e.g., the content of the questions and the seat location of questioners). If a teacher and TAs are able to gather the entire status of questions from questioners quickly, they visit the questioners quickly and support the questioners smoothly.

Moreover, if a teacher and TAs share the responses of questions from questioners, they can support the questioner smoothly when the asked question is similar to the past question.

From these functional requirements, we develop a student support system which visualizes the seat location of the questioner and shares the responses of questions from questioners.

4.2 Student Support Model

In this section, we show a system function which visualizes the seat location of the questioner and shares the responses of questions from questioners.

The student support model using the proposed individual student support system is shown in Fig.1. A student asks a question through the user-interface for question. Then, the entire status of questions from questioners (e.g., the content of question, the seat location of questioners, the number of questions and the number of TAs which is supporting a student) is visualized on tablet PC of a teacher and TAs.

By using the user-interface (Fig.1 ①), students are able to ask a question without hesitation, compared with asking a question by a show of hands. As a result, a teacher and TAs can support all the students which have insufficient understanding and have a problem about the exercise smoothly.

By providing the entire status to a teacher and TAs using the tablet PC (Fig.1 ②), if the individual support is needed (e.g., the question is endemic question), a teacher or TAs visit and support individual questioners (Fig.1 ③). If the entire support is needed (e.g., the number of similar question is large), teacher gives guidance to all the student (Fig.1 ④). As a result, a teacher and TAs support all the students effectively and satisfactorily by fewer teaching staff.
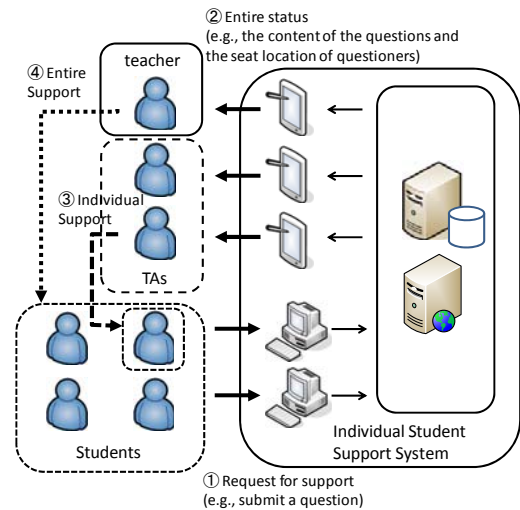

Figure 1 Individual Student Support System

4.3 Processing Flow

The proposed individual student support system is composed of a Web client application for students, a client application for a teacher and TAs and two servers (i.e., Web server and Database (DB) server).

Fig 2 shows a process flow of the proposed system. A student selects a question from the question list and then pushes the submit button (Fig.2 ①). If the question which the student wants to ask is not registered in advance, the student selects other questions (i.e., "etc" on the screen) and pushes the submit button.

The submitted question is sent to the Web and DB servers and is stored in the DB (Fig.2 ②). Then, the question and the seat location of the questioner are sent to the tablet PC of a teacher and TAs. The client application on the tablet PC visualizes the seat location of the questioner with the question (Fig.2 ③).

After the teacher or TA supports the questioner, the responder inputs a response of the question on the tablet PC

(Fig.2 ④). The response of the question is sent to the server and is stored in the DB.
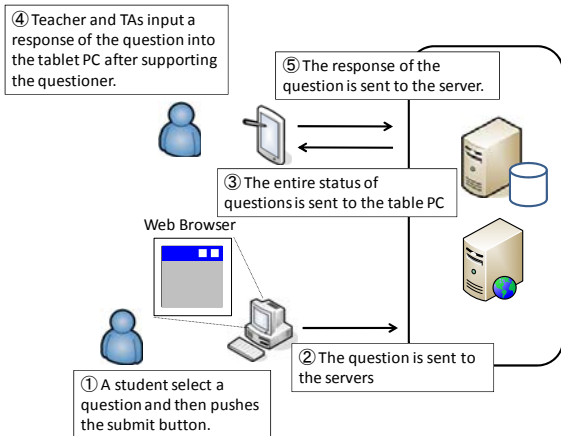

Figure 2 Process Flow

4.4 Client Application for Students

In the proposed system, Web browser is used as a client application to accept a question from a student, because the Web browser is already installed in many computer environments and the educational materials are often constructed as Web contents.

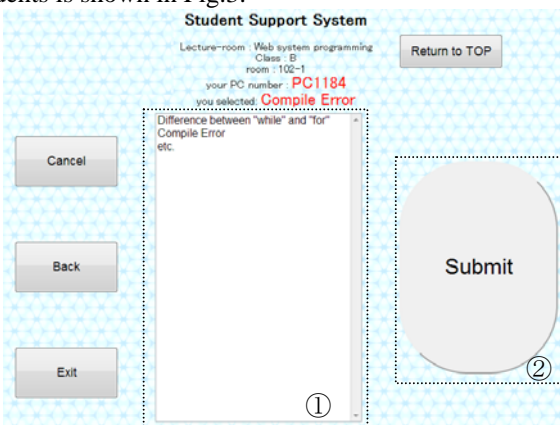Example of the Web browser user-interface (UI) for students is shown in Fig.3.

Figure 3 Web browser UI for students

When a student has a question, the student selects the question which the student wants to ask from the question list (Fig3. ①) and pushes the submit button (Fig3. ②). If the question which the student wants to ask is not registered in advance, the student select "etc" and pushes the submit button. The reasons that the question is listed on the Web browser user-interface are as follows:

(1) The students make their incomprehensible point clear by selecting the question from the question list.

(2) If the number of similar question is large, the teacher can give guidance about the question to all the students.

4.5 Client Application for a Teacher and TAs

In the computer exercise class, we assume that a teacher and TAs have a tablet PC respectively because a teacher and TAs should support a student individually with circulating during classes. By using the tablet PC, a teacher and TAs can view the entire status and input the response of the question after supporting the questioner.

In the proposed system, client application for a teacher and TAs is developed as application for Android tablet PC.

Examples of the user-interface (UI) for a teacher and TAs are shown in Fig.4 and Fig.5.
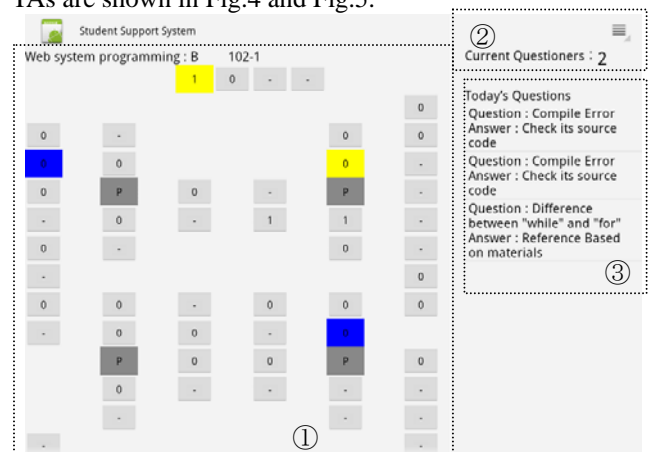

Figure 4 UI for a Teacher and TAs (1)

In the left of Fig.4 (Fig.4 ①), the seating map of the classroom is shown. The seats are displayed as boxes and the boxes of the current questioners are colored in yellow. The boxes of the questioners who is currently being supported are colored in blue. The number shown in the boxes is the number of questions of the questioner. The number of the current questioners is shown in the upper right of Fig.4 (Fig.4 ②).

In the lower right of Fig.4 (Fig.4 ③), the list of the questions and the response is shown. The teacher always checks the list during the class, and if the number of similar question is large within the list, the teacher can give guidance about the question to all the students.

If a teacher or TAs click the seat box in the left of Fig.4 (Fig.4 ①), the screen as shown in Fig.5 is displayed.
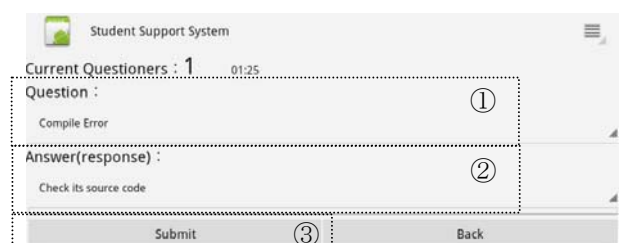

Figure 5 UI for a Teacher and TAs (2)

The question and the response are shown in the upper and lower of Fig.5 (Fig.5 ①, ②) respectively. The responder submits the response of the question after supporting the questioner (Fig.5 ③).

5 Operation and Evaluation

The proposed individual student support system is operated in the three kinds of computer exercise classes held at 2012 first semester in Tokyo University of Information Sciences.

One objective of the proposed system is to prevent the leakage of question and to support as much question as possible. Therefore, we evaluate the number of the supported questions using the proposed system, compared with no using the proposed system.

The average number of supported questions for one class is shown in Table.1.

In the computer exercise class for the first grade, the class is separated into three sub-classes (i.e., Class A, Class B and Class C). the different three teachers use the same educational materials. In one of three sub-classes (i.e., Class A), the proposed system is operated. In the other two sub-classes (i.e., Class B and Class C), the proposed system is not operated.

In the above classes, the influence by the different teachers is not avoided. Therefore, one teacher teaches in the following two classes.

In the computer exercise class for the second grade (i.e., Class A), one teacher uses the original educational materials. In the computer exercise class for the third grade, two teachers use the same educational materials. The class is separated into two sub-classes (i.e., Class A and Class B). To reduce the influence by the difference of teachers, the proposed system is operated every other week in the computer exercise classes for the second and third grade.

From the results of the average number of supported questions for a lesson of one class (Table.1), the average number of supported questions using the proposed system is small except the exercise class for the second grade, compared with no using the proposed system.

The two reasons are considered.

The first reason is that the teacher gives guidance about the question to all the students because the number of similar question is large.

The second reason is that a teacher or TAs forget to input the responses of questions to the tablet PC because a teacher and TAs are overloaded.

Moreover, from the questionnaire, we confirm that there are two types of students. First one is the students who are

willing to ask a question by a show of hands. Second one is the students who are willing to ask a question using the proposed system. Therefore, we need to re-establish the manner of the operation of the proposed system according to requirements of students.

Table 1 The average number of supported questions

Exercise class for the first grade

Use of the proposed system	yes	no
Class A	15.50	
Class B and C		39.06

Exercise class for the second grade

Use of the proposed system	yes	no
Class A	6.40	5.80

Exercise class for the third grade

Use of the proposed system	yes	no
Class A	2	8.33
Class B	3.33	7

6 Conclusion

In this research, we developed a student support system in order to support individual students effectively and satisfactorily. In this paper, we reported the operation and evaluation of the proposed system.

From the results of the evaluation, we confirmed an effect of the proposed system. However, the proposed system needs further modification.

Our future work are as follows :

(1) The improvement of the user-interface (UI) for students, the improvement of the application for a teacher and TAs, and the improvement of the manner of the operation are needed.

(2) Re-examination of the evaluation method including the score of exam is needed.

(3) Combining the proposed system with educational materials is needed in next version to support students more effectively and satisfactorily.

References

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