Web-based Lecture System using Slide Sharing for Questions and Answers in the Classroom

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Abstract: One of today’s hot topics in the field of education is lecture support systems. Learning management systems (LMS) have introduced communication tools such as chat and bulletin boards into the classroom. In this paper, we describe a lecture system that encourages communication by sharing slides that the teacher and students draw with digital ink among them in ensemble learning.

Keywords: lecture system, slide sharing, Ajax, digital-ink

Introduction

Recently, in order to encourage conversation among the teacher and students, communication tools such as chat and bulletin boards have been introduced into lecture systems in the classroom \cite{1}\cite{2}. However, such a system cannot provide a visual explanation, such as by writing figures on a slide, because it conveys questions and answers by text. An interactive communications tool is necessary so that the teacher can proceed with the lecture while responding to students’ questions. Therefore, the lecture system we propose promotes questions and answers by sharing slides in real-time that the teacher and students draw with digital ink among them in the classroom. Although the teacher's drawing was displayed on the students' terminals in the previous work, the new system has a function for displaying a student's drawing also on the teacher's terminal and on other students' terminals. As a result, communication between not only the teacher and the learner but also among the learners can visually assist questions and answers among one another. The function also reduces the workload on the teacher of answering the student. This learning system for sharing slides is suitable for small-scale group study.

1. System Outline

1.1 Slide Sharing and Digital Ink

Figure 1 shows our proposed new system. It consists of an HTTP Server, a database of operations by the teacher and students as well as lists of students, terminals for the teacher and students, and the lecture slides. The system can be used from anywhere through a web browser thanks to interactive web applications. The digital-ink drawing and the switching of slides are executed by asynchronous communication using Ajax (Asynchronous JavaScript + XML). Since the purpose of the study is to promote interaction by sharing slides drawn by the teacher and students, not only the teacher's drawings but also the
students' drawings are displayed on the teacher's terminal and other students' terminals. The slides and the digital-ink data drawn by the teacher and students are simultaneously displayed on the PC. If the teacher switches a slide, the new slide is also displayed on the students' terminals. According to the configuration, students can also change the slide freely.

Figure 2 shows an example of the screen of the system. The system offers slide sharing with digital-ink to enable questions and answers to be made visually. The teacher and students can draw freely on the slide with two kinds of line (free hand and straight line), as the students write in their textbooks and materials during the lecture. It is also possible to change the color and thickness of the lines. The system manages the digital-ink data that the teacher and students draw with each layer. Therefore, the teacher and students can display the digital-ink data drawn by other students by switching the layer and slide freely. For example, the teacher and students' name list and check boxes are displayed in "layer selector" of Figure 2. Upon selecting a certain student's check box, that student's drawing is displayed on one's own terminal. As a result, participants can confirm and understand the series of questions and answers mutually.

### 1.2 Sticky and Chat

The system has a function to attach sticky notes on the slide because students usually attach such notes on important parts of their textbooks and materials. Students can attach and move sticky notes anywhere on the slide. The system also offers a chat function for making an easy question via text.
2. Preliminary Experiment

We performed a preliminary evaluation and analyzed the system’s functions. We used the system to conduct a 40-minute lecture on games programming with 15 slides. The subjects were five graduate students, and we explained how to use the system before the lecture. We obtained five-stage evaluations according to the four items, with the results as shown in Table 1. The students strongly appreciated the value of slide sharing (Table 1: Q1). We consider it is effective that students could learn how to solve problems by checking the slides that other students drew. In some cases, students agreed with other students’ questions and answered instead of the teacher. Because other students can answer the questions of others, the load on the teacher is reduced. Being able to use figures and lines during slide sharing was useful for asking and answering questions. However, the slide sharing was insufficient because of the lack of a function to inform other students that a student was drawing on a slide. Therefore, it is necessary to make other students aware of drawing to make the slide sharing more effective.

<table>
<thead>
<tr>
<th>Explanation</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: Is slide sharing necessary?</td>
<td>4.4/5.0</td>
</tr>
<tr>
<td>Q2: Was slide sharing used for questions and answers?</td>
<td>3.6/5.0</td>
</tr>
<tr>
<td>Q3: Were the problems solved by questions and answers?</td>
<td>3.5/5.0</td>
</tr>
<tr>
<td>Q4: Was your understanding improved by the questions and answers?</td>
<td>3.5/5.0</td>
</tr>
</tbody>
</table>

3. Summary

We developed a lecture system that encourages students to interactively ask and answer questions by enabling the sharing and drawing of slides among the teacher and students. We confirmed the effectiveness of sharing slides by an evaluation experiment. Moreover, the system can be used to reproduce lecture resources such as slides, digital-ink notes, and sticky notes written by the teacher and students. Therefore, we plan to develop the system for reviewing lectures by using the lecture resources.

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References