Synchronous and Asynchronous Discussion System Using Various Media for Improving Lecture Content

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Abstract - In this paper, we focus on discussions among group members aimed at improving the content of student lecture sessions. We developed web-based system CollabSticky for improving the content of student lectures, and specifically the slide content. The system has features that allow for the submission of comments to slides synchronously and asynchronously. An evaluation of the system revealed that the users were able to make comments easily during synchronous discussion and that the system can collect a high percentage of comments which leads directly to the improvement of slide contents during asynchronous discussion. Thus, CollabSticky appears to be a promising tool not only for helping to improve presentation materials, but also to deepen the understanding of a topic among all users.

Keywords: Groupware, CSCW, Lecture Support, Meeting Support, Synchronous and Asynchronous Communications, Web-based Application

1 INTRODUCTION

Many user communication systems can now be accessed via the internet. We have been studying one such system which collects members' comments and feedback regarding meetings using presentation slides [1]. This system has also allowed us to address the problems of collecting student comments or feedback to lectures, enabling comments to be collected not only via a PC, but also on paper or by mobile phone.

In this paper, we focus on discussions among group members aimed at improving the content of student lecture sessions. The research target environment is a lecture in which students make presentations. Initially, the student is instructed to research a specific theme and then to create slides to present at the next lecture, which is followed by a Q&A session. During this session, comments for correction are provided by the teacher and questions or comments are received from the students. It is through this form of communication that the presenter and other students learn to understand better the theme of the lecture. A general model of the student lecture session is shown in Figure 1.

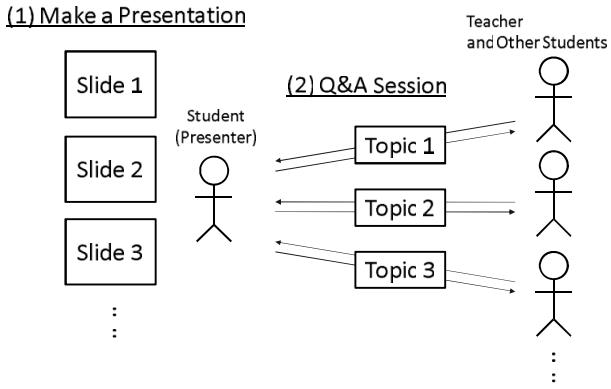

Figure 1 General Model of the Student Lecture Session

Using this model, there is a potential to understand the theme more deeply by re-examining the contents covered in the lecture, revising the slides, and discussing the topics presented among the attendees. Moreover, the revised slides themselves become good educational material. On the basis of this model, here we propose a system for collecting comments as feedback of student lectures and to facilitate asynchronous discussions with the aim of improving the lecture content presented on slides.

2 SYSTEM REQUIREMENTS

CollabTest [2] is an existing system designed to improve quiz content during lectures (synchronous feedback) and after lectures (asynchronous feedback). In this system, the student makes a quiz together with explanations about a specific learning topic assigned by the teacher. As the student likely makes some mistakes or presents information confusingly in the quiz, other students provide comments as feedback to revise the content. Asynchronous discussions through this system enable high-quality quiz content to be finalized. The concept of CollabTest for improving quiz content is shown in Figure 2, and a comparison of the features of this system and the proposed system is shown in Table 1.

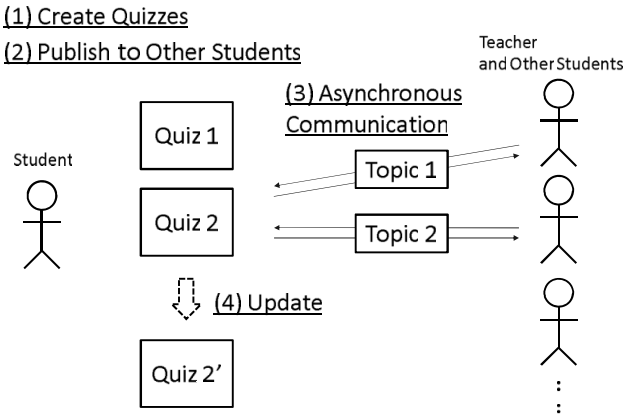

Figure 2 Concept of the CollabTest System for Improving Quiz Content

Table 1 Comparison of CollabTest and the Proposed System

	CollabTest	Proposed System
Communication Environment in Two Phases	Synchronous and Non-Face-to-Face	Synchronous and Face-to-Face
	Asynchronous and Non-Face-to-Face	Asynchronous and Non-Face-to-Face
Target Data	Text data (Quiz)	Image data (Slides)

2.1 Target Environment and Comment Posting Model

CollabTest and the proposed system are designed for use in the same environment, where the communication environment moves from an initial synchronous phase (during the lecture) to an asynchronous phase (after the lecture).

Target data in the case of CollabTest starts from a Synchronous and Non-Face-to-Face environment since the students create quizzes by themselves. In contrast, in the case of the proposed system, students send opinions or questions synchronously during the student lecture and Q&A session. This requires a comment posting feature as well as a slide view feature to be used synchronously. The comment posting model of CollabTest and the proposed system is shown in Figure 3.

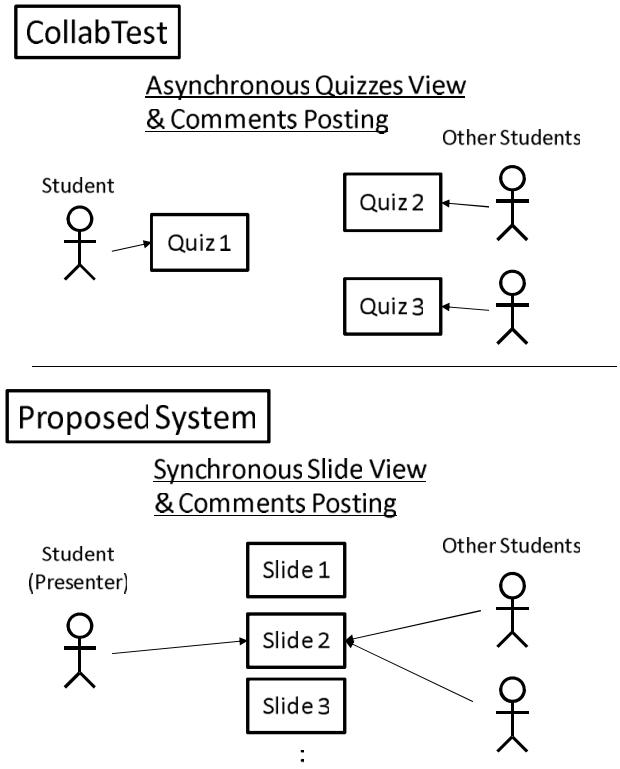

Figure 3 Comment Posting Model of CollabTest and the Proposed System

2.2 Target Data and Referring Method

In terms of data features, the target data for improvement with CollabTest is quiz data which is text-based, whereas it is slide data which is image-based with the proposed system. CollabTest is able to improve quiz content via text chat communications. However, it is not sufficient for the proposed system to use text chat communications to improve slide content as there are many slides and many topics on the slides to be discussed, which means the target topics tend to be ambiguous. Thus, it is necessary to have a feature which highlights a specific point or section of the slide on the x and y axes and registers comments in that specific location, thus minimizing ambiguity. Figure 4 shows the comment reference model of CollabTest and the proposed system.

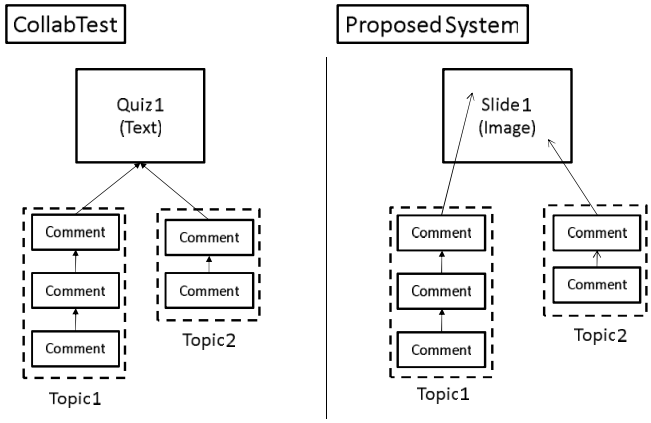

Figure 4 Comment Reference Model of CollabTest and the Proposed System

2.3 Discussion Topic Transition from Synchronous to Asynchronous Environment

The comments submitted by students using the proposed web-based system, which we call "CollabSticky", become discussion topics in the asynchronous environment after the lecture session. This system makes a chat thread for every comment, which we call a discussion thread. Figure 5 shows the transition between comments submitted synchronously during the lecture and the discussion thread used after the lecture.

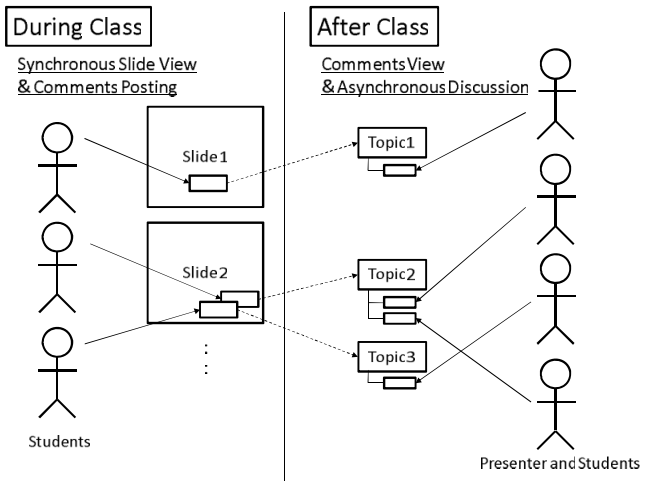

Figure 5 Transition between Submitted Comments during the Lecture and Discussion Threads after the Lecture Using the Proposed CollabSticky System

When someone submits a comment during asynchronous discussion after the lecture, CollabSticky sends an email about the comment to other students to facilitate a quick response.

2.4 Proposed System Utilizes Various Media

We have been utilizing the proposed CollabSticky system in our investigations into how best to collect and encourage comments from students during lectures. In this research, CollabSticky is designed to collect a large number of comments as feedback not only via a PC, but also on paper or by mobile phone. This means that the target environments of this research are not only more specialized classrooms having PCs installed for each student to use, but also ordinary class rooms without PCs.

3 THE PROPOSED COLLABSTICKY SYSTEM

CollabSticky supports PowerPoint slide files. The student presenter uploads his/her PowerPoint file to the system by using a web browser and the server side program then converts the file to jpeg image files. The student then selects the name of the PowerPoint file from the list displayed and CollabSticky displays the first slide in the file. Figure 6 is a screen shot of CollabSticky where users can change to next or previous slides by clicking the right or left arrow in the browser, using a mouse wheel or keyboard shortcuts. In addition, users can see thumbnail images of all the slides in the presentation file. When users click on one of the slide thumbnails, CollabSticky displays the selected slide.

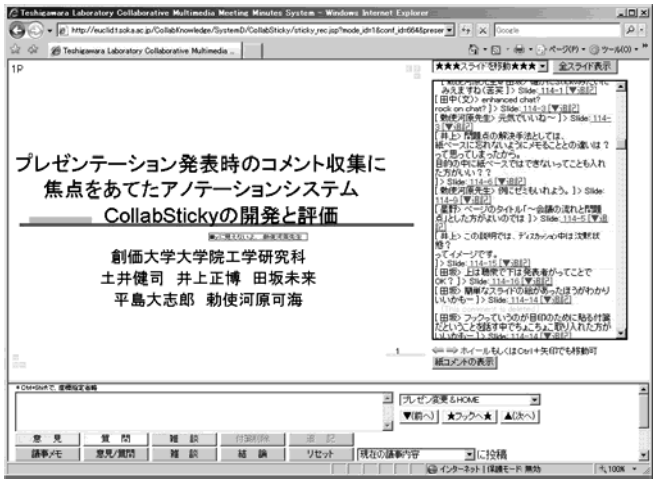

Figure 6 CollabSticky

One of the useful features of this system is rapid slide change. As CollabSticky stores image cache files before or after the current slide and uses Ajax, slides can be changed very quickly.

3.1 Synchronous Slide Presentation and Comment Submission

We use the "Slide View" function for synchronous discussion during the lecture session (Fig. 8, left). The user who clicks the "Make a Presentation" button is recognized as the parent user, and the system then shows the first slide in full screen mode.

Left of this button, there is the "Synchronous Slide" button. CollabSticky recognizes the user who pushes this button as a child user, whose slide changes synchronously and automatically with the parent slide.

When the child user clicks on a particular part of a slide, the textbox below is highlighted and the user can then input text comments. The comment submitted via this textbox is displayed at exactly the location on the slide the child user selected. This is like putting a sticky vote on the slide. CollabSticky recognizes this sticky vote as a parent comment, displaying the same slide to all students but not the presenter at the same time. Therefore, CollabSticky shows not only the same slide synchronously, but also the same sticky votes in real time.

When another student clicks the parent comment, the mode changes to "Adding Comment Mode" and a textbox below is highlighted. A submitted comment in this mode is added to the parent comment which the user just clicked. CollabSticky recognizes this submitted comment as a child comment. When a user mouses over the comment, the parent comment is extended with children comments shown below. In order to view the slides easily, only the parent comment is shown and is translucent. Figure 7 shows a child comment viewed with mouse over.

Figure 7 Child Comment Viewed with Mouse Over

These system features enable comments to be submitted synchronously regarding a specific part of a slide on the x and y axes and for students to communicate with each other in real time.

3.2 Extending Synchronous Discussion to Asynchronous Discussion

In the synchronous discussion, CollabSticky recognizes each submitted parent or child comment as one discussion thread. In the asynchronous discussion after the lecture, users can view all the discussion threads in "Sticky View" (Fig. 8, right).

In "Sticky View", every discussion thread referring to a specific slide is displayed. When a user clicks the "Submit Comment Here" link below the discussion thread, a textbox and a submit button appear, allowing the user to submit a new child comment. Figure 9 shows the submission of a new child comment in the asynchronous discussion environment.

After the lecture, the student presenter can respond to all the submitted comments. However, as we found that submitted responses were not being viewed quickly by the other students, we developed a feature to inform the students by email about the comment and response submissions. We speculated that this feature would increase the speed of communication.

We also speculated that it is efficient for discussion and feedback to involve not only the student presenter and students who submitted comments, but also other group members. Therefore, those members to be informed by email are chosen by the student submitting a comment. This feature should help the members considered most appropriate for a particular topic to join the discussion.

3.3 Collecting Comments Using Various Media

It is necessary to collect comments from many students efficiently. However, in actual lectures, it is not always possible for all students to use their own PC. Additionally, not all students may have the ICT skills needed to input all the comments they want to submit. Therefore, we developed a feature to collect comments on paper or by mobile phone.

In the case of collecting comments by mobile phone, CollabSticky collects them via email. Figure 10 shows how comments are input using a mobile phone. Students input the slide number in the title field and the comment in the body of an email. CollabSticky receives and analyzes the email and stores the data in the database.

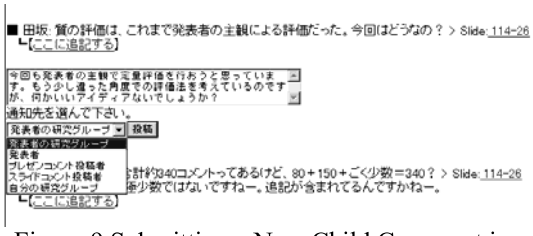

Figure 9 Submitting a New Child Comment in Asynchronous Discussion

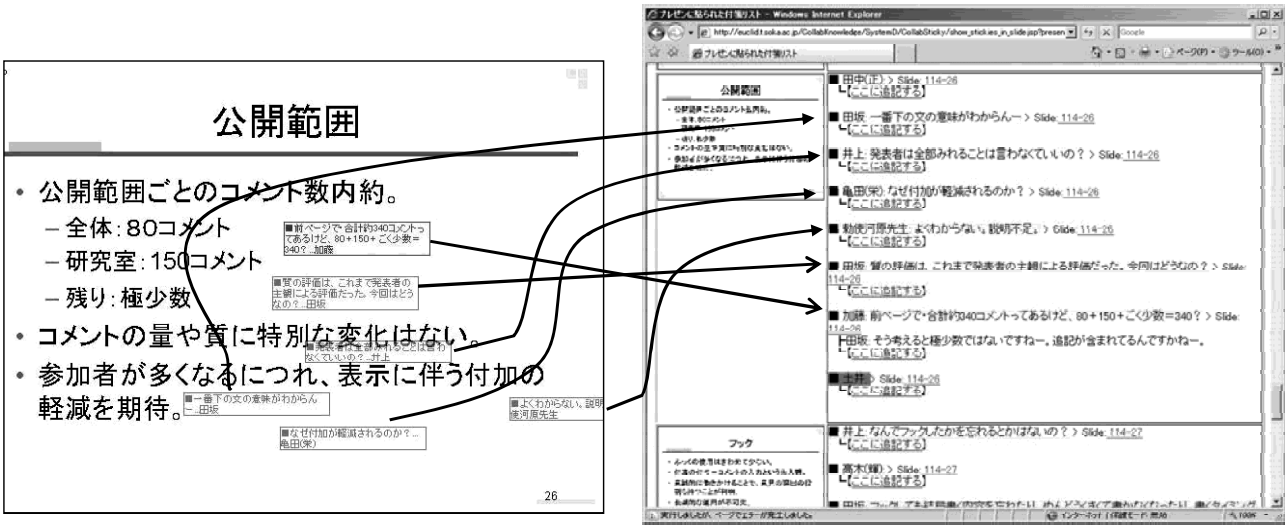

Figure 8 "Slide View" for Synchronous Discussion (left) and "Sticky View" for Asynchronous Environment (right)

Figure 10 Comment Input Screen for Mobile Phone

Figure 11 shows the form used to collect comments on paper, where comments can be clearly and specifically marked relating to the content shown for three slides. CollabSticky converts all of the collected papers to image data and stores them in the database. These are displayed as thumbnails and the original image is shown when the user clicks the thumbnail. The "Slide View" feature has a link to this thumbnails page.

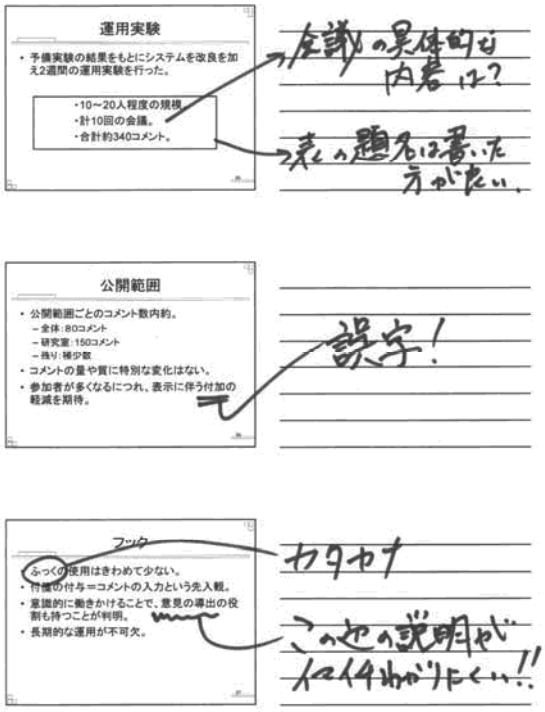

Figure 11 Example of Paper-based Comments

4 EXPERIMENTS AND EVALUATION

We confirmed that the features described in section 3 were normally executed and that the system operated without problem. In the next section, we describe system evaluation in the synchronous and asynchronous phases of discussion, and involving the collection of comments by mobile phone or on paper.

4.1 Synchronous Comment Submission

One of the important objectives of using CollabSticky is to collect large numbers of comments in order to improve the lecture content most effectively via discussion after the lecture. However, during the lecture itself, it is not easy both to understand the slide contents and submit comments by using CollabSticky; the system is useful only if the effort required to enter comments using the system is not prohibitive and allows adequate numbers of comments to be submitted.

Therefore, we devised experiments in our laboratory to ascertain how many comments might be submitted during actual student lecture sessions. A group consisting of one presenter and four students participated in the experiment. The students have ICT skills. In order to create an environment in which the students would acquire new knowledge, we created slides about four topics which were far from the students' research fields. After each of the lectures, there was time for Q&A. During both the lecture time and the Q&A session, the four students submitted comments by using CollabSticky via a web browser. Tables 2 and 3 show the duration of the lecture sessions and the number of parent comments received, respectively.

Table 2 Duration of Lecture Sessions (in minutes)

	Lecture	Q&A	Total
Experiment 1	20:21	12:02	32:23
Experiment 2	8:00	17:05	25:05
Experiment 3	22:32	13:46	36:18
Experiment 4	9:52	14:49	24:41

Table 3 Number of Parent Comments Received During the Lecture Sessions

	Lecture	Q&A	Total
Experiment 1	7	9	16
Experiment 2	8	7	15
Experiment 3	15	13	28
Experiment 4	13	6	19

We judged from the results that sufficient numbers of comments could be collected using CollabSticky. In the case of experiments 3 and 4, the number of comments received during the lecture itself exceeded that received during the Q&A session. Thus, it appears that the effort required to use the system was not prohibitive for the students to make adequate numbers of comments.

In addition, we categorized the submitted comments into four groups, as shown in Table 4. Table 5 shows the number of comments by category.

Table 4 Comment Categories

Opinion	Comment in opposition to slide content, or indication of presenter's mistake
Question	Comment requesting additional information about slide content to aid greater understanding
Impression	Comment on slide without requesting action from the presenter
Other	Chat or other comment which does not fall into the other three categories

Table 5 Number of Comments by Category

	Opinion	Question	Impression	Other	Total
Experiment 1	3	13	0	0	16
Experiment 2	0	14	0	1	15
Experiment 3	8	16	3	1	28
Experiment 4	8	8	2	1	19
Total	19	51	5	3	78

As the presenter should respond to opinion comments and question comments, these two category comments show high potential for discussion among the presenter and other students. Therefore, the experimental results suggest that CollabSticky can collect up to 90% of comments which lead to asynchronous discussion.

4.2 Asynchronous Discussion and Improving Slide Content

We next conducted an experiment to investigate how much asynchronous discussion and revision of slides might result form using CollabSticky. The participants were 5 graduate students and a teacher.

After a graduate student in the role of presenter uploaded a file to CollabSticky, the other students and a teacher submitted comments on the slides as described in section 3. Because the student presenter had to give a presentation in a plenary meeting in the laboratory in the near future, we compared the uploaded slides to the revised slides created after asynchronous discussion by using CollabSticky, and we investigated the number of revisions made.

Table 6 shows the number of submitted comments by category.

Table 6 Number of Submitted Comments by Category

	Opinion	Question	Impression	Other	Total
Experiment	19	6	5	0	30

There were 25 submitted comments categorized as Opinion and Question comments which demanded responses from the student presenter. Of these 25 comments, 18 received a response comments from the presenter. We considered these 18 comments as 18 asynchronous discussion threads and checked whether CollabSticky sent an email to students when each comment and response was submitted.

Ultimately, the presenter felt that 14 comments were helpful to improving his presentation and he revised the slides accordingly. The presenter remarked that this system was very useful to help him improve his presentation, and specifically the content of his slides.

These results indicate that CollabSticky was effective for improving content during asynchronous discussion. However, the presenter did not respond to 7 submitted comments. At this point, CollabSticky does not have a function to follow the status of each discussion thread, so we were unable to determine easily whether the comments were considered irrelevant by the presenter or were forgotten. CollabTest has a navigation feature for discussion threads that indicates which comments were fund to be helpful to improve the quizzes created and it performs well [2]. In future, we plan to add such a feature to the CollabSticky system

4.3 Collecting Comments By Mobile Phone or On Paper

As described in section 3.3, CollabSticky collects comments submitted by mobile phones or on paper. In an experiment to determine the effectiveness of using these two features, we found that no asynchronous discussion threads were generated using these features. This appears to be due to the fact that the users could make insufficient reference to specific slide content; users found it difficult to refer to specific points on a slide, which created ambiguity in system use.

As described in section 2.2, it was necessary that asynchronous discussions made reference to a specific point on the x and y axes in a slide in order to avoid ambiguity of comments. Therefore, in the future, we will attempt to apply the same method in the case of submitting comments by mobile phone or on paper.

5 CONCLUSION

This paper proposed the CollabSticky system for improving the content of student lectures, and specifically the slide content. The system has features that allow for the submission of comments about slides which are changed synchronously with the presenter's slides, the submission of comments that refer to specific locations on the slides, the transitioning of collected comments in the synchronous environment to the asynchronous environment, and communications that promote improvement of slide content itself.

An evaluation of the system revealed that the users were able to make comments easily during synchronous discussion and that the system can collect a high percentage of comments which leads directly to the improvement of slide contents during asynchronous discussion. Thus, CollabSticky appears to be a promising tool not only for helping to improve presentation materials, but also to deepen the understanding of a topic among all users.

We plan to improve CollabSticky by including a navigation tool that indicates the status of discussion threads and to improve the reference to specific points in slides when using the features of comment submission by mobile phone or on paper. We will use CollabSticky in real lectures in order to implement these system changes effectively and will evaluate it in terms of learning effects.

ACKNOWLEDGEMENT

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