Backstage – Designing a Backchannel for Large Lectures

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Abstract: Students and lecturers use computers in lectures. But, the standard tools give a rather insufficient structure and support for better learning results. Backstage is an adjustable backchannel environment where students can communicate by microblogs, which they can link to the presenter slides. The lecturer can get feedback by Backstage and place quizzes with an Audience Response System. Backstage is designed to facilitate specific sequences of learning activities and to enhance student motivation with different functions, like asking questions anonymously via microblogs or to rate other students' questions.

Keywords: lectures, backchannel, taking notes, ARS

Technology supported learning fostering activities in large lectures

Both lecturers and students frequently use computers in large lectures today. Whereas there is some understanding how lecturers use computers for presentations [1], little is known about how students can actively and productively use mobile devices, such as notebooks, tablets or smart phones in large lectures to better engage in learning activities and cognitively process what is being taught. Here, we present a learning environment called Backstage that allows learners to represent slides on their personal mobile devices, to take notes on those slides, and to post and answer questions to and from their peers and lecturers. We included also a feedback function as well as the possibility that students answer lecturer questions.

Computer-supported learning activities in large classrooms

There are a couple of ways students in large lectures use computer technology : displaying slides, taking notes, browsing the internet, using Facebook or sending IMs and emails [2] [3]. The most frequent lecture-related way students use computers is to display the slides of the lecture on one's personal screen [4]. Lecturers often provide their slides in pdf for download before the lecture. To a lesser degree, students use computers for taking notes, especially since formats like pdf do not generally allow adding notes [4]. Taking notes has shown to be a good strategy for encoding and storing knowledge, especially when there are some additional strategies trained in how to take notes [5] [6] . Also additional learning material could be either provided for download by the lecturer or searched for online by students themselves, which may foster learners' understanding [6].

Specific educational technology is needed for supporting and enhancing specific social interactions in lectures that are conducive to learning. Traditional lectures have been criticized for being limited to a specific interaction pattern initiated by the lecturer only, namely asking a question, which only one student can answer directly, and commenting or evaluating the student's answer [7] [8]. There is some evidence, however, that students are more actively elaborating what is being taught and retain more knowledge when they initiate discourse and ask questions themselves (e. g. [9]). But in a large lecture, students often resist to do so due to fear of losing face or lack of metacognitive skills to identify knowledge gaps or to generate meaningful and critical questions (e.g. [10] [11] [12] [13]).

To address these challenges, we have developed Backstage to enable *all* learners in large lectures to ask and reply to questions anonymously.

Backstage – an environment to foster social learning activities in large lectures

Backstage runs on any online mobile device to provide carefully conceived student-student as well lecturer-audience interactions to support active participation and learning. Simultaneously, Backstage is customizable by the lecturer to set number of questions to be received or posed at what times, which results to mirror back to the students, or what interactions to allow between students. Backstage includes different functions, like pre-structured and peer-rated microblogging, displaying and connecting microblog messages to the slides, and an Audience Response System (ARS).

Pre-structured and peer-rated microblogs

Backstage supports microblogging that allows students to post questions to the whole class [14]. Microblogs are short messages with a fixed number of signs, e.g. used in Twitter. These messages and the possibility for students to talk to each other during the lecture is characteristic of so called backchannels [15], which has yet met little acceptance by lecturers and students [14]. It is likely that this lack in acceptance is due to the fact that it is more difficult and time consuming for students to ask questions in written form.

Pre-structured microblogging

Backstage pre-structures its microblog by featuring different communication modes and self-selectable predefined message categories.

Backstage allows for two different communication modes, which can be enabled or disabled by the lecturer: *anonymous communication*, i.e. the author is not shown along with messages, and *private communication*, i.e. the messages are only visible to some users specified in the text bodies.

Moreover, Backstage requires messages to be assigned to predefined categories (e.g., Question, Answer, Remark, Too Fast) to foster specific interaction patterns and encourage students to reflect on what they want to express.

Peer-rated microblogging

Furthermore, students may rate their peers' microblog messages to assess relevance with respect to the lecture discourse. Only those messages may be selected that are rated and recommended by the students, similar to using Facebook's "like-Button" or Amazon's 5-star recommender system . Only those which reach a certain value will be passed on to the lecturer who can see how the messages rank by relevance in real-time in the lecturer display (see Figure 1). Backstage can also display an up-to-date overview of what kind of the predefined message categories is currently exchanged among the students at what rate. For instance, an increase in messages of the question or the Too Fast category may indicate to the lecturer that learners are getting lost.
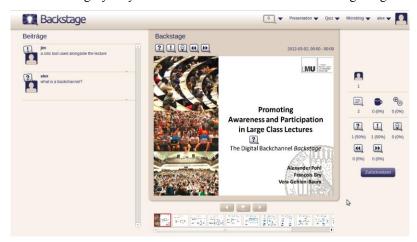

Figure 1: Dashboard of Backstage as displayed to the lecturer

The lecturer can customize the number of messages to be displayed in the ranking. These features serve to reduce the volume of messages which have to be checked by the lecturer during a lecture and is different from some systems that suggest lecturers to additionally rate students' post (e.g. [16]).Also, the answering of any particular question by peer students and this answer could be rated by the audience as well, should reduce the workload of the lecturer. Both features aim to reduce workload and to foster sharing of interesting questions and answers.

Connecting messages with the slides

To align the backchannel communication with the lecture, the lecture slides are displayed in the Backstage interface and each microblog message is assigned to a distinct slide and are filtered accordingly. Furthermore, a message is placed on a certain location on a slide, i.e., messages are used to annotate slides.

The alignment with the slides allows navigating the message stream in a top-down fashion: the relevance of messages may be recognized foremost by the location on a slide and hence, peer students can select to view those messages linked to the slides they want to learn more about.

Audience Response System for quizzes during the lecture

In the last couple of years there has been a development of different tools aiming to engage students during large lectures. One of these tools is an *Audience Response System* (ARS), which offers the possibility that lecturers post questions to all attending students and all students may answer questions anonymously. This is often called a clicker system, which requires proprietary mobile devices and is best known from TV quiz shows like "who wants to be a millionaire?" [17]. These ARS seem to have positive impact on learning and engagement, but also offer new methods for assessing students' understanding, approaching questions by using the wisdom of the crowd, initiating discussion of open questions in the lecture and hence, allowing for new forms of student-lecturer interactions [7] [18].

Backstage can also be operated as an ARS, i.e. be used to conduct short quizzes during the lecture. Quizzes also help to structure the lecture into several topical sections. Starting a quiz results in a context switch on Backstage: the microblogging-functionality is replaced by a quiz input interface and the lecture slides are replaced by the quiz question. During the conduct of the quiz, the lecturer obtains the intermediate collective answer in real-time. When finishing the quiz, the lecturer may publish the quiz and the answer given by the audience as slides which are integrated into the ordinary lecture slides. Thus, students may review and annotate the quiz and its result as usual and use them for reworking a lecture.

Conclusion and expected results

Backstage is a highly customizable learning environment to support student –student as well as student –lecturer interaction in addition to facilitate learning in a lecture through different tools and included instructions. In contrast to many proprietary hardware systems, e.g. clicker systems, Backstage runs on any mobile devices students bring themselves to the lecture.

There are certain aspects, which should foster learning activities in Backstage in comparison to other learning environments. The combination of different features and tools in one learning environment aims to facilitate question asking and elaboration of the learning material. Usability studies show that students actively used the Backstage features in contrast to earlier use of microblogs [14]. Every one of them gave at least one comment or asked a question [19]. Especially the implementation of new features like giving feedback on motivation or learning results to the students should increase acceptance and use of Backstage.

We expect that the possibility for students to give feedback and to answer questions may enhance the use of Backstage. During and after the lecture, students can see which questions or answers are rated highly by themselves and other students, which may enhance a feeling of efficacy and social relatedness [20]. Future research will focus on how different types of feedback can make students and lecturers aware of vital learning processes in large lectures and how effective interaction patterns can be scripted onto large groups of students. Ultimately, Backstage aims to facilitate

students' learning and future studies may inquire how and what kind of knowledge acquisition in large lectures can be facilitated with this tool.

We plan to conduct and report on an in-vivo study to identify which kind of support should be given within Backstage to formulate critical questions and to what extent learners participate and benefit more homogeneously when using Backstage.

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