SMILE – smartphones in a university learning environment: a classroom response system

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Abstract:
We describe and evaluate a tool using smartphones in a university learning environment. Mass lectures often lack in interactivity. Due to missing feedback, the lecture’s content may not be adapted to the students’ understanding. The tool consists of two modules, a comprehension level visualization and multiple choice questions, that are hypothesized to increase interactivity and adaptation to students’ understanding. We report data from a formative evaluation of the tool’s first implementation in a university lecture.

Teaching lectures with large class sizes provides some unique challenges regarding interactivity and adaptation to students’ understanding. A constrained timeframe and class size make answering questions difficult, so lecturers may avoid interacting with students altogether. Furthermore, students avoid posing questions in front of a large and rather anonymous audience (Ratto, Shapiro, Truong, & Griswold, 2003). Finally, gathering feedback on the students’ understanding is often not possible in a large lecture hall containing about a few hundred of students, resulting in low adaptation of the lecture to the comprehension level of students (Scheele, Wessels, Effelsberg, Hofer, & Fries, 2005).

In the past, classroom response systems such as i-clincker® have been used to improve interactivity in and adaptability of lectures. However, these systems are expensive to purchase and maintain. Mobile wireless technologies may offer an alternative because of their reduced size, portability, and low costs (Ogata, Wada, Gan, & Yano, 2008). Instead of distributing a classroom response system, students’ personal mobile devices may be used. Indeed, Ratto and colleagues (2003) suggest that mobile devices may improve the quality of university teaching by encouraging active participation and by adjusting the lectures using students’ feedback.

A classroom interaction tool called SMILE (SMartphon es In LEctures) was developed by students as part of a programming class at the chair of Computer Architecture at the University of Freiburg, Germany. Using free software and online resources (Feiten & Becker, 2012), an Android app was programmed as a native smartphone client. In addition, a web browser variant was written for maximum compatibility with other platforms. The tool consists of two main modules that allow for interaction between students and lecturer. The feedback module enables the visualization of feedback to the lecturer. Students can indicate their understanding of the lecture’s content by using a slide control ranging from “can’t follow” [bin abgehaengt] to “got it” [alles klar] (see Figure 1, left panel). The result is visualized as a bar diagram on a screen for the audience and the lecturer. In addition, the lecturer is provided with a function graph presenting mean scores and the development of the audience’s comprehension over time.

Figure 1. Modules in the Android client: Feedback slider (left panel), multiple choice questions (middle panel), and evaluation questions (right panel).
The multiple choice module allows the lecturer to pose multiple choice questions that students can answer on their mobile devices (see Figure 1, middle panel). The results are immediately presented on the screen in front, giving lecturer and students the percentages of the different answers.

We conducted a formative evaluation of SMILE during its first implementation in a Computing Science lecture over the course of one semester. We hypothesized that a visualization of the audience’s general comprehension may, when showing that the majority of students are not able to follow the lecture, encourage students to raise their hands and ask questions. In addition, the multiple choice questions module may help lecturers detect students’ misconceptions and lack of understanding better compared to using the feedback module alone. Information from both modules may be used to adapt current and future lectures. Lastly, we assumed that students would feel less frustrated if they perceived that the lecturer was aware of their comprehension problems.

To investigate these hypotheses, at regular intervals throughout the semester students completed questionnaires that were integrated directly into SMILE as an evaluation module (see Figure 1, right panel). A paper-based questionnaire was administered mid-term to all students with the goal of reaching participants who did not use SMILE. Finally, we conducted interviews with the lecturer and teaching assistants at the end of term. The questionnaires and interview guides contained items regarding the perception of the lecture’s adaptation and interactivity, the usability of the SMILE interface, and the acceptance of its implementation in the lectures. The formative evaluation also served to continually refine the technical features of the application throughout the term.

Results revealed a low participation rate of about a third of students actively using the tool during the lecture. This might be due to initial technical problems concerning overloads of the wireless local area network and usability features such as automatic system logouts during the lecture frustrating the students. Also, students and lecturer reported that the feedback module created distractions because feedback results and slides were displayed on different screens. As a positive outcome, the feedback visualization stressed students’ comprehension level to the lecturer or corroborated on the lecturer’s estimation of difficult learning content during the lecture. However, the feedback visualization did not provoke more question-asking during the lecture. Nevertheless, the feedback sometimes induced the lecturer to additionally explain difficult content on the black board. In comparison to the feedback module, the multiple choice module was more accepted by both, students and lecturer. It was seen as a good preparation for exams and led to more exchange amongst the students in cooperatively finding the correct answer. Further, the lecturer-student-interaction increased by discussing and explaining the correct answer. The multiple choice format served to uncover students’ misconceptions and to summarize the learning content. Against concerns that SMILE may interrupt the flow of the lecture, the lecturer did not report more noise during the lecture but rather improved students’ attention.

Additional results will be presented on the poster and this evaluation will be used to further improve SMILE. For example, we will modify the feedback module by integrating the feedback visualization into the lecture slides. The lecture slides will also be modified to better set up multiple-choice questions. We plan to test the revised SMILE tool during the next winter term.

References


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