Creating an Interactive Learning Environment: Experience of using a Student Response System

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***Abstract*—The purpose of this paper is to briefly discuss the rationale for using Student Response Systems (SRS) and to share our experience of using this teaching technology in a training session. Our experiences support existing pedagogical research and show that SRS can be used to transform traditionally passive lecture-based classes into stimulating, active learning environments. Students demonstrate better comprehension and motivation when employing SRS compared to being taught in conventional lecture-based classes. Moreover, as teachers, SRS enable us to immediately assess student knowledge of a particular concept, and adapt the instructions we give to the learning needs of the students.**

***Index terms*—Active learning, Clickers, Rapid feedback, Student response system**

I. Introduction

Interactive teaching methods which promote discussion, debate and questions are known to support active learning. However, large class sizes make it difficult to implement these methods. In response to this, teachers have been searching for ways of making large classes more interactive. One approach which has proven successful in various universities and subject areas is using Student Response Systems (SRS) to manage interaction and discussions in lecture-based classes.

The purpose of this paper is to briefly discuss the rationale for using SRS and to share our experience of using the teaching technology in a training session. The reminder of the paper is organised as follows. SRS are briefly described in the next section followed by their impact on teaching and learning. Experiences from a training session and concluding remarks are presented at the end of this paper.

II. Student Response Systems

SRS combine wireless hardware with presentation software, and allow the lecturer to pose multiple choice questions to the students, collect their answers and rapidly display results. The system uses a computer, a video projector, and PowerPoint® to display question slides. Attached to the computer is a base station which receives responses from the hand-held remote controls, or "clickers", students use to answer questions. The SRS software collects results, and the aggregate data are graphically displayed within the presentation for all to see. Depending on the lecturer's choice, data can either be collected anonymously or they can be tracked to individual students (e.g., for homework and exams). Data are also stored in a database for post-analysis after the presentation has ended.

A pedagogical approach often mentioned in literature is to combine the use of SRS with peer instructions, e.g. [1] and [2]. [3] suggests the following steps:

1) Concept question posed
2) Individual thinking: students given time to think individually (1-2 minutes)
3) Students provide individual responses using SRS
4) Students receive feedback – poll of responses presented as histogram display (the correct answer is, however, not revealed)
5) Peer discussion: students are instructed to convince their neighbours that they have the right answer, not their neighbours
6) Re-testing of the same concept
7) Students provide individual responses (revised answer) using SRS
8) Student receive feedback – poll of responses presented as histogram display
9) Lecturer summarises and explains the correct answer.

Research indicates that students improve their understanding of difficult concepts when giving peer instructions in an SRS environment compared with those in conventional lecture-based classes. Reasons for that include more time to think and reflect in class (when given questions), the motivational effects of receiving immediate feedback (display of class response), more active involvement in learning (peer discussion and dialogue), and the feeling that the teacher is adapting instructions to their learning needs [4].

III. Motivations for using SRS

Due to the increasing popularity of SRS a growing body of literature outlines the pedagogical benefits and challenges of using this teaching technology in the classroom, e.g. [5] and

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[6]. The unique contribution of using SRS is the quality of the feedback it enables. Regardless of class size, both lecturer and students obtain real-time feedback on students' understanding of different concepts. The almost-instant feedback allows students to track their own progress in comparison with others, and lets the lecturer assess and adapt teaching to the specific difficulties students encounter. In addition, by displaying class response, an SRS can allow the student to discard the notion that "everyone but me probably understood" and thus encourage interaction. Moreover, research has shown that students using SRSs in class improve their attendance and are more willing to prepare for class because they expect to be questioned [7].

Experience of students in [4] research indicates that peer discussions provide additional value by empowering students to learn co-operatively from one another and move the instructor into more of a facilitator role, so they can offer guidance and advice when needed. Peer discussion also allows a type of "scaffolding" by fellow students, i.e. peer discussions act as a bridge enabling students to translate a teacher's words into their own words and the language between students fosters new insights and understanding since students use the same terminology. Thus, peer discussions reinforce students' learning by actively encouraging reflection during class rather than much later. Finally, after the discussion when the concept is retested, the improved class result gives the students the feeling that they are making progress, which improves student motivation to learn. According to [8] the active learning supported by SRS can result in high-level synthesis and application of difficult concepts, thereby promoting advanced reasoning skills.

IV. Experiences from a training session

We have used SRS in several training sessions, and in general, student feedback has been extremely positive. This supports research claiming that SRS can make classes more interactive and enjoyable for students. To evaluate the students' perception of SRS, a survey comprising 11 statements was performed on a class of 18 students after they had completed a course consisting of 24 lecture hours based on the system.

Survey statements were derived from [4] in order to facilitate a comparison. All questions were formulated as single-sentence statements and linked to a five-point Likert scale ranging from "strongly agree" to "strongly disagree". The answers were collected anonymously using SRS.

V. Concluding remarks

Our experience of using SRS is singularly positive – classes using this technology provide more stimulating and active learning environments compared to those of conventional lecture classes, students experience better comprehension and motivation, and the system enables us as teachers to immediately assess students' knowledge of a particular concept, and adapt instructions to their learning needs.

With the overwhelming positive response of SRS, which is a well-established technology, one may wonder why we have not adopted this teaching technology at Lund University, Faculty of Engineering, earlier. Is it due to conservatism, fear of new technology, a focus on research rather than education, time or budget restrictions, laziness or ignorance? We argue, and agree with relevant literature, that if lecturers are willing and able to make changes to their pedagogical approach and are able to become familiar with this teaching technology, SRS can help create an interactive learning environment which improves learning outcomes for students.

Table I
Student responses

#	Statement	Agree	Disagree
1	Using SRS helps me develop a better understanding of the subject matter when compared to traditional lecture-based classes	94% (92%)	0% (0%)
2	I am more actively involved during SRS classes than during traditional classes	100% (95%)	0% (1%)
3	I have to think more in SRS classes than in traditional classes	100% (91%)	0% (0%)
4	I remember less after a SRS class than after other classes	6% (12%)	50% (63%)
5	Seeing the class responses to a concept question (histogram) helps increase my confidence	72% (65%)	11% (8%)
6	Discussing SRS questions with other students in the class helps me better understand the subject matter	89% (92%)	0% (0%)
7	Hearing other students explain problems *in their own words* when working in our small groups helps me learn	61% (82%)	11% (4%)
8	Using SRS helps the teacher to become more aware of student difficulties with subject matter	78% (80%)	11% (4%)
9	Using SRS helps me enjoy this class more than traditional lecture-based classes	100% (98%)	0% (0%)
10	The SRS approach should be used for other subjects	100% (76%)	0% (2%)

Figures are derived from responses to a 5-point Likert scale (1-5 with 1=strongly disagree to 5=strongly agree). Responses 1 and 2 have been combined to represent the percentage of students who disagree with each statement. Similarly, responses 4 and 5 represent the percentage who agree. The figures in brackets are the results reported in [4] and are provided for comparison.

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