INCREASING STUDENT ENGAGEMENT IN CLASS USING AN OPEN-ENDED STUDENT RESPONSE SYSTEM

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Abstract — A student response system (SRS) is an adaptation of audience response system technology for the educational environment, designed specifically to enhance interaction and active participation in class. During the fall 2013 term, an open-ended student response system was used in an undergraduate engineering statistics course. Twenty-eight students (57\%) completed an online survey at the end of term. Results suggest that the use of questions with an open response system had a positive impact on student engagement and motivation. The results also provide insights for the implementation of student response systems as a way to prompt student/instructor interaction, students’ active participation, peer instruction and group work during class time.

Keywords: Active Learning, Student Response Systems, Student engagement, Peer-Instruction

1. INTRODUCTION

The principles that guide learning, as proposed by Bransford et al. [2] are, among others, metacognition, self-monitoring, self-regulation, conceptual change, transfer of learning, and feedback. These principles have been used as the foundation for the design of the pedagogical approach followed in a statistics course for undergraduate engineering students. The course introduced Peer-Instruction guidelines and used an open-ended student response system (OESRS) to engage and motivate students in their learning process. Peer-Instruction has been defined as an instructional method that engages students in deep learning as well as subject-matter understanding. This study addresses the use of the OESRS, students’ engagement, feedback and satisfaction with this pedagogical approach, and lessons learned by the instructor. Recommendations for future use will also be introduced.

Student Response Systems (SRS), sometimes known as clickers, have been found to increase students’ engagement during class time, especially in large courses, where participation is limited. Studies such as Han and Finkelstein [4], Brady et al. [1], and Chui et al. [3] have reported the benefits of using SRS at the university level. Chui et al. [3] conducted a study, where they looked at the use of clickers and student’s confidence levels. The researchers found that the use of SRS increased students’ confidence in their course competences. Brady et al. [1] studied, whether the use of clickers influenced students’ metacognitive skills. Results of this study found positive relations between the use of SRS and the development of metacognitive competences among undergraduate students. Han and Finkelstein [4] found in their study positive impact of the use of SRS in undergraduate student’s engagement and learning.

In the current study, a survey design method was used to learn about students’ engagement when using OESRS during class time. This study differs from previous studies in the nature of the tool used during class time. Previous studies reported using SRS that only allowed multi-choice questions. The SRS used in the current study allowed the use of open-ended questions as well as other type of questions as explained below. Results of the study suggest a positive response from students in their engagement and motivation towards the course when using OESRS. This study also found interesting shifts in student’s perceptions about their role as learners’ as well as their instructor’s role in the classroom. Results of this study will help inform professors about the benefits and difficulties when using this teaching strategy in their courses. Recommendations will provide instructors with guidance in the transition process from a traditional teaching method to a more student-centered active approach.
2. COURSE DESCRIPTION

The course described in this paper is at its base a 300 level engineering statistics course, where data collected from a laboratory exercise is used throughout the term as a data basis for various statistical calculations. In fall 2013, 50 students were registered to the course. The course consisted of three 50 minute lectures and two 50 minute tutorials per week. At the beginning of the term the students were given the course notes, composed of all presentation slides for all topics. Readings were assigned to individual lectures or lecture topics. These readings were communicated via the university’s course management system calendar and given before the topic or lecture was covered in class. The idea was to lecture in the traditional way as little as possible but focus more on problem solving, which was demanded in previous course evaluations. Students were required to bring a wi-fi device (laptop, smartphone, tablet, kindle) to all classes. Attendance was tracked via the use of the OESRS and independent of right or wrong answers, 5 % of the final course mark were attainable through attendance.

2.1. Use of the OESRS

Student response systems invite learners to actively engage during class time. The OESRS technology used in this study allows instructors to choose from a variety of types of questions. About half of these were actually used in the context of this engineering statistics course. The OESRS allowed multiple choice and many choice type of questions in the same fashion as clicker questions. The question type data collection polls students for an answer (e.g. age), and the software provides the instructor mean, standard deviation, median and quartiles from student responses. Word cloud similarly polls students and the type and frequency of their answers is displayed in a word cloud. Numerical questions require the input of a numerical answer and the software will compare the input to the correct answer and grade accordingly as right or wrong. Similarly, the region question functions on a graphical basis. Students indicate a certain point or region on an image and the software will compare the answers to
a given acceptance region. Question types that do not allow for an easy comparison or grading are the following more open-ended question types: Image upload allows the submission of photos, graphic files or alike for review by the instructor and peers. Sketch questions similarly permit graphical answers to specific questions submitted by the instructor (e.g. draw the axis for a plot). Finally, short and long answer questions (Fig. 1) permit the students to write an answer in a few words or several sentences, respectively.

2.2 Group work as an instructional approach

Group work in class was introduced as an instructional approach. Students were confronted with practice problems to be solved in groups and not in the traditional way, where the instructor presents the solution on the blackboard to the entire class. Students were given time in class to go over their course notes, discuss with their peers and come up with a solution approach on their own. During this time the instructor walked through class, overheard conversations and on a need basis explained certain aspects to the entire class. In addition, students of a group that had already finished the task were assigned to explain a subject matter to another group that was still struggling.

3. RESEARCH QUESTIONS

The research questions that guided this study were the following:

3.1. How does the use of an open-ended student response system influence students’ motivation and engagement towards the course?

3.2 How does the use of an open-ended student response system affect students’ perceptions of teaching and learning processes?

4. METHODS

4.1 Data collection

Two different online platforms were used as sources to collect data for the current study. The first platform was an online survey (using the Survey Monkey platform, https://www.surveymonkey.com/). A link to this survey was posted on the course management system at the end of the term. In order to make the survey anonymous the platform was not able to collect student’s email or IP addresses. The first screen of the survey explained the goal of the study and served also as the consent form. By submitting the survey students were giving consent to use their responses in the current study. The second platform used in this study was the university’s end of term course evaluations. Three questions about the experience of using the tool were included in the evaluation. Questions used in the current survey have been used and validated in previous studies and research conducted university-wide.

4.2 Data analysis

Means and standard deviation from each multiple choice question were computed and graphed in order to analyze participants’ responses. Open ended question responses were analyzed following a grounded theory approach, where categories were created based on students answers.

5. RESULTS

5.1. Multiple-choice responses

Fig. 2 summarizes the answers to the multiple choice questions, where 5 corresponds to strongly agree and 0 stands for strongly disagree. Overall, OESRS, peer instruction approach, and group work was positively received by the group (Fig.2).

5.2 Open-ended responses

A total of five open-ended questions were included in the surveys. Based on these responses a total of six categories were created. These categories are: (a) technical difficulties; (b) engagement; (c) learning; (d) students’ overall reactions to innovation; (e) shift in professors and students’ roles; and, (f) recommendations for future use.

Technical difficulties were defined as problems with the device, software or wi-fi connection (e.g., “maybe less drawing questions. It is difficult to do it on a smartphone, which is what most students used”). Engagement encompassed responses that highlighted attendance, attention and involvement during class time (e.g., “I really liked how she would talk to us during the class lecture instead of just going through slides the whole time. It made it much easier to understand and I felt like we could engage in what she was saying”). Learning covered all those responses where understanding on the content, self-regulation and metacognitive skills was mentioned (e.g., “helped me a lot in understanding the concepts in more details”).
The category students’ overall reactions to innovation contained general comments raised by students in relation to the pedagogical approach (e.g., “I would prefer more theory in class”, “I didn’t like that we had to read before, that confused me”, “the teacher would be able to assess how much of the class understood what was just explained. And then be able to show students immediately where they are going wrong”). Shift in professors and students’ roles referred to comments, where students reflected on their role in the class as agents of their learning and the instructor as a moderator (e.g. “Very well organized and the focus was more on where the students decided we needed more explaining. It was a very interactive class”). The last category created was recommendations for future use. Students mentioned

![Fig. 2 Average of student’s responses to multiple-choice responses](image-url)
interest in using the tool in other courses and were specific on the type of questions that would allow the best use of the software (e.g., “Any class that has a lot of theory and concepts. Wouldn't be ideal for classes with a lot of calculations and tedious problems”).

6. CONCLUSIONS

Overall, students valued the use of this technology in their learning process. The experience was also positively perceived by the instructor. The tool allowed the instructor to get a real time perception of the understanding of the class as a whole and to identify problems of individual students. It allowed, as well, students to reflect on their role in the class as agents of their own learning and the instructor as a moderator of this process. Group work was extremely rewarding both for the students as well as the instructor. The main difficulty perceived with this type of pedagogical approach was having students read before class. Taking together, findings of this study suggest that the use of OESRS has a positive impact on students’ engagement, motivation and learning in an undergraduate level course.

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References


