

PERSONAL RESPONSE SYSTEMS AS A LEARNING AID IN AN EPIDEMIOLOGY COURSE FOR POSTGRADUATE STATISTICS STUDENTS

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Personal response systems (PRS), also known as 'clickers', are most commonly used in large introductory lectures for undergraduate students to anonymously send responses to questions posed by the lecturer. We consider the use of PRS in a masters course setting where groups are typically smaller but where statistics students may be reluctant to participate interactively in lectures for fear of admitting they do not understand the problem, or even that they do understand. We use PRS at intermittent places throughout the Principles of Epidemiology module to check students' understanding and knowledge of the topic using a variety of multiple choice questions within each lecture. Module design, choice and evaluation of questions, wait and response times and student feedback will all be discussed.

INTRODUCTION

Personal Response Systems (PRS) (also referred to as Electronic Voting Systems or Audience Response Systems) have only been introduced as a teaching aid over the past fifteen years, although more basic types have existed for longer (Judson & Sawada, 2002). In recent years there has been a sharp increase in their use. In higher education, PRS are most commonly used in undergraduate large groups; in postgraduate teaching their use has been limited because of the typically smaller class sizes (e.g., Banks, 2006).

The use of PRS in statistics teaching is limited and has in the main been concentrated on large undergraduate introductory and service courses, as an aid to stimulate interest in the subject (Wit, 2003; Lass et al., 2007). The adoption of PRS in lectures has sought to make learning more active than passive, and their use involves equipping students with a handset during the lecture, allowing them to anonymously send responses to questions put to them by the lecturer.

The advantages of the use of PRS may include encouraging increased student attendance, motivating dialogue between lecturer and student – particularly in large groups, providing a supplementary aid to understanding and emphasizing new topics, and enabling all students to express their knowledge anonymously thereby overcoming their possible reluctance to do so in front of others. The disadvantage is that an increased wait time does need to be allowed for in the lecture whilst the students work on their responses.

In this study we describe the implementation of PRS into an MSc in Statistics module called 'Principles of Epidemiology'. The students taking the MSc are typically from a Maths and Stats background, where class sizes in our earlier years (2008-11) ranged from 12-20 students and more recently (2012-14) up to 36 students with the addition of MSci Mathematics 4th year students.

METHODS

In 2008-9 and 2009-10 the MSc module was run in the first semester over a five week period with two hours of lectures per week as well as additional practical work. Since 2010-11 the MSc module has run over four days as a short intensive course in the second semester, with three hours of lectures per day in the morning and two hours of practical work in the afternoon. The PRS questions are implemented into the morning lectures. Handsets are given out at the beginning of the lecture and collected in at the end. The students are given an instruction sheet with their own unique ID number and asked to 'join' the session. As they join they can identify themselves on the screen at the front of the class. This maintains their anonymity but also allows patterns of responses to be tracked over each day.

A total of 22 questions are included in the course with approximately 3-5 per day. Students are required to bring a calculator for some of the questions. All questions take a multiple choice format and some take longer than others to complete. The questions are designed to check the students' knowledge at convenient places in the lecture. The PRS system allows a time limit for each question which can be increased or decreased manually as necessary depending upon how

quickly the responses are being sent. When the time counter for a question reaches zero then a bar chart of the responses is automatically shown. The lecturer can then go back to the lecture slides to explain the correct answer in more detail.

In 2008 and 2009, the first two years of using PRS, the students were given a specific online questionnaire to complete about their PRS experience, which 18 students completed (9 from each cohort, approximately 70%), and also a detailed analysis was done of the PRS results. In subsequent years the standard module evaluation form used to evaluate all modules, has been used.

RESULTS

Students quickly learned how to 'join' the session and took a handset and prepared as they arrived for the lecture. The average time taken per question was 3 minutes 18 seconds in 2008 and 2 minutes 52 seconds in 2009. Two questions requiring computation from 2008 took too much time and had low success rates. One question, relating to the Mantel-Haenszel estimate of the rate ratio, was deleted and the other concerning the method of indirect standardization, was split into two questions. Across all questions the response rates ranged from 45 seconds to 8 minutes.

Students' attitudes to PRS were predominately positive, with 81% rating their overall impression as positive compared to 9% with a negative impression. Similarly 80% said they enjoyed using PRS in the lectures. Most felt it was useful for assessing their own understanding, but were less convinced it was useful for introducing new topics. When asked about the disadvantages, several students said they felt the PRS questions put them under pressure, and two students felt that PRS was a waste of lecture time, particularly the time spent waiting for other students to respond.

The time to response for each student was also exported to standard statistical software to give Kaplan-Meier estimates of response times. In Figure 1, the response times for three selected questions in the course are shown. Q19 involved simple interpretation of model output, where around 40% of students were able to respond quickly. Q6 was a short computational question, where some responses were very quick but ranged up to 3 minutes. Q14 required more extensive computation. Here we see that no responses were received for 3 minutes and required 6 minutes for all responses to be received.

In recent years and with the change in format of the course PRS has continued to be used in a similar way with no changes to the questions. Students continue to enjoy using PRS as something novel within their learning process and feedback continues to be positive, even as the class size has increased. To date this is the only module within the MSc that uses PRS.

A list of the PRS questions and a more detailed set of results are given in Titman and Lancaster (2011).

CONCLUSION

The results of the questionnaire show that the students see the greatest benefit of PRS as providing a way for them to confirm that they have understood the course material just covered. The most useful questions are those that require application of a new concept or method, but which can be completed in a relatively short space of time, e.g. 2 to 3 minutes. Longer questions, such as the question on Mantel-Haenszel estimates, should be avoided because students are reluctant to spend several minutes applying a method which they are not confident they understand correctly and which therefore puts them under pressure.

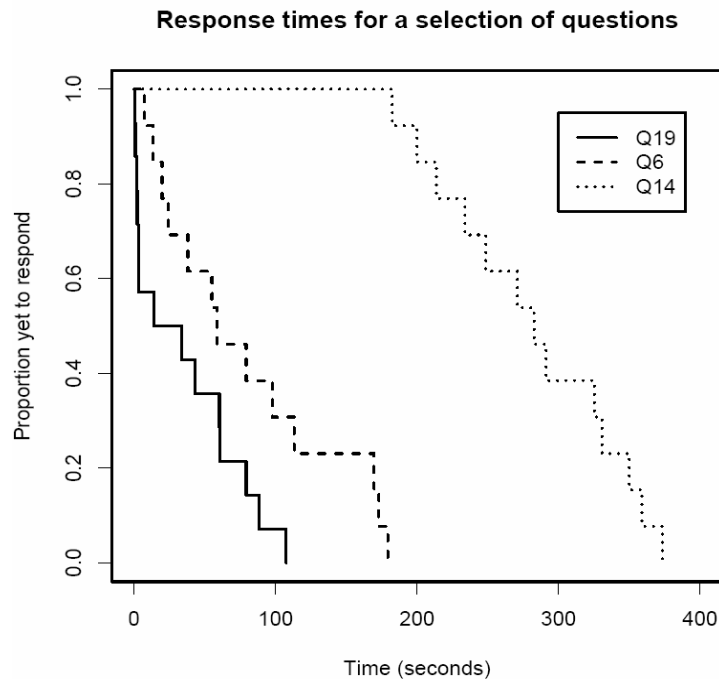


Figure 1: Response times for three selected PRS questions.

An analysis of response times is able to provide different information about the difficulty of the question than the proportion of correct answers. For instance, if the vast majority of students are able to quickly respond correctly to a knowledge-based question, that question may not be necessary, unless perhaps it relates to something particularly worth emphasizing. In contrast, if a significant proportion of students require some time to respond, perhaps because they need to refer back to their lecture notes, this would suggest the question was of use in reinforcing a particular concept. The response times can also indicate a suitable time limit to be used in future implementations of the question.

In conclusion, PRS has definite benefits as a teaching tool for statistics. The benefits for large group teaching of service or introductory courses are transferable to postgraduate teaching to smaller groups. Indeed, some of the practical issues associated with distribution of handsets are less problematic for smaller groups. As with other emerging technologies, care is necessary to ensure that teaching objectives remain central. The main benefits of PRS are not necessarily inherent to the technology, but stem from the pedagogical shift from passive to active learning that they encourage.

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