Using asynchronous electronic surveys to help in-class revision: A case study

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Abstract
Synchronous e-voting systems (commonly known as ‘clickers’) have become increasingly popular as they can be used to enhance interactivity in lectures. Asynchronous electronic surveys (AESs), unlike these voting system, usually serve as a method of gathering feedback before or after teaching sessions. This paper describes and evaluates a project involving the use of AES with an integrated follow-up lecture in an undergraduate science module. The study shows that the AES enhanced the students’ learning experience by (1) prompting them to review previously taught material and (2) providing an engaging context for teaching in the follow-up lecture. As AES can act as an effective link between module components, they can be used as a pedagogical device for improving the coherence of a curriculum. AES is, therefore, a valuable e-learning platform, especially given the growing emphasis on interdisciplinary and multidisciplinary modules in recent years.

Practitioner Notes
What is already known about this topic
• Electronic voting and surveys can either be conducted during the teaching (synchronous) or be employed before or after the teaching (asynchronous).
• Synchronous voting devices, such as ‘clickers’, are widely used in lecturing.
• Asynchronous electronic surveys (AESs) are mainly used in assessments and teaching evaluation.

What this paper adds
• Novel implementation of AES: it can be used in conjunction with a follow-up lecture.
• Novel pedagogic application of AES: it can be used to help (1) students prepare for exams and (2) lecturers tailor their teaching to students’ needs at the same time.
• An evaluation of the students’ perspectives on the use of AES with a follow-up lecture in an undergraduate science module.
Implications for practice and/or policy

- AES can be used to enhance the delivery of lectures as students may find the release of survey results an engaging experience.
- It is a good practice to keep AES simple and anonymous.
- AES with follow-up lectures can provide effective links between different teaching components in a module.

Introduction

The use of information and communication technology has played an important role in improving the efficiency of obtaining feedback from students. As reported in the research literature, there are two principal ways of obtaining electronic feedback from students: online polling and electronic voting (or e-voting). Online polling typically involves collecting responses via the Web asynchronously or in real time (Klaas & Baggaley, 2003). In contrast, e-voting is normally referred to as the real-time use of wired or wireless devices (such as ‘clickers’) that communicate with a master control unit for students to answer questions from their tutors or lecturers during the class (eg, Draper & Brown, 2004; Easton, 2009; Fies & Marshall, 2006). However, there is no agreed definition of the terminologies, and there are overlaps between the two approaches. For instance, if students and their lecturers are equipped with computers or mobile devices connected to the Internet in a lecture environment (Stahl, 2005), online polling can be used in the same way as e-voting systems for collecting instant responses. For the purpose of clarity, I here use ‘electronic surveys’ as a generic term for online polling and e-voting. ‘Web-based surveys’, which form the focus of this paper, are electronic surveys that rely on the Internet for the collection and transmission of information.

In addition to gathering opinions on the quality of teaching in student evaluations (eg, Moss & Hendry, 2002), web-based surveys can be incorporated into activities designed for engaging students with course materials. This application of web-based surveys as a teaching tool can, for instance, take the form of quizzes and other types of assessments (eg, Baggaley, Kane & Wade, 2002; Ko & Rossen, 2010). Collaborative use of voting designed for students to assess each other’s work in lectures has also been reported (Stahl, 2005). A wide range of online services is available for delivering these poll-related teaching activities, and these services vary in terms of cost, question type (such as multiple-choice questions), delivery of polling results, data storage allowance and ease of use, as well as flexibility with customisation (Baggaley et al., 2002).

There is considerable interest in using web-based surveys as they have significant advantages over their more conventional alternatives (Klaas & Baggaley, 2003). Compared with nonelectronic methods, web-based surveys are more cost-effective, time-efficient and less prone to data collection errors (Solomon, 2001), as well as more likely to attract frank answers (Baggaley, 1997). However, these surveys also have their limitations (Klaas & Baggaley, 2003). For instance, web-based surveys may suffer from sampling biases (Solomon, 2001), and doubts have been raised in terms of the scientific validity of the results collected (Rosenblatt, 1999). Students should, therefore, be made aware of the limitations in the reliability of electronic surveys (Klaas & Baggaley, 2003), and quantitative analysis and interpretation of polling results need to be scrutinised and treated carefully.

Despite the differences in technological implementation (ie, web-based or otherwise), electronic surveys can be classified according to their synchronicity requirements. For instance, immediacy in obtaining students’ responses is critical in tutorials and interactive lectures, whereas gauging opinions via the Internet over a period of time allows more flexible and reflective participation. Success with synchronous surveys in lectures and tutorials has been widely reported and applied.
in an extensive range of disciplines (eg, Draper & Brown, 2004; Easton, 2009; Fies & Marshall, 2006; Kay & LeSage, 2009). In contrast, asynchronous electronic surveys (AESs) are more commonly used as a web-based platform for collecting students’ feedback on the quality of teaching and for formative assessments (Ko & Rossen, 2010). This study adds to the current educational developments in electronic surveys by describing and evaluating a particular use of AES in an undergraduate science module.

Apart from serving as a teaching tool during the follow-up lecture, the AES was also integrated as a key link for bridging two parts of the module conducted at different times of the academic year in this project. The adoption of AES in this project is, thus, pedagogy-led (rather than technology-led), and this emphasis on teaching needs in technology-enhanced teaching is consistent with recent e-learning trends (eg, Draper, 2009). The main aim of this paper is to use the AES project as a case study for (1) describing how the impact of electronic surveys can be maximised by using them as a revision tool in a module or curriculum and (2) identifying from the students’ perspectives the main pedagogical issues related to AES, which may be further investigated and tested in future studies.

AES and follow-up lecture: context and implementation

This project was conducted as part of a 2nd-year undergraduate module in geophysics, which had a total enrolment of 28 part-time students from Birkbeck, University of London. The time line of the project, which also provides the background information for supporting the education rationale of using AES, is summarised as follows. There were 11 weekly teaching sessions (3 h each) in the first term of the academic year (October to December 2009). No teaching related to the module took place in the second term (January to March 2010). A web-based AES was introduced over the holiday period in April: all students following the module received an email inviting them to participate in the anonymous poll, and the students had 4 weeks to vote until the 3-h revision lecture held in mid-May. Note that no ‘clickers’ were used in this project. The final written examination of the module took place in early June.

The rationale behind the AES is to provide a link bridging the 5-month gap between the end of the teaching in the first term and the revision lecture/examination at the end of the academic year. In the first stage of the project, AES was used to help the students prepare for the revision lecture and to allow me, the module lecturer, to have a better lecture plan by understanding the students’ needs. The polling results from the AES were then used as the focal point of discussion in the revision lecture, which forms the second stage of the project. The main aims of the revision lecture were (1) to recapitulate the mathematical equations introduced in the module and (2) to discuss relevant examination and revision techniques, including the use of equations in explaining scientific theories in the written examination. The quantitative component of the module was previously identified as one of the most challenging aspects by the students. As a compulsory course, the geophysics module represents a significant part of the effort of improving students’ quantitative skills in the Earth Sciences curriculum. In other words, the mathematical content featured in the AES was of high importance in the degree programs offered by the host department.

The AES was hosted on the free polling site http://www.surveymonkey.com, and the survey consisted of 10 multiple-choice questions, which were designed to probe how ‘comfortable’ the students were with 10 selected equations introduced in the module. Figure 1 shows an example of the questions with the available responses, and the other questions followed the same format. The equations were arranged in the order of increasing complexity and grouped into the two main subject areas covered in the module. The students were invited to select one of the five graded responses available, ranging from ‘I know the equation inside out’ to ‘Have I seen this
equation before?’ (Figure 1). The three ‘intermediate’ answers focus on whether the students were at ease with the scientific significance of the equations (Figure 1), which was one of the main aims of the module and was discussed extensively in the revision lecture. As the purpose of the survey was to help the students get ready for the revision lecture after a long break from the main part of the module, the questions in the survey were not designed to be a test. This point was explicitly specified in the invitation email for participating in the survey (‘No preparation is needed’). The informality of the survey also served to encourage participation by making it less intimidating. Note that the focus of the survey was not on the collection of scientific data about the students’ actual competence.

The second stage of the project involved the follow-up revision lecture based on the polling results and the mathematical equations featured in the AES. The equations were discussed in the order they were presented in the survey: the fact that the questions were grouped in related topics and in increasing difficulty was useful for enhancing the students’ learning during the revision lecture. In addition, the polling results for each question (i.e., number and percentage of participants for each answer) were presented in the revision lecture as bar charts, and the scientific topics related to the equation were then discussed. In other words, the release of polling results and scientific topics of the 10 questions were paired, and more time was spent on the equations that were considered difficult according to the poll. Students were reminded that the survey results were not ‘scientific’ as they were subjective assessments conducted well before the written examination. A total of 20 students (71% of all students) participated in the AES and attended the revision lecture/viewed the videoed revision lecture on the module website.

Students’ evaluation

Methodology

Two anonymous questionnaires were designed to evaluate the project from the students’ perspectives. The first questionnaire on the general teaching of the Geophysics module was given to the students immediately after the revision lecture, and four of the multiple-choice questions were related to the AES project (Appendix 1). A second more detailed questionnaire designed to probe the students’ experience with AES (Appendix 2) was sent to all students by email after the examination: six questions on their experience with the AES and revision lecture (Questions 3 to 7 and 9) and three questions on the general use of AES (Questions 1, 2 and 8). Note that no AES had previously been implemented elsewhere in the curriculum followed by the students. In both
questionnaires, students were asked about their own assessment of whether they felt they already had adequate mathematical background for studying this module before it started. Students who had participated in the AES and attended/viewed the revision lecture were invited to complete the questionnaires. The total number of students who participated in the AES and revision lecture was 20, and the response rate for the questionnaires was about 50% (10 for the first questionnaire and 9 for the second). Owing to the relatively small class size and limited number of participants, the data collected are used here for highlighting teaching-and-learning considerations related to AES and for formulating hypotheses that can be tested in future studies.

Quantitative data from first questionnaire
Table 1 shows that the respondents were positive about the use of AES in this project, particularly in terms of its ability to prompt them to rethink the significance of the mathematical equations introduced in the module (Statements 1 and 2). Students who felt less confident about their mathematical knowledge appeared to appreciate the AES slightly more than those who were more confident (Statements 2 and 4). Note that the results are based on the students’ perception of their mathematical background and not on the students’ actual mathematical attainment.

Qualitative data from second questionnaire
Consistent with the quantitative data from the first questionnaire, the students’ experience with the AES was overwhelmingly positive. Comments such as ‘Online polling made the revision session the most useful one that I have had during my degree so far’ support the use of AES with follow-up sessions. Although the responses are consistent with the lecturer’s pedagogical expectations of the project, they reveal some significant teaching-and-learning considerations behind the use of AES in the module. Note that there was no systematic difference in the comments from respondents with different self-assessments of their mathematical competence.

1 The AES enhanced the delivery of follow-up teaching
The students regarded the AES as a useful preparation tool as it ‘saved time which otherwise would have been used up at the revision session, listing which areas were giving problems’ and ‘gives forewarning of subjects to be covered’. The AES was also seen as helpful in terms of facilitating teaching in the revision lecture by making ‘the whole math concept clearer... due to the math–geophysics linkage, which was well presented’. It also enabled the lecturer to have ‘an idea of which areas to focus on in the revision’ because ‘[m]ost lecturers want us to ask questions but most times we don’t think of any off the top’. From the learners’ perspectives, one student noted that ‘[i]n the follow-up session you can find out where your strengths and weaknesses . . . It’s a useful tool’.

<table>
<thead>
<tr>
<th>Self-assessed mathematical background</th>
<th>1. AES prompted me to rethink equations</th>
<th>2. AES prompted me to link equations with Geophysics</th>
<th>3. AES was a good tool for revision lecture</th>
<th>4. AES has positive effects on my learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate (5)</td>
<td>4.4</td>
<td>4.2</td>
<td>4.2</td>
<td>3.6</td>
</tr>
<tr>
<td>Somewhat adequate/not adequate (5)</td>
<td>4.4</td>
<td>4.8</td>
<td>4.2</td>
<td>4.0</td>
</tr>
<tr>
<td>All respondents (10)</td>
<td>4.4</td>
<td>4.5</td>
<td>4.2</td>
<td>3.8</td>
</tr>
</tbody>
</table>

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The release of the survey results had other positive effects on the follow-up teaching as it ‘broke the ice for the revision session’ and ‘allowed us [the students] to move past topics that most people felt comfortable with and focus on the ones where more people were less confident’. In the wider context, there is a consensus that AES is a useful tool for structuring lectures and pitching them at the right level as the AES ‘might help tutor about some learning related weaknesses that the students had during the course’. In addition, the benefits of AES can facilitate both teaching and learning ‘because the lecturer can identify the difficulties of students and the students know what they expect from the lecturer’.

2 Simplicity and anonymity of the AES were important

Some students commented that the format of the AES ‘encouraged honest answers’. Anonymity is important because it ‘allows you [the students] to be honest without looking a fool in front of your peers’ or ‘without being inhibited by the opinion of others’. Simplicity of the survey format was also regarded as an important element as the AES ‘acts as a focus and takes very little time to complete’. The design of the questions for personal reflection on the mathematical equations was viewed positively: ‘by focusing on comfort with equations it made it less onerous to fill out and meant that the survey remained a survey and not a test’. However, in the broader context, the simplicity of using multiple-choice questions in AES also has its limitations because ‘maybe the choice you [the students] require is not there’.

3 Students considered the release of the survey results an engaging experience

Some students thought that the polling results were useful for finding out how well they were doing: ‘[The results] allowed me to gauge where I was in relation to the rest of the class in terms of my confidence with certain topics’. While some students thought that it was ‘reassuring to know that I was not the only person to have forgotten several key points from the course material’, the survey results also encouraged them to take action: ‘[The survey] also made me more determined to brush up on the things I was less familiar with’ as it ‘highlights the fact that I needed to work on the equation a bit more’. A student even thought that doing ‘badly’ in the survey may have positive effects on learning: ‘[the survey results] will be helpful for most people but may be demoralizing for a small number who think they know nothing—or it may kick them into revising’. However, comparing their results with their peers’ was not a universal opinion: ‘I wasn’t too concerned how well other people knew the equations, as it is me who has to sit the exam’. Despite these different views, all respondents wanted to know the results with one student writing ‘if the results were not known it would make me less inclined to complete future questionnaires’.

4 AES content may have unintended influence on students’ study

Although the students were told in the revision lecture that the equations covered in the survey formed a subset of the equations introduced in the module, some of them, nevertheless, had the impression that the featured equations deserved more attention in their revision: ‘After the survey I made sure that I was confident with those formulae at the very least’ as they ‘assumed they [the equations in the survey] were the most important ones’. One respondent even ‘concentrated more on certain equations’ as the survey was thought to have ‘made it easier to decide which areas to focus on when studying’.

5 There were divergent views on whether AES should be used more frequently in the module or elsewhere

Although all the respondents expressed positive views on the use of AES, they appeared to be more ambivalent about whether it should be used in more courses: ‘I would not like to spend more time completing online surveys for other subjects’ as there may be ‘too many of them to fill in’. Otherwise, AES would ‘suffer lower response rates if it were to be used too often’. In contrast, some
students suggested using the AES more often during the course: ‘[AES is] a useful tool for the occasional reinforcement of understanding subject matter—rather like a test, but with better feedback as you can see anonymously where you stand in the group’. Another student would even like to see it used more frequently as AES ‘could be used each week to emphasise key points of the course notes. Would be good to have two shots, one before any preparation and one after. A score would be good but it should be anonymous’.

**Implications for applying AES in lectures, modules and curricula**

This case study of AES has confirmed some previously reported findings on the use of electronic surveys (eg, Klaas, 2003; Wang, 2003). For instance, responding to multiple-choice questions was appreciated by the students as it was time efficient. The anonymity of AES is capable of creating a sense of confidentiality, which is an advantage of adopting electronic surveys (HANdverk, Carson & Blackwell, 2000). As the students did not feel inhibited and they treated participating in the survey as a ‘trigger’ for revision, the AES was likely to encourage frank responses. Given that results from electronic surveys are not always suitable to provide scientific data for assessment purposes (Solomon, 2001), it is particularly important to exploit the potential of electronic surveys as a lecturing tool and as a link between teaching components. As for the disadvantages of AES, it is potentially prone to ‘fatigues’ with low response rates if it is used too frequently. Furthermore, AES may also have unintended influence on learning: content featured in a survey may attract additional, justified or other attention from the students. Although this case study involved a group of part-time students, none of the advantages and disadvantages of AES identified from the responses to the qualitative questionnaire were exclusive to part-time studies.

The asynchronicity of the electronic survey played a crucial role in bridging the two parts of the science module. It provided some precious opportunities for reflection and preparation to the students and lecturer, and this would not be possible with synchronous voting. As shown by the students’ evaluation, the preparation stage of AES prompted the students to think about the featured course materials, which were then followed up in the revision. In this study, the students perceived the release of the polling results in the lecture as an engaging experience, and it matched the lecturer’s expectation of using the results to enhance the teaching and to use it as a context for interacting with the students. In conclusion, this two-stage approach of AES possesses the advantages of (1) enhanced interactivity in lectures for which synchronous survey methods are renowned (Draper & Brown, 2004) and (2) the capability of linking different teaching components in a module. AES, therefore, has the potential to be applied in other contexts, given that they are perhaps best used in moderation and treated not as time-consuming tests. For instance, they may be applied at ‘supra-module’ levels by providing continuity to related modules in a curriculum while being used as an effective teaching device within modules and lectures at the same time. As interdisciplinary and multidisciplinary modules receive more emphasis in undergraduate teaching (eg, Tong, 2010), AES is a promising tool for providing intra-modular links covering different subjects.

**Acknowledgements**

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**References**


Appendix 1: Students’ evaluation: quantitative questionnaire

Please select one of the following options for each statement: SA (strongly agree), A (agree), N (neutral or not applicable), D (disagree) and SD (strongly disagree).

1. The online polling has prompted me to rethink my understanding of the equations introduced in the module.
   - SA  A  N  D  SD
2. The online polling has prompted me to study the connection between the equations, the diagrams and the related geophysical theories.
   - SA  A  N  D  SD
3. The online polling is a useful tool for preparing for the revision session.
   - SA  A  N  D  SD
4. The polling results will have a positive effect on focusing my efforts in the revision.
   - SA  A  N  D  SD

In your opinion, did you consider yourself having adequate background in maths to study this module at the beginning of the module?
A. Yes  B. Somewhat  C. No

Appendix 2: Students’ evaluation: qualitative questionnaire

1. Online polling is a way to gather your opinion/thoughts on course content or activities via the Internet. In your opinion, what makes ‘online polling’ a potentially appealing teaching/learning tool in *any* undergraduate course?
2. In your opinion, what makes ‘online polling’ a potentially unappealing teaching/learning tool in *any* undergraduate course?
3. Did the use of ‘online polling’ make any difference to your preparation for the revision session of the Geophysics module? Why? Why not?
4. Did the ‘online polling’ prompt you to look at the course materials? Before completing and/or after completing the survey?

5. How did you feel when the results of the ‘online polling’ were released in the revision session? In what ways, if any, does the release of the results affect your learning?

6. Do you prefer knowing or not knowing the results of the ‘online polling’? Why? Why not?

7. I used the equations featured in the ‘online polling’ (1) to explain how different equations are linked to the geophysical principles and (2) to do a quick revision of the course. Does the use of the online polling make any difference to your learning during the revision session? Why? Why not?

8. Do you want online polling to be used in other courses? If yes, how?

9. Can you comment on the following: format of the survey (ie, asking you whether you were comfortable with the equations)/content of the survey (including choice of equations)/relevance of the survey to the exam preparation.

10. In your opinion, did you consider yourself having an adequate background in maths to study this module at the beginning of the module? Yes/somewhat/no?