Impact of Audience Response System in first year Statistics lessons: Click or Not to Click

Abstract

This paper explores the use of an Audience Response System (ARS) in undergraduate Statistics modules at our Institution. This technology allows students to respond to questions during lessons using a handheld response device and then lecturers can immediately view the results of student responses and display them on the screen. We discuss how student engagement with this ARS at Greenwich helps to promote active involvement in learning and greater interaction in the class. Specific usage methods in teaching and their impact on student learning and engagement are described. We found that this implementation provides an attractive way to make students engage with their lesson. Student feedback suggests that this approach provides them with a better learning experience making the lessons more interesting to follow and take part in.

1. Introduction and background

With the increased use of modern technologies in classrooms at schools and colleges around the country, and also in day to day life, students nowadays have become more reliant on the use of modern equipment in their learning process. Most of this generation of students are very much in tune with the latest technology and they depend heavily on electronic gadgets to keep their interest alive. In this context, it is not very surprising to note that it is indeed a tough task to hold the attention of a lecture theatre full of easily distracted first year students, especially when they have various electronic devices within their reach. Keeping students engaged and focused on the lesson in Higher Education is becoming more and more difficult, especially in the first year of their undergraduate degree programmes. Promoting a healthy level of interaction among students during a lesson is also a delicate issue which needs attention, especially in large classes. One way of tackling these issues is to make use of the facilities provided by the technology. It is our view, based on our experience at Greenwich, that appropriate use of the ARS technology in lessons goes a long way to achieve this.

The ARS is a powerful interactive group response system which enables an audience to use wireless response devices to provide instant feedback to questions posed by the speaker. The handheld devices are mostly used to answer multiple choice questions and the responses are quickly translated into test scores, charts, and graphs. Rowlett [1] describes the system in more detail and provides good coverage of the practices and experiences. There has been a number of interesting articles on various aspects of this technology in the literature over the years, see for example Draper [2], Simpson
Impact of Audience Response System in first year Statistics lessons: Click or Not to Click – Nadarajah Ramesh

2. Specific usages and their impact on learning

This technology is being used by many Higher Education Institutions in different contexts for teaching, learning and assessment. How to make use of this system to enhance the learning depends on many things and one can find various suggestions in the literature. A good review on themes, developments and practice can be found in [3]. How this technology is being utilised in teaching and learning at Greenwich to enhance student engagement and interaction in Statistics lessons and the proposed plans for its strategic usage in future are discussed in this paper.

2.1 Short quiz at the start of lesson

One strategic usage is to set up a short (five or ten minutes) weekly quiz at the start of lesson covering the previous week’s material. This method makes students revise regularly at home because they want to do well as the results are revealed immediately. Students often talk about the quiz scores with their peers and, therefore, it makes them more competitive. Incorporating this approach in teaching also helps to warm up and provides an attractive way to get ready for the new lesson. If we discuss the answers to the questions featured in the quiz as we go along, when the polling is closed, then that will serve to reinforce the previous week’s learning. This method certainly benefits those students who missed the previous lecture. In our experience, the prospect of the quiz encourages them to catch up immediately. From the lecturer’s perspective, they can see how well students understood the lesson, expand on any difficult concepts and recap quickly on what was taught in previous week.

2.2 Quick revision at the end of lesson

Another strategy is to set up a quick revision at the end of lesson every week to assess learning. This makes students pay more attention throughout the lecture in preparation for the ARS revision session at the end of the class. It makes them more focused as they have a chance to assess their own learning at the end of each lecture. Regular implementation of this helps students identify their strength and weakness, and areas for revision and further work at home during the week. It also provides students with a sense of satisfaction and achievement, as they get immediate feedback on their learning. From the lecturers’ point of view, possible benefits are that they can see how well students understood the lecture, summarise the lesson, and pick up points to address or revisit in the next lecture.

2.3 Short weekly tests forming part of assessment

Another useful method of application is to set up short (five or ten minutes) weekly tests on previous week material and allow this to count towards final assessment of the module. The contribution towards final assessment makes students take it more seriously and revise regularly at home which helps them build up their knowledge gradually. In addition, this strategy helps to promote engagement as well as attendance because those who miss lessons will be disadvantaged. For the lecturers, it gives an opportunity to keep an eye on students’ progress, design the regular assignments at the right level and identify areas of difficulty for the revision weeks. One other advantage of this is that there is no need to worry about marking the test papers, as the system will automatically do that provided the correct answers are identified. This will save a lot of time for the academics.

2.4 Intermittent usage throughout the lesson

One of the most common methods is to use the system intermittently throughout the lesson, as and when necessary, depending on the nature of the topic taught. This method helps to keep students engaged throughout the lecture and makes them stay focused as they have a chance to assess their own learning during the lesson. This will provide students with a sense of continuous engagement. It helps students compare their learning with their peers, obtain instant feedback and identify difficult areas or concept. This approach gives us a chance to see how well students are following the lesson when new concepts are introduced, identify points for discussion and promote more interaction in the class. Moreover, it helps us adjust the flow of lesson and gain greater control and directions of the delivery, because student responses throughout the lesson allow us to decide whether to expand on difficult concepts or to move forward with next topic if things are going well.

3. Type of questions to use

Designing good quality questions for a purpose is an issue on its own right. Questions will have to be designed carefully to bring the best outcome expected for the intended purpose. Wit [5] outlines some important points to bear in mind in designing good questions and also guidelines for coming up with the answers. We prepared the questions for our lessons with various purposes in mind at different stages of a lesson. Quite often at the start when the purpose is to warm up it may be best to use simple questions designed to check the basic understanding of a concept. It can then move onto questions involving simple calculations to make students do a bit of work before they send in their answers. Some of the questions are designed to verify comprehension and others to initiate discussion depending on the context. There are also questions to probe students’ understanding of the subject and use their responses to decide what to do next. In addition to all these, it is important to make up some brain teasers or thought provoking questions which will challenge students’ thinking and initiate interaction in the class. Examples of some of the questions used in our first and second year Statistics lessons are presented in Figures 1 to 4.
The responses in Fig 2 clearly indicate a good level of comprehension among students which implies the lecturer can move on without spending much time on the model selection issues. Responses in Fig 3, however, show that the concept of regular Markov chain is not well understood by majority of students and therefore it presents an opportunity to initiate discussion. Fig 4 challenges student thinking and provides an opportunity to reinforce the concept of linear correlation.

<table>
<thead>
<tr>
<th>Question</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Markov Chain is Regular</td>
<td></td>
</tr>
<tr>
<td>1. If all elements of P are positive</td>
<td>37%</td>
</tr>
<tr>
<td>2. If all elements of some powers of P are positive</td>
<td>23%</td>
</tr>
<tr>
<td>3. If it is possible to reach any state in just 1 step</td>
<td>17%</td>
</tr>
<tr>
<td>4. If it is possible to reach any state in 2 steps</td>
<td>23%</td>
</tr>
</tbody>
</table>

**Fig 3 - Verify comprehension or initiate discussion.**

<table>
<thead>
<tr>
<th>What type of variable is the Number of Cars in a Car Park?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Qualitative Nominal</td>
<td>0%</td>
</tr>
<tr>
<td>2. Quantitative discrete</td>
<td>0%</td>
</tr>
<tr>
<td>3. Qualitative Ordinal</td>
<td>0%</td>
</tr>
<tr>
<td>4. Quantitative continuous</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Fig 1 - Simple question to check basic understanding.**

**Fig 5 - Student feedback on learning.**

**4. Student feedback**

We introduced this new approach last year and the initial feedback appears to be very positive. Small scale student feedback on the use of this technology in statistics lessons was obtained using the ARS itself. Student response to some of the feedback questions are given below. In a class of 72 students during a feedback session 83% of them said that the use of ARS helps them with their learning (Fig 5). This confirms the informal feedback obtained from discussions with students. Nevertheless, for a question on motivation only 53% thought that this approach motivates them. When asked if they wanted to see more sessions involving the use of ARS 78% of them said Yes and 22% said No. Fig 6 shows that a vast majority of them feel that the use of the ARS generates interaction, provides instant feedback and makes the lessons more interesting. These results and responses to other feedback questions reveal that our approach provides improved learning experience as evidenced by increased student attendance and engagement in lessons that make use of ARS. Based on this observation, we are expanding the application of ARS at present and there are plans to incorporate this technology further in statistics lessons next year.

**Brain Teasers:**

Correlation is a measure of the strength of **Linear** Association. Which of the following four data sets would you expect to have the smallest correlation coefficient with $X$?

1. Y1
2. Y2
3. Y3
4. Y4

**Fig 4 - Brain teasers to challenge students’ thinking.**
Incorporation of ARS in teaching methods helps to draw a higher level of attention in the class and the implementation of this is likely to become popular among students in future, helping them engage better with their lessons. It has the potential to initiate greater interaction in the classroom which creates a healthy learning environment. Our experience shows that appropriate use of this technology makes students pay more attention and promotes greater interaction during the lessons. This approach of challenging students’ thinking when they are provided with a facility to register their answers anonymously, without being hesitant or shy, provides us with an attractive way to obtain greater engagement. Teaching methods which make effective use of ARS have the potential to impact positively on students and hence they are more likely to succeed in enhancing students learning activities in higher education in the next decade. The idea, however, is not to rely heavily on the technology but to use this as a tool to promote engagement and initiate interaction in the class. This approach also facilitates students’ learning and thinking as it makes them feel that they are taking a greater part in their learning process.

References

Supporting Postgraduate Students who Teach Mathematics & Statistics
A series of one-day regional teaching workshops

The Maths, Stats & OR Network is once again pleased to announce that it will be running an extended programme of one-day regional workshops to provide discipline specific support, advice and guidance to postgraduate students who teach Mathematics and Statistics.

University of Birmingham
University of Nottingham
University of Leeds
Queen Mary College, University of London
University of Southampton
Cardiff University
University of Bristol
University of Sheffield
Edinburgh University
University of Manchester

Thursday 22 September 2011
Tuesday 27 September 2011
Wednesday 28 September 2011
Friday 30 September 2011
Monday 3 October 2011
Wednesday 5 October 2011
Monday 10 October 2011
Thursday 20 October 2011
Friday 28 October 2011
Thursday 3 November 2011

For further details please visit our webpage at
www.mathstore.ac.uk/postgrads2011