

USE OF QUIZZES IN LARGE STATISTICAL LECTURES: STUDENT PERCEPTION

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One of the challenges of teaching large classes is effective engagement with students, both to keep students' attention and to monitor their understanding. A simple tool which allows monitoring of understanding and serves as a way of engaging students is to use short multiple-choice quizzes during a lecture. We use a questionnaire to compare student reaction to online quiz platforms, one which allows students to compete anonymously and another personal response system which does not have a competitive element. Analysing the results, there is a difference in student preference for the two types of quiz, influenced by academic background and gender. Interestingly, significantly greater scores were recorded when using the anonymous quiz platform.

INTRODUCTION

A short multiple-choice quiz is a simple tool which monitors both understanding of new concepts and serves as a way of engaging students. The possibility of taking part anonymously encourages even the quietest students to engage with the activity. Audience response systems (ARS) have been used to improve student interaction, engagement, and attention, increase the attendance, stimulate peer and class discussion, provide feedback for both students and instructors to improve instruction and improve learning performance, (Robin & Le Sage, 2009).

In this paper, we investigate two different forms of these quiz platforms, one which allows for anonymity while the other platform has no competition element and the responses are not anonymised. Analysing the results, there is a difference in student preference for the two types of quiz, influenced by academic background and gender.

METHODOLOGY

A multiple-choice quiz monitors both understanding of new concepts and serves as a way of engaging students. Anonymity encourages even the quietest students to engage with the activity. To carry out this research, we initially used voting pads for the students to use during class for pre-prepared quizzes.

The questionnaires were designed on Likert scale, ranging from 1 to 5, where choice of 5 indicated the most popular, most liked/most preferred. The reaction was very positive: informal feedback reassured us that students enjoyed the quizzes, found them a welcome break during a lecture, and most importantly, helped to clarify tricky concepts. However, the process of booking and collecting voting pads, then distributing and recollecting these in class quickly became cumbersome and required much pre-planning.

An alternative method is to use an online system, thanks to fast development of mobile technology, mobile devices can be integrated with clicker system into teaching and learning with improved features. In this method students use a smart phone, tablet or laptop as their voting pad. One such free service, which we found to be one of the best, is Kahoot. This is simple to set up, creates visually pleasing multiple-choice quizzes, and has a reasonable amount of options (including mathematical symbols, Greek letters and so on). Students do not need to sign up to Kahoot to use it and need only enter the quiz's PIN number and a nickname to 'play'. Kahoot's default setting is to produce a 'top five respondents' leaderboard after every question, and points are allocated by Kahoot depending on how long students take to answer a question (and zero points for an incorrect answer), (Mu & Paparas, 2015).

Though these Kahoot quizzes proved to be very popular with students, it became clear that some students were more interested in the leaderboard than in understanding the question asked - many took 'risks' by selecting any option very quickly in the hope that they choose correctly, thus securing a place on the leaderboard. We were concerned that the motivation to appear on the leaderboard was undermining the purpose of introducing these quizzes during lectures. Indeed, as

one student told me, they felt that they had 'achieved something' when they saw their name appear on the leaderboard, even though they had been correctly answering quiz questions all along, just not quite as quickly as other students. To further investigate this, a questionnaire was distributed among students to compare voting pads with online systems such as Kahoot.

The questionnaire looked at a variety of factors which we thought may influence the usefulness of these quizzes.

OVERVIEW

Data were collected during December 2015 and again in December 2016. A total of 146 students completed the questionnaire, from three distinct UCL with different students registered for all three. The sample consisted of 95 females and 67 males who were either in their first year (79), second year (62), third year (15) or fourth year (6). Students were mostly studying for degrees in biological sciences, chemistry, or business, with 20 studying for degrees related to statistics.

RESULTS

Almost 150 students took part in this exercise. Result showed that students enjoyed the Kahoot quizzes more than traditional voting pad quizzes (82% of respondents enjoyed voting pad quizzes as part of a lecture, and 87% enjoyed Kahoot quizzes).

The data we collected implied that our suspicions that students are less likely to think about their answers when an element of competition is introduced were correct.

That is, though more students enjoyed the Kahoot quizzes, they were less likely to consider their answers; students also felt that, probably as a direct result of this, Kahoot quizzes are not quite as effective as the voting pad quizzes in reinforcing understanding.

This was not at all surprising given our observations in class, but what is perhaps more surprising is the gender divide implied by the data we collected when it comes to competition (via the 'leaderboard' in Kahoot): 60% of male respondents strongly agreed with the statement 'I am more likely to participate in quizzes if there is an element of competition with my peers', as opposed to 35% of female respondents.

In asking the students about their preferences for competition and anonymity, students seem to like an element of competition, though many stated a preference for anonymity, too. The result showed somewhat bimodal behaviour, with score of 3 or 5 most popular. This might be due to the Likert nature of the questions, with students stating preference *for* anonymity or feel neutral about it.

Comparison of clicker and Kahoot! Quizzes

A sign test showed significant differences between clicker and Kahoot! quizzes in terms of:

- Enjoyment of quizzes in class ($p=0.0128$, with Kahoot quizzes favoured);
- Answering quiz questions carefully ($p<0.0001$, with clicker quizzes prompting students to be more careful when answering);
- Understanding material better after a quiz ($p=0.0652$, with clicker quizzes promoting better understanding, though marginally).

A weighted scatterplot (bubble plot) in Figure 1, weighted by the number of respondents for each pair of scores, shows the rather stark comparison between the two types of quizzes and the care students take in responding.

Other effects:

Gender and year of study effects were investigated, and to do so, the difference between each student's clicker and Kahoot score for each of these categories: enjoyment, thinking carefully, understanding concepts, remembering material (from now on referred to as 'the four questions') was simplified as follows:

- No difference between Kahoot! and clicker score;
- Higher score for Kahoot! quizzes;
- Higher score for clicker quizzes.

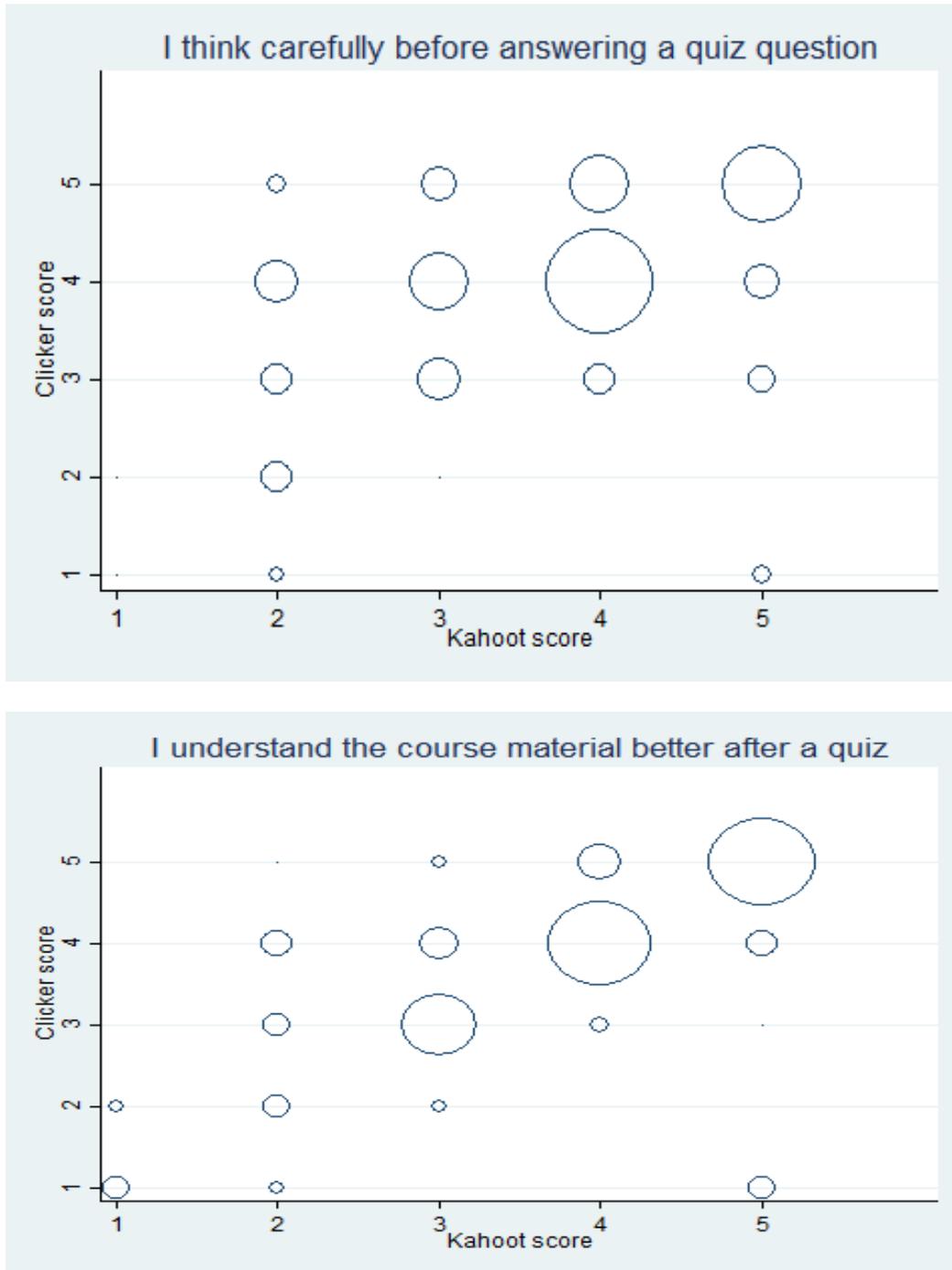


Figure 1. Weighted Scatter Plot Comparison of Kahoot and Clicker Quiz Scores

No significant differences were found between gender and any of the four questions, or between year of study and any of the four questions, on application of a Fisher’s exact test. However, a statistically significant gender effect was found for competition and anonymity preferences: male students tended to rate competition higher than their female counterparts (Fisher’s exact test, $p=0.006$) and female students tended to rate anonymity higher than their male counterparts (Fisher’s exact test, $p=0.025$). No other significant relationships were detected between anonymity preferences and year of study, or between competition preferences and year of study.

CONCLUSION AND FURTHER RESEARCH

With such overwhelmingly positive feedback from students around quizzes, our aim now is to investigate the impact of competition on learning and whether, in the long run, these quizzes really

do help students to better understand the course material, and whether introducing such activities during a lecture helps to motivate students and improve their level of concentration during class.

Some students have already alluded to this in their questionnaire responses, for example, as two students commented in relation to having quizzes during class:

'Encourages you to constantly revise if the quizzes are used regularly.'

'It actually gives me additional motivation to pay attention in class and participate.'

SELECTED COMMENTS FROM STUDENTS

'Mobile quiz goes faster/more general excitement so less likely to properly consider answers'

'Kahoot makes me actually care about whether or not my answer is correct. Kahoot takes a while to set up, but if there's a few consecutive questions I think it's worth it. It gives me additional motivation to pay attention in class and participate. Would be nice to be able to access the questions after the lecture.'

'Another thing that makes the quizzes so useful is when the lecturer explains the answers which gives you an opportunity to find out an aspect about the workshop you didn't pick up the first time'

'All quizzes were good, but the only problem with Kahoot is that you don't always get good reception/signal on your phones and can't participate'

'Although we get workshops that help us practice the mathematical side of statistics, the quizzes that we had before the ICA helped me clarify things that I didn't even know I was wrong about, or I didn't know that I had to know.'

'The quiz questions were time restricted and therefore I pressed any answer that looked remotely correct - I didn't therefore think about the answer more so getting an answer down (and just hoped it was right)'

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