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To Click or not to Click: Introducing Audience Response System during Undergraduate Teaching to Improve Academic Performance

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ABSTRACT

Objective: To determine if the use of audience response system (ARS) during large group teaching to undergraduate medical students promotes active learning, improves retention of information and leads to an improvement in academic performance.

Design: A Prospective Interventional Study.

Setting: RCSI Bahrain.

Method: ARS was used during a 12-week teaching period in the first semester of the first year of the medical program from October 2012 to December 2012. Lecturers integrated Multiple Choice Questions (MCQs) into their PowerPoint presentations together with ARS during Anatomy and Physiology lectures. Students were asked to discuss and respond to the MCQs during the lectures.

Result: Using ARS did not improve academic performance in Anatomy and Physiology, but students reported that using clickers during lectures provided a more interactive learning environment increasing student engagement, promoted active-learning and helped students identify gaps in knowledge.

Conclusion: Using ARS in large group teaching had no impact on academic performance in the Anatomy and Physiology rich modules. However, students overwhelmingly enjoyed using clickers during lectures as they promoted active learning and helped them identify gaps in their knowledge.

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INTRODUCTION

Lectures are commonly used for large student groups and are typically thought of as knowledge transfer platforms from content expert to student, usually focused with three main aims: first, to develop the understanding of the learner; second, to frame the learning under headings in order to make it clear and contextualized; and third, to guide the learner in developing their understanding by providing additional resources for the learner to explore[1].

Learning is a combination of understanding and memory; lectures are a time-efficient method of presenting information to a large group. Traditional didactic presentation foster passive learning with a disconnect existing between the participants and the lecturer. Long gone are the days when academics could pitch up with reasonable subject knowledge and deliver a monologue for a couple of hours and then ask if there are any questions at the end[2]. This type of delivery is passive and does not offer any learner value; the students have limited attention span during the lecture and low retention rate of factual information afterwards, both hallmarks of passive learning.

Interaction is usually missing during lectures as student numbers increase and students become hesitant to speak in larger groups for fear of embarrassment. ARS has been used across academic disciplines and it offers the potential to make lectures more engaging and interactive. It benefits both the instructor in providing real-time feedback of the students' understanding of the material, and the students in establishing their actual understanding whilst the lecture is being delivered. It has been said that ARS technologies such as Turning Point (TP) can be used to spice up lectures, assess student's opinion/understanding related to the material delivered and increase the degree of interactivity in large classes[3]. This approach has been shown to enhance understanding and promote integration of concepts in other disciplines including pharmacology. Such knowledge gain is essential for improving academic performance[4,5].

Audience Response Systems (ARSs) were originally used in game shows such as the UK's "Who Wants to be a Millionaire". This technology was transferred to higher education where it has become an increasingly popular tool to promote interactivity, collect feedback, survey the students' and assess students' understanding of lecture material[6]. The objective of any ARS is to enhance learning by keeping learners actively involved through fostering a greater ability to pay attention[7]. The benefits of using ARS include students being more focused in the class, students actively discussing misconceptions to build knowledge and an increase in learning performance of students[3,8,9]. Academic performance enhancement has been described by many using the ARS in large groups and these reports include a number of publications in the medical education[10,11]. They describe changes in student's behavior leading to increased motivation, improved attention and enhanced critical thinking skills which are the key drivers of academic performance.

The aim of this study is to determine if the use of audience response system during teaching promotes active learning, improves retention of information and leads to an improvement in academic performance.

METHOD

ARS was used during a 12-week teaching period in the first semester of the first year of the medical program academic year 2012-2013. Lecturers integrated Multiple Choice Questions (MCQs) into PowerPoint presentations together with ARS. Students were given ARS devices before the start of each lecture and asked to vote on single best answer for MCQs scattered throughout the presentations. The students selected their response using the individual wireless devices and the results were displayed 'live' as a visual histogram of the collective responses, providing immediate anonymous feedback of their understanding of the lecture content.

One hundred fifty-one medical students in the first year of the medical program were included in the study. Two outcomes were measured: academic performance and students' perceived experience.

We measured the impact of the ARS on students' academic performance by comparing their performance records in modules, which contained a large component of Anatomy or Physiology for the intervention group with those of a control group of 130 students, which consisted of undergraduate students from the previous year's cohort who had not experienced the use of ARS in their large group teaching.

Students in the intervention group were asked to evaluate the usefulness of clickers as an instructional and developmental tool at the end of the second semester of the first year. Fifty-seven (37.7%) students responded to students' perceived experience survey.

All data was analysed using SPSS version 20. Data analysis included an independent t-test to compare the means between the intervention group and the control group. All statistical tests were carried out at a significance level of 5%. The survey of the usefulness of clickers was reported as frequency and percentage.

RESULT

The scores from the modules contained a large component of Anatomy or Physiology from students who had used ARS in academic year 2012-2013 (cohort 2013) compared with those students who had not used ARS (cohort 2012). No statistically significant difference in their performances was found.

The results for the neuromuscular module (mainly Anatomy) delivered in semester one showed an increase in the mean score between cohort 2012 to cohort 2013 by 1.8% (95% CI:-6 to 2.3) but this was later found to be statistically insignificant (p value 0.388), see table 1.

Table 1: Students' Academic Performance

Semester 1 Module	Academic Year	Number	Mean	SD	Std. Error Mean
Neuromuscular module	2012	130	55.54	15.83	1.39
	2013	151	57.38	19.30	1.57
Hemopoietic & Immune System module	2012	130	57.71	18.40	1.61
	2013	151	55.66	20.52	1.67
Junior Cycle 1 Total	2012	130	55.63	15.68	1.38
	2013	151	58.87	17.88	1.45

Another first semester module, the hemopoietic and immune system (mainly Physiology), showed a decrease in the mean score between cohort 2012 and cohort 2013 by 2% (95% CI:-2.5 to 6.6). This too was found to be insignificant (p value 0.380).

The overall accumulated performance in the first semester showed an increase in the mean score between cohort 2012 and cohort 2013 by 3.23% (95% CI:-7.4 to 0.744). This was also found to be insignificant (p value 0.111).

ARS was used during the large group teaching of Anatomy and Physiology and anecdotally discovered that it was very popular amongst students. In table 2, student responses were

captured using ARS and these show that 43/53 (81%) of the students' responses indicated that they enjoyed using the clickers during large group teaching. Students were asked whether the use of clickers in large groups promoted active learning: 46/53 (87%) agreed that using clickers did promote active learning. Thirty-five out of 57 (61%) agreed that the clickers helped them to identify gaps in their knowledge. Twenty-two out of 57 (39%) thought that using the clickers did not help them in identifying gaps in their knowledge. Forty-three out of 56 (77%) responded positively when asked if they thought the use of clickers helped them think more actively during the lecture. Thirty-seven out of 46 (80%) recommended using ARS for large group teaching.

Table 2: Students' Perceived Experience – Summary Results

Item	Responses		Total number of responders
	Yes	No	
Students enjoyed using the clickers during large group teaching.	43 (81.1%)	10 (18.9%)	53
The use of clickers in large groups promoted active learning	46 (86.8%)	7 (13.2%)	53
The clickers helped students identify the gaps in their knowledge	35 (61.4%)	22 (38.6%)	57
The use of clickers helped students think more actively during the lecture	43 (76.8%)	13 (23.2%)	56
Students would recommend using ARS for large group teaching	37 (80.4%)	9 (19.6%)	46

DISCUSSION

Our study shows that students did not improve their academic performance in the first semester when ARS was incorporated into the teaching of Anatomy and Physiology. Like other authors, we had hoped that using the clickers throughout the year would promote a positive effect on student's performance but unfortunately, this was not the case[12]. The relationship between performance and clicker use is not clear and there is conflicting data on whether using clickers in teaching improves student's learning[12,13].

Our study shows that using clickers provided a more interactive learning environment, increasing student's engagement, promoting active learning and helping students identify gaps in their knowledge. These positive effects have been reported in similar studies[14,15]. The majority of students enjoyed using clickers in the lectures (80%) but a proportion of students (20%) did not. Knight and Wood suggest two possible reasons as to why these students disliked the clicker experience: first, the better students did not need the interaction as they were sufficiently capable of reading the lecture material and learning away from the lectures; second, students disliked the time it took away from the main content of the lecture[15].

The positive effects of promoting active learning in students have been described in the literature by others[3,16]. Clicker use in lectures promoted certain components of active learning, such as actively engaging students, allowing them to gauge their level of understanding of the material being presented, and providing prompt feedback to the students[10]. It came as no surprise to find a study demonstrating that the use of clickers was associated with specific improvements in active learning opportunities for students[17].

Essentially, the use of the clickers in large groups promotes a collaborative interactive environment conducive for learning. Other studies have found similar results to ours but ours was the first study to report the use of ARS in Bahrain.

CONCLUSION

We conclude that the use of ARS in large group teaching had no impact on the academic performance of students in modules which contained large components of Anatomy and Physiology, but the students overwhelmingly enjoyed using clickers as they promoted active learning and helped them identify gaps in their knowledge and to think more actively when they were using the system. The majority of students would recommend the use of ARS for large group teaching.

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