Journal of Systemics, Cybernetics and Informatics (2023) 21(3), 63-68
https://doi.org/10.54808/JSCI.21.03.63

Use of Audience Response Systems to Enhance Student Engagement in Online Synchronous Environments: An Exploratory Study

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ABSTRACT [1]

Many higher education institutions adapted to the Covid-19 pandemic by switching their teaching into online mode making use of online synchronous sessions using technologies such as Zoom. It was common for lecturers to find it disconcerting that many students were not turning on their cameras and microphones and how this made it difficult to ascertain whether their students were engaged in the sessions at all.

This paper examines the experiences of teaching staff in eight courses relating to the use of audience response systems (ARS) to improve the experiences of students and teaching staff when conducting synchronous online teaching sessions or hybrid sessions when they had some face-face students and some online students joining sessions synchronously.

Literature is examined that shows the benefits relating to the use of ARS in synchronous online teaching sessions to include anonymity of student responses; enhancement of feedback between teaching staff and students; and teaching staff getting a better sense of student engagement during a session.

An analysis of the eight cases presented confirms these benefits in the literature from the perspective of the teaching staff. The findings apply irrespective of the ARS being used and will be of relevance and interest to any teaching staff seeking to improve the experiences of students and teaching staff involved in synchronous online teaching sessions.

Keywords: Audience Response Systems, ARS, Student Engagement, Online Lectures, Covid-19, Anonymity, Feedback

1. INTRODUCTION

In the wake of the Covid-19 pandemic many higher education institutions switched their teaching into online mode with many making use of online synchronous sessions using technologies such as Zoom. It was common for lecturers to find it disconcerting that many students were not turning on their cameras and microphones and how this made it difficult to ascertain whether their students were engaged in the sessions at all.

The purpose of this paper is to present an analysis of benefits of the use of audience response systems (ARS) to enhance student engagement in synchronous online sessions across eight (8) courses in four (4) institutions. In all but one (1) of the courses the synchronous online sessions had been adopted due to restrictions brought about by the institution's response to the COVID-19 pandemic.

A literature review presented highlights the use of ARS to enhance student engagement in live face-face lectures and synchronous online sessions.

This is followed by a description (in the form of mini case studies) of how ARS were used in in the eight (8) courses and the benefits that were identified by the lecturers for these courses. An analysis of the mini case studies is presented and are compared to the outcomes of the literature review.

Conclusions are drawn about the benefits of using ARS in the context of synchronous online sessions from the perspective of the teaching staff in these courses.

[1] This paper has been peer edited by the following research assistant and final year education student at the University of Canterbury and whose input is gratefully acknowledged: Jessica Gibson.

2. LITERATURE REVIEW

There are two (2) aspects covered in this literature review which are (a) the use of ARS to enhance student engagement in live face-face lectures and (b) the use of ARS to enhance student engagement in synchronous online lectures (which may include face-face session where online student can participate synchronously).

Live face-face lectures

There are four (4) main benefits of using ARS in live face-face lectures that have been identified in the literature which are anonymity for students; student discussion; feedback; and student engagement.

Anonymity has been commented on as being an important benefit in many studies relating to the use of ARS in face-face lectures [3], [6], [8], [18] with one particularly commenting on anonymity relating to engagement for shy students [16]. The relevance is important when it comes to the discussion of sensitive subject areas [5], [13].

Increasing discussion was identified as being a benefit of using ARS in a some studies [8], [18] with the use of ARS being seen as a strategy for motivating learners, and with that, the importance of designing questions that stimulate discussion [3]. The importance of discussion in a group setting being incorporated into the use of ARS is seen as being a factor that enhances student performance [1]. A student in one study stated "… I cannot answer the questions until I discuss them out loud…" [9] which indicates that for some students, the discussion that takes place before the answer to the question is submitted is vitally important for learning. The importance of discussing concepts and peer discussion, and how this could be facilitated through using ARS, was identified in other studies [4], [6], [16].

Improving student feedback is a significant theme that has been identified [3], [6], [7], [8], [16], [18]. The importance of the feedback being from student to lecturer and from lecturer to student with the timing of the feedback also seen as being particularly important in some studies [2], [17]. The concept that feedback was one of the core components of formative assessment as an important part of student learning was part of the basis for one study [9].

Increasing student engagement was identified as a benefit of using ARS in face-face lectures in a number of studies [3], [4], [6], [8], [9], [13], [16], [18]. In some studies, the students involved reported that the use of the ARS had resulted in them feeling more engaged [1], [13].

Live synchronous online lectures

The literature relating to the benefits of using ARS in live synchronous online sessions include the benefits relating to using ARS in traditional face-face sessions as well as the following points.

It was suggested that in a course completed during a Covid-19 lockdown that students who chose to participate in synchronous polls using an ARS were more engaged than those who chose to participate asynchronously, and that there is some evidence to suggest that they performed better in exams [10].

In a study related to delivery that included face-face students and synchronous remote students it was identified that the use of quizzes in sessions is positively connected to the motivation of all of the students [15]. In the conclusion to this study they identified that the hybrid classroom is a very promising model, which may have challenges for some lecturers [15] with the authors also commenting that the benefits of both types of students being able to interact and engage more is seen as being significant.

A study conducted was that related to the use of gamified quizzes using audience response systems as part of a flipped learning approach during the Covid-19 lockdown [19]. In the conclusions to this study, it was identified that the use of ARS was a powerful tool for enhancing engagement during live sessions, and that this was used successfully to place the class sessions in a flipped class model when face-face classes were not possible.

In another study conducted during Covid-19 lockdown the researchers used an ARS to conduct polls with the students during synchronous online sessions [14]. In the conclusions to this study, it included that the use of the ARS served to be an effective way to increase student enjoyment and engagement. The concept of the injection of enjoyment and humour through the use of ARS was also evident in what became coined as the "purple shirt effect" [12] where there was ongoing banter between the lecturer and students via the ARS because of a purple shirt that the lecturer wore to lectures periodically.

The concept of students watching a live stream and placing a high level of value on being able to interact and engage via ARS was noted in a study of teacher education [11].

3. MINI CASES

The courses that make up the eight (8) mini-cases were taught at a combination of the University of Canterbury (UC), University of Canterbury International College (UCIC), Ara Institute of Canterbury and RMIT Online (RMIT) and are shown in Table 1 along with the level of study of the course.

Table 1 – Courses Making up the Mini-Cases.

Course Code	Course Name	Insti-tution	Level of Study
STUSPP	Student Support Programme	UCIC	1st year degree
INF001	Information Systems	UCIC	1st year degree
INFO123	Business Information Systems and IT	UC	1st year degree
INFO243	Accounting Information Systems	UC	2nd year degree
MBAZ604	Business Research Methods	UC	Conversion masters
AMEB600	eBusiness	Ara	2nd year degree
AMRM600	Research Methodology	Ara	2nd year degree
BUSM4741	Financial Analytics for Decision Making	RMIT	Conversion masters

The following is a description of each of the courses, along with how ARS was used in the course, and the benefits of using ARS in the course, with the focus on the only synchronous aspect.

Case 1 – STUSPP (Student Support Programme) at UCIC

This course is not graded but is key to international student adjustment to both tertiary study and living within New Zealand. With many students remaining offshore due to Covid-19 for several iterations of the course it ran in hybrid mode with a mix of face-face and online students. The Student Support Programme is an extension of orientation. Although not graded, students are required to attend (face-face or online for offshore students). Topics covered during this course range from academic integrity, what is required in tertiary education, and cultural identity, through to joining social clubs.

During the first week ARS was used to obtain an idea of where students were from. This allowed for similarities and differences to be discussed. During further weeks ARS was implemented twice more, with good results.

Benefits from the teacher's point of view was the ability to gain some early interaction and engagement. This set the tone for the rest of the course. As each week progressed, more students arrived onshore, and the ability to interact via ARS became less of a requirement. However, the foundation was set and the discussions flowed well as the weeks passed.

Case 2 – INF001 (Information Systems) at UCIC

This course is the same course as run by UC (see Case 3), as some students do their first year of study within the UCIC. The course itself is to introduce students to business information systems and technologies. It also introduces students to the technologies used within industry and gives both a practical and theoretical understanding of what may be required both at higher levels of academic study, and in future careers.

When this course was run online during lockdowns, ARS were used in two ways. First, as an introduction tool where students could show what degree they were interested in and how much of a background knowledge they thought they had in information systems. Second, a mini anonymous training needs analysis was completed at the start of each topic to gain a level of understanding for the teacher regarding the student comprehension skill. If words or concepts were not understood, these were then included in a glossary for the week.

The benefits of using ARS were as a relationship builder, but also a tool to aid all students, rather than just a few, as it would provide a picture of their existing understanding of the topic. In addition to this it also provided for some interaction and engagement.

Case 3 – INFO123 (Business Information Systems and Technology) at UC

This course examines how businesses use information systems and technologies to provide value to the business and support the business strategy. The aim of the course is to teach content and develop problem solving skills and use practical skills that would be used within business.

After being involved with this course for many years in a face-to-face setting, the course was then taught online due to lockdowns. To maintain interaction and engagement with students who often did not have, or did not turn on their cameras, the use of ARS was implemented in tutorials. It provided some way of, although synchronous, at least some communication.

It was probably more of an advantage to the teacher at this stage than the students, as it provided some form of knowing whether the students were understanding the content, although after a period of time it did help establish more communication in the form of message chat.

Case 4 – INFO243 (Accounting Information Systems) at UC

The lecturer in this course had for several years made use of ARS in lectures with the goal in enhancing student engagement. The 2020 iteration of this course took place in the absence of Covid-19 lockdown but with many students viewing the live stream of lectures including a cohort of approximately 30 students from a partner college in another country who would normally have been onshore students.

The 2021 iteration of the course had a Covid-19 lockdown part way through the course that saw part of the course being delivered completely online using Zoom, and for the rest of the time there were some students attending the face-face lecture and others watching a live stream, again including approximately 20 students in the partner college in another country. In essence, in 2020 and 2021 this course was delivered in hybrid mode with face-face students in the lecture theatre and other students viewing the online stream.

During the lectures when the course was running in hybrid mode the ARS was used in three (3) ways. First, a quiz at the start of the lecture included a question about where the students were, which served as a reminder to the student in the lecture theatre that there were students watching the live stream, and also was a check that the live stream was working. Second, quizzes would be used at different parts of the lecture to check on the level of understanding that students had of a range of concepts. Third, at the end of the lecture students were able to use the ARS to ask questions about content or any other aspect of the course.

From the perspective of the lecturer, it was very useful to have the reminder of where students were viewing the lecture from, and with some of the options including that students could indicate that that were at home "in their pyjamas in bed with their laptop" or "on another planet", this served to inject some humour into the lecture.

The tutorials in this course were taken by the same tutor who took the tutorials in INFO123 (Case 4). The ARS was used in the same way in the tutorials in this course.

Case 5 – MBAZ604 (Business Research Methods) at UC

This course is mandatory for the Business Taught Masters programmes at UC. During the 2020 lockdown it was taught in a 12-week term with approximately 150 students enrolled, many of whom were not in New Zealand. Due to the COVID-19 lockdown the first eight weeks of the course were taught online with the students in two groups of approximately 75 students.

Each group participated in a weekly 3 hour synchronous online session using Zoom. When the last 4 weeks of the course approximately half of the students attended lectures face-face with the others attending via Zoom. Across the course the ARS were used in three (3) ways. The first of which was in the first session where the ARS was used to ask questions get a picture of who the students were, what they had previously studied and where they were. The second was to ask students questions relating to the content to get an understanding of what they already knew or what had been covered during the lecture. The third was to allow for students to ask questions.

From the perception of the lecturer the main benefits of the use of the ARS in this course were that students who were remotely located (all students during the first part of the course and approximately half of the students in the second part of the course) were able to participate, with this participation being anonymous which appeared to result in more participation in previous occurrences of the course that had only been taught face-face with limited use of ARS.

Case 6 – AMEB600 (eBusiness) at Ara

This course was 4 weeks into its face-face delivery in semester one of 2020 when the first New Zealand Covid-19 lockdown started which resulted in the remaining 10 weeks of delivery being online using Zoom for live lectures. There were approximately 45 students enrolled in this course and the lecturer had observed that in the weeks of face-face delivery that there was not a high level of interaction or engagement during class time.

The way in which ARS were used in this course had a in three (3) different ways. Firstly, in weeks 5-7, the first three (3) weeks of online delivery the students were asked to bring something to display to the rest of the class as a way of encouraging some more interaction. These included wearing a silly hat; showing off their pet (or a picture of a pet); and showing an unusual photograph of themselves, with this being followed by a poll in Zoom as to who had the best hat, pet or photo. The result of this was that students needed to turn their cameras on to participate and many left their cameras turned on for the duration of the session. Interestingly one of the students found an online photo of the lecturer from a number of years earlier and held that up for the class to see, which ended up being quite a humorous moment that was referred to later in the course by some of the students.

Secondly, quizzes were conducted towards the start of each session to review content from the previous session, with these quizzes including multiple-choice questions and short answer questions.

The third way, which was usually towards the end of a session when the students were given a mini-case study to review. In this situation the ARS was used to ask a general open-ended question that the students could answer multiple times. This allowed an ongoing anonymous real time dialogue to take place between the students and the lecturer. With the responses being anonymous, students appeared to respond a lot more than when they were in face-face mode.

The main benefits resulting from the use of ARS from the perspective of the lecturer was that more students were having their cameras turn on, and the students were asking significantly more questions than they did in the

face-face mode at the start of the course. When the students were completing the questions in the quiz, approximately 70% of the students in the Zoom session would be answering the questions, which was an indication of a higher level of engagement than in the face-face mode at the start of the course.

Case 7 – AMRM600 (Research Methodology) at Ara

The circumstances for this course were the same as for the course in Case 6 with the course being 4 weeks into its face-face delivery when lockdown started and the remaining 10 weeks of delivery being online using Zoom for live lectures.

The way in which ARS were used in this course was in two (2) different ways. Firstly, quizzes were conducted towards the start of each session in a similar way to which they were in the course in Case 6.

The second way, which was usually towards the end of a session when the students were given a research related scenario to review. In the same ways as the approach taken during the course in Case 6, the ARS was used to ask a general open-ended question that the students could answer multiple times. This also allowed an ongoing anonymous real time dialogue to take place between the students and the lecturer. With the responses being anonymous, students were also able to use this mode to ask questions about their work that they might have felt too shy to ask otherwise.

The main benefits resulting from the use of ARS from the perspective of the lecturer was that it was possible to observe the proportion of students that were answering questions to have a picture of their level of engagement, and that with all of the students being able to see the questions that other students had about their work, they were able to learn from the responses that the lecturer gave to those students.

Case 8 - BUSM4741 (Financial Analytics) for Decision Making) at RMIT

This course is a compulsory course in the online Master of Business Administration (MBA) at RMIT and is the only course in that is being reviewed in this paper that was originally designed as an online course. The students in the course are organised into groups of approximately 30 with each group being allocated a facilitator who has a number of roles with one of these being that they conduct a weekly one-hour online webinar.
One of the facilitators used an ARS for quizzes at either start or end of each week's webinars, mainly to check on the level of understanding that the students had of key concepts, and give feedback to the students.

One comment made by many of the other facilitators has been little interaction with students during the webinars. The use of the ARS typically resulted in 70-80% of the students at the webinar answering the questions which appears to be significantly more than the number of students interacting when an ARS was not being used.

The main benefits resulting from the use of ARS from the perspective of the online facilitator was that it was possible to observe the proportion of students that were answering questions to have a picture of their level of engagement and being able to have a picture of which key concepts needed to be covered again based on the feedback loop that the quizzes provided.

4. ANALYSIS

The concept of anonymity was a key aspect in three (3) of the courses (Case 5, Case 6 and Case 7) with this being consistent with the literature that was reviewed [3], [6], [8], [16], [18].

The concept of facilitating discussion was a key aspect in three (3) of the courses (Case 1, Case 6 and Case 7) with this being consistent with the literature that was reviewed [3], [4], [6], [8], [16], [18].

The concept of facilitating feedback between students and the teaching staff was a key aspect in all eight (8) of the courses, with this being consistent with the literature that was reviewed [3], [6], [7], [8], [16], [18].

The potential for ARS to enhance interaction and engagement was a key aspect in all eight (8) of the courses, with this being consistent with the literature that was reviewed [3], [4], [6], [8], [9], [10], [11], [13], [15], [16], [18], [19].

The idea that the use of ARS could create more enjoyment for students was an aspect in two (2) of the courses (Case 4 and Case 6) with this being consistent with the literature that was reviewed [12], [14].

5. CONCLUSION AND FURTHER RESEARCH

The use of ARS in synchronous online sessions or hybrid sessions has the real potential to enhance student interaction, engagement and enjoyment. A key factor in this when student responses are anonymous. Part of this potential is also due to the use of the ARS promoting discussion and feedback between the students and between students and teaching staff.

These findings apply irrespective of the ARS being used and are of relevance to lecturers conducting online synchronous sessions that are part of fully online or hybrid. The research could be extended through gathering data from lecturers involved in a much larger number of courses and conducting a survey of students in courses where online synchronous sessions or hybrid session are being used as part or all of the delivery of a

course. Some of this would enable comparisons to determine the extent to which there are differences between subject areas and course level.

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