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EVALUATION OF THE STUDENTS' LEARNING EXPERIENCE AND COMPETENCY GAIN WITH YACRS

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Learning, Self-evaluation, Quiz Design, Feedback

Abstract

YACRS - Yet Another Classroom Response System is an open-source classroom response system developed by the University of Glasgow in 2014. With vast improvements in hardware and software technology landscape today, there is renewed interest in the use of technology in learning and teaching. Currently, majority of students on tertiary education campuses in Singapore are already wirelessly connected to the internet through their own devices. There is therefore a readily available platform where YACRS can be easily deployed for learning and teaching using student's own devices. The objectives of this study are: (i) assess the students' learning experience with YACRS, (ii) evaluate their competency gain through YACRS, and (iii) develop effective learning and teaching approaches with technology. Throughout an engineering module, live quizzes were posed to the students to encourage active learning. Two questionnaires with a combination of open-ended and closed format questions, which enhance the quality of the feedback, have been designed. The questionnaires were conducted to (i) evaluate the students' learning experience after their first use of YACRS and (ii) whether their learning experience and competencies have changed after using YACRS for one semester (12 weeks). The areas assessed are as follows: (i) Level of experience and satisfaction with YACRS, (ii) Accessibility to YACRS through a smart device, (iii) Design of the question and answer format, (iv) Frequency of in-class quizzes, (v) Students' self-evaluation as a learner, and (vi) Any suggested improvements. Based on the responses, a summary of students' feedback and necessary improvements is presented. Last but not the least, a comparison between the perception of the students in Singapore and Glasgow on the usefulness of technology in their learning is drawn.

Keywords: *Classroom Response Systems, Active*

Introduction

With vast improvements to hardware and software technology landscape today, there is renewed interest in the use of technology in learning and teaching. It is reported in the NMC Horizon Report: Higher Education Edition (2016) that 42% of colleges and universities in the US have implemented the Bring-Your-Own-Device (BYOD) strategy in 2014. In addition, it is also discussed that BOYD policies have enabled lecturers to come up with new ways to assess students' learning.

Students today have grown up in technology-rich environments and are described as "Digital natives" in Prensky, M. (2001). On the other hand, the early generation whom were not born in the digital world but engaged in new technology were coined as "Digital Immigrants". , it is debated in Kirschner, P. A., & van Merriënboer, J. J. (2013) that the exposure to technology does not imply the mastering of knowledge in the use of technology and it does not matter if the student is a digital native or a digital immigrant. In White, D.S. and Le Cornu, A. (2011), the ideas of "Digital Visitor" and "Digital Resident" were further developed, where a digital resident would have a robust online profile and generate content and relationships online. In comparison, a digital visitor would only engage in digital media for a short period and leave before mastering its use. Thus, there are continuous efforts in fostering the digital literacy of the students in relation to the technology being employed for learning and teaching, as discussed in the 2016 NMC Horizon Report.

One such technology developed at the University of Glasgow is an online classroom response system, YACRS (Yet Another Classroom Response System) to support teaching and learning. YACRS is a classroom response system which allows students to participate in quizzes by submitting their response online through a web interface. Thus, it is accessible through various

types of portable electronic devices such as the smartphone, laptop, tablet, and etc. Some examples of CRS evaluated in existing literature include electronic clickers, mobile phone messaging and colour coded ABCD voting cards, which are discussed in Bruff (2007), Cheung (2008) and Deal (2007). A number of factors to consider in deciding whether to use text messages, clickers or ABCD cards are covered in Posner (2011). Key factors that were considered include cost, hardware, internet connectivity, access, anonymity, flexibility in question and answer format, preparation time, response and display, etc.

To the best of our knowledge, YACRS can allow anonymity and is easy to access through an internet connection with a smart device or through short messaging system (SMS). Our students have free access to the internet on campus and most of them carry either a laptop or a smartphone device. However, it is not known if accessibility to a smart device or the cost of the SMS would be a deterrent for some students. In view of the accessibility and cost of implementation for YACRS, an evaluation using YACRS for learning and teaching has been carried out and presented in this paper.

Method

The engineering module, Control 4N, is taught to one hundred and fifty level 4 BEng. (Hons.) in Mechatronics and BEng. (Hons.) in Mechanical Design Engineering students in Singapore. Due to the large classroom size, active engagement with majority of the students is extremely challenging during the classroom exercises in the lecture theatre. It is also discussed in Deal, A. (2007) that lecturers in large lecture courses often face challenges in identifying misconceptions, engaging students and assessing their understanding in a traditional lecture setting. Hence, the effectiveness of improving the students' learning experience through a classroom response systems (CRS) with the students' own smart devices is evaluated in this paper.

In the existing literature, there are some challenges identified with the use of CRS in learning and teaching. In terms of the question and answer format, it has been discussed in Beatty et al. (2006) that the effectiveness of CRS for teaching physics depends on the quality of the questions set. There is a consensus that it takes time and practice to create good questions for CRS and they must be designed with care (Caldwell, 2007; Beatty et al., 2006). Generally, qualitative questions are preferred as they guide the student to focus on the key concepts, as discussed in Beatty (2004). Others have also said that designing questions to identify student misconceptions can be used to steer students towards a deep learning, as compared to the passive learning of factual knowledge (Tanner and Allen, 2005). Some examples of questions and answers format are suggested in Caldwell (2007), which will be considered in developing questions for the

Control 4N CRS. As the question and answer format would affect the efficacy of the CRS, this is also an area that will be evaluated for the CRS.

Last but not the least, it is also discussed in Eison (2010) that a common obstacle to implementing active learning strategies include a reduction in class time to cover course content. Rowe (1980) reported that student learning can be improved by pausing three times for approximately three minutes each in a fifty-minute class. Hence, the YACRS quiz will be conducted two to three times in an hour for three minutes each. As the students will have to be instructed on the usage of YACRS, slightly more time will be required for the first few questions. In addition, the students may have used other forms of CRS previously in their course of studies, thus their first or prior experience with CRS will be surveyed and whether they thought it was useful to their learning. This will be followed up with further questions to evaluate if the students felt that YACRS was useful to their learning and what should be improved.

In this evaluation, the areas that are evaluated with YACRS are as follows: (i) Level of experience and satisfaction with CRS, (ii) Accessibility to YACRS through a smart device, (iii) Design of the question and answer format, (iv) Frequency of in-class quizzes, (v) Efficacy of CRS to their learning, and (vi) Any suggested improvements. Some evaluation methods covered in George and Cowan (1999) like focus groups, stop start continue and questionnaires can be applied. In view of the amount of time required to conduct focus groups, a guided hard copy questionnaire with a combination of multiple choice and open-ended questions was given out to thirty students. In the design of the questionnaire, one particular concern was if the students will provide explanations for their responses. However, it was mentioned in the Evaluation Cookbook from the Institute of Computer Based Learning (web version, 1999) that almost all students were still willing to write sensible and sometimes extensive feedback in the open ended questions.

After their first lecture with YACRS, the students completed the first questionnaire to evaluate their preliminary experience with YACRS. Subsequently, the students completed a post survey on YACRS to evaluate if their learning experience and competencies have changed, after using YACRS for one semester. Last but not the least, a comparison between the perception of the students in Singapore and Glasgow on the usefulness of technology in their learning is drawn.

Results and Discussion

From the lecturer perspective, some benefits that were observed are as follows. The students seemed to be more engaged and excited about YACRS. In addition, there was more physical and face-to-face interaction with the students, on top of the feedback obtained

through YACRS. However, there were challenges in setting the YACRS questions as the multiple-choice format limits the question type. Some students also have difficulties in accessing YACRS from their smart devices. In the first lecture, YACRS was set to “teacher-led” where the teacher had to make the questions active before the students could answer, which was rather cumbersome to use.

From the evaluation, 2 out of 30 students have prior experience with a classroom response system, citing the remote clicker controller as an example, which was found to be insensitive in registering clicking inputs at times. 4 out of 30 students did not manage to access YACRS with a smart device. They were unable to connect but commented that it looks promising. In terms of the students’ experience and level of satisfaction with YACRS, the students rated their first YACRS experience as 4.1 out of 5. Some good comments were as follows: (i) Very interactive, keeps me engaged. (ii) Allows student to actively answer questions and participate in class. (iii) Helps me stay focused. (iv) Lecturer gets to communicate with the students. (v) A good platform to identify whether everyone understands the topic. Other comments are as follows: (i) Time consuming to activate one question at a time. (ii) The teacher does this in class without the need for YACRS. Nice to have but not needed. (iii) Slow response time. (iv) Unable to connect. In view of the comments, the YACRS setting should be changed to “student-paced” instead of the previous setting on “teacher-led”, which will activate all the questions and reduce the time delay in activating the questions. In addition, the students can also be informed in advance that they can participate using the SMS if they are not able to connect to YACRS online. After one semester, the students rated their experience with YACRS fairly high at 3.8 out of 5.

In whether the students thought that the questions are useful to their learning, one-third of the students scored it as extremely useful. In the preliminary survey, an average score of 4.2 out of 5 was given, as compared to 3.8 out of 5 in the post survey. Some comments are as follows: (i) The questions are relevant and slightly tricky to make thinking essential. (ii) Relevant explanation should be given before attempting the question. (iii) Guided cognitive thinking. (iv) Able to see if your response is correct and examine your own understanding. (v) Helps refresh memories and address frequently asked questions by students. (vi) Could be more challenging. (vii) Good for quiz but hard to use for chapter reviews. (viii) Good if material quizzed comes up in the exams. As discussed in Caldwell (2007) and Beatty et al. (2006), the effectiveness of CRS for teaching depends on the quality of the question set and it takes time and practice to create good questions for CRS. Others have also said that designing questions to identify student misconceptions can be used to steer students towards a deep learning, as compared to the passive learning of factual knowledge (Tanner and Allen, 2005). The multiple-choice format used in the YACRS quiz may limit the question type and may not

be the most suitable for this module. Hence, it is suggested that the questions can be designed in future to address common misconceptions by students, which are observed from the exam performance of previous batches of students.

As such, changes were made in the semester to the YACRS quiz for exam revision, which was rated by 83% of the students, as being useful to their learning. After one semester, 97% of the students would still like to continue using YACRS for their learning.

In terms of the frequency of the quiz, 24 out of 30 students felt that it is sufficient. The other students commented that they would like a minimum of 10 questions in a 2-hour lecture, as well as a quiz to summarise the previous lecture and another at the end of the lecture. Almost all the students felt that the response time is sufficient and 2 out of 30 students would like to see more open-ended questions. The students’ expectations of the quiz frequency, as obtained through the survey also concurred with findings in Rowe (1980) where student learning can be improved by pausing three times for approximately three minutes each in a fifty-minute class. After one semester, 80% of the students felt that the frequency of the quiz was adequate. 87% of the students felt that they had sufficient time to respond to the YACRS quizzes.

In terms of the students’ perspective of themselves as a learner, the feedback obtained are as follows: (i) Am a new man! (ii) Learnt how to read the question and that answers could look similar. (iii) Found out things that I didn’t know and correct my understanding of the subject. (iv) Encouraged student to actively participate in class. (v) Learnt to think fast and to learn from mistakes, which results in better understanding. (vi) Could concentrate better with more interaction. (vii) It is engaging and motivates me to listen. (viii) It corrects my understanding of the subject. As discussed in Tanner and Allen (2005), students learn from their mistakes when they get to participate in class. This encourages deep learning, as compared to the passive learning of factual knowledge. It is also discussed in Entwistle et al. (2000) and Trigwell et al. (1999) that active learning is critical to deep learning versus the surface approach to learning and teaching. In addition, students are encouraged to adopt a growth mindset and believe that their abilities can improve with practice, as discussed in Dweck (2006). Hence, it is suggested that the design of the questions can be further improved to encourage students to think deeper and to address common misconceptions early in the course.

In the post survey, the students were asked if they felt that their learning experience and competency have improved and some comments are as follows: (i) Could apply what has been learnt in the class. (ii) Am able to test my knowledge gained and not just learning the materials in the lecture. (iii) Am able to discuss on the spot. (iv) Better understanding of the theory. (v) It helps

to better remember what has been taught in class. (vi) It helps students to be more attentive during lectures. In addition, the students were also asked if they would recommend any improvements or use other technologies available. Some students suggested Poll Everywhere (PollEv), which is a web-based CRS that allows live interactive audience participation by enabling instructors to integrate polls into the presentation. Similar to YACRS, students can use any mobile device to participate in PollEv, as discussed in Posner, M. (2001). The responses are also computed and shown in real time. Another feature of PollEv is that responses can be pushed to the Blackboard Grade Center, which would be useful for institutions, whom are using Blackboard to support learning and teaching.

In a biannual survey of incoming first year students on the technologies that students at the University of Glasgow used from 2007 to 2013, 1949 students across all Schools have completed the survey documented in Honeywell et. al. (2014). The students' perceived views on the usefulness of technology in their understanding of the course material and exam performance are above 75%. However, the students' expectations about the usefulness of technology in their studies reveal that they think technology is most useful for accessing course materials and video recordings of lectures. The usefulness of technology in their studies to collaborate with other students is rated at 70%. In addition, only 59% to 61% of the students felt that instant messaging to communicate with staff and other students is useful to their studies. It is useful to note that the survey captures the students' perceived views on the usefulness of technology and not their evaluation on the usefulness of the technology. To the best of our understanding, the use of YACRS in learning and teaching has not been evaluated in Glasgow. Thus, it would be useful to compare our results with a similar evaluation on the use of YACRS to teach engineering in Glasgow.

Conclusions

In summary, positive feedback has been received from the students on the use of YACRS. The students felt that their competency in the subject has been improved and the lecture is more engaging with YACRS. This is consistent in both the preliminary and post survey. Throughout one semester, the students felt that their learning experience and competency in the subject matter has improved and 97% of the students would like to continue using YACRS. However, it is also suggested that the design of the questions as well as the lecturer's familiarity with YACRS have to be worked on, to improve on the students' learning experience with such a technology. Another similar technology suggested by the students, PollEv might work better for institutions, whom are using Blackboard to support learning and teaching.

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