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Feasibility study into the use of online instrumentation courses for medical radiation scientists

J.L. MacDonald-Hill, H.M. Warren-Forward*

Medical Radiation Science, School of Health Science, Faculty of Health and Medicine, University of Newcastle, Callaghan, NSW 2308, Australia

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ABSTRACT

A Medical Radiation Science (diagnostic radiography) instrumentation course historically taught face-to-face was taught fully online. The purpose of this study was to assess differences in academic achievement as well as gather feedback on student experiences. An anonymous online survey relating to student engagement and directions for future course development was distributed to all students who completed the course. The results clearly supports online delivery as students appreciated the ability to pause and rewind (94%) course content and work at their own pace (88%) whilst maintaining almost identical course results ($p = 0.96$). Future improvements would see the inclusion of interactive on-line modules and the re-introduction of face–face tutorials, appealing to students' desire for more support and human contact (27%) therefore reflecting the flipped classroom approach.

Introduction

While distance education has been available for many years, the increase in technological capabilities, the advances in pedagogical techniques that are growing alongside the changing technology, and broadband capability mean that online education, especially when blended with other resources, can now offer very high quality student experiences of distance learning.[1]

One approach to online learning is the flipped classroom approach which moves away from instructor-centred pedagogy to a more student-centred experience. It effectively flips the Bloom's taxonomy pyramid. Lower level learning outcomes, such as acquiring knowledge, are undertaken during the students' own time so that higher level learning outcomes such as synthesis and evaluation can be focused on in class time. Knowledge is acquired by replacing traditional face-to-face lectures with pre-recorded lectures (Lecture Capture) and/or online teaching material and pre-readings.[2–8] The rationale being that if students work with the fundamental materials before class, they are better prepared to apply the information and engage in higher-level discussions with their peers and the instructor. Class time can be spent on developing important problem solving skills whilst providing feedback for both students and the teacher.[9,10]

The movement away from face-to-face teaching and learning while problematical in the provision of direct radiography skills, (usually learnt by watching and doing) can be embraced in those courses which possess characteristics (predominantly fact-based content) which lend themselves to online learning. Theoretically, such courses can readily be delivered online and provide radiography students with the same or higher level of education as the traditional face-to-face format; while providing some degree of flexibility in teaching delivery.

Impetus for change

The positive research surrounding online learning[11] and the flipped classroom[9,10] approach makes the intention of developing an online format for diagnostic radiography instrumentation courses well justified. In semester 2, 2013, this theory was unintentionally put into practice when a previously face-to-face instrumentation course was unexpectedly and suddenly required to be taught fully online as the course co-ordinator (HW-F) was required to be away from the University. The sudden onset of the situation resulted in limited time for course design and planning for online delivery. However, this situation (while a worst case scenario) provided an excellent opportunity to assess the feasibility of transferring future offerings of this course and other Medical

* Corresponding author. School of Health Science, Hunter Building, University of Newcastle, Callaghan, NSW 2308, Australia. Tel.: +61 (02) 49217142.
E-mail address: helen.warren-forward@newcastle.edu.au (H.M. Warren-Forward).

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Radiation Science (Diagnostic Radiography, Nuclear Medicine and Radiation Therapy) Instrumentation courses to online formats.

Structure of online course

Recordings of the previous years' lectures were made available to students to supplement the forgoing face-to-face lectures and corresponding written lecture notes were also made available. Tutorials were optional and were delivered online and recorded for students to watch at a later date. Optional formative assessments were also part of the online learning materials. All lecture materials and pre-recorded lectures were loaded into the Course Folder in Blackboard Learn. Assessment for the course consisted of three graded formal examinations (following completion of modules 2, 4 and 7) and a written (ungraded Pass/Fail) assignment. Student output from the written assignment was used in-part in the third examination. Exams were administered in the traditional format on campus a week after subsequent module completion.

Study aim

This study aimed to provide a comprehensive overview of the thoughts, experiences and academic achievement of students who completed the online course with the intention of developing future MRS instrumentation courses into online formats.

Methods

Ethical approval was obtained from the University's Human Ethics Research Committee (approval number H-2013-0427).

Study population

The study was conducted in a Medical Radiation Science (Diagnostic Radiography) Program at a New South Wales University in Australia. All students (n = 85) who completed the second year DR Instrumentation course were eligible to participate.

Questionnaire design

Qualitative and quantitative perceptions were collected using an anonymous, voluntary online questionnaire created using SurveyMonkey. An online questionnaire was the most appropriate, time-effective method as students were off-campus during the data collection period. The questionnaire was developed by the authors and checked for face and content validity by academics from differing teaching backgrounds.[12]

The questionnaire consisting of 54 questions was divided into four sections: ***demographics***, requesting information on factors that could influence the choice of learning environment, ***general course questions***, relating to engagement with learning resources, ***specific course content***, seeking information on the specific course modules, and the final section ***future directions*** asked the students to provide feedback on how the course could have been better developed to increase their learning (Fig. 1).

As fixed response and Likert-scale responses limit the input from respondents, the questionnaire incorporated open-ended questions following each Likert-scale response allowing free-text responses to further explore student perceptions, with the questionnaire itself ending with three open-ended questions "The best thing … about the course", "The worst thing … about the course" and "One thing that could have improved your learning experience in the course".

This paper reports on Sections A, B and D only; section C has been eliminated as it sought student perception to specific course content and not directly related to the online delivery of the course.

Student results

Student comparative performance was generated by calculating the weighted percentage scores of the three examinations given to the previous cohort (2012, n = 101) and current cohort (2013, n = 85). Student results were able to be directly compared to the previous offering as the course coordinator made a decision to use where possible the same examination papers; the only difference was a small section, (representing 16% of the third examination and 8% of the course examination) which came from the written assignment and this was unique to each cohort of student.

Privacy and confidentiality of student results was addressed by only the course coordinator having access to the individual student results. In order to minimise issues related to power and authority during course assessment, the research was conducted after students had completed the course and had been provided with their final results.

Statistical analysis

Quantitative analysis

Questionnaire data was captured online via SurveyMonkey and exported into Microsoft Excel for analysis. Frequency and counts were used to compare responses for all interval data. Unpaired t-tests were used to test for any statistical difference between the normally distributed examination results, and chi-square was used to test for significance between student distributions of grades (HD, D, C, P, FF). Significance was tested at the 95% confidence interval.

Qualitative analysis

The qualitative data analysed were the three short answer open ended responses at the end of the questionnaire, namely:

- The best thing (what was particularly useful or interesting?) about the teaching and delivery of the course?
- The worst thing (what was particularly unhelpful or annoying?) about the teaching and delivery of the course?
- One thing that could have improved your learning experience in the course?

Thematic interpretative content analytic method was used to examine the descriptive characterisations of teaching and learning in the responses of students to the three questions.[13–16] Given the small numbers in this study a manual method of content analysis was used.

Results

A total of 36 students completed the questionnaire, giving a response rate of 42%.

Quantitative analysis

Section A: demographics

The distribution in returned questionnaires (27 F:9 M) between genders was not statistically different (p = 0.66) from the distribution of genders within the course (60 F:25 M). Participant ages were also not statistically dissimilar to the course ages (p = 0.83), with the majority (53%) of participants falling within the 18–21 year old bracket with only 6% over the age of 33 years. Three (8%) students identified themselves as having English as their second