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Development and evaluation of a deep knowledge and skills based assignment: Using MRI safety as an example

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ABSTRACT

Introduction: Using magnetic resonance imaging (MRI) safety as an example, this paper discusses the development of an innovative multiple-step assignment task designed to increase student engagement and learning of important concepts. The paper also summarises student feedback about the assessment as well as thematic analysis of categories thought important to students.
Method: A multi-step assignment was designed. Step one was the reading of a MRI safety article, step two was the construction and submission of 5 short answer questions believed to be important concepts of understanding and step three was the answering of 15 questions compiled from all student questions by the course coordinator. The motivation to answer the course coordinator compiled questions was the knowledge that five of these questions would be in the end of course examination. At the completion of the assignment, students were asked to complete an anonymous on-line questionnaire about the assignment task. Thematic analysis was used to gather data on what students perceived to be the most and least important concepts in the article.
Results: All students replying to the survey stated that they understood why MRI safety is an important topic and 79% reported this assignment was both a positive learning experience and provided understanding of the topic. Only 18% of students believed that they would have learned more through a formal lecture.
Conclusion: The design of this assignment task can be used in any course, not just in medical radiation science, where student learning and understanding is critical.

Introduction

Research has articulated that students are capable of taking different approaches to their learning, these being mainly a surface or deep approach. The surface approach has been succinctly defined as 'the student reduces what is to be learnt to the status of unconnected facts to be memorised'. Alternatively, a deep approach is defined where 'the student attempts to make sense of what is to be learnt, which consists of ideas and concepts [and] involves [the student in] thinking, seeking integration between components and between tasks'.[1] One of the most important influences on which approach students adopt to their learning is the design of the assessment strategies used.[2] Furthermore, studies have shown that students are also more likely to take a deep approach if they see the relevance and importance of what they are being required to do.[3,4]

Assessment tasks are far more likely to appear relevant to students if they are 'real-world' tasks.[5] This concept referred to as sustainable assessment deals with the question of whether the assessment equips learners effectively, not just for immediate educational requirements, but also for whether it prepares them for what might be required in the future.[6] Rust indicated two other desirable characteristics, namely that students have some element of choice in the assessment task and that the assessment be linked to an activity.[5] Further, the literature also informs that students are more likely to engage with learning tasks if they are going to be assessed. Therefore, some form of assessment is necessary at the conclusion of a learning experience. If educators want to encourage students to pace their learning and to engage seriously with the material from week one, there is a need to build in regular assessment tasks. Intermediate tasks either need to carry marks, or

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be made course requirements.[5,7] For educators, the challenge is how to get students to do academic work and to facilitate their ability for critical thinking and understanding.

A literature search using CINAHL Complete, Education Research Complete, Health Source: Nursing/Academic Edition, MEDLINE and the journal Radiography revealed only 56 journal articles (after removal of medical, dental, physiotherapy and postgraduate) using the search terms assessment, radiography, teaching and students. The majority of these articles (11) investigated the use of technology such as online learning,[8–10] virtual reality[11] and mobile electronic devices[12]; different teaching approaches (10) such as integrating research informed teaching[13,14] and developing assertiveness skills[15]; student preparation for and experiences of professional placement[16–19] and developing critical practitioners.[20] Others looked more broadly at clinical radiography education.[21,22] No article was found that discussed the development of a specific assessment task.

Only two of these articles were specifically devoted to the assessment of students.[23,24] One of these studies conducted in the United Arab Emirates assessed student perceptions of formative peer assessment and reported that students' experiences with peer assessment were positive with students acknowledging that they received valuable feedback and learned from assessing their peers. They concluded that peer assessment will promote reflection and critical thinking and problem solving skills in radiography graduates.[24] The second, an action research project investigated the views of university-based clinical lecturers and hospital radiographers concerning an assessment framework. A summative assessment tool was developed, including assessment of professional conduct as well as technical competence. Evaluative comment from radiographers and students on the trialling of the tool was positive.[23]

The current research aims were to develop and assess an innovative assessment task for medical radiation science students. Using magnetic resonance imaging (MRI) safety as an example, there are three parts to this research article; the first part discusses the development of a multiple-step assignment task designed to increase student engagement and learning of important concepts. This was achieved by extending the learning environment and opportunity beyond the classroom, and connecting learning with the outside, 'real world', of medical radiation scientists through journal reading and appraisal. The second part assessed student perception to this assignment task and the final part consisted of a thematic analysis of the (student) written questions in order to assess the concepts of MRI safety perceived to be important to the student.

Method

Population

The participants in this research were students enrolled in a first semester second year Instrumentation Course in Medical Radiation Science at The University of Newcastle, Australia. There were 179 students enrolled in the Course (121 Females, 58 Males). Ethics approval was given by the institute's Human Research Ethics Committee.

The assignment task

Background

Clinical partners were consulted about their perceptions of the MRI knowledge held by medical radiation science students and new graduates. They suggested that whilst knowledge of MR physics and its application were evident in students, there needs to be a better awareness of the dangers and hence safety aspects of the MRI environment. Therefore, the most relevant assessment on the MRI module was MRI safety.

Structure of the assignment

The idea of the assignment task came from reading the works of Rust[5,25] which gave the example of an introductory chemistry course that put multiple-choice questions (MCQs) on the course's website each week. These tests incurred no marks or record of being taken. The students attempted the questions as they knew from the beginning of the course that the final exam would include a section of MCQs and that half of these questions were selected from those questions used in the weekly tests.

The current assignment task was designed as a series of intermediate steps to be taken over eight weeks (the time students were actively on-campus during the semester). As there were a large number of students (>150) enrolled in the course, the assignment was also developed to be time-efficient for the assessor and involved elements of both coursework and exam based questions.

The assignment was centered on the reading of a pivotal MRI safety paper 'MR Procedures: Biologic Effects, Safety, and Patient Care'.[26] The article was chosen as it was written by an MRI expert and specifically written for practitioners working in MRI. It included all essential elements from why MRI safety was important, highlighted the key safety issues and provided a comprehensive screening tool as well as noting that the guidelines are continually changing due to increasing magnetic fields used in patient imaging and thus education in this field needs to be continually updated.

Step one of the assessment required the students to read the journal article, step two involved students developing (and submitting) five short answer questions on what they believed to be important concepts of understanding for themselves and fellow students. A five week period was allowed for steps one and two. The five questions compiled by students were submitted as a formative assessment, in that students were required to complete the task to pass the course, however they were not awarded any marks for this part of the assignment. Any student not submitting the five questions would fail the course.

Once all questions had been submitted, the course coordinator assessed all of the submitted questions and compiled 15 questions (pre-examination questions) believed to contain the most important concepts on the topic. These questions, without answers were then released to the students who were required to answer them in preparation for the final course examination (step three). The answering of the fifteen "pre-examination" questions were also awarded no marks and the students were not required to submit their answers to the course coordinator. The motivation for the students to prepare answers to the fifteen questions was that they know that the end of module exam would include five of the "pre-examination" questions. The only summative assessment occurred in the answering of these five questions in the final examination.

According to Rust, if the assessment system is to be as unthreatening as possible, not to mention fair, the assessment process and criteria should be explicit and transparent to the students (Rust 2002). With this in mind, students were given a detailed assignment document that included time-frames, examples of deep approach questions that would enhance student learning as well as shallow questions, which should be avoided. Each element of the assignment was discussed with reference to the marking system. Students had the opportunity to seek academic input from the course coordinator during weekly tutorial sessions about the reading, composition of questions or the answering of questions, or any aspect on MRI safety in general.

The assessment allowed for the reading on at least two occasions of a pivotal journal article aimed for self-education of MRI

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