Classroom practices: engaging the first year university student in "the novel" practical experience

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Abstract: *The opportunity for first-year health sciences student to interact with patients is usually limited. The challenge for health sciences academics teaching first year foundation courses is to demonstrate to students the relevance and links to professional practice of these courses. In the sciences and health sciences practical classes provide students with a social environment, opportunities for collaborative learning and student faculty interaction. Novel strategies which may be used in lecture and practical class formats to motivate students include structuring an activity using familiar materials or processes in order to explain the unfamiliar. Selection of familiar materials to explain new or difficult concepts can introduce an element of fun into the learning experience. These types of activities represent a form of "experiential learning" where knowledge acquisition results from peer interaction and feedback in an entertaining and low risk environment. The focus of this paper is to examine a number of practical class learning opportunities where the activity was structured using familiar materials or processes in order to explain the unfamiliar. These learning opportunities demonstrated obvious links to professional practice. These classes also provided an environment that facilitated active learning within a social context. These examples were collaboratively evaluated against models for motivation strategies. A summary of key points for each of the learning opportunities and a comparative table for the individual learning opportunities, using the framework of instructional questions associated with ARCS motivational categories (attention, relevance, confidence and satisfaction) is presented. These novel practical classes can be used to demonstrate the professional relevance of foundational health sciences courses and fulfil criteria to be motivating, and therefore potentially engaging for students in a social environment. More importantly, as each of these examples indicates, the practical class can provide a scaffold for students to be able to meet learning objectives. Our observations align with those of others who have observed that learning opportunities such as those described in this paper make abstract ideas more tangible.*

Introduction

Health professionals, such as radiation therapists, pharmacists, physiotherapists and occupational therapists, currently undertake university programs comprising both theory and experiential components. The experiential components in these programs may take the form of university based practical classes together with clinical or industry placements. Health science programs frequently present foundation courses in the first year, which may include physiology, anatomy, mathematical sciences and chemistry. In first year the practical class is the mainstay of experiential learning; clinical placements are very often limited to observation rather than involving direct patient contact.

Principles for best practice in first year curriculum (Kift, 2008) include the concept that first year curriculum should be student-focussed, explicit and relevant and that the curriculum should involve and engage students. Noting that patient contact for the health sciences student in the first year is frequently limited, the challenge for health sciences academics teaching first year foundation courses is to demonstrate to the students the relevance and links to professional practice of these foundation courses. With respect to the first year curriculum it has also been noted that

> Teachers have a responsibility in helping their students to develop and utilise this (personal connection with other students) crucial skill. They can facilitate interaction in

> tutorials…..encourage group/team exercises as well as chat/discussion groups, study groups…. (Lawrence, 2002).

Motivation and engagement can be respectively conceptualised as individuals' energy and drive to achieve to their potential and the behaviours that follow from this energy and drive (Martin, 2008). Indicators that a university program is engaging include students being actively involved in what is going on and interacting consistently and positively with staff, and fellow students (Scott, 2006). A number of meta-analyses of literature around collaborative learning support the premise that collaboration promotes a broad range of student learning outcomes (Prince, 2004). In fact these educational practices are associated with higher grades and greater student self-reported educational gains (Kuh, Kinzie, Buckley, Bridges & Hayek, 2007). In the sciences and health sciences the practical class provides students with a social environment (Tapper, 1999) and if they are appropriately structured, they also provide opportunities for collaborative learning and student faculty interaction.

Motivation is a critical component of learning; mere activity may not augment student learning (Leamson, 2000). Various models have been used to describe the motivations of students to learn, including intrinsic and extrinsic motivators (Breen & Lindsay, 1999). The ARCS model, which includes the four key components of attention, relevance, confidence and satisfaction, has been widely used in design, development and evaluation of motivating strategies (Keller, 1987). For example, instructional computer games have been extensively analysed using the ARCS framework allowing construction of key questions around design of instruction. Instructional questions can be posed for each sub-category of the model (Dempsey & Johnson, 1998) and include, for example, association with attention, questions around capturing and maintaining interest and stimulating an attitude of enquiry.

Teaching strategies which may be used in both lecture and practical class formats to motivate students include structuring an activity using familiar materials or processes in order to explain the unfamiliar (Allery, 2004). The selection of familiar materials to explain new or difficult concepts can introduce an element of fun into the learning experience. These types of activities represent a form of "experiential learning" where knowledge acquisition results from peer interaction and feedback in an entertaining and low risk environment. Relatively few papers can be identified which explore this strategy; one recent example, from the biological sciences, is that of a blackboard electrophoresis exercise which examines principles of DNA restriction (Costa, 2007). Other similar approaches include online game play, now considered by some to be part of the twenty first century revolution (Prensky, 2002), as are simulations of television game shows such as "The Sentence is Right" (Beven, 2007) or replicas of board games such as "The Pediatric Board Game" (Ogershok & Cottrell, 2004).

Student motivation and engagement in primary and secondary school settings is recognised as being related to their teachers' enjoyment of teaching in a potentially bi-directional relationship (Martin, 2006). What is not reflected on widely in the literature is tertiary teaching staff enjoyment of teaching. One exception is a description of the student response to the use of the popular television genre of "game shows" to engage a diverse group of first year undergraduates in a law, (justice and social policy) sentencing lecture.

> I have enjoyed using this activity immensely. Rather than lifeless eyes blankly staring down from their raised position in the lecture theatre - threatening to take that last final leap into the sleepy abyss - the students are alive, awake and really loud! They participate with such enthusiasm and vigour….! (Beven, 2007)

The focus for this paper is to present and examine a number of practical class learning opportunities where the activity was structured using familiar materials or processes in order to

explain the unfamiliar. These learning opportunities developed links to professional practice. These classes also provide an environment that facilitated active learning within a social context.

Case studies and analysis

Examples of novel practical class learning opportunities used by academics teaching in a Division of Health Sciences in a large Australian University were shared within the project team using a SharePoint portal over a six month period. These examples were collaboratively evaluated in face-to-face meetings against models for motivation strategies (Keller, 1987). Comparative tables for these learning opportunities were developed regarding purpose, processes and outcomes, assessment tasks and evaluation processes. Key themes arising from discussions were collated and analysed through manual processes involving sorting of notes; reading through information to make general sense; recording of thoughts about the data and organising material into categories (Strauss & Corbin, 1998). A summary of key points for each of the learning opportunities is presented in Table 1.

A comparative table for individual learning opportunities, using the framework of instructional questions associated with ARCS motivational categories, is shown in Table 2. Each learning opportunity was reviewed with respect to the categories; attention, relevance, confidence, and

Example 1: Barnga Card Game (Thiagarajan, 2006) physiotherapy students undertaking communication topic.
Purpose, Process and Outcome: to provide an opportunity for individuals to experience culture clash and to observe their own and others' responses to differences in cultural rules. The game is fully described and options provided in material obtained commercially (Thiagarajan, 2006). Students are put into groups of four and play a card game called "Five Tricks", the announced purpose of which is for individuals and two-person teams to win as many card tricks as possible. Sets of four individuals at each card table receive their instructions and have about 20 minutes to practice the game after which time the entire group plays the rest of the game in silence. Fun ensues as "winning" two-person teams rotate between tables. What players do not know is that each table has received a different set of "rules" for play. Debriefing is undertaken at two levels, firstly, students remain silent and are invited to write answers to three questions: "How or what were you feeling?" "How did you interpret the behaviour of others?" "What can you learn about yourself from this activity?" Secondly, debriefing as a group occurs through talking in groups about the experience—many realise they were playing by different rules only at this point.

Example 2: Coconuts and Pumpkins
Bachelor of Medical Radiation Science students undertaking human anatomy course
Purpose, Process and Outcome: to initiate the process of relating anatomical structures to medical images and to allow students to start to identify themselves as medical radiation professionals. Students were enrolled in medical imaging, nuclear medicine or radiation therapy programs, but had not yet experienced any exposure to their respective disciplines at this stage of their program. The students were arranged in small groups with a facilitator (with a radiation license) in x-ray laboratories. Their first task was to empty their pockets and discover what their three dimensional treasures (Pens, mobile phones, coins, jewellery etc) looked like in a two dimensional x-ray. They were then asked to view an x-ray of the facilitator's handbag and decipher the contents. The students subsequently moved onto positioning and x-raying a chest radiographic phantom, which effectively demonstrated the fundamental imaging concept of two dimensional representation of three dimensional anatomical structures. Students were asked to differentiate various structures for example, anterior and posterior ribs. Their next task was to image a coconut and a pumpkin using both a horizontal and a vertical x-ray beam. The horizontal beam image of the coconut clearly revealed the fluid line between the coconut milk and the air inside. Students were asked "Why didn't this line appear with the vertical x-ray beam image taken earlier?" Pumpkin seeds, flesh and thick skin were all visible on the image, but had different radiographic densities. Again students were asked "Why do some structures absorb the x-ray beam more than others?" These and other questions were explored in small group discussions when viewing the resultant x-rays. Students received instruction in the basic components of interpreting a radiographic image and began to identify themselves as medical imaging professions. They seemed to enjoy taking their 'first x-ray' experience and took home an x-ray of their pocket contents.

Example 3: Logs with toilet paper **Purpose, Process and Outcome:** Teaching students to draw drug dose-response graphs using semi-log paper, students found the concept of logs difficult. The first step involved asking students to plot centimeter, meter and tens of meter distances on linear graph paper. The second step involved taking students to an open area or long corridor and asking them to use a tape measure to plot these distances on the toilet paper. On completion the question, "How else could you draw this?" Or "What paper would be more suitable than a 50meter length of toilet paper?" was posed. Once back in the class the teacher handed out log paper and asked the students to plot the linear distance on this. Once they had mastered a one dimensional plot they were then asked to draw a 2 dimensional plot to solve a problem e.g. 100 people develop a rash and are treated with different doses of a new drug called Brillocream, data for cure rates with different amounts of Brillocream were provided. Students were asked "At what dose is ~50% of the population cured?" This activity clearly demonstrated to students not only how to use semi log paper, but more importantly why it was necessary to use it.

Table 1: Brief descriptions of learning opportunities

satisfaction. Retrospective analysis of the learning opportunities revealed that all ARCS model categories had been addressed, although these had not been incorporated (or intended) in the original design. All learning opportunities used student peer interactions and collaboration in a low risk environment, involved students actively, and used familiar objects or processes to engage students and subsequently, scaffold their learning. The role of the teacher in framing the activity in the briefing stages and teasing out intended learning outcomes in the debriefing stages to promote learning is highlighted.

It should be noted that each of these learning opportunities was developed by individual teaching staff in response to difficulties students were encountering with particular theoretical concepts that were regarded as fundamental to further learning. Informal evaluation was positive for all described learning opportunities, both at the level of staff and student satisfaction and students being able to demonstrate new knowledge and transfer that knowledge (Kirkpatrick, 1994). For example, after introduction of the *Logs with Toilet Paper* exercise subsequent class activities which required the use of logarithms no longer involved significant digressions about data plotting and could now focus on problem solving.

With respect to the teachers' enjoyment of teaching, the following comment was made by one of the teaching staff.

> "For two years in a row I handed out log paper to first year students, showed them how to use it and thought that the reason for using it was obvious. However, constant complaints from students about using log paper ("…using this paper is hard and I don't know why we have to use it anyway") and their poor performances in exercises requiring its use, convinced me that I needed to teach the concept in a better way. The toilet paper activity caught their attention immediately, created a lot of laughs and the results in the exam question were improved dramatically"

These novel practical classes can be used to demonstrate the professional relevance of foundational health sciences courses and fulfil criteria to be motivating, and therefore potentially engaging for students in a social environment. More importantly, as each of these examples indicates, the practical class can provide a scaffold for students to be able to meet learning objectives. Our observations align with those of others who have observed that learning opportunities such as those described in this paper make abstract ideas more tangible (Ross, Tronson & Ritchie, 2005). Critical features are the intentionality of design of the practical classes. As with any learning opportunity to be introduced into course teaching these types of activities need to be appropriately integrated into the schedule and consideration needs to be given to sensitivity or otherwise of the materials to ensure that the subject matter is not trivialised.

ARCS framework and key questions (Dempsey & Johnson, 1998)	**Learning opportunity: Barnga Card Game, Coconuts and Pumpkins and Logs with Toilet Paper**
Attention What can I do to capture their interest? How can I stimulate an attitude of enquiry? How can I maintain their attention?	In all cases familiar objects were being used in an unexpected situation i.e. the University Learning environment. In the case of *Barnga*, card games are familiar to most students (even if online), students are curious to see how this relates to learning in communication. Students are interacting with each other through the game. Students were working in groups and there was identification with artefacts of future employment. In the case of *Coconuts and Pumpkins*, familiar items (contents of pockets, handbag, coconuts and pumpkins) being used in teaching and students commenced identification with medical imaging professions. In the *Logs with Toilet Paper* example a familiar item was being used in teaching. Elements of "toilet humour" as a way of stimulating group interaction and collaboration.
Relevance How can I best meet my learners' needs? How, when can I provide my learners with appropriate choices, responsibilities and influences? How can I tie the instruction to the learners experiences	In all examples, the importance of teaching staff introducing the learning opportunity and/or debriefing the students from the learning opportunity was viewed as critical to successful learning outcomes. For example the *Barnga* Card Game was played with the students without them being aware that the rules for each player were different and therefore the debriefing aspects of this opportunity were particularly relevant. In the *Logs with Toilet Paper* examples relevance was emphasised at debrief. The *Coconuts and Pumpkin* activity was related strongly to the practice of medical imaging.
Confidence How can I assist in building a positive expectation for success? How will the learning experience support or enhance the students' beliefs in their competence? How will the learners clearly know their success is based upon their efforts and abilities?	In all examples discussed in this paper, emphasis is on "construction of knowledge" through learning opportunities rather than "testing of knowledge". In the Case of the *Barnga Card* Game students experience the discomfort of simulated cultural incompetence in a very low risk environment. In the case of *Coconuts and Pumpkins* familiar items are being used to scaffold learning from the known to the unknown. In the *Logs with Toilet Paper* example a familiar item was being used to physically demonstrate dimensions and group interaction and collaboration helps students construct their understanding and be able to problem solve.
Satisfaction How can I provide meaningful opportunities for learners to use their newly-acquired knowledge/skill? How can I assist the students in anchoring a positive feeling about their accomplishments?	These learning opportunities built student understanding of a range of concepts which were fundamental to further learning. For example, in the case of the *Logs with Toilet Paper* exercise, students were provided opportunity to problem solve immediately at the end of the tutorial session. In the case of *Coconuts and Pumpkins* students were introduced to the basic components of interpreting a radiographic image and began to identify themselves as medical imaging professions.

Table 2: Comparative table for individual learning opportunities, using the framework of instructional questions associated with ARCS motivational categories

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