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Developing and evaluating effective bioscience learning activities for nursing students

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ABSTRACT

Effective engagement of nursing students in the study of biosciences remains a challenge for many tertiary institutes. In this study we attempted to implement and then evaluate a simple hands-on intervention, consisting of a series of hands-on games and puzzles, to increase nursing student engagement with core concepts and anatomical learning involved in clinical anatomy and physiology. The study used a quazi-experimental longitudinal before and after design, to explore the effect of a learning intervention on student performance. Set across three different campuses of the same University, it included 1320 first year undergraduate nursing students from 2013 to 2014 who were studying Anatomy and Physiology.

Students were exposed to the interventions or not, and concomitant academic performance, weekly quiz scores, performance in fortnightly worksheets and, across the semester, exam performance were compared. The results show that while the intervention appeared to increase academic performance in students on one campus (2013) compared to the other two, this difference was not sustained into 2014 when a bigger cohort was examined. Despite significant subjective student satisfaction and enthusiasm about these learning and teaching interventions, the data does not support the capacity of these activities to enhance student academic performance. Tertiary entrance scores, being a non-native English speakers and socio-economic status all had a bigger impact on student performance than engagement with fun anatomy and physiology activities.

1. Introduction

A decade of reform within nursing education, from the late 1980s saw a paradigm shift away from a traditional medically dominated model, to a more socio-behavioural focused approach to health and illness (Clancy et al., 2000; Davis, 2010). This was accompanied by a shift in emphasis in undergraduate nursing curricula which placed greater focus on quality patient and family-centred care agendas, reflecting imperatives in the wider health community (Davis, 2010). Subsequent shifts in the curricula content of undergraduate degrees in nursing have included greater integration and assimilation of the biosciences. (Smales, 2010; Craft et al., 2013; Birks et al., 2015; Johnston et al., 2015). This creates significant challenges for academic nurse educators that include; a lack of time to cover complex content in sufficient depth with student cohorts whose background often are devoid of the foundational sciences (Taylor et al., 2015). Such challenges are exacerbated by an apparent disconnect between the teaching methods and styles used within the science disciplines with the learning styles of many individuals who chose nursing as a career (Jordan et al., 1999; James, D'Amore and Thomas, 2011; Johnston et al., 2015). Furthermore, some nurse academics lack a broader foundational knowledge of the biosciences and thus, the ensuing confidence required to teach this demanding and complex subject matter (Courtenay, 1991; Clarke, 1995; Gresty and Cotton, 2003; Davis, 2010).

In a study by Jordan (1994) it was reported that students were

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apprehensive about the difficulty and volume of content in biosciences covered in their nursing degree; apprehension which they apparently shared with the academic staff (Jordan, 1994). Educational literature suggests that students generally acknowledged the relevance of the biosciences to clinical competence (Craft et al., 2013) and indeed frequently place a greater emphasis on the relevance of biosciences to their clinical competence than do their academic instructors (Courtenay, 1991; Jordan, 1994; Jordan et al., 1999; Gresty and Cotton, 2003; Smales, 2010). Davis (2010) argues that this trend has continued, with students appreciating the importance bioscience plays in their clinical development despite, perhaps even inducing, their heightening levels of anxiety around its difficulty (Meehan-Andrews, 2009; Smales, 2010). A recent study by Craft et al. (2013) showed that more than half of commencing nursing students interviewed, were anxious about studying bioscience subjects and that they expected them to be more difficult than the clinical nursing subjects (Craft et al., 2013).

Consequentially, academics within the biosciences are confronted with a number of student based covariates – values, beliefs, learning styles, and academic history – that are further compounded by fear of the sciences. (McKee, 2002; Wilson, 2012; Birks et al., 2013). These student multiplicities further augment challenges to academics, when designing curricula to facilitate learning and engagement with difficult and complex bioscience material (Meehan- Andrews, 2009; James et al., 2011; Johnston et al., 2015). Moreover, maintaining student engagement proves difficult, particularly with the other demands commonly placed on students studying nursing (Salamonson and Andrew, 2006). The need to deliver a variety of immersive, innovative, and 'hands-on' activities are therefore paramount (Wharrad et al., 2005).

Nursing academics need to consider tailoring their teaching methodology, to cater for the breadth of learning styles and provide an environment conducive for the array of academic levels and learning styles of their students (James et al., 2011). Therefore, deliberation upon the four categories of learning styles (visual, aural, reading/writing and kinaesthetic; VARK) should be made when designing/developing new curricula and presentation processes. A (2009) study by Meehan-Andrews found that the majority of nursing students preferred the 'hands on', kinaesthetic approach to learning when compared to the other three; a finding supported by a number of recent studies on health science students (Lujan and DiCarlo, 2006; Brown et al., 2008; James et al., 2011), including Johnston and McAllister (2008) who reported that 85% of nursing students surveyed, genuinely valued the 'hands on' kinaesthetic approach, a method they found complemented lecture material and enabled explicit linking to the relevance of biosciences to clinical practice. Efstathiou and Bailey (2012), suggest that a fundamental component of effective pedagogy of bioscience, is through encouraging active student learning and enthusiasm, whilst promoting student questioning and feedback (Efstathiou and Bailey, 2012).

However, there is very little evidence about the objective value of hands-on activities. While fun hands-on games may enhance student enthusiasm about engaging with biosciences, recognition of the clinical relevance of biosciences may be sufficient to ensure assimilation of content knowledge.

The aim of this study was to provide commencing nursing students with a voice in the development of learning activities for their bioscience courses. Furthermore, we aimed to explore activities that are most commonly and enthusiastically utilised by the students, while, concurrently, successfully engaging the students. We hypothesised that 'Hands-on' activities (games and problem solving tasks) that are efficient, cost-effective, flexible, provide practical relevance, and are engaging, may effectively substitute for the limited teacher-contact time available in the formal settings of the classroom (al-Modhefer and Roe, 2010).

A recent integrative review of the literature around biosciences in nursing indicated that while there was some qualitative research in this area, there was relatively little quantitative research exploring outcomes from interventions (McVicar et al., 2014).

Moreover, it highlighted that while there was some work exploring qualitative experiences of enhanced bioscience offerings in nursing curricula there was little objective data examining whether student enthusiasm related to effective student engagement with content and subsequent academic success. The current study capitalised on a serendipitous offering of a biosciences course, led by the same academic team on three different university campuses, to undertake a broad quantitative examination of the introduction of hands-on biosciences activities.

The main objectives of this study were to use a quasi-experimental design to: a) quantitatively evaluate student perception of a series of simple 'hands-on' practical bioscience activities and b) evaluate the effects of such activities on course outcomes, in terms of scores in various assessment tasks. Effective evaluation required simultaneously controlling for many other possible factors that research literature suggest might influence academic success, including socio-economic status (SES) and tertiary entry scores.

2. Methods

A learning and teaching grant was used to develop learning activities that were implemented in a trial (one campus) and then used as a foundation for further resource development across three University campuses. The campuses were geographically displaced along a 60 km corridor in South East QLD. Course structure and delivery were consistent across the three campuses and had been for some years. Historically, the course had been offered in the same format for several years previously and was convened across all three campuses by the same academic members of staff and supported by experienced sessional (casual) staff with mixed backgrounds in both sciences and acute clinical nursing (mostly emergency) across the period of this study. This mixture of staffing ensured adequate expertise in the biosciences as well as capacity to integrate nursing concepts with clinical examples (Davis, 2010). Moreover, detailed collated information around socio-economic and entry status data was available across the three campuses to enable normalisation for varying student populations.

Participants in the study included 645 first semester, first year undergraduate nursing students enrolled in Anatomy and Physiology 1 (A&P I) at three campuses (A, B, and C), of the same Australian University in 2014. The 2013 semester 1 cohort of 675 first year undergraduate nursing students enrolled in A&P I at the same three campuses (A, B, and C), was used as a comparison/control group.

Students were given guided access to the activities every week during alternating two-hour laboratory sessions and 2-h tutorial sessions over the thirteen weeks of the semester (seven laboratory sessions and six tutorial sessions). Each activity was made available according to relevant teaching content in each class and this was consistent across all three campuses. Activities were introduced as a voluntary part of teaching laboratories and, as such, consent was not required to expose participants to the activities themselves. Consent was requested as part of the data collection process.

All material used to create activities was taken from prescribed resources for the course, including the textbook, lecture slides, and laboratory learning sheets. Therefore, the activity-derived content was accessible by all students. Many activities were constructed by taking an image or table from Marieb and Hoehn (2013), the prescribed course textbook, and printing them onto either A3 or A2