Review

The 'bioscience problem' for nursing students: An integrative review of published evaluations of Year 1 bioscience, and proposed directions for curriculum development

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SUMMARY

Background: The difficulties that nursing students have in learning human biosciences have given cause for concern for over 20 years but the problem remains.
Objective: To conduct an integrative review of published primary research into the 'bioscience problem', evaluate their outcomes, and provide a contemporary analysis of potential directions for curriculum planners.
Review Methods: A systematic search of electronic databases CINAHL, Medline, British Nursing Index and Google Scholar was conducted for empirical research studies, published between 1990 and 2013, designed to either predict performance of students in bioscience assessments in Year 1 of their studies or identify in-course curriculum delivery issues.
Results: The search generated nineteen papers that met inclusion criteria. Twelve papers involved predictive factors for bioscience attainment and seven surveyed student views on curriculum issues. Four others that surveyed reflections of later-year students or qualified nurses on Year 1 outcomes were also retained for additional context. Prediction based on pre-admission academic achievement was not reliable. Student factors including age at entry, self-efficacy in science, and having appropriate study skills in particular appear to be confounding factors. In-course influences such as teaching strategy or lecturer skills are also inconsistent and likely to represent confounders operating at local, institutional level.
Conclusions: The integrative review approach enabled analysis of incongruencies between studies that have been a barrier to curriculum development. Sound admissions criteria based on pre-university academic performance show promise in resolving the 'bioscience problem' but will likely be contingent on innovative support early in Year 1 for study skills and the fundamentals of human bioscience, plus attention to local quality assurance for curriculum delivery.

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Introduction

Modern nursing requires awareness of interactions between anatomical and physiological systems in pathological processes, how medication and care have an impact, and of potential outcomes for the patient (McVicar and Clancy, 2001). Professional expectation therefore is that students grasp both basic *and* applied human bioscience, commensurate with expertise in observational skills, analysis and problem-solving. Concerns have repeatedly been expressed that this expectation is not fully-met (in the UK: Wharrad et al., 1994; Campbell and Leathard, 2000; McVicar and Clancy, 2001; Davis, 2010; in Australia: Wilkes and Batts, 1998; in New Zealand: Friedel and Treagust, 2005; in Finland: Ääri et al., 2004). There is evidence from practice that whilst qualified nurses may be aware of the significance of key observations they are largely unable to demonstrate the analytical skills anticipated for higher level proficiency (McVicar et al., 2010). Enabling the learning required presents an educational challenge that has been referred to as the 'bioscience problem' (Jordan et al., 1999) and is a longstanding issue that is recognised world-wide.

The *Fitness for Practice* document (UK Central Council for Nursing, 1999) paved the way in the UK for the expansion of pre-registration nursing education intended to facilitate the development of higher level skills in all aspects of nursing care. The revised admissions strategy should ensure that students are equipped to commence their degree studies. We should not, however, be too confident that entry requirements alone will resolve the 'bioscience problem' since this remains an issue in some

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countries where graduate nursing is well-established (*e.g.* in New Zealand, Friedel and Treagust, 2005; in Australia, Craft et al., 2012), suggesting that there may be significant modulating factors.

The fundamentals of biosciences typically are taught early in a course as a distinct unit or module and coverage of material therefore can be intense at a time when the students are new to higher education study (Jordan et al., 1999). Historically a number of factors have been suggested to impact on the learning of bioscience by nursing students, additional to academic background, including organisational features, teaching strategy, lecturer ability, and available curriculum time (Trnobranski, 1993; McVicar and Clancy, 2001; Davis, 2010). However, the widespread occurrence and persistence of a 'bioscience problem' also suggest that there may be wider issues too. Pre-registration nursing curricula have undergone considerable refocusing in some countries in recent years. For example in the UK there is now greater emphasis on practice competencies (Nursing and Midwifery Council, NMC, 2010). In the European Union (EU) generally universities sought to become compliant with the 'common' curriculum approach enshrined in the Bologna Declaration which seeks to establish comparability among higher education courses and hence enhance work mobility across the EU (Davies, 2008). Furthermore, there is evidence in some countries that the student population has become culturally more diverse and the proportions of students who are mature-aged, and those with part-time jobs, have increased (Salamonson and Andrew, 2006; Gaynor et al., 2007).

Consequently the currency of issues that have been suggested to impact on bioscience learning is questionable and strategies to resolve them may not be informed. This study therefore presents an integrative review of published evaluations of contributory factors in student learning of biosciences with the aims of presenting a contemporary view on where curriculum planners might best direct their energies to help resolve it.

The Review

Aim

The aims of this integrative review were to analyse issues suggested to influence bioscience attainment by nursing students, and to inform discussions as to how best to proceed with improving the situation.

Method

An integrative review approach was chosen since precise criteria that normally guide a systematic review could not be fully applied to the selected literature. By supporting the selection of research evidence from different methods integrative reviews give strength to the data interpretation (Whittemore and Knafl, 2005). A structured approach to source selection, data extraction and data synthesis is still required (Shuldham et al., 2008) and in the current study is detailed below, and in the following subsections.

To provide a comprehensive view, a search of the research literature related to the learning and teaching of biosciences in pre-registration nursing curricula published between January 1990 and June 2013 was conducted of the databases PubMed, CINAHL, British Nursing Index, and Google Scholar. Key words used to search in the Title and Abstract fields are given in Fig. 1.

Initial inclusion criteria were studies published in English, in peer-reviewed journals within the selected timeframe, which provided primary evaluative data related to Year 1 bioscience learning. Bioscience education typically is especially evident in Year 1 of the undergraduate curriculum (Jordan et al., 1999). Criteria were secondarily modified for the following reasons. Firstly, a decision had to be taken regarding four studies identified in the search (Newton et al., 2007; Donaldson et al., 2010; Shulruf et al., 2011, 2012) that sought predictive factors for Year 1 GPA scores or end-of-Year 1 assessment outcomes, but not

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Key words used in database literature search (Pubmed; CINAHL, BNI, Google Scholar)

- Bioscience* OR science OR anatomy OR physiology OR chemistry OR physics OR biolog* OR biomed*

- AND nurs*

- AND student*

- AND pre-registration OR pre registration OR undergraduate OR diploma OR baccalaureate.

Limits Applied

Language: English

Time Jan 1990 – June 2013

Title and Abstract; Journal and Article.

* = truncation for word (eg nurs*, nurses, nursing)

Note: The same terms used for British Nursing Index with appropriate truncations.

Fig. 1. Literature search key terms