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Advancing student nurse knowledge of the biomedical sciences: A mixed methods study

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ABSTRACT

Background: Nursing students' ability to learn, integrate and apply bioscience knowledge to their clinical practice remains a concern.
Objectives: To evaluate the implementation, influence, and student perspective of a team-teaching workshop to integrate bioscience theory with clinical nursing practice.
Design: The team-teaching workshop was offered prior to commencement of the university semester as a refresher course at an Australian university. This study employed a sequential explanatory mixed methods design incorporating both quantitative and qualitative items.
Methods: An evaluation survey with quantitative and qualitative items and a focus group were employed. The qualitative data were analysed using a thematic approach. The quantitative data was combined with the emergent themes in the qualitative data.
Participants: Participants were final year nursing students. Nine students attended the workshop. All students completed the evaluation ($N = 9$) and 44.4% ($N = 4$) attended the focus group.
Results: The results revealed six themes: (1) lectures are an inadequate teaching strategy for bioscience; (2) teaching strategies which incorporate active learning engage students; (3) the team-teaching workshop provides an effective learning environment; (4) the workshop content should be expanded; (5) pharmacology should relate to bioscience, and bioscience should relate to nursing; and (6) team-teaching was effective in integrating pharmacology with bioscience, and then translating this into nursing practice. Students had felt there was disjointedness between pharmacology and bioscience, and between bioscience and nursing care within their undergraduate studies. The workshop that was based on team-teaching bridged those gaps, utilised active learning strategies and provided an effective learning environment.
Conclusion: Team-teaching that employs active learning strategies is an effective approach to assist nursing students to integrate bioscience knowledge into their nursing practice.

1. Background

Bioscience is a cornerstone of nursing practice, although nursing students continue to experience significant learning challenges, including understanding, applying and integrating the biosciences into the clinical environment (McVicar et al., 2010, 2014; Johnston et al., 2015). Nursing students perceive bioscience as difficult, and therefore struggle to learn the content-heavy subject matter (McVicar et al., 2010). Indeed, the diverse structures and models associated with content delivery of bioscience may cause the information to appear as disconnected and disparate facts, where students employ rote-learning as a coping mechanism in order to achieve assessment outcomes (Logan and Angel, 2011).

Student nurses perceive bioscience to be challenging, which results in considerable anxiety and a lack of confidence, so much so that nursing students forsake learning of nursing theory units in favour of the biosciences (Craft et al., 2013). Additionally, student nurses perceive their bioscience knowledge to be weak, and this lack of confidence in assimilating bioscience with clinical practice has potential implications for patient safety and clinical outcomes (McVicar et al., 2010). A failure to see the relevance of, and the links between, bioscience, clinical practice and patient outcomes are of notable concern, as without a deeper understanding of bioscience in the practice environment, patient deterioration and nursing error may result (McVicar et al., 2010).

In many universities, scientists are employed to teach the biosciences to nursing students. Concerns have been raised that the inability of bioscientists to provide bioscience material in a clinical nursing context has contributed to this lack of integration (Smales, 2010; Craft et al., 2013; McVicar et al., 2015). Furthermore, some nurse educators may not have sufficient science knowledge or confidence to teach and integrate bioscience with nursing (Friedel and Treagust, 2005; Clancy

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et al., 2000). Nonetheless, nursing students value the contribution of bioscientists within their studies, especially where a collaborative effort between both nursing and science has supported the bioscience material to make it more clinically relevant (Christensen et al., 2015; Gordon and Hughes, 2013; Larcombe and Dick, 2003). In light of this information, new innovative mechanisms to enhance nursing students' ability to link bioscience theory to clinical practice need to be explored. Thus, the objective of this exploratory study was to implement a team-teaching approach between a nurse and a bioscientist, to reinforce nursing students' bioscience knowledge, and promote bioscience integration with nursing practice.

2. Methods

2.1. Theoretical Framework

This study employed an explanatory sequential mixed methods research design, to analyse and integrate quantitative and qualitative data in a single study (Creswell, 2008). The process of explanatory sequential mixed methods studies begins with quantitative data collection, and utilises qualitative data to provide more detail, depth and perspective to the research (Creswell, 2008). This study adhered to this process, by collecting quantitative and qualitative data on a student evaluation survey, which was followed by a focus group to gain more detail and add strength to the findings.

2.2. Participant Selection

Students were approached via a recruitment email advertising the workshop, which was scheduled before the commencement of their formal classes in the first semester; those who were commencing their final (third year) of their Bachelor of Nursing were invited to attend. The students emailed their registration for the workshop to the educator if they wished to attend. This workshop was not compulsory for students to attend and did not contribute to student grades or provide any extra credit. The three-day workshop was attended by nine final year students at an Australian university. All students ($N = 9$) voluntarily participated in the evaluation survey and 44.4% ($N = 4$) participated in the focus group. The quantitative evaluation surveys were completed on the final day of the workshop, and the focus group providing the qualitative data was held in the weeks thereafter. The three-day workshop was provided by a biomedical scientist and a nursing academic; these were both known to the students as part of their academic staff, and constituted the workshop teaching team.

The workshop covered the pathophysiology of three body systems, namely the cardiovascular, respiratory and renal systems. Within these systems multiple disease processes were discussed (Table 1). Ethical approval was sought but was not required as it is the policy of this university that evaluations of teaching approaches do not require ethical certification.

The workshop employed a series of guided workbooks and handouts that reinforced material that the students had already learnt; no new content was added. The workshop also included a rat dissection; the main aim of this was to combine the students' knowledge of body systems into an understanding of whole body structure and function, and to also develop experience with surgical procedures. The nursing aspect focussed on how a patient with each disease process would present clinically, and the corresponding physical assessments and nursing interventions that would be initiated in clinical practice.

2.3. Data Collection

After the three-day workshop was conducted, students were asked to complete a 14-item quantitative evaluation. Completion of the evaluation was anonymous and voluntary. The evaluation incorporated quantitative items using a five point Likert scale, and free-form qualitative questions; all participants completed the evaluation. A focus group was subsequently held to gain a deeper understanding of the students' perspectives of the workshop. The focus group was held by the nurse researcher, who was known to the students in other units of their study but was not a contributor or stakeholder in the students' bioscience units. The focus group was voluntary, attended by four of the nine students who had participated in the workshop, lasted forty minutes in duration, and was audio recorded. Prompt questions were utilised as required and were discussed and agreed upon by the research team prior to the focus group. The transcripts were then transcribed by a research assistant for thematic analysis.

2.4. Data Analysis

The quantitative data was entered into IBM Statistical Package for the Social Sciences (SPSS) version 22 for analysis. The SPSS data descriptors were modified to reflect the data collected to ensure the appropriate responses were entered. The qualitative data for both the free-form questions and focus groups were analysed using the three step thematic analysis described by Thomas and Harden (2008); these steps include (1) coding, then (2) organization of codes into descriptive themes and then (3) the amalgamation of descriptive themes into analytical themes with subthemes.

3. Results

The results from the quantitative questionnaire are provided in Table 2, which included the percentages, means and standard deviations. Results from statistical analysis were then integrated with thematic analysis, and these are presented together under the six main analytical themes that emerged (Fig. 1). The themes were: (1) lectures are an inadequate teaching strategy for bioscience, (2) teaching strategies that incorporate active learning engage students, (3) the team-teaching workshop provides an effective comfortable learning environment, (4) the workshop content should be expanded in the future,

Table 1
Summary of concepts covered in the team-teaching workshop.

	Bioscience theory: Pathophysiology and pharmacology	Nursing theory and skills
Cardiovascular system	• Atherosclerosis • Angina • Myocardial infarction • Heart failure	• Cardiovascular physical assessment • Chest pain assessment and management • Basic electrocardiogram interpretation
Respiratory system	• Chronic obstructive pulmonary disease - emphysema and chronic bronchitis • Asthma • Acid base imbalances	• Respiratory assessment • Oxygen therapy • Antibiotics and bronchodilators • Basic chest X-ray interpretation
Renal system	• Acute kidney injury • Chronic renal failure • End stage kidney disease	• Fluid dynamics • Biochemical analysis • Urinalysis