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3 **How should science be taught to nurses? Preferences of registered nurses and science**  
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5 **teaching academics**  
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10 **Concise title: How should science be taught to nurses?**  
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## 13 **ABSTRACT**

### 14 **Aims and objectives**

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16  
17 To identify how science should be taught to nursing students, and by whom.  
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### 20 **Background**

21  
22 An understanding of foundational science and its role in supporting safe and effective  
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24 nursing practice is an important part of student learning. The well-documented challenges in  
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26 teaching this content are compounded by a lack of evidence regarding educational strategies  
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28 that lead to robust educational outcomes.  
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### 32 **Design**

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34 The study employed a cross-sectional design using online surveys.  
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### 38 **Methods**

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40 Two surveys were conducted involving (i) academics who teach science in undergraduate  
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42 nursing programs and (ii) registered nurses (RNs). Participants were asked to respond to a  
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44 range of questions around how science should be taught to nurses. There were n=30 and  
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46 n=1808 respondents respectively.  
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### 50 **Results**

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52 Findings indicated a need to better integrate science content throughout nursing curricula.  
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54 Participants were supportive of a discrete science subject in the foundation year and the  
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56 integration of science content throughout the remainder of the curriculum. Participants  
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3 across both surveys were ambivalent about whether the depth of science teaching was  
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5 adequate for nursing practice. Most nurse academics and RNs thought that nurses should  
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7 teach science, while non-nursing science teachers tended not to.  
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### 10 **Conclusions**

11  
12 Existing consensus clearly values the delivery of science content as an initial and ongoing  
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14 priority of learning throughout the undergraduate nursing program.  
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### 17 **Relevance to practice**

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19 Improving the ways in which students learn sciences will impact on nursing practice, with the  
20  
21 potential to improve patient care.  
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### 24 **KEYWORDS**

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29 Bioscience; Curriculum content; Curriculum design; Nursing; Nursing education; Science  
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**SUMMARY BOX**

**What does this paper contribute to the wider global community?**

- Approaches to the teaching of science content in nursing need to be improved
- In the foundation year, science should be taught as a discrete subject and in later years it should be integrated within the remainder of the curriculum
- Improving the ways in which students learn science for nursing is important for positively impacting nursing practice and ultimately, patient outcomes

## INTRODUCTION

A strong grounding in the biological sciences (biosciences) is essential for safe and effective nursing practice. Such knowledge is critical for developing the clinical proficiency of students in undergraduate nursing programs. Successfully establishing a solid science foundation is vital for promoting a strong nexus between theory and practice. Ensuring that the right depth and breadth of science content is taught to nursing students, as well as integrating it throughout nursing curricula using educationally effective strategies is a complex process. Through the surveying of two populations: (1) science-teaching academics and (2) registered nurses (RNs), data were collected and analysed. Their responses centred on how science content should be taught in undergraduate nursing programs. The findings presented in this paper relate specifically to perceptions of the nature of science content in nursing curricula, who should teach it, how it should be taught and whether or not it is adequate for practice.

## BACKGROUND

The pressured nature of designing responsive, relevant curricula in the context of undergraduate nursing programs is well established (Ralph, 2014). Similarly, the rising acuity of patients in hospitals, diversity of national health priorities, and growing technologically-orientated clinical environment requires a breadth and depth of knowledge from RNs who work in these contexts (Friedel & Treagust, 2005; McVicar et al., 2014; Nairn, 2014; Ralph et al., 2014).

The nature of advancements in the clinical environment have escalated calls for RNs to be taught an adequate depth and breadth of bioscience knowledge as part of their educational preparation; thus ensuring that they are proficient in the contexts in which they practice

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3 (Evans et al., 2013; Friedel & Treagust, 2005; Gresty & Cotton, 2003; Jones, Mitchell et al.,  
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5 2013; Jordan, 1994; Kelly et al., 2014; McVicar et al., 2014; Torrance & Jordan, 1995; Wong &  
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7 Wong, 1999). However, teaching this content in nursing is traditionally a troublesome  
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9 prospect in respect of *how* it should be taught and *who* is best placed to teach it. The  
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11 challenges students face in learning bioscience have been the source of strong ongoing  
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13 debate (Gordon & Hughes, 2013; Gresty & Cotton, 2003; Larcombe & Dick, 2003; Logan &  
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15 Angel, 2011; McVicar et al. 2010; Smales, 2010; Thalluri, 2007). A persistent lack of strategies  
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17 for learning and teaching this content in nursing hinders educational development in this  
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19 important area.  
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27 Nursing academics are challenged to deliver an adequate depth of bioscience content that is  
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29 sufficient to underpin an immense variety of clinical contexts (Craft et al., 2013; Evans et al.,  
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31 2013; McVicar et al., 2014). Compounding this issue is the ongoing trepidation with which  
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33 students learn in these subjects as they are perceived as a difficult area of study within  
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35 nursing programs (Gresty & Cotton, 2003). This situation is further complicated by a lack of  
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37 confidence among RNs around bioscience knowledge and its application to practice (Clancy  
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39 et al., 2000; Friedel & Treagust, 2005; McVicar et al., 2014). While some studies have offered  
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41 strategies to overcome these difficulties (Gordon & Hughes, 2013; Gresty & Cotton, 2003)  
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43 the limited availability of evidence has foiled efforts to establish evidence-based attempts at  
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45 enhancing strategies to improve learning and teaching. This study aimed to explore *how*  
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47 science should be taught to prepare graduates for practice by seeking the perspectives of  
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49 academics teaching science in undergraduate nursing programs as well as practising RNs.  
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## METHODS

### Design

The study used a quasi-experimental design comprising of an online survey distributed to science-teaching academics (Group 1) and RNs (Group 2). Each survey was contextualised for the two participant groups.

The survey instruments used in the study were adapted from a questionnaire developed by Logan (2008). Although designed for the Australian context, minor changes were undertaken to enhance formatting, terminology, and clarity. The face validity of the survey instruments were tested with academics during initial development and further tested with final year nursing students. The questionnaire was delivered via a subscription survey website (SurveyMonkey). The bulk of the surveys consisted of 179 items relating specifically to science topics. This data is reported elsewhere (Author- Blinded for Review). Demographic data were collected, along with responses to questions asking about *how* to teach science in nursing programs and *who* should teach it (Box 1). Respondents were asked to select 'yes', 'no' or 'unsure' to the questions posed and were also given the option of providing free text comments to support their responses.

#### Box 1. Questions about *how* science should be taught and *who* should teach it

1. Do you consider nursing to be an applied science?
2. Do you think science in undergraduate nursing courses should be taught by nurse academics?
3. Do you think that science should be embedded in nursing subjects rather than

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3 taught as discrete subjects?  
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- 5 4. Do you think that the science content of undergraduate nursing courses is  
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7 adequate for practice?  
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### 10 11 12 **Data collection and analysis**

13 Subsequent to securing approval from James Cook University's Human Research Ethics  
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15 Committee (Approval: H5515), an email with the survey link was sent via the Council of  
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17 Deans of Nursing and Midwifery (Australia and New Zealand) to Heads of Schools for  
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19 dissemination to the academic cohort. RNs were recruited via an email sent to state-  
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21 based  
22 chapters of the Australian Nursing and Midwifery Federation for distribution to their  
23  
24 members. Surveys were open for completion from April to August 2014 to provide adequate  
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26 time for respondents across various States and Territories to participate. Data were analysed  
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28 using IBM-SPSS Statistics for Windows Version 22 (IBM Corp., Armonk, New York, 2013) and  
29  
30 descriptive and inferential statistics. Chi-square tests of independence were used to  
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32 compare categorical data (age group, level of qualification, length of practice range) with  
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34 response data.  $P < 0.05$  was regarded as significant. The results of these analyses are  
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36 presented in the following sections.  
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## 45 **RESULTS**

### 46 **Demographical Data**

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48 Thirty academics who resided in seven States/Territories of Australia responded to the  
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50 survey. Given the relatively small number of academics who teach science to nursing  
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52 students in undergraduate nursing programs nationally, this sample was considered  
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54 reflective of the target population. Around half (16/30) were nurse academics. Most  
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3 respondents from Group 1 held a postgraduate degree. The majority (n = 25) were aged over  
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5 40 years, with an average science teaching experience of 8.4 years (range: 1-25).  
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10 A total of 1,808 RNs (Group 2) completed the question set reported on in this paper. RN  
11  
12 participants resided in one of eight Australian states or territories. Most were mature aged;  
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14 few (18%, n = 323) were aged less than 30 years, 40% (n = 707) were aged 30-49 and 43% (n  
15  
16 = 771) were aged <50 years. The median duration of their nursing practice was 15 years  
17  
18 (range 0-50 years), although almost one-third reported less experience. One-quarter (24%; n  
19  
20 = 426) were qualified with a nursing diploma/certificate or hospital education and another  
21  
22 161 held both this qualification and a nursing degree; in all, 59% (n = 1073) held a bachelor  
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24 degree and almost half of all RNs (48%; n = 866) held a postgraduate qualification: degree,  
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26 diploma or certificate.  
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### 33 **Survey Questions**

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36 *Is nursing an applied science?*

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38 When asked whether nursing was an applied science, all except one science-teaching  
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40 academic agreed. The majority of RNs when asked the same question, agreed that nursing is  
41  
42 an applied science (81%; n = 1454) although 10% (n= 195) were unsure.  
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48 *Do you think science in undergraduate nursing courses should be taught by nurse academics?*  
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50 **Figure 1: RNs' and Academics' response to "who should teach science?"**  
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3 When academics were asked whether undergraduate nursing students should be taught  
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5 science by nurse academics, most nurse academics agreed with this suggestion (11/15). Non-  
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7 nurse academics mostly *disagreed* (11/12) and three participants were unsure.  
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12 Sixty-one percent of RNs agreed that science should be taught by nurse academics (Figure 1).  
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14 To explore views in accordance with demographic characteristics, participants were divided  
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16 into four groups according to length of practice experience: 0-2 years; 3-5 years, 6-10 years  
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18 and >10 years. A Chi-square test of independence indicated significant difference between  
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20 groups:  $\chi^2 (6, n=1786) = 19.24, p = .004$ . RNs with *least* experience were more strongly in  
21  
22 favour of science teaching by nurse academics than were those with >10 years of experience  
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24 (65%, 59% respectively). Moreover, the more highly qualified RNs with a postgraduate  
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26 certificate/diploma/degree were significantly *less* in favour of science teaching by nurse  
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28 academics than were those without a postgraduate qualification:  $\chi^2 (2, n=1794) = 7.95, p =$   
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30  $.019$ ). This difference was 58% and 65% respectively. There was no significant difference of  
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32 opinion between RNs by age group or by level of nursing entry qualification (degree, or else  
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34 diploma/hospital trained). Over 340 participants commented, giving positive, negative and  
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36 ambivalent views.  
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45 Across both surveys, a diverse range of comments were made regarding who should teach  
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47 science in undergraduate nursing programs. Overall, there was a clear focus on nurse  
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49 academics working in partnership with science academics when teaching science in  
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51 undergraduate nursing programs. The need for teachers to have strong scientific knowledge  
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53 and an awareness of the context of nursing practice was seen as an optimal combination:  
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3 *Ideally science should be taught by registered nurses with science degrees. Since such*  
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5 *staff are difficult to locate, a mix of science and nursing qualified staff may be*  
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7 *needed.*

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12 *Science should be taught by registered nurses with science degrees.*

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17 One medically-qualified doctor who also had a RN nurse-educator background succinctly  
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19 described the reasons for this view:

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21 *The main reason I think nursing academics should provide education in areas such as*  
22 *pharmacology rather than scientists (or even pharmacists) is because nurses'*  
23 *understand nursing practice, nursing culture and also are better placed to make the*  
24 *link between the science and clinical practice (which is constantly evolving). [I]t's*  
25 *impossible to teach nursing students everything they need to know about*  
26 *pharmacology (which requires 'lifelong' learning) but instead...teach important*  
27 *(generic) concepts and show them how to keep up-to-date with changes in the clinical*  
28 *practice.*

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43 The need for contextualising science to enhance learning was a clear priority for the majority  
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45 of survey respondents, even those who disagreed that nurse academics should teach science  
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47 in undergraduate nursing programs.

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55 *Do you think that science should be embedded in nursing subjects rather than taught as*  
56 *discrete subjects?*

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3 **Figure 2. RNs' and Academics' agreement that science should be embedded in nursing**  
4 **subjects rather than taught discretely.**  
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10 Practising RNs strongly supported the teaching of science in a nursing context, with over  
11 two-thirds (70%) agreeing that science should be embedded in nursing subjects rather than  
12 be taught as discrete units. As RNs with the *least* experience were potentially those with  
13 knowledge of how science is taught in contemporary nursing programs, the views of RNs  
14 with up to 2 years, or with 3-5 years of practice experience were explored (n= 302; n= 203  
15 respectively). There was no significant difference of opinion between RNs according to age  
16 group, by level of nursing entry qualification (degree, or diploma/hospital trained) or  
17 whether they held a postgraduate qualification.  
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31 A Chi-square test of independence indicated significant difference between groups based on  
32 practice experience:  $\chi^2$  (6, n=1786) = 14.88,  $p = .021$ . RNs with <2 years of practice  
33 experience endorsed an embedded teaching model more strongly than groups with longer  
34 practice experience (3-5 years, 6-10 years). Although 73% of the RNs with <2 years  
35 experience favoured embedded units (19% disagreed and 8% were unsure), many of their  
36 open text comments were contrary to the stated main preference, suggesting that provision  
37 of both embedded and separate teaching in a program was ideal.  
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50 In the academic survey, the participants (n = 14) *disagreed* that science should be embedded  
51 in nursing subjects rather than taught as discrete subjects (Fig 2). Many nurse academics  
52 (9/16) thought that science should be embedded in nursing subjects rather than taught  
53 independently. However, non-nurse academics opposed this view; a significant difference  
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3 was found in the opinion of nurses and non-nurses:  $\chi^2 (2, n=28) = 11.86, p = .003$ . Nine of 12  
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5 non-nurse academics held this view, and none agreed that science topics should be  
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7 embedded.  
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12 This view was illuminated by comments that supported an initial discrete science subject in  
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14 undergraduate nursing curricula followed by an integrative approach in which science was  
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16 embedded. Nurse academics strongly supported the need to continuously link science-  
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18 teaching with clinical practice by applying this content to practice throughout the  
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20 curriculum, with participants suggesting that:  
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24 *...science taught in isolation is quickly forgotten.*  
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29 *It [science] should definitely be embedded, but I also think standalone subjects have*  
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31 *their place.*  
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36 *I think that it is important to spend more time integrating the science content with*  
37  
38 *the other nursing courses [subjects]...it is probably better to adopt this approach*  
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40 *rather than trying to embed the science.*  
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45 Science academics were criticized by nurse academics because of a perceived lack of  
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47 attention to detailing the application of the science in nursing practice, with suggestions that  
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49 the non-nurse teachers were not able to provide such experiential insights:  
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53 *If students don't see the immediate relevance they tend to dismiss the content and*  
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55 *this is made worse when non-nurses are teaching as there is little chance of clinical*  
56  
57 *integration.*  
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5 The surveyed RNs who had most recently completed their studies commented:  
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8 *I think it is good to have separate subjects to teach the science, as it goes into more*  
9  
10 *depth ...but it should also be embedded in other nursing subjects so that nurses are*  
11  
12 *constantly revising and learning nursing and relating it to science (RN, <2 years*  
13  
14 *experience).*

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19 *A combination of the two as the pure science is useful and when reinforced in nursing*  
20  
21 *subjects is very powerful and easier to remember/apply (RN, 2-5 years' experience).*  
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26 Many of the more experienced RNs also endorsed embedded science teaching:  
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29 *Absolutely. It should be core in the fundamental of all nursing subjects.*  
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34 *Science should not be stand-alone. If you bring science relevant to nursing practice it*  
35  
36 *will make more sense and be less threatening for students.*  
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46 *Do you think that the science content of undergraduate nursing courses is adequate for*  
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48 *practice?*  
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50 **Figure. 3 RNs' (n=1801) and Academics' (n=30) agreement that the science content of**  
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52 **undergraduate nursing courses is adequate for practice**  
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3 Both academics and the surveyed RNs were asked whether they thought that science  
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5 content was adequate for practice. In the academic survey, both nurse academics and non-  
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7 nurse academics were unsure whether the science content of undergraduate nursing  
8  
9 curricula is adequate for nursing practice. Half (13/26) agreed and the remainder disagreed.  
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11 Of the 12 respondents from this cohort who thought that science content was inadequate,  
12  
13 eight were nurse academics and four were non-nurse academics. Surveyed RNs were also  
14  
15 uncertain regarding the adequacy of the taught science content. Of 1808 RNs, 40% agreed  
16  
17 the content was adequate, 30% disagreed and 30% were unsure.  
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24 The perceived adequacy of teaching depth in the sciences decreased as the RNs' age group  
25  
26 increased. A Chi-square test of independence indicated significant difference between age  
27  
28 groups:  $\chi^2 (10, n = 1800) = 103.99, p = .000$ . Older RNs aged 50-59, and 60 or more, were less  
29  
30 approving (35%; 33%) than those aged 21-29 (of whom 52% approved). Similarly, more  
31  
32 experienced RNs were less approving of the depth of current science teaching and the  
33  
34 approval decreased with length of nursing experience. The more experienced RNs (6-10  
35  
36 years and >10 years) were significantly *less* approving ('yes' response) (47%; 33%) than those  
37  
38 with 0-2 years, or 3-5 years of experience, of whom 52% and 54% respectively thought  
39  
40 science subjects were adequate for practice.  
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48 Furthermore, level of qualifications influenced perceptions of the adequacy of the depth of  
49  
50 science teaching. RNs with a bachelor degree (BN) were significantly more approving of the  
51  
52 depth of science teaching than those with a lesser entry qualification alone (diploma,  
53  
54 certificate or hospital trained) ( $\chi^2 (df 2, n = 1,808) = 66.27, p = .000$ ). Forty-two percent of  
55  
56 baccalaureate qualified RNs agreed the depth of science content was adequate versus 35%  
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3 of those with other nursing qualifications (and almost half of this latter group- 47%- were  
4  
5 uncertain). Conversely, RNs with a postgraduate qualification were significantly less  
6  
7 approving of the depth of science teaching compared with those without:  $\chi^2$  (df 2, n = 1808)  
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9 = 46.52, p = .000). The approval rating was 32% in the postgraduate group and 48% in the  
10  
11 'other' group.  
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17 Across both surveys, a diverse range of comments were made regarding the depth of  
18  
19 teaching in science in undergraduate nursing programs and its adequacy for practice.  
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21 Comments given by 10 academics and 340 RNs were diverse and reflective of the  
22  
23 inconsistency of views in response to the question. The comments commonly questioned  
24  
25 the variability of science teaching across education providers; and strategies used to teach  
26  
27 science to nursing students:  
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31 *From my experience working with undergraduates, it [the depth and adequacy of*  
32  
33 *science content] depends on the university and the course.*  
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38 *[The] content is sufficient, but is presented discretely, and students often "brain*  
39  
40 *dump" these subjects once studied.*  
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45 The preparedness and capacity of nursing students to successfully learn science theory and  
46  
47 apply it to practice was addressed frequently:  
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51 *As a consultant and teacher - I rarely find students that readily understand the*  
52  
53 *sciences as they relate to the practice of modern nursing. The current place of*  
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55 *practice is dynamic, energetic with principles that remain originating from sciences:*  
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57 *e.g. blood chemistry, oxygenation, respiratory ventilation, circulatory physiology.*  
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5 Non-nurse academics were notably uncertain about whether the depth of science content  
6  
7 taught was appropriate for clinical practice. However, one comment on the lack of theory-  
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9 practice linkages was made by a non-academic nurse in response to the issue, stating:

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11 *[It is] difficult to know [whether the depth of science content is adequate for practice]*  
12  
13 *as I am not a nurse and don't see students in a nursing context."*  
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19 The impetus to adopt conceptually focused curricula was hindered by the issues of limited  
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21 time to teach science content to an appropriate depth, as well as a perception that the  
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23 importance of science teaching in nursing degrees is on the decline:  
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27 *The amount of time available to teach nursing science and the readiness of students*  
28  
29 *to undertake science has declined. This has resulted in some 'watering-down' of*  
30  
31 *concepts which surely means they must struggle with concepts later particularly*  
32  
33 *related to pharmacodynamics and pharmacokinetics."*  
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38 While participants were unsure whether science content in undergraduate nursing programs  
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40 was adequate, comments broadly reflected a belief that science is a fundamentally  
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42 important focus for student learning and a critical foundation for nursing practice.  
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## 47 **DISCUSSION**

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49 As science is a crucial aspect of undergraduate nursing curricula, the depth to which it is  
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51 taught, and in what way content is delivered is vitally important to student learning. The  
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53 results of this study offer an interesting snapshot of how science should be taught in  
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55 undergraduate nursing programs. Although limited by a quasi-experimental design, strong  
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3 participation by 1808 RNs and a cohort of academics is unique. Clear consensus emerged  
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5 across most questions asked, with only the final question around the depth and adequacy of  
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7 science content for nursing practice reflective of uncertainty.  
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12 The overwhelming support for defining nursing as an applied science among nurse-  
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14 academics amidst non-nurse academics who collectively disagreed with such a position  
15  
16 warrants consideration. The term “applied science” is used to define the way in which a  
17  
18 purely theoretical science is adapted for practical, often humanistic purposes (Feibleman,  
19  
20 1961). Throughout both surveys, RNs and nurse academics believed that science must be  
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22 applied to nursing contexts to enhance the educational quality of science teaching in  
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24 undergraduate nursing programs. By failing to direct science teaching towards nursing  
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26 contexts, there is little evidence that it benefits students in their preparation for nursing  
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28 practice. Previous studies clearly indicate that nursing students prefer contextualised  
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30 examples of clinically relevant science content (Davies et al., 2000; Davis, 2010).  
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38 Similarly, RNs are able to positively influence patient outcomes when they apply science  
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40 knowledge in the clinical environment (Jordan & Hughes, 1998; Prowse & Lyne, 2000). There  
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42 is, therefore, a clear imperative to adopt contextualised learning experiences to allow early  
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44 linkages between theory and practice to develop.  
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50 The need for strong linkages between science content and nursing practice is further  
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52 emphasised by broad consensus that nurse academics and science teachers should work in  
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54 partnership to ensure that the depth and context of science is adequate (Gordon & Hughes,  
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56 2013; Gresty & Cotton, 2003). While non-nurse academics were likely biased towards  
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3 retaining their teaching role, the need for a team approach to teaching in undergraduate  
4 nursing science subjects is clearly suggested by non-nurse academics' lack of awareness  
5 around nursing contexts, as much as it is by nurses' lack of confidence and knowledge in the  
6 biological sciences (Campbell & Leathard, 2000; Clancy et al., 2000; Craft et al., 2013). The  
7 need to marry the theoretical nous of science academics with the practical insights of RNs  
8 will typically require both to work together – except in instances where the qualified  
9 scientist is also a RN. Because the likelihood of locating staff with these dual qualifications is  
10 low, appropriate team teaching strategies need to be established. In this way, we can ensure  
11 adequate depth, consistency, content and delivery of science in undergraduate nursing  
12 programs.  
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29 Issues with the way in which science content is delivered throughout the curriculum were  
30 noted across both surveys. While respondents were supportive of an initial discrete science  
31 subject, their preference towards employing an integrative approach to science content  
32 after the delivery on an initial “foundational” subject was clear. Interestingly, less  
33 experienced RNs preferred both embedded and single subject science teaching. While a  
34 discrete science subject is common to most Australian undergraduate nursing programs  
35 (Logan, 2008), the integration of this content throughout other subjects across nursing  
36 curricula is less clear. A search of the literature failed to return evidence-based models of  
37 integrating science content throughout curricula, and may pose a possible area for future  
38 research.  
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55 The absence of any clear conviction by respondents to the RN survey regarding the adequacy  
56 or inadequacy of science content is similarly of concern. While participant groups across the  
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3 surveys were unsure about the adequacy of science content for nursing practice, their  
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5 comments clearly outlined what was inadequate for practice. The variability of science  
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7 content from program to program frequently featured in participants' comments indicating  
8  
9 the need for nationally consistent guidelines for the teaching of science in nursing curricula.  
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11 A similar recommendation in response to a lack of confidence among nurses in  
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13 understanding this content was made by Clancy (2000) who argued for a national teaching  
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15 and learning strategy. Similarly, the findings of this paper support a systems-focused,  
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17 context-driven approach to science content delivery in undergraduate nursing programs.  
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19 These findings suggest that such an approach should include a discrete science subject in the  
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21 foundation year and the integration of science content throughout the remainder of the  
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23 curriculum.  
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31 Interestingly, the relationship between how science is taught and the scientific literacy of  
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33 students was articulated on a number of occasions. There is a lack of research on whether  
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35 nursing students' knowledge of science helps them in critically evaluating scientific  
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37 literature. Nevertheless, logic arguably dictates that a lack of confidence with science  
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39 concepts will similarly affect confidence in understanding scientific evidence. Wong and  
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41 Wong (1999) found that students' success in science subjects was a strong predictor of their  
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43 academic success throughout the broader undergraduate nursing program. A lack of  
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45 foundational science knowledge may impact on a student's ability to critically approach  
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47 related literature. This prospect emphasises the need for a strong science presence  
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49 throughout nursing curricula and opens another avenue for contextualising science content  
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51 through evaluating learning activity in future research.  
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3 The limitations of this research largely relate to the subjectivity of perspectives offered in  
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5 the context of a paucity of evidence. While the perspectives of experienced academics and  
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7 RNs in practice are valuable, an ongoing lack of research prevents comparative analyses of  
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9 responses with actual student outcomes. A further limitation relates to the limited number  
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11 of academics teaching science to nursing students which restricts the available pool of  
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13 respondents upon which to base analyses. This study presents a single snapshot in time and  
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15 place; validation of the findings may be warranted through replication given the complex  
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17 and dynamic nature of healthcare practice.  
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## 23 24 **CONCLUSION**

25  
26 There remains a clear need to ensure authenticity of science both in respect of content and  
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28 the strategies by which it is taught. Most significantly, there is a need to ensure a broad  
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30 range of expertise across those who teach science in nursing programs to ensure that the  
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32 depth and pitch of content is appropriate. This study provides evidence to support  
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34 enhancements in the delivery of science content to nurses. Nationally and internationally,  
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36 there remains a need for consistent approaches to science education in nursing if a strong  
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38 foundational level of knowledge in the biological sciences is to characterise the profession.  
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## 45 46 **RELEVANCE TO PRACTICE**

47  
48 This study offers valuable strategies to enhance the teaching and learning of science in  
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50 nursing education, based on strong representation from RNs' views and academic  
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52 stakeholders. Improving approaches to teaching science may enrich student learning and  
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54 better equip nursing students for the rigours of practice.  
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## REFERENCES

- Campbell J, & Leathard H (2000). Nurses' knowledge of biological and related science. *Nursing Times Research*, 5(5), 372-380. doi: 10.1177/136140960000500509
- Clancy J, McVicar A, & Bird D (2000). Getting it right? An exploration of issues relating to the biological sciences in nurse education and nursing practice. (32, 6). *Journal of Advanced Nursing*. 32(6),1522-32.
- Craft J, Hudson P, Plenderleith M, Wirihana L & Gordon C (2013). Commencing nursing students' perceptions and anxiety of bioscience. *Nurse Education Today*, 33(11), 1399-1405. doi: <http://dx.doi.org/10.1016/j.nedt.2012.10.020>
- Davies S, Murphy F, & Jordan S (2000). Bioscience in the pre-registration curriculum: finding the right teaching strategy. *Nurse Education Today*, 20(2), 123-135. doi: <http://dx.doi.org/10.1054/nedt.1999.0375>
- Davis G (2010). What is provided and what the registered nurse needs — bioscience learning through the pre-registration curriculum. *Nurse Education Today*, 30(8), 707-712. doi: <http://dx.doi.org/10.1016/j.nedt.2010.01.008>
- Evans S, Berry C, & Mate K, (2013). *Targeting the bioscience-practice nexus to facilitate learning in first year nursing students*. Paper presented at the Proceedings of The Australian Conference of Science and Mathematics Education (formerly UniServe Science Conference), 19th – 21st September. Australian National University, Canberra, pp. 122-129.
- Feibleman J (1961). Pure science, applied science, technology, engineering: An attempt at definitions. *Technology and Culture*, 2(4), 305-317.
- Friedel J, & Treagust D (2005). Learning bioscience in nursing education: perceptions of the intended and the prescribed curriculum. *Learning in Health and Social Care*, 4(4), 203-216. doi: 10.1111/j.1473-6861.2005.00104.x
- Gordon C, & Hughes V (2013). Creating relevance and credibility: New approaches for bioscience education in pre-registration nursing curriculum. *International Journal of Innovation in Science and Mathematics Education*, 21(2), 53-65.
- Gresty K & Cotton D (2003). Supporting biosciences in the nursing curriculum: Development and evaluation of an online resource. *Journal of Advanced Nursing*, 44(4), 339-349. doi: 10.1046/j.0309-2402.2003.02813.x
- Jones D, Mitchell I, Hillman K, & Story D (2013). Defining clinical deterioration. *Resuscitation*, 84(8), 1029-1034. doi: <http://dx.doi.org/10.1016/j.resuscitation.2013.01.013>
- Jordan S (1994). Should nurses be studying bioscience? A discussion paper. *Nurse Education Today*, 14(6), 417-426. doi: [http://dx.doi.org/10.1016/0260-6917\(94\)90002-7](http://dx.doi.org/10.1016/0260-6917(94)90002-7)
- Jordan S & Hughes D (1998). Using bioscience knowledge in nursing: Actions, interactions and reactions. *Journal of Advanced Nursing*, 27(5), 1060-1068. doi: 10.1046/j.1365-2648.1998.00611.x
- Kelly M, Forber J, Conlon L, Roche M, & Stasa H (2014). Empowering the registered nurses of tomorrow: Students' perspectives of a simulation experience for recognising and managing a deteriorating patient. *Nurse Education Today*, 34(5), 724-729. doi: <http://dx.doi.org/10.1016/j.nedt.2013.08.014>
- Larcombe J, & Dick J (2003). Who is best qualified to teach bioscience to nurses? *Nursing Standard*, 17(51), 38-44.
- Logan P (2008). *Science in Undergraduate Nursing Programmes: Generating Symbiotic Praxis*. PhD Thesis. Charles Sturt University, Bathurst.

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2  
3 Logan P & Angel L (2011). Nursing as a scientific undertaking and the intersection with  
4 science in undergraduate studies: Implications for nursing management. *Journal of*  
5 *Nursing Management*, 19(3), 407-417. doi: 10.1111/j.1365-2834.2011.01247.x  
6  
7 McVicar A, Andrew S, & Kemble R (2014). Biosciences within the pre-registration (pre-  
8 requisite) curriculum: An integrative literature review of curriculum interventions  
9 1990-2012. *Nurse Education Today*, 34(4), 560-568.  
10  
11 McVicar A, Clancy J, & Mayes N (2010). An exploratory study of the application of  
12 biosciences in practice, and implications for pre-qualifying education. *Nurse*  
13 *Education Today*, 30(7), 615-622. doi: <http://dx.doi.org/10.1016/j.nedt.2009.12.010>  
14  
15 Nairn S (2014). Nursing and the new biology: Towards a realist, anti-reductionist approach to  
16 nursing knowledge. *Nursing Philosophy*, 15(4), 261-273. doi: 10.1111/nup.12067  
17  
18 Prowse M, & Lyne P (2000). Revealing the contribution of bioscience\*-based nursing  
19 knowledge to clinically effective patient care. *Clinical Effectiveness in Nursing*, 4(2),  
20 67-74. doi: <http://dx.doi.org/10.1054/cein.2000.0105>  
21  
22 Ralph N (2014). *The McDonaldization of nursing education in Australia*. PhD thesis. Monash  
23 University, Melbourne.  
24  
25 Ralph N, Birks M, Chapman Y & Francis K (2014). Future-Proofing Nursing Education: An  
26 Australian perspective. *SAGE Open*, 4(4), pp.1-11. doi: 10.1177/2158244014556633  
27  
28 Smales K (2010). Learning and applying biosciences to clinical practice in nursing. *Nursing*  
29 *Standard*, 24, 35.  
30  
31 Thalluri J (2007). 'Course tailored' continuous online formative self-assessment tool  
32 improves students' academic performance in biosciences. *Focus on Health*  
33 *Professional Education: A Multi-Disciplinary Journal*, 9(2), 97-100. doi:  
34 <http://search.informit.com.au.elibrary.jcu.edu.au/fullText;dn=163889;res=AEIPT>  
35  
36 Torrance C, & Jordan S (1995). Bionursing: Pharmacology in the bionursing model. *Nursing*  
37 *Standard*, 9(52), 25-27.  
38  
39 Wong J & Wong S (1999). Contribution of basic sciences to academic success in nursing  
40 education. *International Journal of Nursing Studies*, 36(4), 345-354. doi:  
41 [http://dx.doi.org/10.1016/S0020-7489\(99\)00032-2](http://dx.doi.org/10.1016/S0020-7489(99)00032-2)  
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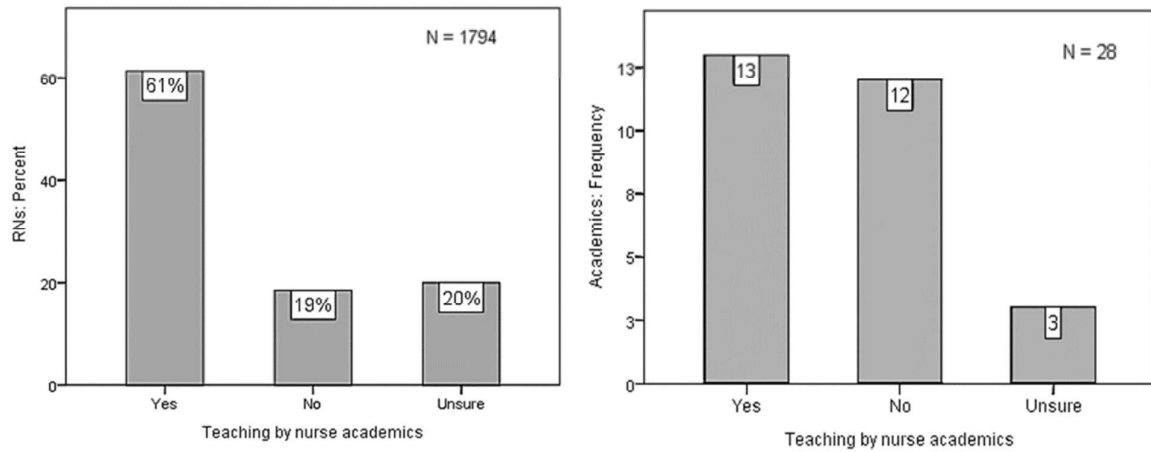


Figure 1: RNs' and Academics' response to "who should teach science?"

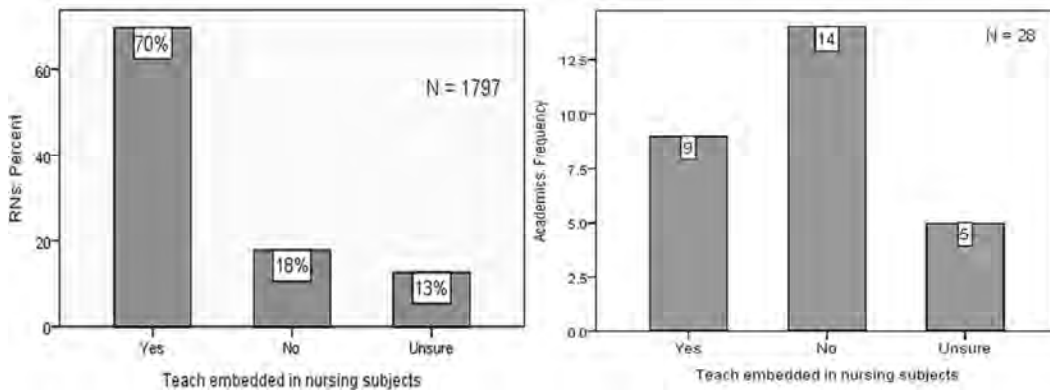
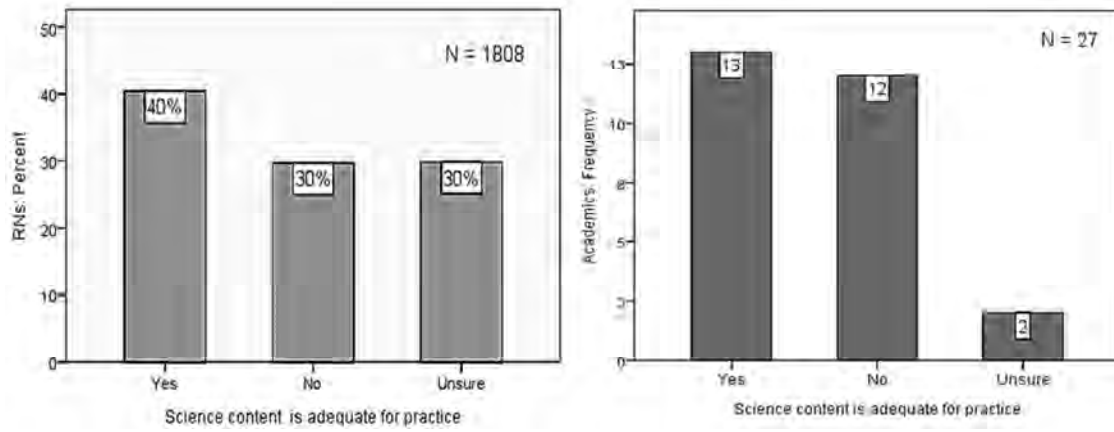


Figure 2. RNs' and Academics' agreement that science should be embedded in nursing subjects rather than taught discretely.





**Figure. 3 RNs' and Academics' agreement that the science content of undergraduate nursing courses is adequate for practice**