

Creating confidence: exploring the effectiveness of a pre-study resource as a 'front loading' strategy in a foundation nursing science course

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Abstract

The nursing student cohort are typically characterised by diverse academic backgrounds and interest in science. In an effort to bridge the gap in science knowledge and increase student confidence, a pre-study resource was developed for a first year science foundation course of a nursing program. This paper reports on the impact that the pre-study resource as a 'front loading' strategy in a first year science foundation course had on nursing student confidence when used both as a pre-study tool and supplementary course resource throughout the semester. The paper also examines whether the pre-study resource specifically affects confidence levels within the student cohort viz. mature age students versus school leavers. The findings show that the pre-study resource was found to be most effective amongst mature age students when used as a pre-study tool and continued to increase student confidence across both cohorts by the end of semester. The implications in relation to course design and teaching approaches to support wider participation in higher education are discussed.

Introduction

A number of activities exist to widen participation at each stage of the student-life cycle (Higher Education Academy, 2001). Once students have commenced a program it is important to consider whether appropriate support mechanisms are in place, particularly if the program attracts a large group of diverse students. A key factor in course design should take into account whether a particular type of background is assumed, and if so, how easy is it to engage students from diverse groups into the course. Inherent within first year programs there are generally one or two courses that students identify as 'more difficult' than others and that these courses can become the 'make or break' experiences for commencing students (Wilson, 2009). Wilson (2009) has emphasized that support of such courses by way of appropriate course design is imperative, particularly for those cohorts which are characterised by diverse academic backgrounds.

The learning and teaching of science subjects in undergraduate nursing programs can be difficult and a number of issues which contribute to this have been documented (McVicar & Clancy, 2001). In particular, there are unique problems of pedagogy associated with the biological and physical sciences for nursing. Nurse educators are faced with the fact that nursing students have a wide range of different educational backgrounds and life experiences. Many of these students have a low opinion of their abilities in science and struggle to recognise the relevance of science in their program of study (Caon and Treagust, 1993;

Jordan et al., 1999). Given that most of the attrition from nursing courses occurs in the first year of study it is important to gain an understanding of why students leave after the first year. Andrew et al (2008) reported that nursing students who leave in the first semester tend to do so because they feel unprepared and developed a strong dislike of the nursing course, whereas those who leave in the second semester prefer to stay but are forced to leave due to external influences. This is particularly relevant for many first year introductory science courses which are generally offered during the first semester and particularly in this study involving a nursing program. These science courses are intended to lay the foundation for the nursing-specific courses usually positioned in a later time of the program.

One curricular strategy considered to maximise the likelihood of student success, particularly of students in the first semester is through the creation of enabling rich environments by “front-loading” such courses (Pascarella & Terenzini, 2005; cited in Wilson, 2009). In this study, the impact of front-loading on students’ confidence levels in learning sciences is explored. The front-loading strategy encompassed the development of a pre-study resource for a foundation science course for first year nursing student by providing an optional contextualised science resource for students to complete either prior to or early in their studies.

Background

The biological and physical sciences are an important component of the University of Queensland’s (USQ) Bachelor of Nursing (Pre-Registration) program, the delivery of which has proven challenging. In 2007 this program underwent a major revision of its curriculum. One consequence of this change, among many, involved the development of a new course NSC1500 Biophysical Sciences in Nursing which comprises four distinct disciplines, namely physics, chemistry, biochemistry and microbiology/immunology.

An obvious disparity in science background exists amongst this cohort, 60% of which is made up of mature age students. A 2009 survey revealed that 30% of students had not studied science for a period of up to 10 years or more (18% > 10 years; 12% 4-10 years, n=101). Anecdotal evidence from the survey has shown that there is a close relationship between previous science study and level of workload required to adapt to an unfamiliar discipline. McKee (2002) argued that one way to achieve a suitable standard in these disciplines while not overloading is to establish a required base knowledge before starting the course. For example, Gretszy and Cotton (2003) developed a freely available online resource with the view of improving the bioscience knowledge of nursing students prior to commencement of their studies. In NSC1500, an intensive chemistry bridging course is made available to students prior to commencing their studies. Survey data has shown the bridging course was beneficial in their studies. However, this has proved costly and not accessible to all students, many of whom are in full time work prior to taking up their places in the program. Online resources can provide alternate additional support to students, and hyperlinks to external sites have been previously embedded in the course materials. However, many of these links are often unreliable and are time inefficient as students have to filter through information that is either too advanced or irrelevant which in turn generates more anxiety. Alternative ways of improving and supplementing nursing students’ base knowledge of biophysical science needed to be investigated.

The 2009 survey also showed that 56% of students were not confident in studying science before the course while 37% felt they were not prepared for the course (n=100). This prompted the development of a pre-study resource in the form of a CD during semester 2, 2009 that was tailored to the subject material covering four distinct areas in NSC1500: physics, chemistry, biochemistry and microbiology/immunology. The key aim of the 'Ready, Set, Go...' pre-study resource CD was to offer extra support material and guidance about biophysical sciences within a nursing context to help build a good foundation for other nursing studies.

The main design of the pre-study resource consisted of a brief overview of the main topics covered in the four modules. Emphasis was given to the use of concept maps and concepts highlighted as 'critical' to enable students to understand the major connections that needed to be made during the course. In addition there was a focus on 'key questions to consider' at the end of each topic to get students thinking about what the material will cover and what sort of connections they should make by applying what they have learnt previously in science and/or their own life experiences. A covering letter was supplied with the CD containing information on the rationale for its development and how to best utilise it as both a pre-study resource and during semester.

Research Questions

The aim of the study was to explore the following questions:

- (i) Does the pre-study resource designed to increase student confidence in studying first year foundation science have an impact on their confidence levels?
- (ii) Does the pre-study resource have an impact on confidence levels for students who have left school for a considerable amount of time?
- (iii) How did the pre-study resource contribute to students learning sciences?

Methodology

Method

In evaluating the effectiveness of the pre-study resource on confidence levels, a concurrent triangulation research design was employed (Creswell, Plano Clark, Gutmann, & Hanson, 2003). This is a research design where both quantitative and qualitative methods are used simultaneously, that is, both the quantitative and qualitative data collection happen during one phase of the research (Creswell, et al., 2003). The results of the analyses of the quantitative and qualitative data was later merged for a better understanding of the research questions (Creswell, 2002).

A repeated survey questionnaire was designed with both quantitative and qualitative questions. The quantitative questions related to students' perceptions of the pre-study resource and their levels of confidence in studying sciences. The questionnaire was complemented with an open-ended question asking students to provide their comments. Demographic and personal information such as gender and number of years since studying science were collected from the students.

Qualitative data were collected by means of focus group interviews with students from the quantitative sample and those who agreed to participate in the qualitative study. The

interview questions related to their levels of confidence in studying sciences before and after using the pre-study resource and general questions on how the intervention can be improved.

Sample

A majority of students (77.4%) received the CD before the commencement of the course whilst 16.9% received it during the first week of semester. Two questionnaires were administered to the entire cohort of students who enrolled for the course (n=189) for the first semester in the academic year of 2010. The first questionnaire was administered in week 2 and the second at the completion of the course during the last week of semester. For the first survey, the response rate was 93.7% (n=177), with further non-responses within the survey itself producing a response rate of 84.7% (n=160), and 47.6% for the second survey (n=90).

Three focus groups were held with nine students at the end of the exam period. These students were those who have agreed to participate and were able to attend the scheduled interviews. Each focus group interview took approximately one hour.

Data analysis

The survey data were analysed using the Predictive Analytics Software Statistics (PASW) version 18. A repeated measures design was used to explore the impact of the intervention at three different time conditions. The first time condition related to the time before intervention, the second time condition related to after intervention approximately two weeks later, and the third time condition related to the last week of semester at the completion of the course.

The focus group interviews were firstly transcribed and later prepared for analysis by classifying the responses into distinct areas related to the research questions. After grouping the interviews into the respective areas of interest, the entire interviews in each of the areas of research interest were read. At this stage of analysis, the key purpose was to determine and explain any pattern of relationship that emerged by grouping the data into common themes. The entire transcripts were read a few times, focusing on the stated aim of the study and the questions posed. For the open-ended comments found in the questionnaire, a similar treatment was conducted focusing on the identified themes and mapping them into a schema that could explain the quantitative findings further.

Findings

This section reports on the findings synthesised from the quantitative data and interviews in relation to the research questions. The first two research questions were further divided into two parts.

Research question 1: Does the pre-study resource designed to increase student confidence in studying first year foundation science have an impact on their confidence levels?

Sub-question: What is the impact of the pre-study resource only on student confidence level at the beginning of the semester?

Prior to commencement of the course 52.3% of the student cohort indicated that they were not confident in studying science. Two weeks into the semester the percentage of students reporting that they were not confident reduced to 23.3%.

A paired-sample t-test was used to explore whether the pre-study resource made a difference in the student confidence levels before and after the resource was introduced at the start of semester. The results are shown in Table 1.

	Mean		Standard Deviation		p value	Eta ²
	Time 1 (n=160)	Time 2 (n=160)	Time 1 (n=160)	Time 2 (n=160)		
Confidence level	1.51	1.83	0.59	0.54	0.000	0.23

Table 1: Differences of confidence levels in studying sciences

There was a statistically significant increase in confidence levels from Time 1 ($M=1.51$, $SD=0.59$) to Time 2 ($M=1.83$, $SD=0.54$), $t(159) = 6.89$, $p < 0.0005$ (two tailed). According to Cohen (1988), the effect size using the eta-squared values is considered large at 0.23¹. The result shows that the pre-study resource alone has a large impact on students' confidence level two weeks into the semester.

Sub-question: What is the impact of the course embedded with the pre-study resource on student confidence level by the end of the course?

The post-survey revealed a similar result as for the pre-survey with 54.5% of the student cohort still indicating that they were not confident in studying science entering into the course. However, the number of students who reported that they were not confident by the end of the semester decreased substantially to 8.2%.

A paired-sample t-test was used to explore the student confidence levels before and after completing the course. Table 2 shows the results of the paired-sample t-test.

	Mean		Standard Deviation		p value	Eta ²
	Time 1 (n=90)	Time 3 (n=90)	Time 1 (n=90)	Time 3 (n=90)		
Confidence level	1.53	2.02	0.603	0.474	0.000	0.45

Table 2: Differences of confidence levels in studying sciences

The results in Table 1 shows that there was a statistically significant increase in confidence levels from Time 1 ($M=1.53$, $SD=0.60$) to Time 3 ($M=2.02$, $SD=0.47$) with $t(89) = -8.50$, $p < 0.0005$ (two-tailed). The effect size using the eta-squared statistic (0.45) was considered large (Cohen, 1988), which means, the magnitude of the difference in their confidence levels from Time 1 to Time 3 was large. This quantitative result indicates that the NSC1500 course on a whole, embedded with the pre-study resource, is statistically significant with a large effect in increasing all students' confidence levels from low at the beginning of semester to high at the end of the semester.

¹ The guideline proposed by Cohen (1988) for interpreting effect size values were: 0.01= small effect, 0.06= moderate effect, and 0.14= large effect.

The qualitative interview findings also broadly support the quantitative results to indicate that students' confidence levels are higher after using the pre-study resource. A majority of the students (50%) in the interviews reported that they did not feel confident at the beginning of the course but their confidence levels in learning sciences did increase towards the end of the semester. One of these students is a mature aged student having left school ten years ago and not finished Year 12. There is also one student who reported that the confidence level was high at the start of the semester and grew stronger towards the end of the semester. This student holds a doctorate in Science and has worked in the science industry for a number of years. On the other end, there is a student who reported that the confidence level was high going into the course but was not confident at the end of the semester but felt more confident in the following semester's nursing-specific courses. This student reported;

“...I didn't think I really retained the knowledge of [foundation science] ... in doing [nursing courses this semester], I found that I have actually learned more than I realised. So things are starting to click for me ... I am able to apply stuff.... So, it is coming together.”

Research question 2: Does the pre-study resource have an impact on confidence levels for students who have left school for a considerable amount of time?

A one-way analysis of variance (ANOVA) was conducted to explore the impact of the time students left school on their confidence levels at two different conditions. One ANOVA test was conducted for Time 1 (before intervention) and Time 2 (after intervention), and another test was conducted for Time 2 (after intervention) and Time 3 (at the end of semester). For both tests, there were four groupings of the time that students left school before attending university (Group 1: less than 1 year, Group 2: 1 to 3 years, Group 3: 4 to 10 years, and Group 4: more than 10 years).

Sub-question: Is there a difference in confidence levels for students who have left school more than 10 years, four to ten years, one to three year, and less than one year before and after intervention at the beginning of semester (Time 1 and Time 2)?

There was a statistically significant difference at the $p < 0.01$ level in confidence level for the four time groupings: $F(3, 144) = 4.53$, $p = 0.01$. The effect size calculated using eta squared, was 0.09 or considered medium according to Cohen (1988). The post-hoc comparisons using the Tukey HSD test showed that the mean confidence level for the students who left school for more than 10 years (Group 4, $M=1.61$, $SD=0.55$) were significantly different from the students who left school less than one year ago (Group 1, $M=1.98$, $SD=0.55$) and those students who have left school for one to three years (Group 2, $M=1.96$, $SD=0.33$). It did not differ significantly from the group of students who left school four to ten years ago (Group 3, $M=1.80$, $SD=0.58$).

Sub-question: Is there a difference in confidence levels for students who have left school more than 10 years, four to ten years, one to three year, and less than one year after intervention and at the end of semester (Time 2 and Time 3)?

There was no statistically significant difference at the $p < 0.05$ level in confidence levels for the four groups of students. However, the mean confidence levels for the various groups of students at the end of the semester continued to increase: Group 1 (left school less than one year) = 2.00; Group 2 (left school one to three years) = 1.92; Group 3 (four to ten years) = 1.88; and Group 4 (more than 10 years) = 1.75.

Even though there are no statistically significant results, it is noted that the confidence levels for all the groups of students have increased from Time 1 to Time 2, and Time 2 to Time 3. What the results have indicated is that despite the confidence levels of the mature students compared to the younger students is not significantly different statistically at the end of the semester, the confidence levels of the mature students have continued to increase throughout the course in a similar pattern to the younger students. This could indicate that the pre-study resource has brought about a 'level-playing field' effect on students' confidence levels by the end of the course. That is, the mature students particularly those who have left school for a considerable length of time are enabled in terms of increased confidence levels at the beginning of the course through to the end of the course. Hence, supporting these students to build academic success throughout the course can potentially increase retention rates.

The qualitative interview findings also support the quantitative data that the pre-study resource among other factors plays a role in building the confidence levels of students. Particularly, those students who are mature aged and have left school for a period of time. One student reported that the pre-study resource had helped build his/ her confidence level as this student did not complete Year 12 but had left school for more than 10 years.

Research question 3: How did the pre-study resource contribute to students learning sciences?

When the students were interviewed about the aspects of the pre-study resource that were useful and facilitated their learning, a majority of the responses focused on the design element of the materials. The students reported features such as "layman's terms", "step-by-step", "simple and easy to read format", "basic stuff and layer up to harder stuff", "go through same subject several different times". This finding is also similar to the open ended comments at the end of the questionnaire. Some of the students further elaborated that the pre-study resource had contributed to their learning as it served to prepare them effectively in terms of building their confidence level in learning sciences. This is illuminated from the student interviews and open-ended comments such as "... gave us reassurance", "useful before starting and as backup", "catch-up", "to get a brief idea", "to gain confidence".

In the student interviews, students reported two broad dimensions other than the pre-study resource that have facilitated in their learning of sciences. The first dimension related to the lecturers' approach in teaching. Students reported that the lecturers who were effective were the ones who were able to explain the concepts in simple terms and relate them to nursing or from the nursing perspective.

Students have reported:

"... [the lecturer] put things simply in terms that you could understand, ... teaching technique is so much different compared to somebody else...".

"... learning those concepts that are directly related to nursing in the future ..."

The second dimension related to the curricular matters where other learning opportunities were created to complement the pre-study resource. Students reported that the self-directed learning sections during semester, the chemistry workshops organised before the semester commenced, the quizzes, the modular examination format, the supplementary tutorial classes, and the text-book, all contributed in varied extent and degree to facilitate their confidence levels and in learning sciences.

Discussion and Conclusion

This study explores the impact of front-loading in a course to enable nursing students' academic success through increasing their confidence levels in learning sciences, particularly among non-traditional students such as mature aged students, students who have left school for more than 10 years before entering universities. Both the quantitative and qualitative findings have provided support that the front-loading strategy can attribute to differences in students' confidence levels and that the pre-study resource would be effective in maximising the academic success of non-traditional students.

The explanation for the confidence levels for the mature student at the beginning of the semester in particular could be attributed to the front-loading strategy facilitating their learning process through enabling their learning efficacy through the presentation of materials that used simple terms or language and in a scaffolded manner when introducing the concepts or terms. When the materials are presented in such a manner, it helps in explicating assumed science knowledge (Wilson, 2009). Furthermore, this study has shown such a strategy might effect a 'level-playing field' influence on students' confidence levels at the beginning of the course which affectively can reduced levels of anxiety and thus contribute to academic success. Particularly, impacting the more mature aged students and or those who have left schooling for a considerable number of years before returning or entering higher education. This is a significant finding since studies have reported that the majority of students who leave after the first semester of studying foundation sciences in nursing have indicated that they leave because of perceived difficulty in learning sciences. Indeed it is widely known that the experience that a student faces in the first four weeks of semester is linked to their decision to continue their studies. Therefore an increase in confidence in those early weeks can set the scene for future academic success.

Wilson (2009) has emphasised that an effective front-loading strategy should be one that develops students' academic confidence and self-regulation through creating students independence from teachers. This perspective seems to imply that a teacher implementing such an approach might be one who activates student learning, a concept unlike a student-focused approach to teaching (Prosser & Trigwell, 1999; Trigwell, Prosser, & Taylor, 1994), and the facilitatory teaching method commonly used in problem-based learning (Mayo & Donnelly, 1995). The student-focused approach of teaching is further illuminated with students reporting that the teachers who were effective were those who were not transmissive in approach. Furthermore, related to student-focused teaching approach, students have also reported that a teaching approach that helps students to relate the foundation sciences to nursing is effective in increasing their confidence levels. This finding about 'relatedness to nursing' is consistent to the many studies that have reported to be a barrier to nursing students in learning science courses (Caon & Treagust, 1993; Jordan, Davies, & Green, 1999; Wharrad, Allcock, & Cahapple, 1994). Students feel less confident when they could not see the relevance or how the science courses apply to nursing profession and or practice. In fact, it is interesting to note that one student who reported lower confidence level at the end of the semester when entering the course realised that the knowledge learned made 'more sense' in the nursing courses in the second semester.

The study also illuminates the importance of creating a learning environment that provide as much affordances as possible to maximise students' confidence and academic success (Wilson, 2009). Wilson's (2009) notion of a rich learning environment is consistent with the

learning environment studies that have found that the learning environment – the physical, social and psychological contexts - are determinants of learning affecting student achievement and attitudes (Fraser, 1994, 1998; Fraser & Walberg, 1991). The qualitative findings reported that the pre-study resource was effective in building their confidence levels together with other co-curricular learning and teaching activities and design elements. Therefore, having a pre-study resource is insufficient in providing that rich affordance to student learning and building confidence levels. In addition to the co-curricular activities to support the pre-study resource, a teaching approach that adds to the ‘richness’ is also needed.

In summary, this study has showed that to implement an effective front-loading strategy within a course, the focus should not only be placed on the creation of the resource but on both the course design and teaching approach. An effective course design and teaching approach in teaching foundation sciences in nursing should be about supporting and enabling students to make the connections of foundation sciences to nursing at the present time and future contexts. What this highlights is that even with a front-loading strategy, the notion of a constructively aligned course (Biggs, 2003) and it being student-focused (Prosser & Trigwell, 1999; Trigwell et al., 1994) remains. This study has provided early results to show that a course embedded with front-loaded materials can be a worthwhile academic success strategy to pursue in enhancing the retention rates of students in first year and first semester courses, particularly with the continuing increase and widening student participation in higher education.

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