When level 2 is the 1st year at University: Evaluation of a Preparation Program for Direct Entry to Pathophysiology and Pharmacology.

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Abstract

At our institution Diploma-qualified Enrolled Nurses have been provided direct entry to the level two pathophysiology and pharmacology course in their first session of study. This has resulted in angst within the student body and academic staff. The project aims were: 1. Develop a preparatory face-to-face workshop; 2. Develop and evaluate a preparation website to support student revision, understanding and confidence with key concepts, and 3. Review students' self-reported self-efficacy (pilot SE Tool) regarding key bioscience concepts. Regular access to the website was evident throughout the session. Of 196 students, the interaction rate of those with a pass grade or better was 35.7 per student whilst those who failed averaged 25.7. The SE tool helped students identify and prioritise topics for revision; 35 of 69 students volunteered their completed SE tool. The preparation support website, workshop and SE tool were successful in initiating self-reflection and enhancing the student experience.

Keywords

Nursing, pathophysiology, pharmacology, direct entry, transition, self-efficacy, bioscience

Background

Rural and regional institutions have an imperative to succeed in 'growing our own' health professionals to maintain our communities' health workforce (Birks, Al-Motlaq & Mills, 2010). Enrolled Nurses (EN) who complete the Diploma at TAFE (Technical and Further Education) have been provided direct entry to pre-registration Registered Nurse (RN) degree programs based on recognised prior learning of their TAFE study. Since 2013, these students have been given credit for level one human bioscience courses leading to study of the level 2 pathophysiology and pharmacology course in their first year. In recent years, with the increasing diversity of recognised university entry pathways, the TAFE to University pattern has become a 'norm' rather than an exception. Those entering from TAFE have been shown to lack academic literacy, a key component for university success and significantly impacting on completion (Watson, 2008). Moreover, direct entry to level two courses often results in bypassing of supportive first year university programs (Hutchinson, Mitchell & John, 2011).

Recognition of the importance of physiology and pathophysiology to nursing clinical practice has been examined demonstrating that the better the knowledge and confidence of nurses, the greater the impact on improving quality of care (Jordan & Reid, 1997; Prowse & Lyne, 2000). It has also been long recognised that nursing students struggle with study of human bioscience and its relevance to nursing practice (Pitt, Powis, Levett-Jones & Hunter, 2012; Freidal & Treagust, 2005) irrespective of being deemed foundational to practice. This recognition has led to a pervasive 'science anxiety' amongst first year nursing students (Cox & Crane, 2014). A recent study indicated that amongst Australian university students,

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depression, anxiety and stress scales were higher than those of the general community and that the student's field of study was related to the levels of distress (Larcombe et al., 2014). For these EN entry students there is the added gap, which may be several years, between their last formal study experience and university entry. It has been suggested that previous health related work experience might mediate these difficulties yet evidence is conflicting (Logan, Cox & Nielsen, 2013).

Despite ENs having experience in the clinical workplace, many of these students find their clinical competence challenged and have difficulty adapting to academic requirements (Hutchinson et al., 2011). Certainly, student feedback at our multi-campus, regional and rural institution indicates they find transition from the vocational education arena more difficult than they expected. Furthermore, educational psychology research indicates that academic stress levels are highest among re-entry students whose motivation for entering higher education is to achieve career goals (Michie, Glachan & Bray, 2001). It is reasonable then to expect that the EN trained students are more likely to experience increased stress and anxiety and so be at more academic risk generally. Compounding this stress is the study load; students are enrolled in three courses in their first session (four courses being a normal full-time load), the students are working – often supporting a family, as well as enrolled to study by distance and online. Added to this, for many at this institution (up to 67%), is their status as the 'first in their family' (FiF) to study at university (Logan, Cox et al., 2013).

The level 1 human bioscience courses are designed to provide foundational core concepts to support understanding of the effects of disease processes and the drugs used to either maintain quality of life or return the body to good health. Meyer and Land (2005) distinguished core concepts as foundational knowledge and threshold concepts as those that provided transformational meaning. They characterised threshold concepts as those that are irreversible and integrative. The importance of identifying threshold concepts lies in creating better frameworks to enable students to have the 'ah-hah' moments that become unlikely to be forgotten or unlearned (Meyer & Land, 2005). Ultimately the different health disciplines use common foundational material in different ways associated with their practice (Barradell, 2013). That means lecturers need to communicate what 'the integral ways of thinking' (Barradell, 2013) are in order to practise a discipline and support student self-efficacy (SE). Few human bioscience, pathophysiology and pharmacology courses are taught by academics who have clinical practice backgrounds, most being physiology majors (Nicol, 2002).

Several studies on student SE indicate that the higher a student's SE the more likely they are to attempt and persist with challenging tasks (Archer, Cantwell, Bourke, 1999). Those with a low SE were more likely to withdraw from study (Andrew, 1998). SE is related to a person's expectations and self-belief that they can successfully perform a task or behaviour and consequently it influences their willingness to persist (Bandura, 1986). Self-efficacy surveys are designed to determine how confident a person is to perform a task and then potentially monitor change over time. Andrew (1998) developed an SE in Science survey for nursing students that measured confidence in science pre entry to a human bioscience course. A similar tool does not exist for pre-entry to pathophysiology and pharmacology.

Boelen and Kenny (2009) undertook an evaluation of an Australian university transition program designed specifically for ENs. They report that prior the transition program, self-confidence in anatomy, physiology and chemistry all ranked below 5 (out of 10) (60 students) and that confidence was inversely proportional to the length of time as an working EN. The authors reported a significant difference in student confidence after the program and with 31

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of 70 students indicating that a re-acquaintence with science knowledge had contributed to that improved confidence. The social interaction and networking possible during the program were equally highly regarded and helped to reduce anxiety.

A review of student course evaluation scores and pass/fail rates at our institution had indicated that the cohort entering pathophysiology and pharmacology were experiencing a 'second year slump' (Logan, Dunphy, McClean & Ireland, 2013). At the time of the review EN entry did not result in credit for level 1 human bioscience due to the qualification level being that of certificate. The instigation of course credit was achieved with the upgrading to EN diploma level training and it was suspected that the direct entry which began in 2013 was amplifying the effect of the 'second year slump'. To address the issue a voluntary program for EN students enrolling to study by distance was put in place in 2014 with the overall aims to:
1. Develop a preparatory face-to-face (F2F) workshop to introduce students to level 2 science, promote self-reflection and reduce 'science' anxiety;
2. Develop a preparatory website to: a) provide targeted revision materials to support the students individual results derived from the SE tool, and b) support students entering level 2 science who were unable to attend the workshops;
3. Develop and pilot a self-efficacy survey tool (SE Tool) specifically designed for EN students entering level 2 science to encourage self-reflection of their confidence in key bioscience concepts. The tool highlighted the terms needed to support study in pathophysiology and pharmacology. Preliminary results are included here as part of the program evaluation.

Method

Preparation for Pathophysiology and Pharmacology workshops

A one-day face-to-face (F2F) workshop was held, at three separate venues, for those students who had been given credit for level 1 human bioscience subjects. Workshop attendance was voluntary and occurred in the two weeks prior to the commencement of session. Participants were introduced to the university website, general resources available to students and in particular those designed and recommended to students in their first year at university. An introduction to writing for science and avoiding plagiarism was included. The program also enabled students to review their learning styles and utilised options for capitalising on individual styles within mini-lectures held on the day. Completion of the SE tool by participants at the commencement of the workshop enabled the workshop leaders to decide what topics would be used for the mini-lectures. Students were also introduced to the subject preparation website at the workshops.

The preparation support website

To support the students' revision efforts, a website that mimicked an actual subject teaching site was created. The website included the SE tool, information about learning styles and links to the First Year in Science resources website. It included a series of pre-recorded lectures on key level 1 human bioscience topics considered fundamental to pathophysiology and pharmacology. Multiple choice question tests were provided for students to self-test their knowledge. For those students not attending the face-to-face workshops, online introduction sessions were held. All students enrolled in pathophysiology and pharmacology two weeks before session commenced were automatically given access. An announcement on the

teaching site alerted those enrolling late that they could request to be added to the preparatory site. The pathophysiology and pharmacology course was only offered by distance study mode at the time of preparatory website data collection.

Development and piloting of a Self-efficacy survey tool (SE tool)

A list of level 1 chemistry, microbiology, anatomy and physiology key concepts were identified as foundational for pathophysiology and pharmacology in collaboration with peer lecturers. These were used to design the self-efficacy survey tool. The tool asks students to rank their level of confidence in their knowledge of the concept and their confidence in applying the concept to disease processes. By completing the tool the students could use their results to prioritise areas for revision prior to commencement of Pathophysiology and Pharmacology 1. Pilot testing of the tool occurred at the face-to-face 'Preparation for Pathophysiology and Pharmacology' workshops. The tool was included as part of the website resources. Students accessing the website, who did not attend the face-to-face workshop, were also invited to volunteer their completed tool to the evaluation project.

At the commencement of the workshop the SE tool was distributed to all students and the purpose of the tool explained. Submission of a copy of the completed tool as part of the research project was voluntary. Students who consented to be part of the research project were asked to complete the tool again in week 6 of the session. The second SE tool included a short series of open-ended questions to help evaluate the tool and the workshop experience.

The University Human Research and Ethics Committee (HREC) approved the mixed method evaluation of the SE tool (Number 2014/013). Website utilisation data is provided as de-identified aggregated descriptive statistics only. Although the face-to-face workshops were evaluated using qualitative methods, only the narrative comments provided by students as part of the SE tool evaluation are included in this report in keeping with the granted HREC approval.

Results

The F2F workshop

The qualitative feedback of the workshop evaluation is not available for publication as it was not included as part of HREC approval. Only the comments volunteered by those who participated in the SE tool are covered by the approval. We can say that, generally, the overall reception of the workshop was positive and those who participated indicated that it had been worth the effort of travelling to have the face-to-face access to lecturers and conversations with fellow students. Of those who participated in the SE tool evaluation comments recommending the workshop attendance were unanimous. They included the following comment

> I had no idea how better prepared I was until I met fellow students at residential school for a [nursing] subject. They had completed more [science] subjects than I had, but their understanding and notes were ''shallow' as were their results for the mid-session test ... I am still overwhelmed by the depth of understanding that I need to jump to ... I wish the workshop had been even earlier and that I was put through a mini-online assessment much like the [preparation site] resources to get me thinking in a more constructive way.

Review of website utilisation

At the end of session 231 students had completed the pathophysiology and pharmacology subject with substantive grades. Initial enrolment to the preparatory website numbered 196 indicating a significant number of late enrolments. Many of these late enrolments would have been students repeating the subject after failing it the previous session.

Regular accessing of the website was evident throughout session including the weeks prior the exam period. Of 196 students enrolled in the preparatory website, 153 accessed the website. However, 36 of these students withdrew from the subject either before or after the census date. Of the remaining 117, 60% utilised the website. One student, who did not attend the F2F workshop, made the following comment as part of their SE tool participation

> I didn't use it [the website] as fully as you may have intended, as it was so overwhelming.
> But, now that I am into [the] subject I have accessed it to review information.

A review of the website access data revealed that 47% of the students who passed the course utilised the site to read content, rather than just visit, at least 10 times. In comparison, 36.7% of the group of students who failed the subject who were accessing the site did so less than 10 times. This indicates that of the group who failed the course, just 34% accessed the preparatory website in any worthwhile manner. Table 1 provides a summary of website resources utilisation by students. It reveals that lecture videos were not a popular resource in comparison to MS Powerpoint lecture slides. Of the resources, the SE tool was the most popular, followed by the writing for science guides and the learning styles survey and support materials. The revision multiple-choice (MCQ) tests were not universally undertaken with less than half the students attempting them. The rate of correct answers was also less than half.

Resource (content reads only)	No. of students who accessed lecture videos	No. of times lecture videos were accessed	No. of students who accessed lecture slides	No. of times slide sets were accessed
Average	9.9	13.6	34.2	48.4
Median	10	13	32	45
Min: Max	0:23	0:37	26:62	29:92
Std Dev	5.8976	8.2524	8.8798	18.1623

Table 1. Utilisation of resources on the preparatory website by students.

The SE Tool pilot

Of all 196 students enrolled in the preparatory website, 69 (35%) utilised the SE tool and 35 (51%) volunteered their completed tools for the research project. Only two of these were students who did not attend the face-to-face workshops. They accessed the SE tool from the website. Unfortunately, only six students replied to the request to repeat the SE tool after week 6 of session. Of these two had postponed their study of pathophysiology and pharmacology whilst four completed the second tool. The students who withdrew advised they had opted to study only two instead of three courses during the session to better enable them to succeed at a later date in pathophysiology and pharmacology through minimising the

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competition for their time. This is also gave them more time to adapt to university before undertaking the course.

One student who signed the consent to participate and volunteered their SE tool did not complete the demographics questions. Of the 35 participants, 21 (68%) were the first in their family (FiF) to study at university. Of the FiF group 19 had achieved Enrolled Nurse qualifications. In total, Enrolled Nurse qualifications had been achieved by 24 of the participants. Credit for level 1 science had been awarded to 22 (two participants did not answer this question) and another two participants were repeating pathophysiology and pharmacology 1. The range of years since last studying level 1 human bioscience was 6 months to 10 years.

Student comments concerning the usefulness of the SE tool indicated it successfully alerted students to areas of required study and, as intended, helped them determine topics for revision. One student commented "it focused my attention on where I felt my knowledge was deficient so I could prioritise…", and another stated it "clearly identified areas that I had not even considered or touched on in the Diploma". One negative comment also had its positive aspect as noted by the student:

> Actually, I am not sure it helped. I looked at the results and felt I didn't know enough, and that it would be a real slog to get through. It highlighted how much I didn't remember from my prior studies, but maybe that is a good tool! At most it made me prepare myself mentally for the content of BMS.

This comment does indicate the anxiety related to studying science topics. A summary of the SE tool concept rankings is given in Table 2 and Table 3 gives an example of the survey concepts with the associated raw scores of how the students ranked their confidence.

Ranking by students N=71 concepts	I rank my confidence in my understanding of the topic as (n=35 students)					I rank my confidence in my ability to apply my knowledge to disease processes involving these topic areas as (n=34 students)				
	Not very confident	Only just confident	Reasonably confident	Very confident	Super confident	Not very confident	Only just confident	Reasonably confident	Very confident	Super confident
Mode	18	10	4	1	1	23	9	2	0	0
Median	17	10	6	1	1	20.5	9	3	0	0
Average	15.9	10.7	6.1	1.5	0.8	20.1	9	3.9	0.5	0.5
Min: Max	1:25	5:16	1:14	0:7	0:3	8:28	2:16	1:12	0:2	0:2
Std Dev	5.36	2.68	2.89	1.36	0.8	4.9	2.91	2.58	0.65	0.5

Table 2. Summary of the SE tool results.

Final grades achieved by those participants in the SE Tool evaluation (all except 2 attended the workshop) showed that the majority passed the course. However, of the 35 research participants, 19 withdrew from the pathophysiology and pharmacology course before the census date. Of the remainder, 15 passed and two failed.

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Place a tick in the box that most closely indicates how confident you feel with these concepts	I rank my confidence in my understanding of the topic as (n=35)					I rank my confidence in my ability to apply my knowledge to disease processes …as (n=34)				
	Not very confident	Only just confident	Reasonably confident	Very confident	Super confident	Not very confident	Only just confident	Reasonably confident	Very confident	Super confident
Homeostasis	2	13	14	4	2	9	11	12	2	0
Limbic system	24	6	3	2	0	27	3	3	1	0
Hydrostatic pressure	18	10	4	2	0	19	9	4	1	1
Role of hormones in electrolyte balance	20	7	6	0	2	23	5	4	1	1
Mitosis	18	10	5	1	1	20	9	4	0	1
Role of antibodies	12	15	6	1	1	16	12	5	0	1
The differences between viruses, bacteria, fungi, moulds, protozoa.	13	14	6	2	0	18	13	2	1	0

Table 3. Example of SE Tool responses.
(Numbers indicate the number of students who choose that rank).

Discussion

It is a widely held view that the first year experience is critical to future success and persistence in university education (Willcoxon, Cotter & Joy, 2011; Krause, Hartley, James & McInnes, 2005), however, direct entry to second level study is a relatively recent area of investigation as is transition from TAFE. Our sample had a high proportion of students who were the FiF to study at university and this is typical of the nursing student cohort at our institution (Logan, Cox et al., 2013). Earlier research with first year human bioscience students indicated that being 'first in family' was a risk factor associated with poor progression (Logan, Cox et al., 2013). The study by Southgate et al. (2014) noted that FiF students have poorer outcomes after first year than non-FiF students and they indicate the lack of scaffolding after first year was the probable cause. This may go some way towards explaining the 'second year slump' that had been noted at our institution. A high part-time student study load (three courses instead of two), mature aged student responsibilities, and TAFE transition alongside a high FiF ratio within the student cohort could be expected to raise the numbers of stressed and struggling students.

The statistics retrieved for usage of the website and the information provided as part of the piloted SE tool give an indication of the student engagement with voluntarily accessible resources, but we did not undertake measures of the impact on student confidence. The results of the online MCQ tests could not be expected to inspire the students' confidence, although it may have had the effect of triggering a sense of determination and dedication. The work of Meyer and Land (2005) and Barradell (2013) indicates that those students with a higher SE would persist. Students can opt to have their credit for human bioscience

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rescinded. However there is a risk that the student then does not succeed in passing the level 1 science courses preventing their progression. This would be a challenging personal decision to make and has an inherent associated cost with enrolling in the extra subjects. Not succeeding in pathophysiology and pharmacology also has a cost factor associated with it. For each course failed a student's chances of success are halved (Abele, Penprase & Ternes, 2011). The retrospective review undertaken in 2012 (Logan, Dunphy et al., 2013) indicated the nursing students would attempt a course multiple times in order to achieve a pass grade. It is possible that in rural communities where professional work choices are more limited, the potential stagnation of career prospects weighs more heavily than the associated cost of repeating courses. The fact that a substantial number of students delay studying pathophysiology and pharmacology until a later session, despite it causing delays in their progression, is both an economic and a pragmatic indicator of the personal need for success on the first attempt. A slower adaptation period may impact positively on grade point average and therefore progression, but at this point in time we do not have those figures.

Student engagement with learning materials is important to successful study (Salmonson, Andrew & Everett, 2009). The resources provided on the website were a mix of level 1 lectures and targeted revision materials to support study of pathophysiology and pharmacology. Most videos were 15-20 minutes in duration and included the provided MS Powerpoint slide sets. Access statistics for the pre-recorded video lectures indicate these failed to engage the majority of students despite the cohort studying by distance mode. The written text and diagrams of the slide sets appeared to be much preferred. In a yet to be completed research project, there is an indication in the narrative data that internet access and poor download speeds in regional and rural Australia may play a role in the students' choice of resources (Logan & Cox, unpublished). Regardless, it is apparent that the resources could benefit from being revamped to facilitate increased engagement.

The SE tool is currently based on identified core concepts, as defined by Meyer and Land (2005), from human bioscience content needed to study pathophysiology and pharmacology. The tool is therefore quite long and could benefit from being trimmed down by being linked to threshold concepts rather than core concepts. There are challenges in performing this task as identifying key human bioscience core and threshold concepts for nursing clinical practice has proven difficult and the level of depth of knowledge needed remains contentious (Logan, Cox et al., 2013). At a time when the physiology textbooks are expanding with increasing levels of detail it becomes more and more important to determine the appropriate core and threshold concepts to tailor programs appropriately. As course failure is a major contributor to student attrition and has been linked to the lack of delineated core concepts (Jordan, Davies & Greene, 1999) investigating this aspect that contributes to academic success should be prioritised.

The few comments that we can include here, with respect to the workshop, indicate that those who attended the F2F sessions were better able to make use of the website. Despite this, the actual use of the site exceeded our hopes and in our view is a reflection of the students' wish for targeted support and revision assistance. The fact that they continued to access the preparation website throughout the pathophysiology and pharmacology course, demonstrates that timing of access is important.

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Limitations of the data

The SE tool was not designed to be a statistical diagnostic tool. It was designed to encourage self-reflection about bioscience knowledge and assist with prioritising use of the website resources. Further research is being undertaken to understand the utility and impact of the tool. Although the frequency of student usage of the website materials could be tracked, the way in which students then used the resources to support their study was unable to be captured.

Conclusion

The F2F workshop provided attendees with an opportunity to meet fellow 'direct entry' students, enhance understanding of their learning styles and discuss areas of concern with experienced pathophysiology lecturers. This assisted with self-reported perceived anxiety. Provision of an SE tool enabled the students to self-identify the key areas about which they felt less self-efficacious for pathophysiology and pharmacology study and thereby helping them to determine topics for revision. Improvements and modifications will be made to the pilot SE tool and preparation website based on student feedback. Research into identifying the core and threshold concepts for clinical practice would further enhance the development of these resources. Given the substantial number of students who delayed study of pathophysiology and pharmacology until a later session, the impact of this decision should be evaluated. For the increasing number of Diploma-qualified Enrolled Nurses, for whom level 2 is the 1st year at University, provision of targeted support to assist the TAFE to university transition is a worthy investment of university resources to help build student confidence, self-efficacy, course progression and completion.

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