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Addressing obstacles to success: Improving student completion, retention, and achievement in science modules in applied-health programmes: A summary

Science education research literature suggests that the decontextualised nature of much science learning can be an obstacle to many learners. Science ideas are often expressed in formal, abstract, logicoscientific modes of communication, whereas people mostly use more informal and storied narrative modes of communication (Bruner, 1986). It takes practice and careful support to learn to use these new modes, and learners may not feel the need unless they can see an *identity* for themselves as learners and users of science knowledge (Gilbert, Hipkins, & Cooper, 2005). To help students achieve this identity, it may be necessary to create explicit “border crossing” strategies so they are supported to make the necessary translations between science and their other world views (Aikenhead, 1996).

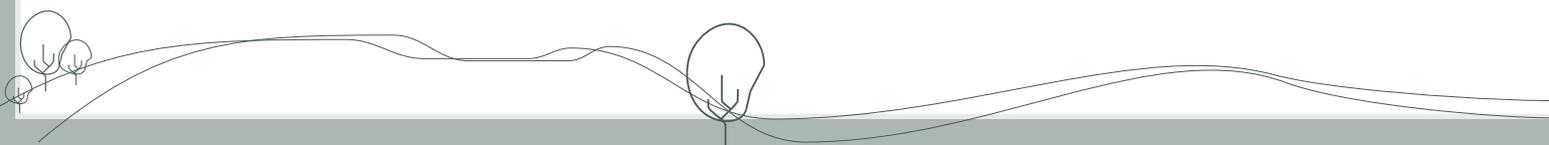
There is also a “border” between science theory and science-in-use in the workplace. Aikenhead (2005) found that nurses are most likely to draw on their procedural knowledge when making decisions on the job, while Nutley, Walter, and Davies (2003) point out that such procedural knowledge is likely to be tacit. They contrast this with declarative knowledge, which is more likely to be taught and assessed in science modules for midwifery and nursing. They suggest that there is a need to investigate “whether practice is more a case of ‘from doing to knowing’ (the social construction of knowledge) rather than ‘from knowing to doing’ (rational EBP¹ models)” (Nutley, Walter, & Davies, 2003, p. 129).

¹ EBP = Evidence Based Practice

Aims and objectives

This research aimed to find new ways of teaching the necessary science knowledge in undergraduate degree programmes for midwifery and nursing, without creating an obstacle to overall programme success. Helping students to see clearer connections between their science learning and their goal of becoming midwives or nurses became central. We sought ways to support

students to make links between theory and practice. We aimed to contextualise the science teaching modules by using rich narratives of practice. We anticipated that their effective use would require a change from traditional teaching, which tends to leave students to create theory–practice links for themselves.





Research questions and methodology

The research comprised two phases.

Phase One (2006) addressed the question: “What aspects of science do newly graduated midwives and nurses *really* need to know in order to practise competently?” Activities included:

- a review of current literature
- focus groups with midwifery and nurse educators, and new-graduate midwives and nurses, to explore the science they see as *actually used* in practice.

Phase Two (2007) addressed the question: “How can science be taught more effectively to help students make more meaningful theory–practice links?” by:

- designing, delivering, and evaluating the effectiveness of a pilot intervention in two subject areas of the first-year nursing science module, based on the “essential” science knowledge and skills identified in Phase One, matched to aspects of the current curriculum being taught
- designing, delivering, and evaluating a breastfeeding and lactation module to first-year midwifery students.

Phase One: The research as it unfolded

To explore the science that midwives and nurses actually used in practice, focus groups tapped into the “know-how” of educators and new graduates, in order to build narratives for use in the science modules. Using a narrative approach (Aikenhead, 2005; Benner, 2001), we collected rich contextual stories, which were analysed to expose the underpinning science, and provide a source of narratives for the Phase Two learning materials.

The use of narrative as a pedagogical strategy for interweaving theory and practice was central to the intervention. The short, focused narratives were designed to put the theoretical ideas and the contexts of life and work into closer juxtaposition. However, a challenge arose as the narratives collected drew on concepts of un-wellness that did not match the existing first-year curriculum, which focused on normal body functioning. Instead, tutors developed new narratives which drew on familiar life contexts. For example:

New Zealand race-walker Craig Barrett collapsed during the last kilometre of the 50 km walk in the 1998 Commonwealth Games. He became confused and disorientated and staggered aimlessly before being removed from the race and successfully treated. (Wintec, 2007)

Making space in the curriculum for these stories was another challenge. Science tutors reviewed their materials with a view to content reduction and sought to: cut some topics; prune subtopics not essential to understanding; trim use of overly technical vocabulary;

and reduce any unnecessary repetition (American Association for the Advancement of Science, 2001).

Phase Two interventions

Nursing students are taught science in a full-year module. The two topics selected and developed as the intervention were the cardiovascular system and the renal system. Each involved three classes over three weeks. Existing content was streamlined, narrative stories added, and a feedback process put in place. Some changes were also made to supplementary laboratories, including adding question worksheets to highlight the theory–practice links we hoped the students would build for themselves.

The feedback process involved using “tickets out of class” (TOC) (Angelo & Cross, 1993). These short feedback sheets provided opportunities to increase student participation and interactivity, by encouraging students to reflect on the intent of the lecture and on their own learning and ask any outstanding questions. The strategy also enabled tutors to check the sense students had made of the theory and the narrative examples used. These insights provided useful feedback as the project unfolded.

The intervention for the midwifery module involved integrating and aligning science content into four classes. When lactation theory was taught, the relevant science for the anatomy and physiology of lactation was covered by the science tutor. The content for the science components was streamlined, TOC were implemented, and additional self-completion exercises for students were introduced. One main narrative was used to link all four lectures.

Evaluating the interventions

A range of strategies was used to seek evidence of the impact of the changes on students’ understanding, their attitudes to the science module, and their ability to see links with their prospective role as nurses or midwives. Tutors self-reviewed their teaching and engaged in a peer interview. Data from both midwifery and nursing students was gathered from:

- the TOC
- an established group evaluation process called Small Group Instructional Diagnosis (SGID)
- a routine end-of-module evaluation process, known at Wintec as a SETMAP.

Evidence of the success of the nursing intervention also drew on:

- the additional laboratory worksheet questions
- patterns of self-directed study using Moodle (an online learning management system)
- results from a summative multiple-choice test at the end of the module.



Evidence of the success of the midwifery intervention also drew on:

- results from a summative assessment essay with an additional criterion, where students were to describe the science and rationale underlying the process of lactation and breastfeeding.

Findings: Evidence of effectiveness of the intervention

Students' engagement with the science

The TOC generated a range of questions, and some students demonstrated beginning attempts at linking theory and practice, prompted by the narratives. For example, during one renal lecture on body fluids, one student asked:

How do you treat people that have too much water or too little water in their system, and how do you tell just by observing someone without weighing them?

Tutors reported midwifery students seemed particularly interested, asking questions about the narratives and often wanting to talk after class. Students reported that using narrative or "real life" examples had been helpful for learning and putting learning into context:

The story at the beginning—makes it more relevant to course, seems to help understanding and visualisation of issues talked about.

However some early feedback from students was discouraging for tutors as it highlighted gaps in understanding, and for a time the tutors felt they were doing a worse job than they had previously. A turning point came when they began to address the actual questions raised rather than re-covering their own teaching agenda. In this way, the tutors were challenged to rethink the teaching role and, specifically, the ways they used their expertise to support students' learning.

Issues and challenges

Content reduction

Tutors noted that content reduction had worked well and had played an important part in establishing relevance and maintaining the interest of students. However, the questions generated sometimes took up more time than content reduction freed up, and so the end of some lectures still felt rushed. Tutors were also concerned that some key concepts linking first-year content to second year were not covered. Despite the content reduction, students still viewed the amount of information in lectures, together with numerous "jargon" terms, as hindering their learning.

Designing effective narratives

The first attempt used narratives in a way that illustrated the relevance of the intended conceptual learning,

but the context did not link in any necessary way to the concepts being taught. On the second attempt, the narratives were shaped to open up questions of importance for *conceptual* understanding, contexts and concepts were more interwoven, and the story invited discussion that would draw students into a more personal response to the intended learning. We learnt that effective narratives need to position both the context and concepts as integral to intended learning. Narratives carry links in both directions—creating a two-way bridge between theory and practice.

Rethinking assessment

The end-of-year summative test results for 2006 and 2007 nursing students were compared for five topics taught during the year, including the two intervention topics.

Despite the interventions, results were similar in both years, and the overall failure rate in 2007 remained around 30 percent. Seeking to understand this, the tutors identified a mismatch between the intent of the intervention and the assessment tools. They concluded there was a need to revamp the multiple-choice questions to focus on application of science to practice situations rather than just on remembering detail. If the types of learning outcomes that are sought change, so should the assessment. Similarly, the essay topic for the midwifery students was seen, on reflection, to be in need of restructuring to allow students a clearer opportunity to demonstrate theory–practice links.

Scalability and sustainability

Although developing the narratives took a lot of effort, one of the tutors recommended this approach to other tutors in a newly developed degree. The tutors have also begun incorporating similar narratives in nonintervention topics. As already noted, pedagogical change needs to be accompanied by a review of assessment practices, adding yet another dimension to the work in very busy roles.

Contribution to building capability and capacity

This project involved two sets of collaborations, one nested inside the other. In the first instance, staff from four different areas at Wintec collaborated. This team then worked with researchers from the New Zealand Council for Educational Research (NZCER). With so many different perspectives being brought together, relationships and partnerships were fundamental to our success.

A two-way interchange allowed for the knowledge of tutors (both theoretical and practical) and the knowledge of researchers (again both theoretical and practical) to be brought together as new ideas were tried out and new meanings forged. This paralleled the aim of the research, which was to help students make more



meaningful theory–practice links, and respected the potential of each to inform the other (Mackler, 2005). Having enough time, both in regular meetings and in all-day workshops with the external partner, was critical to maintaining relationships, for talking through our ideas, and establishing shared understanding.

Conclusion

New ways of teaching science knowledge were endorsed through students’ positive feedback. There was evidence of increased motivation and engagement of students compared to previous years and some evidence of clearer connections between science learning and future practice. As a result, tutors will continue to use the principles of content reduction and inclusion of narratives in their teaching. There was no clear evidence of improvement in summative assessment results. An emergent focus was the need to address assessment practice, so that it better reflects the intent of the innovation and the reduction of fine detail in the module content.

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