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Contemporary Research Topics

learning and teaching 3

November 2011-2017

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Formats include: theoretical frameworks of education practice; case studies of education practice; and perspectives.

Articles can be written in the first person. Case studies of education practice may include of a particular learner's journey. Submissions for the Case studies section should capture a sense of narrative, capturing the learner's journey and include the background and history where necessary to clearly outline both the problems and the solutions intended to address them. Perspectives aim to immerse the reader in new points of view from educators who are working on bold approaches to education practice and learning. These perspectives may take the form of personal accounts of frameworks of education practice could describe the context of approach, the genesis of the education practice, challenges faced in implementing and completion of the education practice framework, and a discussion of the overall success of the education practice framework including an effort to explain how this particular framework could be applicable on a larger scale. Perspectives may also take the form of editorials, reports on successful or promising approaches, or visions of how the future of Learning and Teaching might look.

Other types of articles may also be considered, though it is recommended that authors first submit a brief proposal to scopedifference@op.ac.nz. All research published in Scope: Learning and Teaching must have been considered under appropriate ethical review processes.

Articles should be written in an engaging, literary style that is accessible to non-experts. Ideally, authors will begin by posing a series of intriguing questions, creating a pleasing narrative tension that pulls the reader along to the conclusion.

High standards of writing, proofreading and adherence to consistency through referencing style appropriate to the author's discipline is accepted. A short biography of no more than 50 words; as well as title; details concerning institutional position and affiliation (where relevant);and contact information (postal, email and telephone number) should be provided on a cover sheet, with all such information withheld from the body of the submission. Low resolution images with full captions should be inserted into texts to indicate where they would be preferred; while high resolution images should be sent separately. Enquiries about future submission can be directed to scopedifference@op.ac.nz.

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Case Study

WHAT'S IN THE BOX? A CREATIVE LEARNING ACTIVITY DESIGNED TO DEVELOP CRITICAL THINKING SKILLS

Liz Ditzel and Josie Crawley

ABSTRACT

In this paper we describe a creative learning activity used to foster the development of student nurses' critical thinking skills. The activity is designed in four stages and uses a set of small wooden boxes and a children's picture storybook. First, students are placed in small groups and each presented with a box. Using only observational skills, they are asked to infer and list the box's contents. Second, students have a children's story read aloud to them and are asked to reconsider the contents of the box, given the reading. Third, students are invited to examine the box through touch and sound and reach a consensus about its contents using this information. The activity concludes with a discussion of how to apply the skills used in this activity to a different nursing context that requires evaluation and judgment.

INTRODUCTION

Experienced nurses engage in multiple clinical reasoning (critical thinking or problem solving) episodes for each person in their care, many times a day. Because of their knowledge, skill and experience the expert nurse may appear to perform these processes in way that seems automatic or instinctive. Clinical reasoning however, is a learnt skill that requires a different teaching approach to that used when learning routine nursing procedures. Taking this into consideration, we have developed a creative learning activity to develop critical thinking skills among first year nursing students.

LITERATURE REVIEW

The literature on critical thinking provides a range of conceptions ranging from a focus on generic skills (Ennis, 1989; Halpern, 1997) to a notion of critical thinking for critical being (Barnett, 1997). Critical thinking is an essential part of self-directed learning and self-assessment in all education disciplines, particularly nursing and is a defining characteristic of a registered nurse (McDrury, 2006). Nurse educators expect learners to be reflective and self-aware; curious, open and motivated, and develop and use criteria for evaluating (Cooper, 2000; Dieklemann, 2003; Nelson, 2017). For the learner, critical thinking is a part of a variety of activities where there might be alternative viewpoints with different intended outcomes (Brookfield, 1997; Moon, 2008). This approach leads the learner to assess the evidence in order to make a judgment, for example, when evaluating the likely contents of an object such as a box. However, little research attends to the practical aspects of how to teach critical thinking skills.

Stories and the act of storytelling help nursing students to develop an understanding of peoples' lived experiences and learn about practice and the world around them: building, interpreting and deconstructing narrative knowing (Banks-Wallace, 1998; Ironside, 2003; McDrury & Alterio, 2002; Wadsworth, Colorafi & Shearer, 2017). Stories contribute to the critical thinking process by opening up students' thinking to new possibilities (Stowe & Igo, 1996).

Reflective stories about nursing practice along with others' experiences of health or illness bring teaching to life (Schwartz & Abbott, 2007). They also connect relationships and offer a subjective dimension that students are more likely to remember (Cooper, 2000). Working reflectively through stories can also instil sensitivity toward others in a way that cannot be garnered from a standard nursing textbook (Overcash, 2010). Through self-reflection, stories can provide students with opportunities to integrate their own life experiences into their clinical practice (Schaefer, 2002). Critical thinking is promoted when listeners become immersed in the process of sequencing, analysing and synthesising information as they write, tell or listen to stories (Carroll, 2010; Nehls, 1995). In this way, stories link personal and professional experiences with classroom learning (Lordly, 2007).

Educators can enrich teaching and further capture the attention of students by using narratives from popular literature, films, poetry, and depicted in art that link theory to practice and inform student experiences (Brown, Kirkpatrick, Mangum & Avery, 2008). Books written for children have also been used to "awe and inspire" nursing students (Krautz, 2007, p. 223). Such books are an interesting and valuable teaching resource because readers can more easily identify with characters and the choices that they make. They help students to vicariously participate in an experience such as grief and loss, suffering, joy and helplessness that may be outside their personal experiences (Crawley, Ditzel, & Walton, 2012). Picture books are particularly valued, as illustrations often take the place of words and are open to multiple interpretations designed to capture the reader's imagination (Thacker, 2003; Vallone, 2004).

Our interactive classroom learning activity uses a children's narrative and a four-stage process (Ditzel, 2015). The sequence of events is important as it allows time for critical reflection. Two teaching tools are used, one a set of five custom-made small sealed wooden boxes that makes a distinctive 'klinky' sound when an object inside it moves around. The other tool is a children's storybook called *The Box* (Lightfoot, 2005) telling the story of Flora and Annie who discover a box outside their house. While Annie wonders what's inside the box, Flora's concern is that it belongs to her so she can care for it. The sisters imagine what could be in the box and suggest a wide range of possibilities.

THE STRUCTURED LEARNING ACTIVITY

Stage 1: Observing the box

The first stage requires students to observe, discuss, describe, and infer the contents of the 'klinky box' by using only observational skills. Students are allocated into small groups (five is ideal) and ground rules for safe group discussion are established (Vallone, 2004). This time is well spent as it builds an atmosphere based on respect and professional relationships. The teacher's role is to be a participant and facilitator in the discussion. We expect students in their groups to listen to each other with attention, contribute to the discussion if they wish and provide reasons for disagreeing and agreeing with each other. Students are then directed to observe and take turns to orally describe the box's appearance and attributes to their group before writing a description of the box on their learning worksheet. The observational part of this activity concludes when students brainstorm their ideas about the box's contents, record all of these possibilities on yellow Postit notes and place them on the classroom whiteboard.

Stage 2: Reading the book

Next, the book is read aloud to the combined class making sure the audience can see the pictures. Learners are seated where they can see the pictures or a projector is used to show the book pages on the whiteboard or screen. Although intended for children, the book must be appropriate to the adult's experience and relate to a teaching theme. The Box was chosen for its short but simple language, imaginative content, and emotionally appealing colourful illustrations. Before reading the book, we suggest that facilitators should practice reading it aloud, paying attention to pitch, tone and rhythm as your enthusiasm for story will be infectious, create interest and make the story memorable (Crawley, 2007). Also consider aspects of non-verbal communication like how much eye contact you want to have with the audience, and the effect that your own facial expression, frowns, quirks, gestures or mannerisms may have on the listeners. To help learners draw on their experiences related to the teaching theme(s) without limiting the specific factors the learners will bring from their engagement with the story it is important to ask reflexive questions such as: What could possibly be in the box that is outside Flora and Annie's house? Is this box different or the same as the one in front of you? How are you going to find out what is really in the box? Why do we need to find out what is in the box?

Stage 3: Reflecting

After reading the book to the students it is essential to pause for thought and allow time to reflect upon the book's story and images. After a short break, return students to their groups, invite them to reconsider their box's contents, add new possibilities to the list and record new ideas on the whiteboard using different coloured Postit notes. When students run out of ideas and lists are completed, ask each group to group and sort and group their ideas into categories on the whiteboard. Using a different colour shows the difference between the contents before and after the reading.

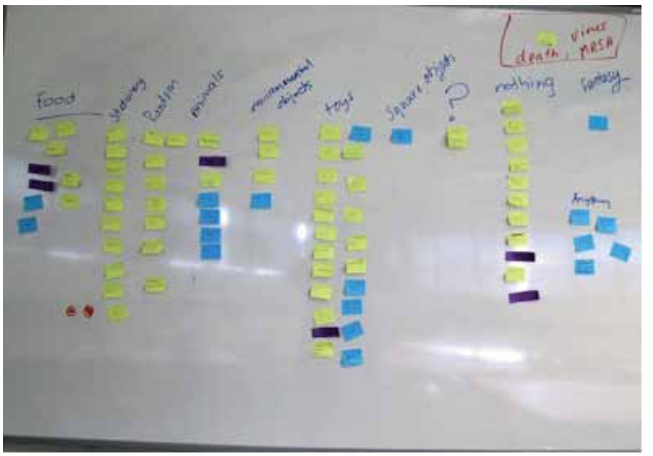

Figure 1: Posit notes showing categories of ideas

Stage 4: Manipulating the box

Next, invite group members to pick up, touch and listen to the sound made by manipulating the box. Ask groups to discuss their perceptions of the box's contents based on the new information gained from touch and sound. Now is decision time! Each group must come to a consensus as to what is in their box. Allow time for discussion and debate and once all members agree, ask each group to draw their interpretations on a separate piece of paper before transferring these drawings to the whiteboard (see Figure 2).

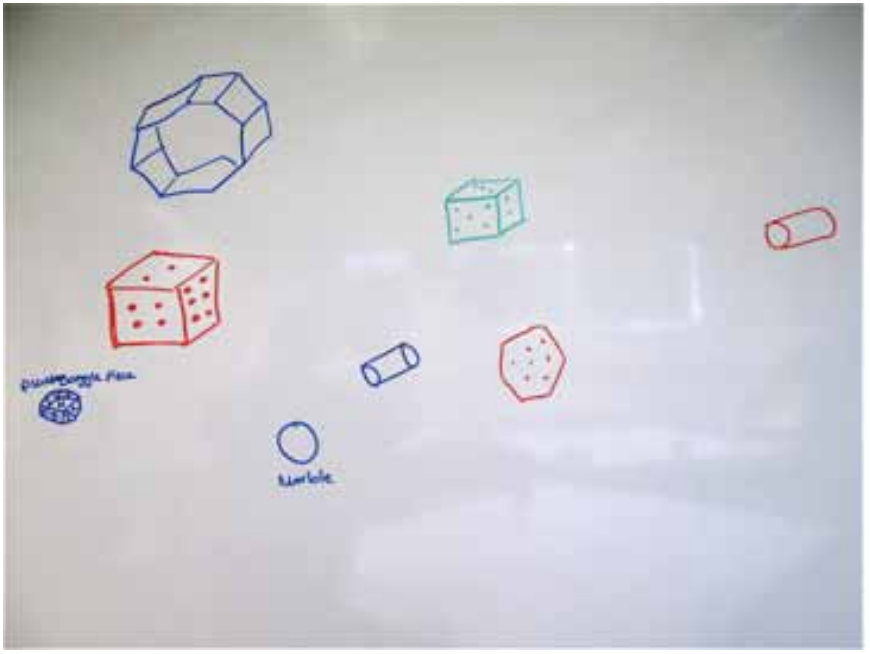

Figure 2: Student drawings of possible contents

Once the drawings are completed invite each group to present and explain their perceptions to the class. At his point, check that the key learning points have been covered and recorded on a worksheet that contains the lesson's learning objectives. A written record of learning helps students to see the point of the exercise. Finally, much to the students' frustration, the contents of the box are never revealed! This is a deliberate strategy designed to illustrate that not all problems in healthcare are easily solved.

DISCUSSION

In this learning activity the boxes and the book help students to see the world differently, to challenge the status quo by asking important questions such as: 'why?', 'why not?' and 'what if?' The central activity of critical thinking is "the assessment of what might be called evidence, in order to make a judgment" (Moon, 2008, p. 33). Here the teaching tools interplay to help students evaluate the evidence and judge the contents of the box. While the 'klinky' boxes are tangible objects open to inspection and manipulation, the book offers words and pictures that encourage invite scepticism and stimulate student's imagination. As participant observers in this activity, we note that learning starts by sharing personal experience, is facilitated by open-ended and semi-directed discussion, employing the many processes people use in daily living to perceive, imagine, intellectualise, decide and evaluate, i.e., to think critically.

The structure of "gathering, examining and analysing data, before determining what to do next" concurs with Nelson's (2017, p. 62) four characteristics of critical thinking among nursing students. It also correlates with Phillips and Bond's (2004) dimensions of critical thinking among first year management students, a process they they categorised as: "weighing up, looking at it from all angles, looking back on and looking beyond what is there (Philips & Bond, 2004, p. 283). For example, in our activity nursing students judged the contents of the box by 'weighing up' and 'looking at it from all angles'. The relationship between the stage uses in our learning activity and the critical reflection categories (named as A-D) identified by Phillips and Bond (2004) is shown in Table 1.

Learning activity stages	Critical reflection categories
1. Observing the box	weighing up (A)
2. Reading the book	looking beyond what is there (D)
3. Reflecting on the boxes' contents	looking back on (C)
4. Manipulating the box	weighing up (A) looking at it from all angles (B)

Table 1. learning activity stages and critical reflection categories

Visual inspection (looking) and oral description help students to determine the physical attributes of the box (e.g., it appears to be wooden and there is no apparent way to open it). Listening to the sounds produced by the contents of the box provide more clues when the object moves and makes a distinctive 'klinky' sound. Information gained from shaking and touching the box, feeling its weight and the object move within it, also helps students to think reflectively. In this way, the evidence is evaluated using simple comparisons, identifying the pros and the cons, and the positives and negatives of the list of alternative solutions. Students also demonstrate reflective thinking and problem solving skills when they discuss different ways to test their ideas about what is in the box, such as weighing, X-ray, and scanning, without it being opened. Knowledge develops from shared pieces of information that are inferred from group members' previous experience.

The essential part of this critical thinking exercise is to apply the skills used in this activity to a different context. In debriefing this activity we challenge students to think of ways that evaluating the contents of a small wooden box could be transferred and applied to other situations. The discussion includes how to best relocate such learning and exploring reasons for using the same sequence - look, describe, evaluate, listen, touch - to safely perform a nursing procedure such as a physical health assessment on a person. This conversation introduces novice nurses, who have little clinical experience, to the possible medical tests and specific nursing assessments that could be used to examine the internal parts of people. Students' reactions to being allowed to handle the box (this is usually with great excitement as they can't wait to get their hands on it) are also related to the high standard of professional behaviour required when nurses examine parts of the body or take a person's vital signs (i.e., blood pressure, pulse, temperature and respiratory rate). We also explore student's feelings including disappointment, frustration and sometimes anger, to not being able to open the box and relate this to patient conditions that cannot be diagnosed or treated.

Before the book is read	*After the book is read*
Objects: other boxes, trinkets, wads of notes, marble, tennis ball, toy car, gall stone, Lego bricks, paper.	*Small sculpture, musical instrument, beach ball, clothes.* *A spaceship.*
Living creatures: bird, spider	*Snake, fish, cat, plant, rabbit* *Bonsai tree*
Nothing, i.e. empty box	*A mystery, ashes of the dead, torn love letters, poisonous gas, liquid or creature, treasure, ghost, evil spirit.*

Table 2: List of the boxes' possible contents

In stages two and three of the learning activity, students look "back on" and "beyond what is there" (Phillips & Bond, 2004, p. 277). Looking back on involves reflecting upon a situation and seeing it differently to how it was originally seen. Changes in thinking are obvious to students because new items are recorded in a different colour. The role the book's imaginative narrative and images play in opening up students' thinking to look beyond what is there is shown in italics in Table 2.

Prior to the book being read aloud to students, items typically include objects smaller than or the same the same size as the box such as, an apple, toy car, bracelet, keys, mobile phone, etc. After the reading, students seem to' look beyond what is there' and items tend to be larger (e.g., a beach ball, set of clothes) and alive (e.g., a cat, plant, snake or fish); more ethereal (e.g., a ghost, or spirit) or curiously; more sinister (e.g., a toxic gas, virus or deadly organism or poisonous creature). Sinister items on this list alert the novice nurse to the possibility that a person may have an undiagnosed viral illness that is contagious, emphasising the importance of taking protective measures when performing a health assessment. Ethereal items flag the importance of the nurse not being judgmental or dismissive of a person's concerns however 'fanciful' they may appear to be. The range of items prompt us to keep an open mind to the unexpected or improbable, for example, a person reporting that 'evil spirits' possesses them, may be suffering from a mental health illness. In the same vein, a person reporting they have a rabbit inside them, may have deliberately or accidently, ingested a soft toy rabbit.

CONCLUSION

Hands-on activities that promote curiosity and questioning, together with reflective storytelling, facilitate learning by enlivening the classroom and supporting students to build confidence and capability, especially for new or abstract concepts. Using the picture storybook in a safe classroom-learning environment invites students to use their imagination and open up their thinking to new possibilities. Listening to the children's story and looking at the illustrations in the book helps students to think reflectively by considering things from a different perspective. This activity can be used in a range of disciplines, such as health, social work, design, that require students to use problem solving skills based on a sequence of observation, description, assessment, and evaluation of alternatives such as researching an essay topic or exploring and valuing difference.

The 'what's in the box?' lesson yields some surprising results and is fondly remembered by students. Although students are firstly frustrated by the problem of what is in the box, they arrive at solutions by inferring from their past experiences and collective knowledge. The depth and breadth of the discussion facilitated by this structured learning activity is truly rewarding and is well worth the time and effort.

Dr Liz Ditzel is a Principal Lecturer in Nursing at Otago Polytechnic. She is a RGON and has a Certificate in ICU nursing. Previous research has investigated mentoring experiences and the relationship between nurses' job stress, psychological sense of community and burnout among New Zealand nurses. Current research interests focus on immersive learning through simulation and creative teaching in nurse education.

Josephine Crawley is a Senior Lecturer in Nursing at Otago Polytechnic. She is an RN and her Masters in Education is endorsed in counselling. She has particular interests in communication, narrative pedagogy, and health promotion.

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BACHELOR OF NURSING STUDENTS IN YEAR 2 OF THEIR STUDY

Karole Hogarth

This case study describes an approach to assessment used in Otago Polytechnic's Bachelor of Nursing programme. The case study (Box 1) is considered with reference to Scott's key tests for powerful assessments (Box 2, Scott 2016).

With case-based learning, students develop skills in analytical thinking and reflective judgment by watching, discussing and interacting with complex, real-life situations. In nursing most case based assessment is clinically focussed with little evidence that it is used in the sciences. This means that there is a disconnect between how we want our students to view the sciences ie as an integrated component of all theory. Mostly nursing sciences are taught by scientists who are not nurses or vice versa. We have an advantage that nursing at Year 2 is taught by a nurse who is also a scientist. This means that context is given to the material with stories and anecdotes and experiences from practice that are relevant and enable the links to be made.

One of the many difficulties that Bachelor of Nursing students often mention on their student feedback is the amount of content they are required to learn for their examinations. We still use this method of assessment widely in our school for our theory courses and it does come with some challenges for the students. The courses most affected by this are the sciences mainly Year 1 Bioscience and Year 2 Pathophysiology.

For both of these courses we have introduced LT (KuraCloud) as an additional learning resource for the students. In Year 2 the programme is specifically used to augment the knowledge of the student in particular pathologies that are of importance to the NZ health environment. The case studies include actual patient data, video vignettes where the patient, family, nurses, physicians, dieticians etc discuss the case, their experiences, case management, diagnosis, treatment protocols, and medications anything relevant to the students understanding of the disease. Patients have given permission for their image and information to be used in a learning environment though the students must be aware of the privacy issues related to the use of the Lt material.

These case studies are also the platform for the end of year examination for the course. Historically Pathophysiology has been taught didactically and assessed with 2 exams to evaluate semester content. This for many years resulted in a large number of exam fails and cumulatively, course fails.

In 2014 LT was implemented and the assessment profile changed to reflect the student feedback and to try and reduce the amount of rote learned content that students needed to retain without any application to their practice. Four smaller tests were introduced these were put into Moodle our Learning Management System and the students sat these in a controlled environment with a specific timeframe. The questions were taken from the ''Test Bank' for the course so were the same or similar to what had been asked historically.

The results can be seen in the change to the course completion success. Three years of follow up shows that student success in a Year 2 pathophysiology course has increased significantly with this intervention. 2014 n=112 (7 course fails), 2015 n=111 (0 course fails), 2016 n=98 (4 course fails). This is in comparison to the 2 years prior to implementation; 2012 n=106 (12 course fails), 2013 n=110 (12 course fails).

Who: -Bachelor of Nursing students in Year 2 of their study

What: Use of an online case study model to deliver integrated knowledge and information showing application of nursing theory while linking to pathophysiology and clinical practice.

When: Students have face to face lectures for all topics. Six have been selected to discuss and develop further in online tutorial leading to the case study, which is discussed in small groups. The online learning is available from the beginning of the year to all students , the accompanying lecture material is taught across 8 theory weeks the case study group work is repeated in 4 blocks with a quarter of the class in each block – this learning may be asynchronous to the lectures but can be related to other aspects of their learning such as clinical practice and other theory courses.

Where: Learning occurs in class with structured lectures and group tutorials. Other learning such as the Lt component are able to be looked at, discussed, gone through as many times as the student wishes

How: Student assessment changes to 4 smaller online tests Final examination case study based

Why: Student feedback showed that many were very unhappy with the structure of the examinations and struggled to learn the content and put it into context with their other learning.

Box 1: Nursing pathophysiology assessment summary

- The assessment task or tool under consideration:
- Attracts high levels of positive feedback from graduates looking back on the best aspect(s) of their studies;
- Clearly addresses the key capabilities set down for the program/unit, especially those identified as characteristic of work ready plus graduates in the field of education concerned;
- Brings to bear different perspectives, taps into multiple domains of learning;
- Is integrated – that is, it concurrently seeks to assess key personal, interpersonal and cognitive capabilities in the profession/discipline concerned along with appropriate and effective use of relevant competencies;
- Is not just problem-based but solutions oriented; involves doing not just knowing;
- Has a whole-of-program focus;
- Directly relates to what has been learnt;
- Produces representations of what students can do rather than just a grade
- Can be digitally enabled
- Is, whenever possible, dilemma-based /'wicked'/ real-world focused/authentic and demonstrably relevant to effective early career practice;
- Can be used for learning (formative) as well as of learning (summative);
- Is scalable.

Box 2: Powerful assessment criteria

STUDENT FEEDBACK

"The mini exams were really helpful, as I found that learning less knowledge but in more depth for each examination helped me to consolidate this knowledge, as opposed to having two big exams and not being able to remember anything due to the sheer volume of knowledge required. I was then able to put this knowledge into practice during clinical. All in all, I found this learning style was very effective."

"I enjoyed the broad range of topics and the tutorial/case study part."

"This was my favourite part of the course, it was very interesting, and very informative. I liked how much of what we learnt was related back to nursing practice, rather than being purely pathophysiology. I think it was good having four tests throughout the year, rather than one big exam, and the technical difficulties of having to sit the tests on computers were well dealt with."

"Interactive, exciting, interesting."

"The content was relevant to what I saw on the wards, which made me interested in learning it. The lecturer had a number of real life stories to go alongside these lectures, which helped consolidate the information."

"Everything that I learnt in patho was beneficial and very useful to my practice and learning. How it has been structured is perfect, and I think it works well. I enjoyed this paper a lot, it is interesting, and I can see how our learning is relevant to practice."

Karole Hogarth is a Principal Lecturer and has worked at Otago Polytechnic since 2005. During this time, she has worked within the Schools of Occupational Therapy, Midwifery and Nursing. She is a Registered Nurse (WINTEC) and holds a Bachelor of Science (First Class Honours) and a PhD in Anatomy, both from the University of Otago. Her research interests are science education, simulation, reproductive biology and technology in education.

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OFF CAMPUS LEARNING: BACHELOR OF CULINARY ARTS VIA ASSESSMENT OF PRIOR LEARNING (APL)

Adrian Woodhouse

This Powerful Assessment (PA) case study is explained by Principle Lecture/Academic Leader, Adrian Woodhouse, of Otago Polytechnic's Food Design Department. The PA that will be examined is the Bachelor of Culinary Arts via Assessment of Prior Learning, which is off campus, and predominately field based, this process has been in place since 2011.

The Bachelor of Culinary Arts via Assessment of Prior Learning is a values based education programme is off campus learning. It is a one year undergraduate programme, but learners are already established within their professional field (at least 10 years within the hospitality field, and three-five years as Head Chef/comparable position and responsibilities). The Programme compares and measures learners' knowledge against formal qualifications.

Rather than the traditional education assessment and set up, the programme is facilitated by practitioners, who have all had ten plus years' experience within the field.

When it comes to understanding the Framework of Practice, the actual methodology of learning, it is a notion of values, and how those values underpin students' learning. As a teacher, and as a learner, I don't tend to believe in assessment in the traditional sense, I adhere to a humanistic approach of learning. In many traditional courses, there is formative assessment throughout a programme and then a final assessment like an exam at the end of the course. Within the BCAAPL, there is formative assessment throughout the process, but the programme is structured so that the emphasis is on the summative assessment at the very end of the process.

Throughout the year, there are two workshops that the learners and facilitators must attend. These provide a platform for rich discussion, unpacking traditional views and values of education. Many of our learners and facilitators are not traditional learners, so these workshops enable us to provide a platform for academic discussion in a non-traditional format.

In order to assign a learner with a facilitator, each learner is tasked with providing a 'food memory morning tea'. This food memory task enables the learner to unpack who they are, how they see food, and from there, we as assessors can see their values and begin to understand their framework of practice. Based on the food memory morning tea, learners are assigned a facilitator that aligns with the learners' values. This sets up the relationship between the facilitators, learners, and assessors from the beginning.

Formative assessment is a process throughout the programme, but papers and assessments are stair-cased towards a final learning point. Writing skills are stair-cased, and each assessment builds upon the last. Rather than stand-alone assessments, the dialogue and conversations that occur within each task, unpack and challenge both the learners' and facilitators' views and values. We have found that generally the writing skills drastically improve over the course, and that the work that is produced is of a high standard. We believe that this is in part due to the stair-cased nature of our assessments, so that the skills gained are able to be honed and built over time. I like to think that our course outline is less about 'ticking boxes', and much more about 'connecting boxes'.

When dealing with values based education, it is impossible to have one set pathway, a 'cookie cutter' if you will, as everyone has a different set of values, and they present in a multitude of ways. Good design is based on other people's needs, the awareness that values and needs also differ based on place, space, and experiences. Coming to terms with this, and adapting this awareness into your framework of practice is a transformative process, and is where some of the most critical and meaningful learning occurs.

Throughout the process it's a constant question for both the facilitators and learners'; what are the learners' motivated by? What are their values? Why are their values important? What does the learner want out of the process? These questions inform the assessment and facilitative process, and guide the learner and facilitator through the programme. There is an interesting tension between meaningful learning, and the learners' who want to get the top grades, how can you get an A+ on a values based education? It is interesting to explore these questions, and values with the learner, why do they value those grades, how does this reflect in their wider value set and framework of practice?

The entire programme (although broken up into assessments), ultimately build towards a capstone assessment. Assessments along way can be indicative rather than final marks, if things come together at the end, then there is capacity for the assessors go back and readdress assessments and marks. The end goal that learners' are working towards is the completion of a portfolio and an oral defence to a panel of assessors. These two components unpack personal and professional upbringing, key formative factors, articulate case studies, authentic knowledge reflective in practice, demonstrating their professional framework of practice. Within these meaningful assessments, values are challenged, especially within the oral presentation.

The entire programme demonstrates powerful assessment and meaningful learning. It is a values based education process, and showcases how knowledge is created within professional practice. Our aim is to promote and facilitate lifelong learning, and enable people to find their place within practice.

Adrian Woodhouse has a professional background is a blend of contemporary food design and artisan food production. He is a Programme Manager for the Bachelor of Culinary Arts at Otago Polytechnic.

Case Study

QUALIFIED TO SURF CHAOS: A SELF-DETERMINED DEGREE

Samuel Mann, Glenys Ker, Phoebe Eden-Mann and Ray O'Brien

ABSTRACT

Heutagogy is an approach offered in adult education which is based on learner determined learning, which recognizes transformative learning processes that go beyond a teacher-delivered focus on content. The development of a new programme is described that is explicitly designed to be learner determined, including the articulation of the learner's subject area. Questions for further development and research are discussed.

INTRODUCTION

This paper explores the role of curriculum in a programme of study designed explicitly according to heutagogical principles. Mann et al. (2017) examined the nature of heutagogical education with a case study of a suite of qualifications for experienced professionals offered by Capable NZ. A new programme with Capable NZ is intended for learners without this extant professional experience. This paper explores the curricula design to enable self-determination in education.

Hase and Kenyon (2000) defined heutagogy as the study of self-determined learning. It applies a holistic approach to developing learner capabilities, centering learning as an active and proactive process (Blaschke, 2012), with learners acting as "the major agent in their own learning, which occurs as a result of personal experiences" (Hase and Kenyon, 2007, p112).

Hase and Kenyon (2007) described heutagogy as a "child of complexity theory". Anderson (2010 p39) described how complexity theorists are often at odds with positivist researchers and educators, who attempt to eliminate or control all the variables that influence learning. Rather, complexity, and hence heutagogy, seeks to create learning activities to allow effective behaviour to emerge and evolve. McElroy (2000) noted that "the point at which emergent behaviours inexplicably arise, lies somewhere between order and chaos" (p196). This sweet spot is known as the "edge of chaos (where) complex systems innovate by producing spontaneous, systemic bouts of novelty out of which new patterns of behaviour emerge" (after Kauffman 1996). Crucially, heutagogy implies a different relationship with the curricula. Hase and Kenyon, for example (2007) describe how heutagogy goes beyond andragogy's focus on adult education with self-directed learning linked to experiences to a different relationship with the curricula "we thought that andragogy did not go far enough...curricula were still very much teacher-centric with little opportunity for any real involvement at a micro or even macro level by the learner" (p112).

Hase and Kenyon (2007) derive design implications for heutagogical education that included the "recognition of emergent nature of learning and hence need for a living curriculum as key driver" and "involvement of learner in this living curriculum" (p114). Similarly, Blaschke (2010 p64) described the need for a

> "flexible curriculum: In a self-determined learning environment, the learner is the driver in creating flexible curriculum, which is defined by the student: learners create the learning map, and instructors serve as the compass"

In the case study of Capable NZ's suite of programmes (Mann et al. 2017), the approach taken was an Independent Learning Pathway. Capable NZ works with learners to recognise and extend learning in a professional work-based context at both undergraduate and post-graduate levels. At undergraduate levels Capable NZ works with learners to align their professional framework of practice - their professional identity - with graduate profiles. These learners are expected to learn new areas, mostly to wrap their practice in theoretical context, but there are no formal classes. Instead the focus is on an individualised supportive environment for personal reflection.

The alignment of the learner's professional framework of practice with the qualification's Graduate Profile provides the basis for the Independent Learning Pathway. In a sense, this provides flexibility of curriculum by avoiding a traditional curriculum that focusses on a body of knowledge that comes from a discipline. Instead the body of knowledge is accessed through the learner's professional experience. This extant professional experience is not available to the learners of a capability degree.

So the question for this paper is how to structure a programme to allow for learners to self-determine the curriculum and their intended occupation, but to do so from a position of limited professional experience?

BACHELOR OF LEADERSHIP FOR CHANGE

Positioning

Figure 1 shows the positioning of the BLfC in terms of prior experience and the level of self-determination (adapted from Mann et al. 2017). The BLfC (third from top), like the existing Capable NZ programmes, is an individualised learning journey – if it were duplicated for each learner, there would be different collections of little blocks making up the graduate profile for each learner to represent different individualised learning journeys (so too are the post graduate programmes but they are research/enquiry based, the relevant comparison here is with the prescribed blocks of the traditional taught programme).

The BLfC assumes no prior experience. There are some elements of looking back, primarily in the development of understanding of personal values and identity. The graduate profile is closer in style (not level) to that of the post-graduate programmes, but the learner is supported to use an Emergent Professional Framework (operationalised throughout the degree as an "exit strategy") that helps them define and explore their own career framework of practice. Unlike the traditionally taught degree where the learning experiences are pre-bundled and arranged by subject area, the BLfC is arranged by a progression of capabilities. While some capability development is likely to be 'pre-packaged' e.g. development of enquiry capabilities, the bulk of the learning will be through curated experiences and group and individually negotiated projects are framed by the individual's developing capability framework.

The BLfC provides an independent learning pathway for learners who have not had significant previous work-practice experience. In some ways this requires a hybrid between the Capable NZ focus on reflection on experience in work-practice, and the designed learning experiences of a traditional taught programme. In the BLfC's case, the learners do not have the professional experience to look back on, but neither can we pre-prescribe subject-based courses leading to a specific discipline (even if we wanted to, heutagogy notwithstanding) - we instead curate a set of experiences for the individual learner/s.

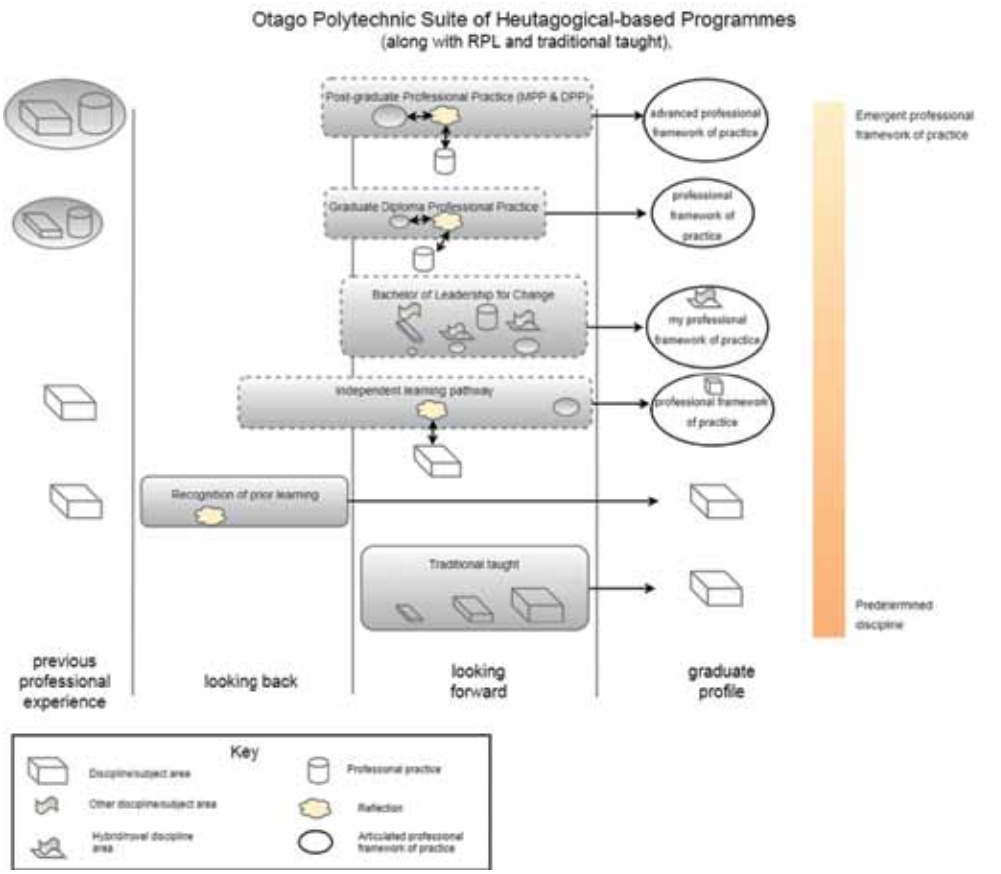

Figure 1: Qualifications designed for heutagogical delivery, from top: DPP and MPP; GDPP, BLfC; and ILP (a delivery approach to various qualifications), and for comparison an RPL degree, and a traditionally taught degree (Otago Polytechnic).

GRADUATE PROFILE

Defining the graduate profile is particularly crucial for the BLfC because we don't have the specific discipline (such as Engineering or Information Technology) to fall back upon. Indeed, the BLfC programme is designed to support learners towards careers in fields or vocations that might not yet exist. In a review of practice and learning, Reich and Hager (2013) pointed out that "practices are emergent, in the sense that the ways that they change and evolve are not fully specifiable in advance".

For these reasons, as well as all the usual employability skills, graduates will also have to be equipped with special skills - those associated with managing their own career (Carpenter 2013) and with developing their own emergent professional frameworks of practice. So the aim of this programme is to prepare graduates to succeed in emergent professional fields for career paths which focus on making a difference to communities, enterprises and environments in a constantly changing global environment, it also prepares people to enter current professional fields (excluding regulated professions) well equipped to adapt to rapid or significant change.

The BLfC learner experience is based on the Capable NZ ILP but with an important difference; a scaffolding of supported experiences replaces the ILP learner's pre-existing experience. In the ILP, the learners are already embedded in the workplace, usually with some sort of pre-existing employment relationship (not necessarily paid). The learners can then use both their experience of work and their on-going work environment to provide the basis for their reflective learning. In the BLfC however, this existing experience of work and workplace cannot be presumed. The programme is structured to provide these opportunities while still remaining true to the principles of heutagogy.

For the Bachelor of Leadership for Change we are using a competency - capability framework (Figure 2):

- Competency: what the graduates can do;
- Capability: how they use those skills when the going gets tough (or unexpected opportunities arise); and
- Meta-capability: Knowing what competencies and capabilities are important for each learner's emergent professional framework of practice.

The crux of the degree is that learners define their own framework of practice which should align with/exceed that of the qualification itself. So, for example, they might define themselves as a "thought leader in values-based marketing". The longer articulation of this framework would include, for example, a consideration of what code of ethics apply (or creating/hybridising one) expected professional behaviour and so on which is then the basis for the competencies of knowing that code of ethics (etc.) and using it in difficult situations. So, rather than this being done in qualification development by experts, the learners themselves are doing it (on the basis of the curated experiences). The articulation of that framework is, then a meta-capability. This includes the capabilities to articulate, test and productively use the capability and competency framework to make sense of and assess the impact of their emergent professional framework. What this means is the ability to understand how all the competencies and capabilities mix to define each learner's own professional framework. This meta-capability forms the basis for each learner's negotiated learning agreement (sometimes called their "exit strategy") from which form the basis of regular reviews and from which their personal learning plan will be derived.

Graduate Profile:

On completion of the qualification, graduates will be able to demonstrate the following competencies and capabilities to make a difference in communities, enterprises and environments:

1. Apply competencies and capabilities to enable transformational change in communities, enterprises and environments.
2. Integrate an appreciation of the bicultural context of Aotearoa New Zealand and the Treaty of Waitangi within an emergent professional framework.
3. Articulate ethical and sustainability frameworks such that they act as sustainable practitioners.
4. Recognise and incorporate one's own values, mindsets and biases within a grounded theoretical framework.
5. Create and maintain healthy relationships and collaborations in communities and organisations.
6. Synthesise experiences, capabilities and competencies to create an emergent professional framework of practice.

A significant part of the BLfC programme is work-based-practical learning. Portwood (2007) argues the examination of work-based projects suggests that it is 'reflective pragmatism' and the 'principle of productivity' which is at the core of work-based-learning. Raelin (2008) suggested that reflective practice extends WBL beyond the individual to the collective, and highlights reflective practice as a key mechanism for learning and knowledge production. This is supported by Siebert & Costley (2013), who also believe that the provision of a framework that enables a learner to utilise reflective practice, helps learners to make sense of their experiences, which in turn allows them to learn from their experiences. Reflective practice aids learners in developing their knowledge and skills, enables them to build confidence, and guides them in planning and implementing their personal, academic, and professional development.

DELIVERY

Figure 2 shows the three year structure of the BLfC. It is designed to deliver the Graduate Profile through a progressive series of learning outcomes which balance the tightrope between a pure learner determined pathway and enough structure to provide guidance. The degree can best be considered by starting at the end, the individualised "myProfile: My Capabilities" at graduation. This individualised transcript contains the learner's own articulation of their framework of professional practice. It describes their specific interpretation of the graduate profile in the evidenced description of their specific competencies and capabilities. Evidence is provided that links to work-based experience that they have in demonstrating those attributes (this is directly analogous to the assessment of the ILP for the BAppMgt and BSS).

The creation of this "my Profile" forms the focus of the degree. Throughout the degree the learner is facilitated to develop and implement their "exit strategy"; what they want do when they graduate, their first job, and what they will do to get there. This forms the basis for their individualised learning and begins even before the degree starts proper, as part of the entry process.

The Curated Experience and Leadership for Change projects are about the learner experiencing and operating within different environments of work practice.

Figure 2 characterises four types of learning (in reality these are overlapping and integrated with elements of each within each other). All of these operate within a framework of reflective practice.

1. Emergent Professional Framework: this forms the infrastructure for the degree. Regular reflective check-ins develop the exit strategy

2. Curated experience: these might be work-based learning experiences

3. Targeted learning: these are individualised opportunities for learning specific competencies and capabilities. These might learnt via any means including self-directed learning, online resources, and projects or through otherwise scheduled classes (e.g. courses from BAppMgt).

4. Leadership for Change Projects (LfCP): Substantial project work aligned with the learner's framework of practice. Both individual and group projects.

The first year is focused on achieving:

- Understanding and confidence of identity;
- A personal framework of practice; and
- A self-directed learning toolkit.

The Emergent Professional Framework provides an infrastructure that wraps around a series of curated experiences, aimed at exposing the learner to a variety of models of thought. The curation of these experiences will be about creating an experience specific for each learner but taking advantage of collaborative and collective learning of small groups wherever possible. They will mostly be in the form of experiences that scaffold towards the later and more substantial projects. Here, and throughout the degree, learners will be expected to work both alone and in groups, creating a community of practice.

The first block will focus on identity, and could take the form of an intensive residential experience. The identity course serves to give each learner a baseline measure of where they are at with themselves in their personal and professional development. From this baseline, progress can then be measured. Tools such as the 21st Century

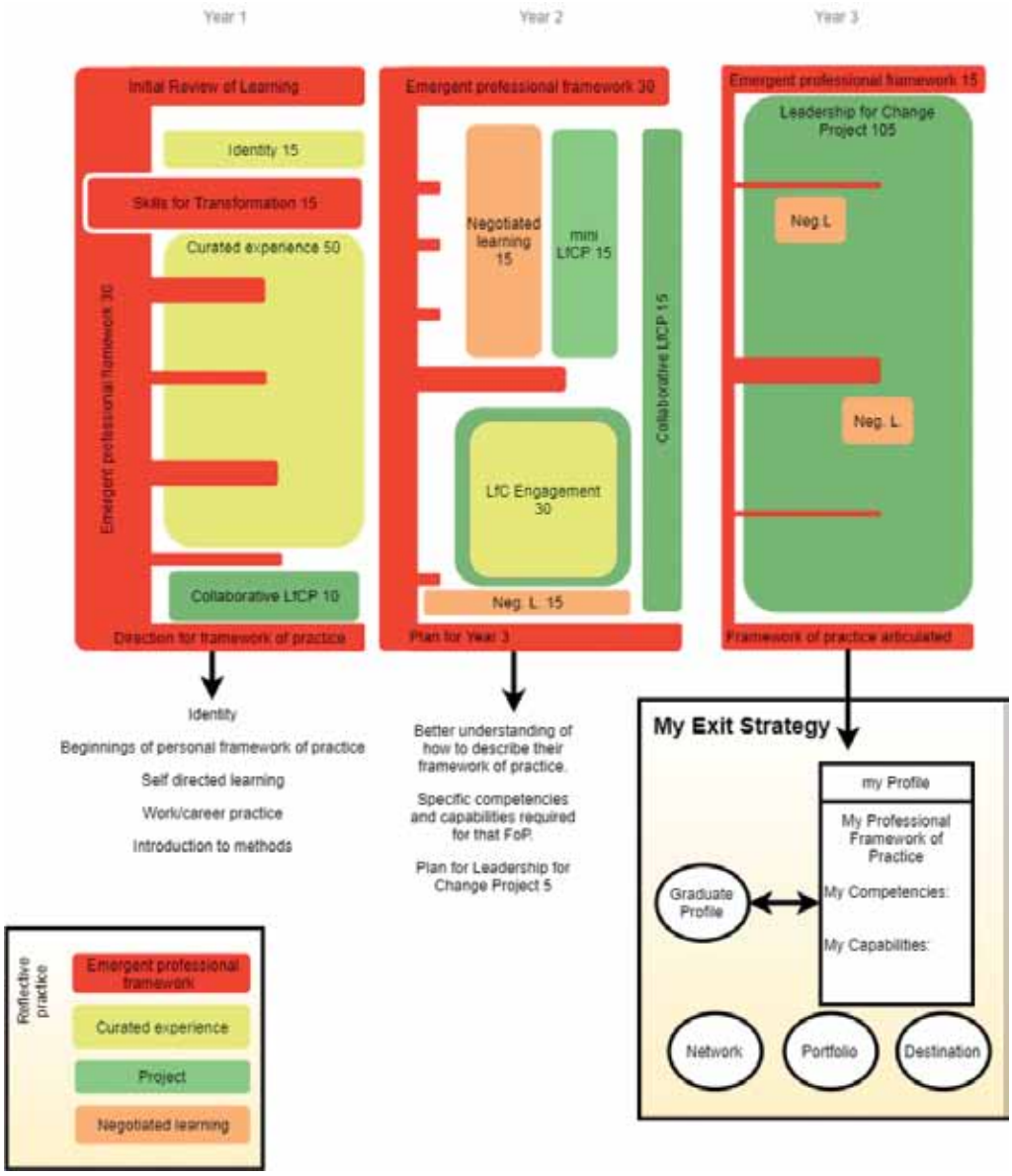

Figure 2: BLfC programme structure

Skills, from the World Economic forum will be used as a way for learners to establish where their strengths and weaknesses lie and identify where they choose to focus for their personal and professional development. The identity course is an impactful and supportive start to the degree.

The Emergent Professional Framework "toolkit" will include building the skills required to successfully undertake this sort of degree, particularly critical thinking and reflective practice. A "Skills for Transformation" block of learning provides an introduction to the specific skills of transformation; communication, collaboration, as well as concepts of resilience and transformation.

The Curated Experience is a purposeful experiential learning activities in which the learning occurs through the experience. A key feature of this that the experience spans a range of models of work practice. It not just the same work done in different places. So, for example, a learner might be interested in working on housing quality, we would ensure that they experienced a range of these – local government, housing NZ, landlord agencies, social service, marae and start-up social enterprise. They might all claim to focus on housing quality, but have very different understandings, theoretical underpinnings, measures of success, etc., which can be characterised as models of work practice. The curated experience can, then include work experiences, community and industry projects and structured problem solving activities if they provide an opportunity for experiencing different models of work practice. By the end of the first year, learners should have experienced a range of these different models of work practice and have some idea of which they have affinity for.

The second year starts with a reassertion of the framework of practice and a consideration of the competencies and capabilities required of the intended graduation framework of practice. The first semester allows for targeted learning wrapped around a mini project. After a significant check-in, the learner will then spend time in an environment that as closely as possible matches their intended third year project and eventual workplace: "Leadership for Change placement". A short burst of targeted learning will focus on any ideas identified during the Leadership for Change placement. Finally in year 2, the learner recaps and reasserts their intended framework of practice and a plan for year 3.

In year three, the Emergent Professional Framework element is reduced further and the main focus of the year is the learner's Leadership for Change project. In accordance with the community of practice, they would also contribute to their colleagues' project in a collaborative fashion (in all three years). The collaborative aspects are purposefully less explicit as the degree progresses. The intention is that collaborative and collective way of working is normalised to the point where this is the natural way of working (but not explicitly required to allow for the possibility of remote individual projects).

The BLfC is a facilitated learning experience. An integral part of the BLfC programme is the identification of learning from experience and the sense-making of that learning as the learners develop a framework of practice. Therefore the role of facilitator of learning is in guiding the learners' critical approaches to learning, and is where their work should begin (Eraut 2008). Boud (2001) similarly argued that the tutor is there to facilitate the learner in their learning through critical reflection. One of the tasks of the early stages of the BLfC is to stimulate learner reflection.

SUPPORTING AUTONOMOUS LEARNERS

Stephenson (1998) considered the implications of supporting student autonomy. He described situations where there is a "transfer of responsibilities" whereby "students have direct responsibility for aspects of their education which are either not often directly addressed within an institutional setting (such as student motivation and personal development), or for aspects which are the traditional preserve of teachers and accrediting bodies (such as the direction, content, pace, location and assessment of the student's studies)". Stephenson argued that this transfer of responsibility brings inherent risks, and that it is the responsibility of the teacher (facilitator in our case) and institution to support learners in assuming these "daunting responsibilities".

This "transfer of responsibilities" can well describe the case of the Bachelor of Leadership for Change. Stephenson described how students, "preferably in association with other students, and in applied contexts" take responsibility for the following, all of which apply to the Bachelor of Leadership for Change learner:

- Formulating the strategy of their overall learning based on an awareness of their own development needs (their strengths, weaknesses and aspirations);
- Devising a programme relevant to that strategy;
- Negotiating approvals for their proposed programmes and access to resources;
- Determining the pace, location and character of specific learning activities;
- Monitoring actual against planned progress and reviewing the continuing relevance of the programme they planned for themselves;
- Demonstrating their achievements, if necessary against external benchmarks;
- Critically reviewing the effectiveness of their overall learning experience and the
- Relevance of their original formulation; and
- Planning the next stage of their development.

Stephenson argued that this transfer of responsibility brings inherent risks (Figure 3), and that it is the responsibility of the teacher (facilitator in our case) and institution to support learners in assuming these "daunting responsibilities".

Exposure of deeper motivations

Taking responsibility for negotiating the overall strategy of their education forces students to ask fundamental questions about themselves and to share the answers (or lack of them) with others. They need to be clear and explicit about why they are in higher education, what is important in their lives, what their longer term future might be. They have to decide how best to use the next two to three years of their lives. They have to commit themselves to a personal direction, or if they are not ready to do so to be clear about any implications of their decision to keep their options open.

Autonomous learners feel at risk

Will their ideas be relevant or considered good enough? Who are they to have a say about how they should be taught - it is 'going above their station'. What happens if they are not taken seriously?

Outside their experience and expectations

pervasive feeling among students entering university for the first time that education is something 'which is done to you,'

Locus of control

Varying readiness of students to take more responsibility for their learning.

Figure 3: Risks to learner from assuming role of autonomous learners

Fortunately, Stephenson described how strategies for developing independent learning capability can help learners overcome these anxieties and risks. These strategies are embedded in the approach, curriculum, delivery and support (both facilitators and learning support) of the Bachelor of Leadership for Change (Table 1).

Developing a belief in "taking it on"	
Explanation	Implication
Explanation: cycle of legitimation: Three recurring stages acceptance of themselves as persons (I AM); acceptance of their right to take direct actions concerning their own future (I CAN); confirmation that their own actions (or studies) have led to achievements in the field to which they aspire and which are recognized by established practitioners (I HAVE).	Implication for Bachelor of Leadership for Change: **- Crucial role of the early focus on understanding and affirmation of identity** - Early establishment and articulation of the **end-game exit strategy with on-going collegial discussion with established practitioners** (part of EPF course 1 and on-going).

Supportive and enabling course structures	
Explanation	Implication
Explanation: Autonomous learners need reassurance (for the reluctant) and enabling procedures (for the enthusiast) of a clear course structure with specific tasks, staged outcomes, public criteria for judging progress, procedures for securing help, and advice and ease of access to materials. Few students can enter higher education for the first time with readymade proposals for the programme they wish to pursue. Time must be provided to help students explore their interests and needs. A life-planning 'syllabus,' described as the 'Statement,' with specified staged tasks …and presented to students as their first major assignment.	Implication for Bachelor of Leadership for Change: The **Emergent Professional Framework course sequences** are explicitly designed to provide an infrastructure for this learning. The "exit strategy" with **repeated check-ins provides the structure for articulating the learner's individual emerging direction.** Within the EPF, learning outcomes (and modules) **focus on life/career planning, and specific tools sets such as critical thinking and research methods.** The check-ins during the EPF are intended to be both challenging and affirming – navigating this sweet spot takes considerable skill but fortunately is the skill already demonstrated by facilitators in Capable NZ.

Tutor support for learner responsibility	
Explanation	Implication
Explanation: Supporting autonomous learning requires tutors to go beyond their traditional roles as providers of information and assessing performance.	Implication for Bachelor of Leadership for Change: Otago Polytechnic and Capable NZ in particular are well versed in this **facilitation role** and will form the basis of the "teaching" relationship.

Support from fellow students	
Explanation	Implication
Explanation: On a capability programme, well-managed support groups are particularly important, providing a general culture of interpersonal support where specialist tutorial help is not readily available. In contrast with taught students, autonomous learners have to deal directly with general educational as well as specialist issues. Mixed interest groups can play a positive role in helping students share concerns, explore ideas, exchange experiences and take risks.	Implication for Bachelor of Leadership for Change: For the Bachelor of Leadership for Change, a **community of practice** will be important. While not the norm for Capable NZ's experienced learners who tend to have a community of practice within their work practice, we have had success with many communities of practice within groups of learners – both with common interests and where groupings are more arbitrary (eg geographic). For the Bachelor of Leadership for Change, this community of practice will be very important. It will be established early with the **experiential Identity course, and continued throughout the degree with the blending of curated experiences and Leadership for Change Projects.** Leadership through collaboration and collective learning are fundamental to the degree.

A focus on learning learning	
Explanation	Implication
Explanation: One of the most difficult things for autonomous learners is to judge how well they are doing. One widely used approach to this problem is to encourage students to use records of achievement. The better schemes often have titles which convey this purpose, such as learning logs, portfolios of learning and personal review of learning. If being able to manage their own learning is the desired outcome, students need to become conscious of how they learn, to develop the habit of seeking learning opportunities from their experiences and evidence that they can improve performance and understanding through application of lessons learnt from previous experience.	Implication for Bachelor of Leadership for Change: **Learning how to learn in a self-directed environment is a key outcome of the first semester.** This is established with learning how to be a reflective practitioner, and structures such as the exit strategy which provides the basis for the on-going record of achievement. Specific competencies and capabilities for learning are enabled by focus on tools such as research and design methods, communication and team work.

Table 1: Developing independent capability (explanations adapted from Stephenson 1998)

DISCUSSION

Mann et al. (2017) considered the role of the facilitator (considered in depth in Ker 2017) in the framing of Freire and his emancipatory view of transformation (e.g. 2000) whereby the facilitator works "alongside the student to develop rather than direct the students' understanding" (Costley and Dikerdem 2011 p38). Anderson (2010 p40) described "enabling learners to surf at the edge of chaos", and not to "eliminate or constrain the creative potential of actors engaged at this juncture". Heutagogical education is by necessity surfing at the edge of chaos. This paper has described a qualification explicitly designed to support such surfing.

Capable NZ's existing ILP programmes (both undergraduate and postgraduate) clearly follow a learner-determined heutagogical approach. For all of these, the learner is experienced and is combining existing work practice knowledge with new learning to articulate their new professional framework of practice. For the new BLfC, despite being explicitly designed as heutagogical, the relationship is a bit more tenuous. Without either the taught class structure or specified content, the self-determined learner could be left with nothing, so the (as yet untested) structure of the BLfC aims to provide a scaffolding within a heutagogical approach. The trick for the facilitators will be to not let this structure intended to help learners inadvertently diminish the value placed on learner self-direction of the learning process.

Mann et al. (2017) concluded with a research agenda which we add to here.

The nature of learning is an important question: did the learners know they were learning? Was it transformative? Did it involve "emotional turmoil"? How can we construct opportunities for learning how to learn that do not become a requirement that sits uneasily with heutagogy? It would be useful to carry out longitudinal studies of learners in these heutagogical programmes. Also, to explore the relationships between transformation in learning and change of practice in the learner (and beyond). These questions about the process of learning have an added dimension for the BLfC when the role of previous experience (or the lack of it for the BLfC learner) is added to the mix.

The relationship between the surfed chaos of heutagogical learning and the expectations of organisational reporting remains a challenge. In preparing the curriculum document for the BLfC we were confronted on multiple occasions with a template asking "is your process A or B?" to which we almost always responded with a "C" (or a "17" or an "orange" - not even a letter!). Further research should be undertaken on developing organisational processes to support heutagogical learners - a process on engaging learners in ethical maturity, for example.

In a traditional taught qualification there is a requirement that the learner engages with a body of knowledge that represents the scholarship of a profession or discipline. This body of knowledge is validated by the academy and with reference to the professional body (sometimes in a formal manner with the professional acting as gatekeeper to entry to the profession). In the Independent Learning Pathway a generous take on the graduate profile is supported by the recognition that the learner is the expert in their own work and when the learning becomes new learning, the approach goes beyond "about work" to become "in work, at work, for work" (Lester and Costley 2010). This is not the case, however, for the BLfC which is about a future, possibility as yet unknown work. Further research would be useful to model the implications of underlying models here. This would be useful for considering the extension of the heutagogical Capable NZ approach, for example to programme to support recent graduates. Further, while the Capable NZ programmes are post-discipline, and the new BLfC is a process-based degree for emergent disciplines it would be perhaps the holy grail to design a heutagogical degree for a hitherto content-heavy, technical discipline.

CONCLUSION

This paper explores the role of curriculum in a programme of study designed explicitly according to heutagogical principles. A case study was presented of a new programme with Capable NZ is intended for learners without extant professional experience. This paper explores the curricula design to enable self-determination in education.

This paper is based on a single case study. As such it is limited to describing the experiences of one institution in implementing a heutagogically based approach. Care should be taken with generalizing from this case. Further, no success metrics are given here, and it would be useful to include learner voices, possibly through longitudinal study.

Professor Samuel Mann teaches for CAPABLE NZ. Sam's 2011 book "The Green Graduate", subtitled "Educating Every Student as a Sustainable Practitioner", sets out a framework for integrating sustainability into every course of study. His subsequent book "Sustainable Lens: a visual guide" explores the visual narrative of sustainability. This book proposes a "sustainable lens": to act sustainably we need to first "see" sustainably. Sam has a weekly radio show and podcast Sustainable Lens where he and a colleague have conversations with people from many different fields who are applying their skills to a sustainable future. Recent work focusses on the development of a Transformation Mindset. Sam gained his PhD from the University of Otago in 1998 titled "Spatial Process Modelling for Regional Environmental Decision Making".

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Case Study

CURRICULUM MAPPING OF CHILD HEALTH ACROSS THE BACHELOR OF NURSING

Emma Collins

INTRODUCTION

In New Zealand, the Ministry of Health recognises that child health is important and this is evidenced through various government initiatives, such as the Well Child Framework (Ministry of Health, 2016). As child health is a priority for our public health system, the health workforce, including nurses, must be prepared to work with this diverse and vulnerable population. There are no clear guidelines, frameworks to follow or standards which much be met within the nursing curriculum in New Zealand, to ensure all nurses graduate competent to work with children. Child health nursing appears to have no clear or defined place or pathway. Curriculum mapping is a tool that can be used to provide transparency to all or part of a curriculum. This article discusses the process of applying a curriculum mapping approach to the teaching of the child health content in a Bachelor of Nursing programme. The delivery of child health skills and knowledge should be transparent across the programme so that staff and students are confident that the material is being delivered. This involved shaping an appropriate curriculum mapping process, and determining the content of child health nursing necessary for an undergraduate degree. A number of recommendations were made once the curriculum mapping was completed including some changes to curriculum delivery. As a result of this curriculum mapping, students can be confident that they have had the opportunity to gain the foundational knowledge and skills required of a novice practitioner in child health nursing.

RATIONALE / ISSUE

All Bachelor of Nursing programmes in New Zealand have varying curriculum content. In the Bachelor of Nursing degree reviewed for this study, child health was taught in a number of papers, across a number of years. No single staff member seemed to have 'ownership' of the child health content. The author felt that the child health content needed to be streamlined, clarified and aligned so that all staff and students are confident that child health nursing content is covered, and covered appropriately. Once it has been determined what content needs to be covered, and where, academic staff can then focus on how they are to deliver the content in a manner that best suits the needs of the learners.

One of the key concerns identified was that there were no clear guidelines as to what needed to be taught in relation to child health. It needed to be defined further as to what content needs to be taught, as it is impossible to teach everything there is to know about child health nursing, in an undergraduate degree. Also, child health is considered to be a speciality area, and therefore many nurses go on to postgraduate study to learn more about the topic. So therefore what needs to be taught, if anything, at undergraduate level?

LITERATURE REVIEW

Curriculum Mapping

Curriculum mapping is concerned with what is taught, how it is taught, when it is taught, and the measures used to determine whether or not the student has achieved the expected learning outcomes (Harden, 2001). Harden (2001) continues on to state that curriculum mapping provides a broad picture of a particular aspect of the curriculum, and allows for greater transparency for staff and students. This is supported by MacNeil and Hand (2014) who state that curriculum mapping can improve the transparency of the curriculum and assist the facility in examining program alignment, pedagogy, and assessment. Teachers and students should be able to look at the curriculum and know what skills and knowledge are taught, including when and where. In the Bachelor of Nursing programme studied, it was unclear if the students had a clear outline of the teaching of child health throughout the course, and many staff also seem to be unaware as to what child health content is taught. Curriculum mapping 'represents spatially, the different components of the curriculum' (Harden, 2001), and should therefore provide transparency and clarity as to where these skills and knowledge are taught. After the curriculum mapping has occurred, instructional alignment could then be completed to define further the specific content to be taught within each year.

The solution to streamlining and structuring the child health nursing skills and knowledge within the Bachelor of Nursing programme is through curriculum mapping. This is similar to the work completed by Landry, et al. (2011) who used curriculum mapping in nurse education to identify redundant course content and identify gaps in the curriculum.

Curriculum mapping is a technique where the aspects of a curriculum are pulled apart, examined, and mapped out to decide whether or not the content is covered, where it is covered and whether or not it is taught in the appropriate time and place. It is an ongoing process that can offer collaboration and collegiality (Uchiyama & Radin, 2009). For the purposes of this exercise, the curriculum mapping is focused on the taught curriculum (Harden, 2001; Spencer, Riddle & Knewstubb, 2011), that is, the actual content that is being transmitted to the students across the Bachelor of Nursing programme. Uchiyama and Radin (2009) state that curriculum mapping helps to answer three critical questions. The first of these is 'who is doing what', which was identified as a key question to be answered. The next critical question, adapted for this project, is 'How does the work align with the program goals and standards'. How the content aligns with what needs to be taught in child health nursing will be discussed further on. The third question is 'are we working efficiently and effectively', which was beyond the scope of this particular project.

A distinct process for conducting a curriculum map is unclear in the literature. There are however some authors who discuss the process that they used in a mapping exercise. Harden (2001) discusses 10 windows through which the curriculum can be viewed (Table 1).

The expected learning outcomes
Curriculum content or areas of expertise covered
Student assessment
Learning opportunities
Learning location
Learning resources
Timetable
Staff
Curriculum management
Students

Table 1
10 windows for curriculum mapping (Harden, 2001)

Once these elements have been viewed then these different perspectives allow the curriculum to be aligned and transparent. Uchiyama and Radin (2009) state that curriculum mapping is a cyclical process consisting of 5 stages, which when followed, will result in a more streamlined and integrated programme (Table 2).

develop individual maps for each course
review and aggregate maps (horizontally) by course
aggregate the maps (horizontally) by course
identification of strengths, gaps, overlaps, revise course and implement revisions
repeat the process

Table 2
5 stages of curriculum mapping (Uchiyama and Radin, 2009)

Sumsion and Goodfellow (2007) developed their own process after review of current literature to a matrix that included one axis with skills and attributes (literacy, numeracy, IT, self-awareness, communication, cultural understanding, critical analysis, problem solving, creativity, organisational skills, ethics), and another axis with indicators - assumed, encouraged, modelled, explicitly taught, required and evaluated.

Spencer, Riddle and Knewstubb (2011) mapped their curriculum according to what was explicitly taught, what was encouraged and what was modelled (and a combination of these). They also looked at what content was assessed and what content was assumed. These maps were visually easy to look at and determine what content was covered and what was not.

There also appears to be a growing body of literature that discusses the use of technology to complete a curriculum mapping, such as that discussed by Komenda, Vita, Vaitsis, et al. (2015). In this paper the authors discuss a framework for mapping using data mining using a specifically developed computer programme.

It is through the review of these models for curriculum mapping, that a process for this particular project, has been developed.

PROCESS

The process for undertaking this curriculum mapping project, determined by the above literature searches, was as follows:

1. **Decide on the content that needs to be covered.** Deciding on the content is an integral aspect of the curriculum mapping process (Harden, 2001).

2. **Determine the learning outcomes for the content.** A list of learning outcomes that need to be achieved have been determined from the key document used (RNZPS & NCYPA, 2014).

3. **Determine where the learning outcomes are best placed in the programme.** An attempt has been made to map the learning outcomes to what existing papers best suit the learning outcomes

4. **Determine what is currently being taught.** Once the learning outcomes have been determined, the next part of the process is to determine whether or not those learning outcomes are currently being achieved in the course or not. This is essentially mapping the current teaching and learning in the programme and involves engaging with staff teaching in the programme.

5. **Identify the gaps in the learning outcomes.**

6. **Make recommendations to what needs to be included or adapted into the taught curriculum.**

Determining the content that needs to be covered

One of the most significant questions at the commencement of this project asked what child health content we should be teaching. Like most speciality areas, in any discipline, child health nursing has a vast array of content. Majority of this content is taught at post-graduate level once the student becomes a registered nurse (RN) and is working in paediatric nursing. What *specifically* do we need to teach to our undergraduate nursing students?

A literature search was conducted utilising a number of different key words and combinations to determine whether or not there was any literature on this specific topic, which produced no useful findings. There were no results which specifically stated what specific content in relation to child health nursing should be taught at undergraduate level. There was one potential result (Gibson, Fletcher, & Casey, 2003). It referred to formulating a set of competencies that specialist children nurses should possess. It identified a number of knowledge, skills, abilities, values and qualities. This article was interesting reading but unable to be translated directly to the New Zealand environment due to the differences in nursing registration between New Zealand and the UK, where the study took place. As no other peer-reviewed referenced journal search resulted in any useful results, I then turned to any other sources of literature that could be found.

The Nursing Council of New Zealand authorises all nursing schools in New Zealand and gives direction for curriculum delivery and content (NCNZ, 2014). In this handbook, there is no specific information in regards to what child health nursing content should be delivered. The handbook does state however that the curriculum needs to be based on the national health priorities and contemporary health care and practice trends, of which child health features considerably.

There are a number of Paediatric Nursing text books on the market, and all generally have similar information regarding the care of children. Two such text books were reviewed for the purposes of this project – Hockenberry and Wilson, 2013; and Haley, (Ed), 2013. There obviously is a vast amount of information included in these texts, and neither text book differentiated between content that should be delivered at undergraduate level, and the remainder at postgraduate level.

Along with an extensive literature search, a number of other resources were reviewed (WHO, 2003; NZNO, 2013). None of these resources were able to clearly state what content in regards to child health, should be delivered to undergraduate nursing students.

There was one document, however, that does determine what the essential skills that all nurses should understand in regards to working with children. This is the New Zealand Child Health Nursing Knowledge and Skills Framework (2014) and has been developed by the Royal New Zealand Plunket Society (RNZPS) and the NZNO Nurses for Child and Young People Aotearoa (NCYPA). This document acknowledges the responsibility that society has to ensuring the care and protection of our children, their place in our society, and the nurses' responsibilities to the Nursing Council of New Zealand. It also identifies that there are a number of levels of practice involved in child health nursing, from a newly registered nurse to a nurse practitioner. The core part of this document is that it identifies a number of aspects of care, and then, what in regards to this aspect of care, is essential for all nurses to know, extended knowledge for speciality nurses, and extended further for those practitioners in advanced practice. This document clearly states that when someone becomes a registered nurse (RN), they should have been taught the essential aspects of care for child health knowledge and skills. Therefore, for the purposes of this report, I will be using what this document states as 'essential' knowledge and skills as the basis for what should be covered in the Bachelor of Nursing curriculum.

Determining the learning outcomes

The learning outcomes were adapted from *New Zealand Child Health Nursing Knowledge and Skills Framework* (RNZPS & NCYPA, 2014). There were 34 learning outcomes in total. In some cases, knowledge and skills from the framework have been merged to make one learning outcome. Some knowledge and skills have also been omitted as they are not appropriate for the undergraduate nurse.

The essential skills from the framework were adapted into learning outcomes using the term 'Gained foundational knowledge (or skills)…'. For example, the essential skill *"Functions in accordance with legislation to safeguard the best interests of children"* was changed to *"Gains foundational knowledge in legislation specific to children"*. Foundational knowledge is defined as "the basic building blocks needed for the sequential and cumulative development of understandings and skills in a specific discipline" (McInnis, 2002, p34). The author goes on to state that in the higher education realm, foundational knowledge encompasses this but also refers "to the learning required for lifelong learning in particular fields" (McInnis, 2002, P34). In this context, foundational knowledge therefore means that the student has gained the necessary building blocks of child health nursing so that they are able to enter into this field of nursing at a novice level. When a student graduates they are a novice practitioner with little understanding of the contextual meaning of the recently learned theory (Benner, 1984). Benner (1984) goes on to state that their behaviour is rule governed, limited and inflexible.

The student's experience of learning about child health can potentially progress from gaining this foundational knowledge, through to understanding, and application. The experience may begin by being taught the content, or the knowledge and skills in a dedicated learning situation. They will then have the *knowledge* that they need in this initial stage. The *understanding* of this knowledge may be when they are able to explain the topic themselves, in their own words. This is often not formally assessed and we can only assume that the student can translate that knowledge into understanding. A deeper understanding of the content will occur when the student is able to *apply* that knowledge and understanding. This could be in a simulated experience, or on a clinical placement.

For some learning outcomes, the foundational knowledge stops at understanding. For other learning outcomes, the foundational knowledge includes application, as this is necessary for the learning to become deeper. For example, learning outcome 1 – *gained foundational knowledge of child health determinants and their distribution in the population group.* Students are delivered content regarding this topic in a lecture situation. It is then the student's role to think about this content, and gain understanding from it. There is no apparent need, as an undergraduate, to have to apply this knowledge in a simulated or clinical situation. Therefore the foundational knowledge for this particular learning outcome stops at understanding. Learning outcome 7 however, is different. This learning outcome – *gained foundational knowledge regarding effective communication with child and family/whanau*, may also be taught in a lecture situation. It is in the simulated or clinical experiences, that the student is able to *apply* this knowledge and learning when they talk to children and their families. Application is a crucial aspect of foundational knowledge, in this particular learning outcome. In the mapping process, it is stated whether or not a learning outcome needs to have just knowledge and understanding, or whether application is required as well for foundational knowledge.

Many of the learning outcomes are not specifically assessed. Therefore staff will not know whether or not the student actually does have this foundational knowledge when they graduate. We can say, however, that the student has received instruction in these learning outcomes, and had the opportunity to learn about the topic. They have been given specific information that, if completed, will give them this foundational knowledge in child health nursing.

It is through gaining this foundational knowledge in child health nursing and achieving these learning outcomes that the student will be able to graduate as a novice practitioner, prepared to begin to work with children and their families.

Determining where the learning outcomes are best placed in the programme, determine what is currently being taught, identify gaps, and make recommendations.

A curriculum mapping process was determined which best suited the needs of the current curriculum delivery model. This process was determined from the above mentioned literature review. In the first instance, each individual learning outcome was reviewed. For each of these, current curriculum content that related to this learning outcome was determined. To do this, course outlines were accessed along with online course content, and discussions with course coordinators. Learning opportunities within the courses were then explored. This included more specific details such as lecture and tutorial topics. The learning location was then reviewed, ie, where this learning should take place, whether this learning outcome is best suited to the classroom environment, simulation, lab, online learning tool or clinical placement. Notes were made on what is already being delivered and what may need to be adapted for this specific learning outcome.

Table 3 gives three examples of the outcome from this mapping process. The current learning opportunities were clearly identified which led to a number of recommendations being made.

MODIFIED LEARNING OUTCOME	CURRENT LEARNING OPPORTUNITIES	RECOMMENDATIONS
Gains foundational knowledge of nutrition and hydration needs including breast/infant formula feeding/weaning, food preparation and storage	Some limited information in Pregnancy and Childbirth workbook. Generic nutrition knowledge in relevant module	Increase the content of breastfeeding and infant feeding. Include content into online interactive paediatric workbook. Introduce a child nutrition tutorial.
Gains foundational knowledge of hazards for children and injury prevention strategies	Home safety assessments year 1 Discussion of home safety in child health module	Increase the content of home safety in the online Paediatric workbook including interactive activities
Gains foundational knowledge in oral health and dental care for children	Lecture on the social and political impact of poor oral health in Professional Nursing Lecture and tutorial in Pathophysiology	Keep current content. Include more interactive content on the topic in the online Paediatric workbook

Table 3
Examples of outcomes from mapping process

RESULTS

The primary outcome of this process of curriculum mapping is that it has provided *transparency* to the teaching of child health nursing across the Bachelor of Nursing programme. There were a number of conclusions that were determined from this mapping process. The most considerable outcome was that most of what was considered essential skills and knowledge for nurses beginning to work with children, was already being covered. This was a surprising finding. As there was little transparency in what was being taught, it was assumed that there were many gaps in the teaching and learning of child health. This was not the case.

There were some learning outcomes that appeared not to be covered at all within the programme. These needed to be addressed as soon as possible, as they are significant knowledge and skill gaps for the students. Many learning outcomes were being taught but were not aligned well. A curriculum alignment of some of the content would enhance the learning experience for the student.

There was a significant overall recommendation that came out of this mapping process. It was recommended that the teaching of child health be stair-cased in the following manner: Year 1 – Introduction to nursing children; Year 2 – Well child nursing; Year 3 – Sick child nursing. This came about as a significant amount of the teaching and learning was structured in this manner anyway. It just wasn't identified clearly as such. By doing this, further transparency to curriculum content was provided, and a clear path for the teaching staff and students was laid. The learning outcomes are then able to be allocated to an appropriate year, which assists in the curriculum design, alignment, and planning of course content.

CONCLUSION

In summary, the process of undertaking a curriculum map of child health nursing in the Bachelor of Nursing programme was considerable. This curriculum mapping exercise was the initial step in providing well organised and appropriate child health nursing content within the Bachelor of Nursing and therefore determine the place of this essential component. The mapping process identified was able to produce results that determined a clear set of learning outcomes, identified gaps in curriculum content, and therefore provided direction and transparency for future teaching. As a result of this mapping and gaps being rectified, students can be confident that they have enough knowledge to be able to be a novice practitioner in child health nursing, and hence be a work ready graduate.

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Case Study

FROM PRACTICE TO EVIDENCEAND EVIDENCE TO PRACTICE: BACHELOR OF NURSING YEAR 3EDUCATION AND POWERFUL ASSESSMENT

Jean Ross

INTRODUCTION

The focus of this case study, presents how best to equip the Bachelor of Nursing (BN) graduates to be meaningful contributors within the health care sector, whilst considering the social, cultural, economic, and environmental challenges, that can hinder the provision of care for the people of Aotearoa, New Zealand. Registered Nurses (RN) use up to date evidence to inform their practice with the overall aim to improve the sustainability of health care for patients/clients/families/whanau and communities. A case study assessment based on real clinical problems is the focus of this assessment in which students' offer and develop evidence-based solutions is detailed. This case study demonstrates how third year student nurses are engaged in evidence-based assessment and evaluation, demonstrating its fitness of purpose: to prepare students to be work ready and further unable them to contribute to the growing evidence-based health care landscape as well as contributing to the knowledge generation of the nursing profession.

BACKGROUND

The BN programme is a three-year full time degree; learning includes both theoretical and practical application of technical skills that are taught at Otago Polytechnic through a number of interactive mediums. As students progress in the programme they apply their learning in various clinical settings. Clinical settings include primary (community including older adult residential facilities), secondary and tertiary (hospitals) levels of care both in the urban and rural contexts of the Otago and South Canterbury regions of the South Island. Successful completion of learning in years one and two of the BN programme (NZQA Level 500 and 600 respectively) is necessary before entry to year three (NZQA Level 700) can commence. The learning in years one and two creates a strong foundational knowledge for students entering year three. Year three directly brings together clinical practice, theoretical, research and scientific knowledge including ethical and professional responsibilities which enables students to apply and demonstrate the RNs competencies to practice, in their allocated clinical placements. On successful completion of the BN programme and passing the national state finals the graduates are eligible to register with the regulatory nursing body, the Nursing Council of New Zealand and are entered onto the national RN register and can practice as an RN.

CASE STUDY ASSESSMENT

This case study assessment showcases how I have endeavoured to ensure that education and assessment is powerful, in other words, meaningful for the student's learning and application in clinical practice and improves the purpose of the assessment and ultimately works in collaboration with industry.

The assessment has a purpose in that it meets the students' learning experience providing them an opportunity to engage with the wider health care industry and discuss their rationale for their individual chosen clinical problem, the evidence-based findings and recommendations in practice; through public exhibitions; at prospective interviews for employment and publication. The following questions related to discussing this powerful assessment are now presented:

- Who - Bachelor of Nursing (BN) third year students are the focus of this case study.
- What Third year BN students identify a clinical health care problem and work through a process to develop solution(s) while engaging with the best evidence–based research from national international literature and national and regional health care documents and policies.
- When The case study assessment invites the students at the completion of their second year of the degree (prior to commencing the third year of the BN programme) to critically reflect on their clinical experience and identify a problem in the clinical setting areas that could be improved; could be undertaken in a different way to current practice, or changed completely. The aim of this is to provide the students sufficient time to critically reflect on practice before commencing the third year of the BN programme and enable them to be prepared to embark on the assessment, at the commencement of the third year.
- Where The case study assessment aligns with the clinical health care place(ments) that students have encountered as a component of their clinical health care experience. The experiences the students encounter are in the community, mental, surgical and medical health care placements attached to rural and urban community and hospital settings.
- How The powerful case study assessment is a combination of three individual parts, but when combined together is representative of a powerful assessment that includes both formative and summative learning:

Part one

- Part one is a written essay and has a word limit of between 2800-3200. Student's focus on the individual identified clinical issue/problem (as discussed above) and critically discuss in writing their rationale for pursuing this problem.
- Students develop a question associated with the clinical problem and use the PICO/T model which "is an acronym that describes the elements of a well-formed clinical question" (Riva et al., 2012 cited in Whitehead & Maude, 2016 p. 60) to assist them to narrow and refine this question in order to undertake an individual literature search. The literature search situates the identified clinical problem within the social, cultural, economic, and environmental challenges, which can hinder the provision of health care related to the associated population and context. This review identifies the best evidence from the literature.
- The assessment requires the student to discuss the implications for practice based on the evidence outlined from the critically reviewed literature and further indicate what solutions (noted as recommendations) could impact positively upon the identified problem aligned with the specific clinical setting
- Students, summarise their recommendations and rationale related to the identified clinical problem and develop a solution orientated approach.
- At the completion of part one the student work is assessed against the marking criteria and feedback is provided from the lecturer marking team; represented as the formative learning process.

Part two

- Part two progresses the student assessment completed in part one to transfer the evidence-based literature review, solutions and recommendations associated with the identified clinical problem into one of three knowledge transfer mediums which will be further assessed (summative learning). The student can chose from one of three types of presentations; a visual poster, a written submission or a digital electronic presentation, following the available guidelines. Also the student is required to provide a written rationale as to why the medium had been chosen.
- The chosen medium is assessed against the marking criteria and feedback is provided from the lecturer marking team: the summative learning process.

Part three

- Part three of this powerful assessment showcases all of the students' visual, written and digital presentations at a public School of Nursing Evidence-based Practice Exhibition. The aim is to transfer this new knowledge to colleagues, peers, industry and the public to improve and sustain health care with new solutions to clinical problems.
- The students, plan, manage and organise the Evidence-based Practice Exhibition, invite and host the guests and are actively present at the exhibition to present their findings and talk with the guests (Figure 1).
- Further, the students' visual, written and digital presentations are accessible in the School of Nursing to display this knowledge as a learning resource and to inspire the BN year one and two students the learning that is achieved by the third year students (Figure 2). Equally, students are invited to publish their work in the School of Nursing Online Journal www.nursingjournal.org.nz. Access to these resources are also exhibited regionally by invitation from the Southern District Health Board with excellent feedback from industry.

Figure 1 Evidence-based Practice Exhibition 2017 Student Poster Display
Source: Published with permission from Sherry Lilley

Feedback from industry:

> *"I have just come back from Otago Poly where we looked over the posters the 3rd year students have done, wow there was some really good work. I think it is such a shame that it is not seen by a wider audience. Would you support a display in the main foyer of some of the posters? I can organise it with the [person's name removes] who happens to look after the foyer displays if you give your approval."*
>
> (Senior nurse Southern District Health Board, 2017)

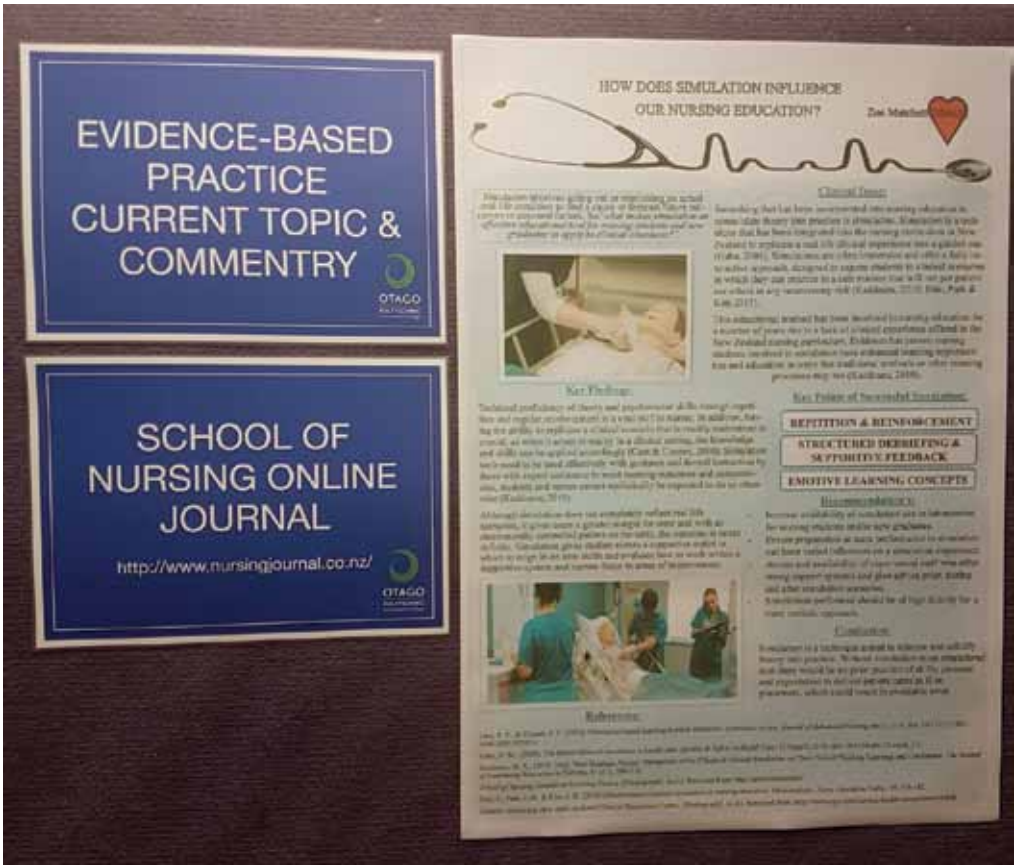

Figure 2 Continuation and promotion of student evidence-based practice current topic located in the School of Nursing
Source: Jean Ross

Feedback from students:

"Evidence-based research was a great fun to explore our interest and curiosity. Also it was brilliant to reformat the findings into another media (e.g. poster) to publish. It was excellent to have the forum [exhibition] day to show others what we did and what are the findings from our own research"

"having a physical poster that I used at interviews and letters from lecturer to acknowledge participation"

"How we got to research our own p[problem, made me think of how research gathering is done methodically"

(Otago Polytechnic, 2017 Student Reflection on a Course (Full))

Evaluation of the powerful assessment

This powerful assessment is fit for purpose and demonstrates its fitness of purpose. The focus of the case study assessment offers formative and summative learning and extends this learning at an open presentation to colleagues and industry confirming that we are developing graduates who are not only going to be work ready for today but also work ready plus for tomorrow.

Assessment evaluates:

- •students' critical reflection of clinical practice including the socio-political, cultural, ethical and legal influences on nursing practice leading to an identified clinical problem
- •students' engagement and access and use of appropriate literature, national health related strategies and documents including the content of previous BN courses including theory, scientific information, evidence-based literature and research
- •students' information literacy skills as they critically appraise the appropriate literature to inform their understanding of the problem in context
- •students' rationale for presenting the evidence either through the medium of a poster, a digital display presentation (Figure 3) or a submission to present the clinical problem, the recommendations for the implementation of evidence-based changes aligned with a particular context and population group
- •students' commitment to organise and attend the Evidence-based Practice Exhibition and be available to lecturers, colleagues, industry and the public to discuss the clinical problem and the best evidence-based solutions.

Figure 3 Evidence-based Practice Exhibition 2017 Student Digital Display
Source: Published with permission from Sherry Lilley

WHY

Evidence-based literature and research informs clinical nursing practice which improves the health care of the people of Aotearoa, New Zealand. The rationale as to why this powerful assessment has been developed and incorporated as a component of the year three BN programme is used for learning, career development, which informs local, regional and national nursing practice through local exhibitions and online publications. The assessment is real-world/authentic focused and invites students to critically reflect on clinical practice and to identify issues of concern. This assessment integrates evidence in practice while concurrently informing evidence of practice.

CONCLUSION

This case study assessment presented how best to equip the BN graduates to contribute to the profession of nursing and improve the health care sector and the provision of care for the people of Aotearoa, New Zealand. This case study assessment is based on real clinical problems in which students' develop creative, dynamic and integrated evidence-based solutions demonstrating its fitness of purpose: The assessment attracts high levels of positive feedback from students and industry at the dynamic exhibition in which multiple domains of learning are encouraged including digitally. This case study assessment prepares students to be work ready and further unable them to contribute to the growing evidence-based health care landscape as well as contributing to the knowledge generation of the nursing profession.

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Case Study

ASSESSING RESEARCH IMPACT BEYOND ACADEMIA: A NEW ZEALAND INTRODUCTION

Lesley Brook

ABSTRACT:

In anticipation of changes in the research funding environment in New Zealand, it is timely for tertiary education institutions to consider how they might assess the impact beyond academia of their research. This article considers international models for the assessment of research impact beyond academia that are relevant to the New Zealand context. Common elements for a research impact assessment model are identified and different approaches to each element considered. The focus is on the United Kingdom's Research Excellence Impact Framework in 2014 and prior and subsequent work on research impact assessment in Australia. The identified elements together comprise a framework which may assist institutions looking to develop an appropriate model for research impact assessment.

INTRODUCTION:

Governments are beginning to introduce national models for research impact assessment. The first to do so was the United Kingdom, as part of its Research Excellence Framework (REF) exercise in 2014.[1] The Australian Government will conduct research impact assessment nationwide in 2018.[2]

The New Zealand Government's Tertiary Education Strategy 2014-1019 already expects tertiary education organisations to 'achieve greater transfer of knowledge, ideas and expertise to industry and wider society' to increase innovation.[3] This has been reinforced by the Tertiary Education Commission (TEC) which will give researchers the option of referencing the impact of their research in the 2018 quality evaluation process that influences institutional funding from the Performance-Based Research Fund (PBRF).[4]

New Zealand is part of the international Small Advanced Economies Initiative, which has developed a framework for considering impact when making decisions about whether to publicly fund research programmes.[5] The Ministry of Business Innovation and Employment now gives significant weighting to the impact of the research that it will fund, encompassing not only the benefits to New Zealand's economic, social, human or natural capital, but also the credibility of the indicative implementation pathways to deliver those benefits.[6]

Against this background, the Tertiary Education Commission (TEC) is expected to allocate tertiary education institution funding in part based on research impact assessment by 2024, when the subsequent Performance-Based Research Fund quality evaluation round would be expected on the current six yearly cycle.

Allocation of funding however is only one of four primary purposes for research impact assessment which have been identified, the other three being advocacy, accountability, and analysis.[7] The same four purposes drove the development of an institutional impact assessment framework by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), an Australian federal government research institution:[8]

1. 'Accountability: the ability to provide defensible, robust evidence of impact'
2. 'Allocation: to enable more informed decision making'
3. 'Advocacy: an increased capacity to articulate future and delivered impact'
4. 'Analysis: the opportunity to better understand and maximise research impact'

For these four purposes it is timely for New Zealand tertiary education institutions to begin to consider how to assess research impact beyond academia.

LITERATURE REVIEW

Relevant literature was reviewed to identify the important elements of an institutional model for impact assessment, and the possible approaches that could be taken in respect of each of those elements. The literature included policy papers discussing the feasibility and desirability of research impact assessment, articles reviewing one research impact model or comparing different models, and documentation for selected models.

The likely future direction of national research impact assessment is relevant, in so far as that can be anticipated. A future New Zealand research impact assessment model is likely to be informed by what has been happening in the United Kingdom and Australia.

The REF2014 in the United Kingdom was conducted jointly by the Higher Education Funding Council of England (HEFCE), the Scottish Funding Council, the Higher Education Funding Council for Wales, and the Department for Employment and Learning Northern Ireland. Managed by a HEFCE-based team, the REF2014 assessed the quality of research outputs, and the vitality and sustainability of the research environment, as well as research impact beyond academia.[9]

In 2012 an Excellence in Innovation for Australia (EIA) Research Impact Trial was held in Australia. The EIA Trial was initiated by the Group of Eight and the Australian Technology Network of Universities. Twelve universities participated. That Trial relied heavily on preparatory work by HEFCE for the REF2014, which in turn had drawn upon earlier international work including in Australia.[10]

In the first half of 2017 the Australian Research Council has run a pilot exercise assessing research engagement and impact separately for 10 broad discipline groups. Participation by Australian universities was voluntary. The assessment of engagement involved both metric indicators and a narrative statement. Impact was to be assessed with qualitative information in impact case studies supplemented with quantitative information if any is available. Panels with both academic and end-user representation were to carry out these assessments. The pilot exercise will inform a full engagement and impact assessment process in 2018.[11]

The EIA Trial and the REF2014 had key similarities: they retrospectively examined impact already achieved, used a case study approach, and excluded impacts within the academic community. They defined impact as 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia'.[12] The accompanying lists of inclusions and exclusions for the definition of impact were virtually identical.

"'Impact" has become the term of choice in the UK for research influence beyond academia'.[13] The same could be said of the Australian government,[14] and the CSIRO's institutional impact assessment framework excludes contributions to academic knowledge because CSIRO had existing systems in place which track research excellence.[15] New Zealand is following suit: in 2018 researchers will have the opportunity to demonstrate 'any impact that their research has had outside academia'.[16] Other models for impact assessment that include academic impact were therefore not examined in detail.

The literature review identified the following as important elements of a model for impact assessment:

- Retrospective vs prospective approach
- Categorisation of types of impact
- Indicators of impact
- Comparing different types of impact
- Assessment approach

It is suggested that these elements together provide a framework against which decisions can be made about the design of an impact assessment model for an institution. Various approaches that could be taken in respect of each of these elements are considered and compared below.

DISCUSSION: ELEMENTS FOR RESEARCH IMPACT ASSESSMENT

Retrospective v prospective

The EIA Trial and the REF2014 were retrospective assessments, to assess the track records of institutions in achieving impact during a defined period, however a prospective approach to impact assessment has several benefits for institutions. The first of these benefits is to enable the collection of evidence of impact in preparation for participation in a national impact assessment process. The EIA Trial '… highlighted the need to introduce mechanisms to capture impact systematically and regularly ...'.[17] This evidence of impact includes baseline data.[18]

A second benefit of a prospective approach is that it will assist researchers to prepare and plan for impact[19] and hence maximise the impact achieved. For example, the opportunities for altered behaviour include stakeholder engagement activities by researchers during their research, to increase interest and understanding amongst stakeholders.[20]

Thirdly, a prospective approach is likely to help researchers to strengthen funding applications by anticipating research impact and to track impact for reporting to funding agencies.[21] In the United Kingdom research councils 'have begun to request that research proposals should explain how the planned research is likely to have an impact and to outline the "pathways" by which that impact is likely to be achieved'.[22]

A national impact assessment model for New Zealand is likely to be retrospective, consistent with the approach of the TEC to its evaluation of research quality in the Performance-Based Research Fund. Nevertheless because of the approach which New Zealand funding agencies such as the Ministry of Business, Innovation and Employment are now taking to impact, and the advantages for planning and maximising impact, institutions would benefit from a prospective approach to impact assessment.

Types of impacts

Categorising impacts by type assists researchers to consider a variety of impacts which their research may have, helps with the decision-making process, and enables mapping onto other frameworks internationally.[23] Categorising impacts by type also communicates and measures what is valued. The priorities of New Zealand's Ministry of Business Innovation and Employment are reflected in the indicative fund portfolio balance: 70 per cent for Economic objectives, 25 per cent for Environment objectives and 5 per cent for Society objectives.[24] The Tertiary Education Strategy also refers to economic, environmental and social outcomes.[25] The National Statement of Science Investment includes Health as a fourth dimension of impact, and anticipates impacts will span economic, social, cultural and environmental objectives. By way of example, 'the impact of endangered species protection could be considered in terms of economic (tourism revenue), environmental (role in the ecosystem), and cultural or social (as taonga or public amenity) values'.[26]

Choosing types of impact for assessment in an institution is not just about how many types or what to call them; it also involves deciding how widely or narrowly to define impact. Although designed for the evaluation of programmes rather than research, the Kellogg logic model illustrates the process to achieve impact and helps us understand what impact is and is not: ***Inputs*** are the resources needed, ***Activities*** are what is done with those inputs, ***Outputs*** are the direct products of the activities, ***Outcomes*** are changes in behaviour, knowledge, skills, status and level of functioning in the short to medium term, and ***Impacts*** are the changes to organisations, communities or systems in the longer term.[27] The Kellogg logic model has been adopted,[28] adapted,[29] and endorsed[30] for research impact assessment. Impact may be defined broadly to include some or all of those intermediary outcomes, or may be confined to the final impacts.

An example of such an intermediary outcome is policy change, which is included in some impact assessment models.[31] However the Society Panels in the EIA Trial reported that: 'case studies often claimed the effect on policy as impact when the actual impact would be changes that arose from new policy. Evidence of the latter was rarely presented.'[32] One of the REF2014 case studies, from Swansea University, illustrates the effects of changes in policy and practice. Intermediary outcomes of this research included new recommendations from the Department of Health, the implementation of phone-based advice by ambulance service providers, and assessment of patients for alternatives to hospital admission. The final impacts were estimated at some 1.2 million fewer than expected hospital conveyances, the costs saved from those journeys of approximately £24 million, and unspecified benefits for patients and their families.[33]

The variety in number and names for types of impact in various models indicates that the categorisation of impacts is somewhat arbitrary,[34] including whether to include outcomes and in particular whether to include policy change. Nevertheless it is suggested that maintaining the distinction between outcomes and impacts is important, because the outcomes are desirable not as an end in themselves but as a means to achieving the beneficial impacts. Otherwise the impact assessment model risks incentivising researchers to engage in the activities or produce the outcomes that are rewarded, even if those activities or outcomes might not be the most effective ways to achieve impact from the particular research.[35]

For a New Zealand institution it would be appropriate to use the three impact types being used by the government – economic, environmental and social. Either or both of cultural and health impacts could be identified separately rather than including them as social impacts.

Indicators of impact

Having identified what the research impacts are, it then becomes necessary to determine how to measure whether and to what extent those impacts are achieved. The approach adopted to measuring research impact needs to be applicable to all institutional disciplines. '[F]or some important impacts there may be no meaningful quantitative measure, or there may only exist metrics that are illustrative or indicative of the impact in some approximate way. Any evaluation that excluded those impacts that cannot be directly quantified would be biased'.[36] In similar vein: 'The quality and reliability of impact indicators will vary according to the impact we are trying to describe and link to research.' and 'A collation of several indicators of impact may be enough to convince that an impact has taken place.', especially a combination of quantitative and qualitative indicators.[37]

Outcomes are useful indicators of impact to capture in a research impact assessment model. They show that impacts are more likely to be achieved, that progress is being made along the pathway towards impacts.[38] Even if public policy change is not included as a type of impact, it can be an indirect indicator that impact is reasonably expected to occur as a result of implementation of that policy change.

Engagement activities

An institution considering introducing research impact assessment must also decide whether to include engagement activities as evidence of impact. It is attractive, particularly for funding allocation, to measure researcher and institutional activities to disseminate research findings because that is a variable that can be controlled by the researchers and their institution, whereas outcomes and impact depend upon the successful uptake and use of research by others.[39] Such engagement activities would be included under a 'contributions' approach[40] or 'productive interactions' approach.[41] The Australian 2017 pilot's engagement assessment examines the interaction between researchers and research end-users, for mutually beneficial exchange of knowledge, technologies and methods, and resources. The focus is on exchange, partnership and reciprocity, rather than knowledge transfer and dissemination.[42]

Such engagement or translational activities can be described as enabling; they create the environment in which impact can occur, by facilitating uptake. In that sense they are a necessary pre-condition of impact,[43] however they do not guarantee that the research will be used let alone that impact will occur.[44] Similarly a focus on knowledge exchange activities 'may only demonstrate immediate uptake and use of research and make it difficult to identify impact over any longer time period'.[45] It is concluded that engagement activities are a poor indicator of impact, so measuring them may result merely in more engagement activities rather than encouraging a focus on those engagement activities most likely to lead to impact.

It is therefore not sufficient to measure only engagement as evidence of impact, but is it necessary for an institution to measure engagement? It has been suggested that '… to link research to ensuing events and impacts, systems require the capacity to capture any interactions between researchers, the institution, and external stakeholders and link these with research findings and outputs or interim impacts to provide a network of data'.[46] The advantage of capturing engagement in a research impact assessment model is to provide evidence of the causal link between the research and the impact.

If there were no limits on the cost of a research impact assessment model, evidence that research has caused impact could encompass relevant outputs (dissemination), outcomes (uptake and use, for example implementation in policy or practice) and impact (the difference made). The outputs and outcomes would provide both evidence that impact is possible or likely to occur and evidence of causation. However although engagement activities are necessary for impact to occur, evidence of them may not be required to verify causation of impact. For example in the United Kingdom the Department of Culture, Media and Sport's Film Policy Select Committee 2012 report 'A Future For British Film' expressly acknowledged the research of Dr Charlotte Crofts, so no supplementary evidence of engagement activities was necessary.[47] In another example, white papers and government documents citing the research could be identified.[48]

If engagement activities do not reliably evidence impact, and are not necessarily required to evidence the pathway by which impact has been caused, the main reason for an assessment model to capture engagement activities would appear to be as a learning tool, to assist researchers to consider what they can do to create the conditions in which impact is most likely to be achieved.[49] It is suggested that this object can be achieved in other ways, without requiring researchers to record all engagement activities. It is concluded that it is therefore unnecessary for a research impact assessment model to capture engagement.

Standard metrics

A case study approach allows for a wide variety of impacts and pathways to impact to be assessed, but using metrics for assessment has been suggested as a low-cost alternative.[50] A standard set of metrics is also useful for analysis of the results of assessment.[51] However the major drawback to using metrics is the difficulty in establishing a comprehensive list of indicators of impact.[52] Setting up and maintaining a comprehensive list of indicators of impact could be very costly.[53]

It is also questionable whether a comprehensive list of indicators of impact is possible. Any prescriptive list of metrics is likely to be incomplete, due to the wide variety of impacts that are possible, which risks disadvantaging some disciplines.[54] The King's College London review of the REF2014 impact case studies found that the development of robust metrics is unlikely due to the diverse and inconsistent quantitative evidence supporting claims for impact. The diversity of impacts claimed would also not have been captured 'through a "top-down" taxonomy'. The lack of standard metrics can be a strength because it allows researchers 'to select the appropriate data to evidence their impact'.[55]

Another drawback of standard metrics is that '… it is likely to encourage researchers/research groups/HEIs to game the evaluation process to their advantage'.[56] For example it was only a year or so after the introduction of university spin-offs as an indicator of technology transfer before 'the actors involved adjusted their behavior in order to maximise their "score"'.[57]

Metrics and case studies are not mutually exclusive. Metrics could be used in addition to case studies, to provide quantitative as well as qualitative measures.[58] To help with analysis, tags and codes[59] and some drop-down menus and standard definitions[60] could be useful. Some metrics, such as quality adjusted life years or an audience participation index, would allow for easier comparison of case studies with similar impacts.[61]

The New Zealand Government is likely to follow the case study approach used in the United Kingdom and Australia, allowing institutional choice of the indicators of impact to include in a narrative description. The TEC's approach to impact for the 2018 PBRF quality evaluation includes a generic "other evidence" category as well as broadly described examples of impact.[62] A New Zealand institution can therefore take a flexible approach to the choice of indicators of research impact, including intermediary outcomes such as policy change, and without standard metrics. Including both quantitative and qualitative evidence of impact may strengthen the evidence of impact.

Comparing impacts

The EIA Trial considered reach and significance together to compare and rank different kinds of impacts. 'Reach' was defined as 'the spread or breadth of influence or effect on the relevant constituencies', and 'significance' as 'the intensity of the influence or effect'. In hindsight the panels recommended that these components should be rated separately and the results shown on a matrix or integrated somehow.[63] Reach and significance have also been used in assessing impact case studies in the REF2014 and another model.[64] Panel members for the REF2014 did not agree whether reach and significance should be assessed together or separately.[65]

There are alternatives to the "reach and significance" approach. The Small Advanced Economies Initiative proposed the allocation of a maximum of eight points for all impacts with a maximum of three points for any one impact.[66] Other alternatives include a cost-benefit approach[67] or an econometric approach.[68]

In some models contribution, or attribution, has been added to the "reach and significance" approach.[69] This recognises that besides the research under consideration, other factors are likely to contribute to impact, for example collaborators, independent or subsequent research, and other influences on uptake and use, because '… research is one factor amongst many influencing outcomes'.[70] The review of the EIA Trial commented on the narrow focus on reach and significance and recommended consideration be given to including contribution as an additional assessment criterion.[71] In the review of the assessment process for the REF2014, there were views for and against adding contribution as a separate factor.[72] If contribution is to be added, this must be done in such a way as 'to avoid inflating an assessment of an impact that had low reach and significance but high contribution'.[73]

Institutions in New Zealand may also wish to consider gathering information on contribution to impact as well as reach and significance. Contribution is already taken into account for co-authored publications as part of the TEC's PBRF quality evaluation of research.

Assessment approach

There are a range of methods for measuring impact: peer review, input measures, output measures and benchmarking, anecdotes, case studies, cost-benefit analysis, hindsight studies, surveys, economic models, and econometric analysis.[74] In the REF2014 and in Australia peer review has been used, with panels assessing case studies submitted by institutions. Panel assessment is time-intensive for panellists, which limits the number of case studies that can be considered.[75] The '… right balance between comprehensiveness and feasibility must be struck'.[76]

If panel assessment is used then panel structure must be determined. The REF2014 had sub-panels for each of the 36 discipline-based units of assessment, grouped under four main panels.[77] Analysis using Field of Research codes has revealed the multidisciplinary and diverse nature of the research underpinning the impact case studies for each unit of assessment.[78] This discipline-based approach has been questioned, because a wide range of impacts may be generated within each discipline.[79] The EIA Trial grouped impact case studies into four clusters that were outcomes-based.[80] Nevertheless, the Australian Government's national impact assessment may follow the Fields of Research framework.[81]

Panel membership must also be decided, in particular whether it should comprise only academic peers or include a proportion of stakeholders or users of research. The EIA Trial demonstrated that expert panels comprising majority end-user representation are able to assess case studies.[82] A subsequent study also recommends having a predominance of non-researchers and a high mix of different stakeholders on the assessment panels.[83]

At the institutional level self-assessment is a possible alternative to panel assessment.[84] Self-assessment is limited by the extent of the researchers' understanding and knowledge of the impacts which their research is likely to have or has had.[85] However it has the advantage of being able to be more comprehensive, because it is not limited in the number of case studies that can be considered.

The New Zealand Government is likely to adopt a panel assessment for national impact assessment to consider impact case studies submitted by institutions. For the institutions themselves however, self-assessment is a more cost-effective way to apply impact assessment to more than just a selection of case studies, and could be used as a first step in identifying and selecting impact case studies for further attention by the institution.

CONCLUSION

Adopting a research impact assessment model provides a tertiary education institution with a foundation to work up impact examples for a future national impact assessment process (the Allocation purpose), to inform funding applications (Advocacy), and for reporting to funding agencies and promotion of the institution (Accountability). It is suggested that internal impact assessment should also be designed to help researchers grow in understanding of impact and how it is achieved, to maximise the impact of their research (Analysis).

A research impact assessment model should have the flexibility to be strengthened and adapted as required in future, due to the institution's own increasing experience with impact assessment, as well as the evolving national and international context, in particular the results of the 2017 pilot in Australia and the approach adopted by the Australian Research Council for research assessment in 2018.

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Case Study

AN ASSESSMENT OF LEARNING OPPORTUNITIES CREATED BY A MULTIDISCIPLINARY STUDENT PROJECT USING THE MODEL OF KNOWLEDGE CREATION.

Richard Humphrey, Peter Harris, Matthew King and Jennifer Rodgers

ABSTRACT

The paper presents the facilitators' reflections on the benefits and challenges of developing and facilitating project-based learning for students from different disciplines. It reflects on the staff initial project collaboration, development and conclusion of a multidisciplinary student project between Bachelor of Applied Science (BappSci) Physical Activity, Health and Wellness students (n=3) and students studying for their Bachelor of Engineering Technology (n= 7). This paper assesses the opportunities for multidisciplinary knowledge creation using the conceptual model of knowledge creation disseminated by Fong (2003). It goes on to present the collective reflections of staff involved and lessons for future project collaborations.

INTRODUCTION

In this ever-changing world the importance of knowledge has been postulated as being a primary resource or asset for income creation (Fong, 2003). Knowledge and intellectual-based assets are distinctly different from tangible assets, such as land, machinery and materials. For graduates to be successful in this knowledge intensive, post-industrial era, they have to be capable of acquiring, processing and utilising new knowledge (Nonaka, Toyama & Nagata, 2000). Businesses and organisations seek ways to train their staff to be constantly innovative but face endless challenges in this pursuit (Fong, 2003). Knowledge-creating skills are of particular importance in ensuring businesses maintain commercial credibility and in turn the employment of the graduates they recruit (Leonard-barton, 1995).

Researchers have explored the benefits of multidisciplinary teams as an essential means for new knowledge creation and innovation (Nonaka & Takeuchi, 1995; Fong 2003). As a result of Fong's (2003) research, the model of knowledge creation was proposed to understand the processes within multidisciplinary project teams. It was conceived that applying this model within the education setting might enable educators to more effectively facilitate project-based learning activities.

Project–based learning is a term used to describe a broad range of approaches with a variety of practices and outcomes (Palmer & Hall, 2011; Helle et al, 2006). There is a wealth of literature espousing the benefits of project-based learning as a means of developing student-centred learning and highly desirable professional competencies (Palmer & Hall, 2011; Loureiro, Sherriff & Davies, 2009). Acknowledged benefits include the development of teamwork (both internally and externally), improved self-directed learning, ownership of the project, commitment, competence and comprehension of the commercial world beyond the classroom (Palmer & Hall, 2011; Zhou, 2012); all benefits highly desirable to businesses and organisations seeking to create new knowledge and foster innovation (Fong, 2003). The essential pedagogical move from teaching to facilitation fosters a more reflective and iterative learning environment, ideal for creative endeavours (Zhou, 2012).

Palmer and Hall (2011) state that there is general consensus that project-based learning includes: finding the solution to a problem or completion of a task that requires students to complete a number of activities; students typically work in teams; the project itself is meaningful, often multidisciplinary, requiring work over an extended period; the project involves the development of an artefact (product, design, model, computer simulation etc); the completion of the project requires a written report or oral presentation; and teaching staff take a hands off advisory role, facilitating rather than leading.

Fong's (2003) model of knowledge creation is a five-process model. The first process, "boundary crossing", refers to the boundaries routinely observed between team members, often with different skills and experience, and externally between the team and client or consultant. The second process is knowledge sharing, which occurs between the various group members. In this process there is believed to be an advantage in having greater diversity within the team, which enables broader discussion. The third process is knowledge generation; new learning or knowledge develops through the group discussion and collaboration.

The fourth process in Fong's (2003) model is knowledge integration; the consolidation of knowledge within the team and the piecing together of the constituent parts to create the project's solution. The fifth process is the collective team learning gained by the team's involvement in the project. Failure is a key driver for innovation in this process and support is essential for the teams problem-solving processes.

The project described in this paper set out to provide learning opportunities for students from engineering and health disciplines. The host institution's guiding principles include sustainability, which was an additional area intended for staff research using the product or solution of the project.

THE PROJECT

The student project was initiated by a group of three BappSci Physical Activity, Health and Wellness students undertaking their third year research project at Otago Polytechnic. They proposed a Public Health study to objectively assess the volume of alcohol consumed by students at social events and house parties. Inspired by the "Fun Theory" Bottle Bank Arcade (http://www.thefuntheory.com/bottle-bank-arcade-machine), which was created to encourage bottle recycling. The students proposed taking this idea a step further with the construction of an interactive bottle bin, which would capture data from the bottles deposited. This would enable the Health and Wellness students to calculate the volume of alcohol consumed from the bottles deposited in the bin.

It was planned that any students hosting an event could book the completed bin. The bin would be delivered to the venue (student house or flat), students would deposit their bottles in the bin, which would reduce the broken glass in the vicinity and resultant injuries. When bottles were inserted into the bin, the mechanism inside sorts the glass by colour and takes a 360 degree photograph of the bottle and its label, enabling the students to calculate the volume of alcohol from the bottles deposited. When the bin was collected the party organiser would be required to provide an indication of the number of people attending the event so that an average units of alcohol consumed per person could be calculated. In addition, it was hoped that the reduced glass debris in the local environment would aid neighbourly relations and social sustainability.

The Health and Wellness student's research project supervisor carried out initial scoping with colleagues from the School of Engineering, to gauge interest and feasibility of the project. Once interest had been established, further conversations were completed, in order to identify the appropriate staff and Engineering students to be involved in the project. The Health and Wellness students liaised with their research project supervisor and the Engineering lecturer in order to create a working brief for the Engineering students to draw upon in order to initiate their elements of the project.

Whilst the initial scoping with the Engineering school was being conducted, the Health and Wellness students also engaged in meetings with a representative from the local city council. This potential stakeholder was the council official responsible for glass recycling. They were contacted and invited to consider the students' proposal. During these meetings the students gained knowledge of the needs of the council, potential sources of funding and glass recycling infrastructure that could be used to further the projects aims. This knowledge was also incorporated into the working brief for the Engineering Design students.

Having received the working brief, the Engineering students set about researching and designing concepts that could satisfy the brief. The design course for the Engineering students focused on Customer Centred Design theory with targeted outputs including reflective design development and a testable functioning prototype. Students worked in independent groups and were assessed on their progress toward the prototype development and completion with 3D computer models, control programmes and fabrication of prototype components.

Contact was made with suppliers of materials and existing bottle waste management businesses. With the information gleaned, the Engineering students designed and presented their concepts, which included estimates for construction. Feedback was provided to the Engineering students from supervisors and the Health and Wellness students. Several projects were shortlisted and developed further before a final presentation where the decision was made as to the most suitable concept.

Following the decision being made, funding was sought to fund the purchase of materials and construction of the bottle bin. Having secured the funds the materials were purchased and construction proceeded.

INTERRELATIONSHIPS BETWEEN THE FIVE PROCESSES OF KNOWLEDGE CREATION AND THE STUDENT PROJECT

As previously explained, Fong's (2003) model of knowledge creation is a five-process model. To assess the opportunities created by the student project staff reflected upon the processes outlined within the model.

The first process, boundary crossing, occurred on a variety of levels. The disciplinary boundaries between Engineering and Health and Wellness were traversed, with the further potential addition of discipline of sustainability. There were crossovers by both staff and students, which increased with the diversity of experiences shared within the multidisciplinary team. Further boundary crossing occurred between the students and council glass-recycling official, who might conceivably be considered the client.

The most interesting instances of boundary crossing occurred between the students from Engineering and Health and Wellness. The Engineering students had limited experience with the student drinking culture, which lead to a number of early proposals including seemingly impractical components (for example the use of QR codes or Bluetooth pairing).

The second process, sharing of knowledge, occurred both within and between the disciplinary teams. Within the Engineering team, individual members held specialist knowledge of certain areas essential to the project. Some had knowledge of electronics, others welding and fabrication, others commercial paint and finishing. Sub-groups formed to address elements of the project independently before bringing them back together.

The Health and Wellness students were able to share their research on student drinking culture, technical requirements gained from their meetings with the city council official and feedback on suggested incentives to promote interaction with the bottle bin. While the two groups were not assessed upon their collaborations, the sharing of information in a timely manner was essential for both groups of students gaining a successful outcome in their assessments.

Staff shared their knowledge and experience but were mindful of the need to adopt a hands off, advisory approach, as suggested by Palmer and Hall (2011)and Donnelly and Fitzmaurice (2005); facilitating the project rather than taking the lead. Further, sharing of knowledge also occurred between the council official, material suppliers, the original arcade bin creators, glass/waste disposal companies and the student project team.

The third process, knowledge generation, occurred as a result of the other interacting processes within the model. Not only did the students gain new technical knowledge which helps to keep them up-to-date with current technology in a rapidly changing technological landscape, but also new knowledge and experience around more traditional soft skills such as team working, time pressures, self-directed learning and ownership of the project as suggested by Palmer and Hall (2011) and Zhou (2012).

The final product took elements from a number of the initial proposals and the knowledge gained during the course of the project. The scale of the bin came from one proposal combined with information from the health and wellness research. The mechanism came from another proposal, which was initially informed by the original arcade bin creators. The bin's delivery system was informed by the knowledge shared by glass recycling companies and the council official but added the camera and light sensors, which captured data for the Health and Wellness students while sorting the glass for recycling.

The fourth process in Fong's (2003) model, knowledge integration, saw the respective elements coming together with a cohesive solution to the original working brief. Unfortunately, the time constraints placed on the project meant that the students initially involved did not complete the construction of the bottle bin.

The students' inability to finish the bin's construction meant some of the knowledge consolidation opportunities were missed by those initially involved. However, through logging and status reports, the students who subsequently took over the project gained from these opportunities and could then springboard onto a previously vetted solution.

The final process, collective team learning, occurred throughout the project. All students gained insight and experience in working with clients and consultants. The health and wellness students gained an appreciation of engineering and engineering solutions to real world challenges. The Engineering students gained knowledge of Health and Wellness interventions, soft skills and commercially relevant experience. All team members had to utilise problem-solving processes and develop contingencies to overcome failure. Project team members were encouraged to develop alternate plans to minimise the negative consequences of any elements not meeting the needs of the project.

THE STUDENT EXPERIENCES

All of the students involved managed to contribute to the creation of a viable solution to a real world project. For the Engineering students there was the experience of receiving the brief, researching the topic, designing and constructing a solution. The interactions with the "customers" (Health and Wellness students) offered opportunities to experience feedback and debate the merits and drawbacks of respective proposed solutions as well as experience first-hand the importance of documenting acceptable solutions for defined parameters and the considerations that must be made when expectations change or the design development leads in a new direction.

Similarly, the Health and Wellness students benefitted from the experience of developing the brief and interacting with the Engineering students in order to see the bin come to fruition.

The initial scoping was conducted in plenty of time. However, making contact with the appropriate colleagues and identifying suitable students for the project took several months. This delay impacted on the time available to complete the project. Delay also occurred as a result of the time taken to access funds for the purchase of materials. Initially it was believed that funding would be secured from an external funder. However, during the funding application process, guidance was sought from the funding body and it was made clear that they would only fund research on proven concepts, not pilot studies such as this one. Internal funding was gained but took time to secure.

For the initial cohort of Engineering Design students, these delays and course time constraints meant that, although they were able to engage in all the collective team learning opportunities, the resulting outcome of the course was a minimally functional prototype, which was sufficient to satisfy their assessment needs but not suitable for the Health and Wellness students needs. Having the materials and bottle bin prototype did provide opportunities for subsequent Engineering students, who were able to quickly pick-up where the previous students had left off.

Unfortunately, as with the Engineering students, the initial cohort of Health and Wellness students were not able to make use of the bottle bin in order to collect data for their final year research project. Course completion and time constraints impacted upon the original Health and Wellness students, who initiated the project. They had always had a "fallback" plan prepared as an alternative, which was the collection of data by more traditional survey means (using the AUDIT alcohol consumption survey tool) in order to successfully complete the assessment for their research project. However, a student from the next cohort was able to take advantage of the bottle bin project and picked up the research the next year.

STAFF REFLECTIONS

While staff had experience in project-based learning, their inexperience in multidisciplinary student project design meant that a number of curriculum planning elements were missed. However, it was entirely probably that the project would not have proceeded if greater time had been spent planning, as it was time sensitive, due to the needs of the students involved.

Reflecting on the challenges within the project, staff concluded that it would have been wise to have a number of prioritized stages within the project, which would have enabled the completion of a solution in sequential modules, which could have been further progressed as time allowed, rather than designing and constructing an integrated 'ideal solution'. One opposing challenge to this staged solution approach was the need to secure funding and for all materials for the final product costs to be calculated and included within the funding applications. As a result of reviewing this issue, the supporting institute has proposed to set funds aside to be utilised for cross-disciplinary projects. In addition, support provided for the early scoping and planning (e.g. end of the preceding academic year) of such projects to improve planning and increase the probability of properly scoped projects being completed within the time available.

At times, during the initial design and construction phase of the bottle bin project, it might have been beneficial to appoint a Project Manager or Coordinator to ensure:

- Tasks were completed
- Everyone knew what was happening
- The needs of all disciplines involved were met
- The project was completed on time

It was frustrating for some parties to not see or know if progress was being made. However, as Fong (2003) highlights, failure can be a fundamental component within problem solving, which a Project Manager may struggle to overcome within tight time constraints, such as an academic year.

CONCLUSIONS

It was agreed that the benefits for students working on the multidisciplinary project outweighed the drawbacks, although the impact of drawbacks could be minimised if future projects were staged and well managed. For projects to be feasible, dedicated funding needs to be allocated and managed in a way that fits the projects. Complex and slow funding application processes stifle creativity and innovation, which are fundamental benefits this style of learning sets out to foster (Zhou, 2012).

Paradoxically, the tolerance or accommodation of failure is an anathema to traditional forms of education despite being seen as an essential driver for innovation (Fong, 2003). Ensuring students can meet their learning outcomes despite, or even because of, failure can be challenging and requires a paradigm shift for those traditionally trained educators. Designing curricula and assessments to validate the knowledge gleaned from engaging in project-based learning takes time. The longer the time available for the planning of a project-based learning scheme the better. Using reflective reports, as well as completed project solutions, ensures that students can demonstrate their learning and development even if the project outcome falls below expectations.

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