Guidelines for providing feedback in the clinical dental setting

Lee Adam (PI), Angela McLean, Alison Meldrum, and Alison Rich

Project overview

Feedback plays an essential role in the student learning process. It helps to improve students' understandings of their subject, and has also been shown to increase students' motivation, interest, and self-awareness, which encourage improvement (Fugill, 2005; Hattie and Timperley, 2007; Mattheos, Nattestad, Falk-Nilsson, and Attstrom, 2004). Students, however, often report that the feedback they receive on their clinical work is sparse, and non-useful or even demeaning (Anderson, Rich and Seymour, 2011; Fugill, 2005). Student evaluation surveys indicate similar issues with feedback at the University of Otago School of Dentistry. In this research project, staff and students of the school were interviewed for their perspectives on current feedback practices in the clinical teaching and learning environment. Results show that staff and students similarly believe feedback should be an immediate, individual, realistic and respectful dialogue, designed to encourage students' self-reflection, problem-solving, confidence and learning. Results of this project have been written up as guidelines for staff and for students, and prepared for publication.

Introduction

In dental and oral health care education, students report that the clinical setting is where much of their learning takes place (Victoroff and Hogan, 2006). Consequently, effective clinical teaching is considered crucial for student learning in the dental education setting (Schonwetter, Lavigne and Mazurat, 2006). However, teaching in dental education has specific challenges. In the clinical dental environment, students are required to carry out difficult and irreversible procedures while still relatively inexperienced (Anderson, Rich and Seymour, 2011; Fugill, 2005). The environment is therefore both a place of professional health care, and a teaching and learning space, placing the clinical teacher in the dual role of supervisor and teacher. In order to ensure the clinical setting is a safe and effective environment for both students and patients, a high level of supervision and teacher-student interaction is required (Anderson et al., 2011).

Research into effective clinical teaching practices in the dental setting highlights teacher feedback as a crucial factor in teacher-student interactions (Fugill, 2005). However studies show that students report receiving little or no feedback, or that the feedback they receive is non-useful or even 'demeaning' (Anderson et al, 2012; Fugill, 2005). Consistent with this, results of a 2014 student survey undertaken in the University of Otago Faculty of Dentistry (Rountree and Adam, 2014) revealed that, of the five most unsatisfactory aspects of the clinical learning environment, three pertained specifically to feedback from clinical teachers. Students reported that poor feedback limited their learning and that they wanted more specific feedback in order to apply and increase their confidence and learning outcomes. Thus, there is a clear need to improve feedback processes in the clinical dental learning environment.

Project objectives

- To enhance student learning through improving the way teachers approach feedback in the clinical setting. This will be done through identifying what is good feedback in the clinical dental setting, and reporting strategies for good feedback back to staff and students
- Produce a resource for clinical staff on approaching feedback effectively
- To develop workshops and training on effective feedback in the clinical setting
- To encourage clinical teaching excellence in the Faculty of Dentistry

Approach and methods

Following ethical approval, all teaching staff at the Faculty of Dentistry were invited to participate in an individual interview regarding their experiences of feedback processes in the undergraduate clinical teaching environment. A total of 12 teaching staff participated. Interviews were semi-structured, and based around the critical incident method (Victoroff and Hogan, 2005). Staff were asked to recount incidences of both effective and ineffective feedback with students. Interviewees were prompted to expand on their explanations, and to reflect on the factors that make feedback processes both easier, and more difficult, in the clinical teaching environment. They were also asked what they thought were the main components of good or effective feedback processes.

In addition to the staff interviews, all undergraduate students at the School of Dentistry were invited to attend a focus group regarding how tutors and students engage in feedback in the clinical learning environment. A total of 19 students attended one of six focus groups, and a further two students provided email comments regarding their experiences, with particular reference to feedback. In the focus groups, students were asked to discuss what kinds of feedback they found most useful and least useful, kinds of feedback they would like to receive, to describe the kind of feedback they believed was most helpful to their learning, factors that make feedback processes more difficult or easy in the clinical learning environment, and what they perceived their role to be when engaging in feedback with tutors.

All of the focus groups and interviews were audio recorded and transcribed. Data were analysed using a general inductive approach (Thomas, 2006). The data were organised into broad themes from which guidelines could be developed.

Key findings

Both the students and the staff reported similar difficulties and opportunities in engaging in feedback in the clinical learning environment, as well as similar views regarding what are ideal feedback processes.

The data on effective feedback from both the staff interviews and the student focus groups were organised into the following main themes, which in turn formed the basis of the developed guidelines.

Feedback should be:

- As immediate as possible/practicable
- Tailored to the individual

- Realistic (directed at guiding the student towards the level at which s/he can be expected to be performing at the time)
- Respectful
- A dialogue (not given or received, but engaged in with active participation)

Feedback should be aimed at:

- Encouraging students to self-reflect
- Encouraging students to problem-solve
- Building students' confidence
- Increasing or enhancing students' learning experiences

The guidelines for staff and for students developed in this project are currently being prepared as an online print resource which, when completed, will be available on the Faculty of Dentistry website.

Discussion and implications

One of the most interesting findings of this research was that staff and students had similar views regarding feedback. Both students' and staff descriptions of effective feedback practices and processes focussed on a relationship of mutual respect. Students and staff also had similar views regarding effective learning in dental education. In particular, staff saw their role as challenging, guiding and encouraging students to reflect on their practice. Similarly, the students' data highlighted their desire to be challenged, guided, and encouraged to reflect on their own learning and the gaps in their knowledge, rather than be told what to do. Both staff and students indicated that they saw mutually respectful feedback processes as an important way to achieve this.

Both the staff and the students' reports highlighted some barriers to students' learning in the clinical environment. Most of these barriers related to processes within the clinics. Subsequently, changes have been made in the environment to begin addressing some of these barriers.

Outputs

- Guidelines for staff for engaging in feedback in the clinical learning environment have been drafted (currently in the graphic design stage)
- Guidelines for students for making the most of their clinical learning have been drafted (currently in the graphic design stage)
- The project findings and implications were formally presented to teaching staff at the Faculty of Dentistry Teaching Excellence Day, February 2016
- A paper provisionally titled "Barriers to students' learning in the clinical learning environment", which reports on the students' focus group data, has been prepared (undergoing final editing) and is planned for submission to the European Journal of Dental Education
- A further paper describing this study and the results and implications is currently being drafted and planned for submission to a dental education journal

References

Anderson, V. R., Rich, A. M. & Seymour, G. J. (2011). Undergraduate dental education in New Zealand: 2007-2009 final-year student feedback on clinical learning environments. *New Zealand Dental Journal 3,* 85-90.

Fugill, M. (2005). Teaching and learning in dental student clinical practice. *European Journal of Dental Education, 9,* 131-136.

Hattie, J. & Timperley, H. (2007). The power of feedback. *Review of Educational Research,* 77*(1),* 81-112.

Mattheos N., Nattestad A., Falk-Nilsson E. & Attstrom R. (2004). The interactive examination: assessing students' self-assessment ability. *Medical Education,* 38: 378-389.

Rountree, J. & Adam, L. (2014). *BDS clinical tutor evaluation results*. Dunedin, New Zealand: University of Otago Faculty of Dentistry.

Schonwetter, D. J., Lavigne, S. & Mazurat, R. (2006). Students' perceptions of effective classroom and clinical teaching in dental and dental hygiene education. *Journal of Dental Education, 70*(6): 624-635.

Thomas, D. R. (2006). A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation, 27*(2), 237-246.

Victoroff, K. Z. & Hogan, S. (2005). Students' perceptions of effective learning experiences in dental school: A qualitative study using a critical incident technique. *Journal of Dental Education, 70*(2), 124-132.

Final Report on University Teaching Development Grant – Paediatric Outpatient Teaching Clinic.

Title:

Evaluation of Paediatric Outpatient Teaching Clinics.

Project Team:

Dr Liza Edmonds, Tracey-lee Fisher, Associate Professor Ralph Pinnock, Andrew Gray, Zina Vandervis & Jordan Gibbs.

Snapshot:

Paediatric outpatient, or ambulatory paediatrics, is somewhat of a challenge to provide to undergraduate medical students. There are pressures such as busy clinician time, service delivery and the variability of clinics that impact on medical students' abilities to optimally see children & their families in this environment. This project aimed to evaluate students', families' & children's and tutors' experiences of taking part in a dedicated paediatric outpatient teaching clinic for undergraduate medical students. All students, families, children over 8 years of age and tutors participating in teaching clinics were asked to complete a survey about their experiences. All participants reported a positive experience in taking part in the clinics. The results of this study are currently being prepared for publication. Our findings support the ongoing provision of these clinics for medical students & demonstrate a positive working relationship between the DHB and the University in providing such clinics.

Introduction:

Outpatient, or ambulatory, paediatrics is a growing focus and area of paediatrics. With a move towards more community based health provision, an emphasis on preventative medicine and the growing burden of chronic disease there is a need to improve exposure and learning for undergraduate medical students to this area of paediatrics. Indeed many of them will ultimately be working in medicine outside of the acute hospital based medical realm. It is a challenge however, to provide medical students a high quality opportunity to experience outpatient paediatrics. The pressures of busy clinics, variable attendance, variety of conditions and service provision make it a challenge to meet students' learning needs.

As a result of these challenges paediatric outpatient student teaching clinics have been developed to improve students' experiences of these clinics. However, the experience of the students, parents & children and tutors has not been explored or evaluated. Overseas literature has revealed that there are many different methods of providing outpatient or ambulatory paediatric teaching to undergraduate medical students. This project aimed to evaluate the experience of all participants in attending these clinics.

Methods:

Paediatric Outpatient Teaching Clinics are conducted in the paediatric outpatient service of the Southerndhb on a weekly basis during the University of Otago academic year. All 5th year undergraduate medical students are

allocated to attend this clinic once during their attachment in paediatrics. If a student does not perform to the expected standard they are offered an additional opportunity to attend a further clinic as part of a remedial process to strengthen their performance. No assessment outcomes are attached to this clinic. Clinics are supervised by a senior paediatric trainee post fellowship examinations. They meet students with the families and children and also provide direct feedback to the students and discuss the cases with students before and after clinics.

Patients are selected from triage letters of referral to the Southerndhb. This is a joint clinic between the University of Otago and the Southerndhb. Eligibility for these clinics include that the family must be local (so as to not incur additional costs), be willing to participate (they are all informed of the nature of the clinic prior to attendance) and have a relatively low triage category so that their referral issues are not complex or multi-factorial.

All participants of the clinics (students, tutors, caregivers and children over 8 years of age) were offered the opportunity to take part in the evaluation of the clinic. Written and informed consent was obtained at the time of clinic. Evaluation was taken out by completing a survey of their experiences including demographic information, referral information, and impression of the clinic experience (via questionnaire) and outcomes of the clinic visit. Analysis & questionnaire development was completed by a biostatistician (AG).

Ethics approval was obtained by the University of Otago Human Ethics Committee (H15/012) and locality approval by the Health Research South (Project ID 01112).

Findings:

A total of 76 students participated in the paediatric outpatient teaching clinic. One student was excluded due to needing remedial work & requirement to repeat the clinic. Of the 76, 74 returned their questionnaires ((97%). Of the 77 families who attended clinic, 2 were excluded (due to being seen by the remedial student & short notice attendance due to a family withdrawing at short notice). Of these families 67/75 completed a questionnaire (89%). Children over the age of 8 years were offered questionnaires (n=12) of which 10 completed a questionnaire (83%). All 3 tutors completed a questionnaire.

The majority of children attending the clinics were under 5 years of age (72%). Of the medical students the most common age bracket was 20-25 years (88%). Differences in the ethnic make-up between patients and students were noted. Patient ethnicity was in the majority European descent (85%) compared to students who had two common ethic groups – Asian (41%) and European (39%). Referral reasons were diverse with the most common being behavioural or developmental concerns (22%) and cardiovascular such as murmurs (21%).

Several statistically significant interactions were found between several variables. Those families with increased deprivation were more likely to have

reported that they would have liked to have seen the tutors without students present (p=0.02). In addition to this, students who saw those families with increased deprivation were more likely to report that they would have liked to have more time to discuss these families with the tutor (p=0.04). Both the patient gender & age of the patient influenced the reported student's confidence with communication. The older the age of the patient (p=0.04) and being male (p=0.04) resulted in the student being less likely to report being confident in their communication during the consultation. While tutors were highly rated, there was significant differences between tutor rating for being learner friendly (p=0.001) and providing time for discussion (p=0.08). Student age was also found to have an interaction with those students who were younger reporting a lower level of satisfaction with tutor feedback (p=0.04).

Of the patients seen 55% were discharged back to primary health for ongoing care and 21% required referral to another service such as developmental services. Family questions about the experience of attending a teaching clinic were overwhelmingly positive with all children reporting that they enjoyed meeting the students and would take part again. Students also reported a positive experience and enhanced learning.

Discussion/implications

This project has provided an evaluation of both students', tutors' and also caregivers' experiences of an undergraduate medical student outpatient teaching clinic. This is the first report of a wide range of experiences both for the students but also the children involved. The feedback is overwhelmingly positive and supports the use of such clinics to provide students with consistent high quality learning experiences. It also provides support that this is a positive experience for the patients attending as well. It is interesting to see that the statistically significant findings highlight that for different communities, such as those with increased deprivation, reported experience is different to other patient groups & that students experience this as well. Perhaps this group presents a more complex and challenging dimension to health presentations or perhaps is less health literate. It is difficult from our study to tease this out completely and would be of interest to be explored in the future.

Strengths of our study include a high response rate. This allows us to be more confident in our findings but with only a small number of students and older children responders it limits our ability to generalise these findings. Perhaps going forward gathering a larger number of children who can give feedback to these clinics may allow us to strengthen the clinics and provide feedback both to the tutors but also the students themselves.

Communication was also highlighted within this cohort. Having an older patient and also male patients appeared to have an interaction in how students perceived their ability to communicate with families. This is part of the challenge in paediatrics with younger patients being less able to communicate

verbally & parents taking a lead role. However, when the patient is an older child, they become part of the communication triad, and the complexity of communication increases. Communication between student and tutor was also acknowledged in the student's reports, with feedback highlighted as an important feature of high quality learning experiences.

Going forward these paediatric outpatient teaching clinics are an integral part of our provision for undergraduate medical education within the Paediatric Department of the Dunedin School of Medicine. This project confirms that it is a positive experience for both the students, tutors and families who have taken part. An example of this is a quote from one family "Very organised. Students were polite and considerate. Appreciated being able to talk thoroughly with the Doctor. Thanks :)". Another is from a student "Thank you for organising this opportunity for us. I found it a safe environment for me to learn in, and very beneficial for me becoming comfortable with interacting with parents and their children".

This CALT grant has provided us with the support to evaluate these clinics and to be confident in this method of teaching. It is an example of the benefits of a joint project between the University of Otago and the Southerndhb. Going forward it highlights future needs such as tutor support and development.

Acknowledgments:

The project team need to acknowledge the support of the Committee for the Advancement of Learning and Teaching (CALT) for supporting this project.

Without their support it would have been a challenge to complete this project. We also need to acknowledge the families and children who attended these clinics to assist with teaching. Without them these clinics would cease to exist. Their good will and generosity need to be acknowledged. The staff of the paediatric outpatient department of the Southerndhb also need acknowledgment for their patience and accommodation of these clinics in a busy outpatient department. We would also like to acknowledge Dr Anne Thornton who provided the follow up & high response rate by chasing questionnaires from families.

Other Outputs:

Paediatric Outpatient Teaching Clinics are continuing this year and ongoing. By completing this project it has provided support for the ongoing benefit of the clinics for undergraduate teaching. In addition, this project is currently being prepared for submission to a peer review journal for publication. It would be expected that it will also be presented at a peer-reviewed conference in the future.

COMMITTEE FOR THE ADVANCEMENT

OF LEARNING AND TEACHING

FINAL REPORT ON GRANT

31st March 2016

Name: HILARY HALBA.

Department: THEATRE STUDIES PROGRAMME, DEPT. OF MUSIC & THEATRE STUDIES.

Title of Project:

"DEVELOPING MARAE-BASED LEARNING IN THEA 253/353 THROUGH WĀNANGA"

Aims and Approach of Project:

This project's aim was to analyse and consolidate the Kaupapa Māori-based, practice-led and experiential elements of THEA 253/353 in 2015 by investigating the incorporation of a marae-based wānanga module into the

course. The research question upon which the study was focused is: how can Māori pedagogical methods form the foundation for the practice-led study of bicultural theatre? As the project developed, we hypothesised that the teaching of disciplinary knowledge may be achieved through wānanga-based pedagogies in a broader context than that of Theatre Studies.

Introduction, Context and Rationale:

This research was aimed at providing us with information from which we can draw conclusions about the use and value of wānanga as a pedagogical tool in teaching not only in Theatre Studies but in other areas of the performing arts – and possibly more broadly across the university. The aim of the 2015 wānanga was to research and analyse the most effective means of delivering marae-based learning, using both wānanga and the tū taha ke ai pedagogical method– an experiential learning principle where an "an exchange of knowledge" takes place (Halba & McCallum, 2011, p. 73).

The project was designed to investigate the teaching of disciplinary knowledge in Theatre Studies through wānanga-based pedagogies, in this case study in THEA 253/353 Bicultural Theatre. This paper examines ways in which theatre has investigated and represented bicultural culture and identity in Aotearoa/New Zealand. It also examines and critiques ways in which bicultural theatre has been created and analysed in this country, and is an excellent example of research-informed teaching. The paper is delivered through a mix of lectures, seminars and practical theatre workshops. Students write analytically and reflectively, present performative seminars that focus on Kaupapa Māori-

based research methods, and create a devised performance piece in which they are all involved at the end of the semester.

The study for which we received the UTDG was focused on examining how wānanga-based Kaupapa Māori-led teaching and learning principles may be incorporated and developed in the curriculum of THEA 253/353 in a marae-based, rather than a classroom-based, context.

Approach:

The THEA 253/353 class attended a wānanga on the weekend of August 1st & 2nd 2015 at Arai-te-Uru Marae in Dunedin. Rua McCallum, the project's kaitiaki and Research Assistant – and the class' tutor – also attended the wānanga with me. Guest teachers – some of the most experienced in New Zealand theatre, music and dance (Mr. Rangimoana Taylor, Ms. Louise Potiki-Bryant and Mr. Rob Thorne) – taught units on theatre marae. Some of these units focused on Māori or intercultural performance, and others centred on more generic disciplinary knowledge in practice-led Theatre Studies and performance making.

With the participants' permission, we filmed aspects of the wānanga, and Rua and I subsequently viewed the film to analyse ways in which students approached their learning in the wānanga setting. Rua and I also collected data during the wānanga through participant observation and from verbal feedback from students, including at the poroporoaki. After the wānanga, we collated written feedback from the students, and conducted participant interviews. We also talked to tutors.

Key Findings:

One of pedagogical methods Rua and I investigated at the wānanga was tū taha kē ai which is a southern Māori learning device, which can be used correspondingly with, and in, the wānanga. In the tū taha kē ai pedagogy, while travelling the land, creation stories, whakapapa whenua and knowledge are imparted as the student accompanies their tohunga and or kaumatua. On each consecutive journey, traversing the footsteps of the tīpuna, more information would be disclosed, absorbed, remembered and understood. Knowledge transmission and understanding became a way of life between teacher and student, student and teacher. This concept was aplpplied at the wānanga. Although a number of ideas explored at the wānanga had been initially introduced in the classroom, it was at the wānanga where the ideas were experienced in context and hence the students learned more deeply. One student we interviewed after the wānanga said, "The mihimihi [statement of introduction] was taken more seriously on the marae. We did it in class but we didn't do it so seriously. On the marae, it was as if we were introducing ourselves for the first time. We 'understood' the concepts from class but they came more naturally into context on the marae."

Teaching and learning were facilitated in a more holistic way on the marae. Another student we interviewed remarked that, "On the marae we learned from our peers as well as from the teachers. We embraced the need to make our own decisions. There was a different hierarchy from the classroom. Passing or failing was taken away. We had the choice to participate on our own terms."

Although most were in an unfamiliar situation (more than half – including several international students – had never been to a marae before), one interviewee noted that she felt less intimidated on the marae than she did in a more traditional university classroom, saying "I never felt like 'damn, I should have known that'." Another said, "I'm worried that questions in the classroom might be met with derision. On the marae, people were ok to ask and others were interested in the answer. People wanted to share information and give things."

Subsequently, we found that the students' approach to the post-wānanga process of devising a piece of theatre was duly informed by the principles they had absorbed at the wānanga. One interviewee remarked, "The devising process revolved around relationships, and that stemmed out of the wānanga." Another said, "Something about it [the wānanga] was to do with connection. We wanted to keep telling stories." Yet another said, "I would have loved to create the whole play on the marae."

I conclude that the wānanga process provided the students with deep and life-long learning. One student whom we interviewed remarked, "At uni, knowledge is piled on you and you have to sift through it. At the wānanga, you follow the crumbs. There is respect. You acknowledge where you are going and what you want out of it….It changed my course of study for the future." Another interviewee said, "The wānanga carved into status gaps. The teachers still had status, but a fluid status. At the wānanga we were guided rather than being

pulled along." That student later remarked, "You can ask for help at the wānanga; you can't ask for help in the same way when you get back to uni."

Very significantly, as far as life-long learning goes, one interviewee noted, "Words contain knowledge but practical knowledge empowers you even more. It creates more meaning for the knowledge – how to share it, how to use it. Experiencing immerses you in knowledge so deeply." That student further stated, "It encouraged me to question, 'Why can't it be like this when we go back to university?' I look for more, even now; I look for more experience."

Discussion and Implications:

We believe our initial findings have far-reaching implications that go beyond Theatre Studies. The holistic learning environment of the wānanga could be used for not only teaching elements of Te Ao Māori, but also for teaching disciplinary knowledge in a range of subject areas. The wānanga setting provides a fruitful environment for facilitating deep and life-long learning, and for developing self-motivation and resilience in the students.

This project certainly changed the way in which we approach teaching in THEA 253/353. I propose the inclusion of a wānanga each time the course is taught, if resources allow. I also intend to research the inclusion of wānanga-style teaching in other Theatre Studies papers. However, we need to better understand the interface between the classroom and the wānanga. Understanding this interface will be the next phase of my research in this area. Rua and I found that when the group got back to the classroom, familiar signifiers and behaviours returned.

Whereas on the marae, a self-determining agenda prevailed (students saw a job that needed doing and did it – be it taking notes, helping a peer, or working alongside Rua and I, and other staff present at the wānanga, in a range of spheres to do with daily life on the marae), upon returning to the classroom they sat in rows, waiting to be told what to do. Moreover, they waited for Rua and I to return to our roles as lecturer and tutor in a more traditional western academic sense. When Rua and I enquired about this behaviour when we interviewed students for this project, the interviewees acknowledged this practice had happened. One of the students we interviewed said, "The further we get from the wānanga some threads of connection start to untwine. The complexities of uni life take over." Another said, "Coming back disconnects you from that environment."

Summary of Spending:

See attached spreadsheet.

Outputs:

Rua and I presented the project's interim findings at the International Applied Theatre Symposium, "Performance of Hope" on November 9th, 2015 at the University of Auckland (https://cdn.auckland.ac.nz/assets/education/about/news-and-events/docs/2015/Performance%20OF%20Hope%202015%20Visual-Proof.pdf).

I will also present a paper detailing further findings from the study at the Australasian Drama Theatre and Performance Studies conference "Resilience: Revive, Restore, Reconnect" at the University of Southern Queensland, 22 – 24 June 2016. From this paper, a journal article will be drafted, which may be offered to the *Australasian Drama Studies* journal, or to another suitable journal.

COMMITTEE FOR THE ADVANCEMENT OF LEARNING AND TEACHING FINAL REPORT ON GRANT

Title of Project:

Developing postgraduate academic writing support through writing group pedagogies

Name: Vijay Kumar Mallan & Rachel Spronken-Smith

Department: Higher Education Development Centre/Graduate Research School

Amount Awarded: $19,817.00

Snapshot of the case (150 words)

This project involved designing and developing a centralized academic writing programme to develop postgraduates to lead peer writing support in their departments. A literature search was undertaken to explore models of structured writing programmes offered successfully in other research-intensive universities. A pilot ten-week doctoral writing programme was developed in consultation with postgraduates, research supervisors and learning advisors. Twenty postgraduates participated in the pilot, with feedback indicating it was a very valuable programme. Importantly, several postgraduates went on to facilitate peer writing groups in their departments/and or, assist in future teaching of the writing programme. Writing groups provide an alternative space for postgraduates to develop their academic writing skills. Given the benefits of both the writing programme and the peer writing groups, it is suggested that institutional support be continued to run the doctoral writing programme on a regular basis and to support the development of peer writing groups.

Introduction

The most important tool for success as a graduate research candidate is the ability to write (Goodson, 2013, p.10). The mastery of this ability places demands on the graduate writer to learn sophisticated writing conventions and practices. The challenges faced by supervisors in providing support add to the plethora of complexities for the graduate writer. Indeed, research at the University of Otago by Daskova et.al (2008) which analysed 427 responses from academic staff indicate that it is challenging for supervisors to provide academic support as it takes a lot of time and effort to correcting drafts. International research too has acknowledged that not all supervisors have the knowledge and skills to provide advice on "language and discourse organization issues" (Woodward-Kron, 2007, p.254) and that some supervisors feel uncertain about the complexities of writing (Pare, 2011). It has also been noted that many supervisors "do not see writing support as their responsibility, but as the responsibility of those in writing centres, since … writing is a generic skill rather than rooted within the academic exchanges within each field" (McAlphine and Amundsen, 2011, p.10). The difficulties of graduate writers are also manifest in the number seeking writing advice from the Student Learning Centre (SLC) here at

the University of Otago. These demands indicate that graduate research candidates find research writing complicated and challenging.

In order to meet these growing demands, a pedagogical response was to trial a sustainable writing support programme involving a structured programme on doctoral academic writing, followed by peer writing groups. Peer writing groups have been widely reported to function positively to improve both the process and the product of writing. Research on writing groups have advocated that writers in these groups work in a supported emotional space and thus become more confident and develop a sense of belonging to a scholarly community (Aitchison & Guerin, 2014). Additionally, writing groups are considered social practice pedagogies that have "specific characteristics that match the requirements of advanced research scholarship and writing" (Aitchison & Guerin, 2014, p.7).

Overview of project

This project involved four phases:

1. A comprehensive literature search was undertaken to explore both models of structured writing programmes currently offered successfully in research intensive universities and models of doctoral writing support. We also identified patterns on learning advice sought by postgraduates at the SLC to guide us on programme development.

2. A structured doctoral writing programme was developed in consultation (through surveys) with graduate writers, research supervisors and learning advisors from the SLC. Feedback was also sought from colleagues from HEDC and colleagues in the International Doctoral Education Research Network. A pilot doctoral writing programme was offered to 20 PhD students (who had been confirmed in their candidature) and involved sessions of 3 hours per week for ten weeks. The writing programme was framed as a "discursive space to support research students to learn scholarly genres" (Kamler & Thomson, 2014 p. 168). The programme involved three stages: facilitation of content by staff, practical skills training and finally, peer writing pedagogies to enable the peer writers to facilitate peer writing groups. Members of the research team and colleagues with special expertise were invited to contribute to the programme. As well as teaching sessions, a series of resources were also developed to support academic writing.

3. Postgraduate participants were then encouraged to establish peer writing groups in their departments. Moreover, volunteers were also sought to assist in the facilitation of sessions in the next iteration of the doctoral writing programme. Three peer writing groups were established in the departments of Zoology, Media, Film and Communications Department, and HEDC. Twelve postgraduates also assisted in facilitating sessions in the 2016 generic academic writing programme.

4. Feedback was sought from postgraduates on both the value of the doctoral writing programme, and the PhD peer writing group initiatives.

Key findings

In relation to the doctoral writing programme, the key findings were:

- The need for centralised support to develop the necessary skill set for leaders of peer writing groups.

- The value in using a range of experts to help facilitate sessions in the generic academic writing programme. Not only did postgraduates benefit from exposure to a range of experts, but this model also means the programme is more sustainable, since many staff contributed. What is needed though is support for a central person to have oversight of the programme and coordinate contributions.

- The value to academics teaching on future iterations of the programme of having postgraduate support to help facilitate sessions.

In relation to the peer writing groups, the key findings were:

- The fact that participants of the programme indicated that they learned a wide range of skills through the writing groups as they had a mutual obligation and commitment to read and critique drafts from their peers. During the process, they became aware of writing for an audience, the importance of an argument in a thesis, being critical and also being supportive by providing developmental feedback to peers. The dialogic exchanges between the peer leaders and participants allowed for co-construction of knowledge in a supportive peer lead environment. Participants reported that the peer relations formed during the programme enabled them to address issues of knowledge, textual practice and also identity.

- Participants who were mentored valued the opportunity to engage with experts other than their own supervisors. The peer writers learnt from experts and they practiced what they have learnt by facilitating prior, during and after the sessions – they developed confidence and expertise by engaging with the other postgraduates and the experts. Prior to group discussions, a considerable amount of work was already done and this allowed for them to "learn by teaching"

This study indicates that there was a definite value in the project and the University should consider ongoing support. Doctoral writing is viewed broadly and includes generic practices such as speaking, reading, critiquing and actual writing in a socially situated context. While generic skills of writing (e.g., structuring a thesis, argumentative strategies, academic phrases) may be useful to a certain extent, developing writing in the discipline is essential. This means the combination of a centralised doctoral writing programme complemented by peer writing groups in departments, is a useful model to support.

Key outputs and outcomes

The outputs and outcomes of this project include:

- **Positive learning outcomes** by participants in the project. Participants reported that:
  "I am more productive now, I know what the components of the thesis are, I know how to communicate a complex idea with other writers in a simple manner, writing is a thinking process, I need to write for an audience, I learn by providing feedback. I did not know about linguistic bundles and linguistic moves which are essential for thesis writing".
  Others said that their supervisors noticed improvements in their drafts and that the group bonding boosted their confidence.

- A **journal article** highlighting the mentoring experiences of the peers is currently in preparation for the *Journal of English for Academic Purposes*.

- The peer writers will facilitate **voluntary drop-in doctoral writing sessions** for other postgraduate students at the SLC from June 2016. Academic Staff from SLC will be available to mentor the peer writers.

- **Three peer writing groups** (in HEDC, Zoology and Media, Film and Communications Department) have been formed and are facilitated by participants of this programme. Peer writers are actively taking the lead to form more writing groups across campus.

- **Teaching resources** have been prepared to be trialled and refined by peer facilitators. These will be made available for writing groups and departments.

Discussion and implications

This project was undertaken to consider alternative pedagogies to support graduate writing. The main reason why this project was undertaken was because little or no formal support is provided to both graduate students and supervisors on doctoral writing. Additionally, international research suggests that many supervisors are uncertain about dealing with writing complexities and thus provide feedback on writing that may not be developmental. Writing development is also often separated from supervision and research learning pedagogies. "Fixing" of writing problems are predominantly relegated to learning support units. Besides the issues with writing, there is also the tighter time frame for completions, which is associated with the duration of the scholarship-, this puts pressure not only on the candidates but also on their supervisors.

Given these issues, this study investigated how a centralised academic writing programme complemented by peer-led writing groups could provide support to postgraduates. The findings indicate that peer-led groups benefitted not only the participants of the programme but also the peer facilitators by providing them the opportunity to learn to become competent researchers and academic writers. Supervisors benefit from reading drafts that have been critiqued by other writers and thus could focus on the "textwork and identitywork" (Kamler & Thomson, 2014, p.19), which are essential for scholarly writing.

The recent Australian Council of Learned Academics (ACOLA) report in Australia is going to change the research training system and aims to ensure Australia's postgraduate programme remains among the best in the world. Part of the initiative involves improving the training system including skills development which incorporates academic writing skills. Similarly, the UK

Quality Assurance Agency has noted that "... research students now experience and expect structured research training as part of their programme: (QAA 2012:3). Given that one of the most important tools for academic success is the ability to write and publish, Otago needs to consider helping students develop a healthy writing habit by providing the right support. In order for Otago to remain competitive, attractive and to continue producing graduates who are internationally competitive with the right skills, Otago should consider institutionalising graduate writing support.

We recommend that

1. An independent language specialist (a Teaching Fellow or Professional Practice Fellow) is employed specifically to facilitate learning through and of graduate writing. Staff from HEDC can support the specialist. The specialist can facilitate campus-wide peer writing groups and thesis writing circles. The value of peer writing groups is clearly evident from the present research and international research.
2. Discipline-specific graduate writing courses, similar to the one currently offered by Associate Professor Karen Nairn, be developed and offered via summer school or as credit bearing courses through HEDC and/or the Education Faculty.

Finally, it is important to note that writing groups alone cannot replace the scholarship that is co-constructed during supervision sessions, but they have the potential to support the development of doctoral writing, as well as providing strong social support to candidates – a necessary ingredient in an often isolating study experience.

References

Aitchison, C and Guerin, C (2014). Writing groups for doctoral education and beyond. Routledge, London.

Daskova, J., Mirosa, R., Murchaver, T. (2008). Postgraduate Researh Candidates: Otago supervisors' perspective on quality candidates and shortcomings affecting progress. Unpublished brochure.

Goodson, P. (2013). Becoming an academic writer. Sage Publications, California.

Kamler, B & Thomson, P. (2014). Helping doctoral students write. Pedagogies for supervision. New York: Routledge.

McAlphine, L and Amundsen, C. (2011). Doctoral Education: Research-Based Strategies for Doctoral Students, Supervisors and Administrators, Dordrecht: Springer.

McGagh, J, Marsh, H, Western,M, Thomas, P, Hastings, A, Mihailova, M, Wenham, M. (2016). *Review of Australia's Research Training System*. Report for the Australian Council of Learned Academics, www.acola.org.au.

Pare, A. (2011). Speaking of writing: supervisory feedback and the dissertation. In L. McApphine and C. Amunsden (eds), Doctoral Education: Research –based strategies for doctoral students, supervisors and administrators. Dordrecht: Springer

Woodward-Kron, R. (2007). Negotiating meanings and scaffolding learning; writing support for non-English speaking background postgraduate students. Higher Education Research & Development, 26:3, 253-268.

Summary of spending

1. ARF/O4 FTE 0.360	$19420.00
2. ACC	101.00
2. Books	200.00
	19 721.00

A copy of the final statement from the Activity Centre is attached.

Signature:

VIJAY KUMAR MALLAN
Principal Investigator

30 April 2016

Monitoring the social and environmental responsibility of Otago students

Developing a research instrument that draws on the Revised New Ecological Paradigm Scale with other validated instruments that measures students' ethical reasoning skills and moral intentions, so as to validate and instrument that departments may use to evaluate the extent to which their students acquire aspects of social and environmental responsibility and incorporate into future longitudinal models of change to answer the question "How does the social and environmental responsibility of our students change as they experience higher education with us?"

Project Leader: Damien Mather (Marketing) Email: **damien.mather@otago.ac.nz**

Participating staff members: Professor Kerry Shephard, Ms Lynley Deaker, John Harraway, Dr Sheila Skeaff, Dr Brent Lovelock, Dr Liz Slooten, Dr Mick Strack, Dr Miranda Mirosa, Tim Jowett, Dr. Leah Watkins, Dr Hilary Phipps

Introduction

The University's Community-engaged Learning and Teaching Special Interest Group, with particular interests in researching the impact of community-engagement on the social responsibility of our students, and staff. It is widely recognised that community-engagement has significant impacts on student learning . Members of the Commerce Division have significant interests in the social responsibility and ethical practices of their students and graduates, particularly in business situations. The University's Education for Sustainability Research Group has longstanding interests in evaluating the attainment of sustainability attributes by students and the use of research instruments and statistical approaches to model how these attributes change as students experience higher education with us. The university's graduate attributes include: "Ethics: knowledge of ethics and ethical standards and an ability to apply these with a sense of responsibility within the workplace and community" and "Environmental Literacy: basic understanding of the principles that govern natural systems, the effects of human activity on these systems, and the cultures and economies that interact with those systems". Graduate profiles in some parts of the University emphasise these qualities more than others. All of our Business School programmes, including those accredited by the AACSB, anticipate that an Otago education will graduate socially and environmentally responsible business people. Otago education aspires to a great Otago profile, but we find it difficult to make judgments on the extent to which our graduates apply their knowledge of ethics and ethical standards with a sense of responsibility within the workplace and the community.

Thus we are motivated to develop and validate, using linkage strength to relevant behavioural outcomes, a refined set of question items to measure ethical reasoning, moral foundations and environmental paradigm.

Method

Thus we researched, refined and further developed a student questionnaire based on 3 scholarly sets of instrumental questions developed from 3 main literature sources for (1) Moral Foundations (Graham et al., 2011), (2) the second version of the Defining Issues Test (DIT2) for Ethical reasoning (Rest, Narvaez, Thoma, & Bebeau, 1999), (3) The New Environmental Paradigm (NEP) (Dunlap, Van

Liere, Mertig, & Jones, 2000) and a recently published set of eco-social behaviour frequency questions developed by some of the participating research team (Watkins, Aitken, & Mather, 2015) that measured eco-social consumption and linked strongly with Moral foundations (Graham et al., 2011) traits.

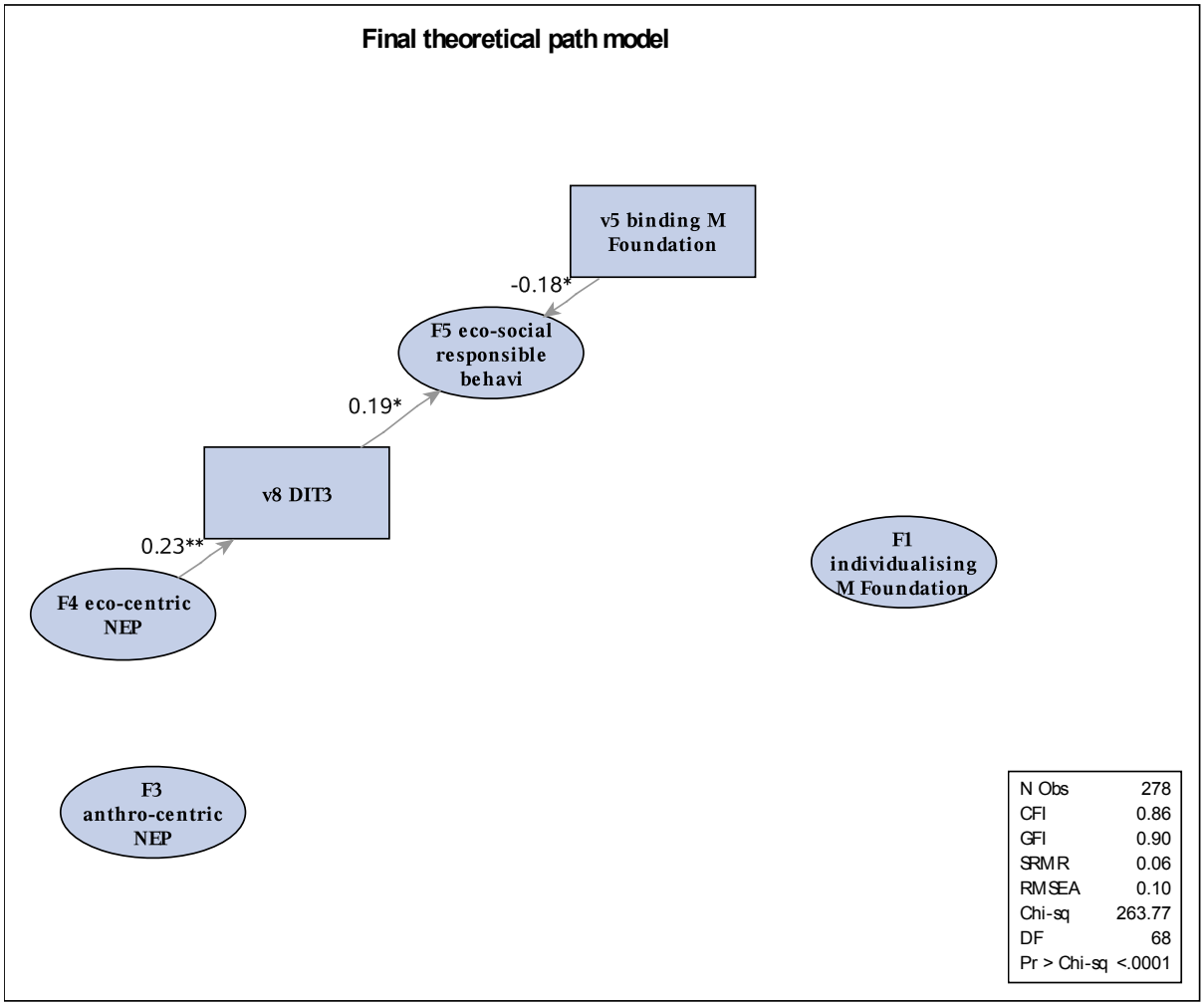
These scales were refined in several important ways over several development rounds prior to inclusion in the final questionnaire as participating team members critiqued, challenged, augmented and refined the items and their associated question framing so as to enhance the relevance to the underlying student traits they were intended to measure and to improve relevance, clarity and ease of response by the participating students.

Specifically, the eco-social responsible consumption items (Watkins et al., 2015) were enriched by the addition of eco-social responsible non-consumption items, such as frequency of volunteering for socially worthy causes, and the fundamental question framework for the DIT2 (Rest et al., 1999) was re-designed to avoid scenario relevance, cognitive load and cognitive dissonance bias problems as perceived by the research team. DIT2 (and its predecessor, DIT1) instruments were designed around participants rating and ranking 6 or 7 alternative response behaviours to ethical problem scenarios. Our new question framework for the DIT, which we now refer to as DIT3, was developed around a Best-worst scaling approach (Finn & Louviere, 1992; Levin et al., 1986) using the same 6 types alternative response behaviours, breaking the original difficult ranking task into a series of smaller, easier and more reliable subtasks via a balanced incomplete block design, thus eliminating significant cognitive load and dissonance bias, and framing the ethical problem scenario so as to be much more relevant to a typical Otago student.

After several pre-tests and minor refinements, the survey was delivered to 8 different classes across the Dunedin campus, including classes in food science, human nutrition, human development, marketing and tourism. See Appendices 1 and 2 for more details on the question items used. F1 – F5 refer to moral foundation traits (F1 and F2), New Environmental Paradigm traits (F3 and F4) and Eco-social responsible behaviour construct (F5) respectively. All are measured by multiple items, as documented in Appendix 1. A single DIT3 score was derived from the Pearsons correlation of each individual student's 1-6 rankings of the 6 possible DIT2 reasonings obtained from the responses to the best-worst scaling design in Appendix 2 to the ideal ranking corresponding to the highest ethical reasoning ability score, of the 6 reasonings as originally published . 281 questionnaires were returned.

The instruments were refined and validated using a 2-step structural equation model refinement framework as recommended by Anderson and Gerbing (Anderson & Gerbing, 1988). 17 of the original items listed in the table in Appendix 1 were sequentially removed from the fully correlated measurement model during the measurement model refinement step (step 1 in the recommended 2-step process) owing to either a lack of item discriminant ability or strength of original trait measurement, leaving 14 items including the manifest (single trait measurement) DIT3 score. The two-way correlation relationships between traits and DIT3 in the Measurement Model were then modified to directed causal paths as informed by the relevant literature the so as to form the initial Theoretical Model. The second step of the 2-step process, refining the Theoretical Model, was performed. A further 9 sequential modifications to measurement items or structural paths was then required to produce a final theoretical model, below:

Results:



Standardised causal path loading shown are significant at the 95% confidence level. An overall model fit statistic GFI of 0.90 is considered indicative of an acceptable final Theoretical Model (Anderson & Gerbing, 1988)

Note the binding moral foundation trait was finally measured by only one (manifest) item (V5 in the table in Appendix 1).

Thus we find that our new DIT3, evolved from the existing DIT2 demonstrates a significant direct predictive validity on our refined measure of eco-social responsible student behaviour. Recall this measure is based on 4 tasks, where each task comprises selecting two, the best and the worst, alternative ethical reasoning out of 3 possible choices, and then deriving an individual DIT3 score via correlation with an ideal ranking.

Furthermore, we find that a refined subset of the eco-centric component trait of the NEP has an indirect significant positive, predictive relationship with our refined eco-social behaviour construct.

Less usefully, we find a significant negative predictive relationship between the single manifest item from the binding moral foundation scale and our refined eco-social responsible behaviour construct.

Conclusions:

This gives us clear support for using our newly evolved DIT3 as an instrument for measuring and monitoring Otago students' ethical reasoning and moral foundation development.

We also have the flexibility of choosing to continue to employ the NEP scale, or our refined subset, for the same purpose.

Future directions:

The team anticipates several peer-reviewed journal articles arising from this work, with one focussed on the newly evolved and validated DIT3 construct method, and at least one other on measuring student ethical reasoning ability. We expect to deploy one or both of the above validated constructs in future longitudinal studies on student ethical development.

For more information or queries please contact the author: damien.mather@otago.ac.nz

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin, 103*(3), 411.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. *Journal of Social Issues, 56*(3), 425-442.

Finn, A., & Louviere, J. J. (1992). Determining the appropriate response to evidence of public concern: the case of food safety. *Journal of Public Policy & Marketing*, 12-25.

Graham, J., Nosek, B., Haidt, J., Iyer, R., Koleva, S., & Ditto, P. (2011). Mapping the moral domain. *Journal of Personality and Social Psychology, 101*(2), 19. doi: 10.1037/a0021847

Levin, I. P., Johnson, R. D., Deldin, P. J., Carstens, L. M., Cressey, L. J., & Davis, C. R. (1986). Framing effects in decisions with completely and incompletely described alternatives. *Organizational Behavior and Human Decision Processes, 38*(1), 48-64. doi: http://dx.doi.org/10.1016/0749-5978(86)90025-7

Rest, J. R., Narvaez, D., Thoma, S. J., & Bebeau, M. J. (1999). DIT2: Devising and testing a revised instrument of moral judgment. *Journal of Educational Psychology, 91*(4), 644.

Watkins, L., Aitken, R., & Mather, D. (2015). Conscientious consumers: a relationship between moral foundations, political orientation and sustainable consumption. *Journal of Cleaner Production*. doi: http://dx.doi.org/10.1016/j.jclepro.2015.06.009

Appendix 1 *List of measurement items, sources, derivation and role in initial measurement model*

Role	NAME	LABEL
F1 individualising moral foundation	A1	a1 V1 Whether or not someone suffered emotionally
F1 individualising moral foundation	A2	a2 V2 Whether or not some people were treated differently than others
F1 individualising moral foundation	A3	a3 V3 Whether or not someone cared for someone weak or vulnerable
F1 individualising moral foundation	A4	a4 V4 Whether or not someone was denied his or her rights
F2 binding moral foundation	B1	b1 V5 People should be loyal to their family members, even when they have done something wrong
F2 binding moral foundation	B2	b2 V6 Men and women each have different roles to play in society
F2 binding moral foundation	B3	b3 V7 I would call some acts wrong on the grounds that they are unnatural
F4 New Environmental Paradigm eco-orientation	NEP_1	nep1 V9 We are approaching the limit of the number of people the earth can support
F4 New Environmental Paradigm eco-orientation	NEP_11	nep_11 V19 The earth is like a spaceship with very limited room and resources
F4 New Environmental Paradigm eco-orientation	NEP_13	nep_13 V21 The balance of nature is very delicate and easily upset
F4 New Environmental Paradigm eco-orientation	NEP_15	nep_15 V23 If things continue on their present course we will soon experience a major ecological catastrophe
F4 New Environmental Paradigm eco-orientation	NEP_3	nep_3 V11 When humans interfere with nature it often produces disastrous consequences
F4 New Environmental Paradigm eco-orientation	NEP_5	nep_5 V13 Humans are severely abusing the environment
F4 New Environmental Paradigm eco-orientation	NEP_7	nep_7 V15 Plants and animals have as much right as humans to exist
F4 New Environmental Paradigm eco-orientation	NEP_9	nep_9 V17 Despite their special abilities humans are still subject to the laws of nature
F3 New Environmental Paradigm human-oriented	NEP_10	nep_10 V18 The so called ecological crisis facing humankind has been greatly exaggerated
F3 New Environmental Paradigm human-oriented	NEP_12	nep_12 V20 Humans were meant to rule over the rest of nature
F3 New Environmental Paradigm human-oriented	NEP_14	nep_14 V22 Humans will eventually learn enough about how nature works to be able to control it
F3 New Environmental Paradigm human-oriented	NEP_2	nep_2 V10 Humans have the right to modify the natural environment to suit their needs
F3 New Environmental Paradigm human-oriented	NEP_4	nep_4 V12 Human ingenuity will ensure that we do NOT make the earth unliveable
F3 New Environmental Paradigm human-oriented	NEP_6	nep_6 V14 The earth has plenty of natural resources if we just learn how to develop them
F3 New Environmental Paradigm human-oriented	NEP_8	nep_8 V16 The balance of nature is strong enough to cope with the impacts of modern industrial nations
F5 eco-socially responsible behaviour	C1	c1 V24 Contributed money or time to charity
F5 eco-socially responsible behaviour	C2	c2 V25 Attended a debate or lecture on a current political or social issue

Role	NAME	LABEL
F5 eco-socially responsible behaviour	C3	c3 V26 Purchased from organisations because of their social responsibility and/or environmental commitment
F5 eco-socially responsible behaviour	C4	c4 V27 Discontinued purchase of water in plastic bottles
F5 eco-socially responsible behaviour	C5	c5 V28 Taken fewer aeroplane flights
F5 eco-socially responsible behaviour	C6	c6 V29 Welcomed someone of a different ethnic group to yourself into your home

F1 moral foundation items framed as 'When you decide something is right or wrong, to what extent is this relevant to your thinking?'

F2 moral foundation, F3 and F4 NEP items framed as 'How much do you agree with this statement?'

F5 items framed as 'How often have you made this behavioural change for reasons of environmental and/or social responsibility?'

Appendix 2: Balanced incomplete block design for DIT3 instrument used in survey.

Each task comprises 3 of the possible 6 alternative ethical reasonings, and students choose 2, the best and the worst reasoning, respectively, from the 3. Taken over the whole design, the responses facilitate a complete unique ranking of the 6 if there are no ties.

task	alt	Alternative choices for best and worst ethical reason within each best/worst task
1	1	People have to make social inequalities known if society is to change for the better
1	2	Lucy and her flatmates could treat themselves to some chocolate this week if they don't have to buy food
1	3	It is Lucy's duty to report her friend and not eat the food herself
2	1	Lucy wouldn't be able to tell her mum that she had taken food from the Food-bank as she knows that she wouldn't approve
2	2	People have to make social inequalities known if society is to change for the better
2	3	Lucy may go to court if she is caught deceiving the Food-bank
3	1	It is Lucy's duty to report her friend and not eat the food herself
3	2	Lucy may go to court if she is caught deceiving the Food-bank
3	3	It is the right of all citizens to have adequate food, water, clean air, clothing and housing
4	1	It is the right of all citizens to have adequate food, water, clean air, clothing and housing
4	2	Lucy wouldn't be able to tell her mum that she had taken food from the Food-bank as she knows that she wouldn't approve
4	3	Lucy and her flatmates could treat themselves to some chocolate this week if they don't have to buy food

CALT Grant Final Report

Project Title**:** Mastery Learning in Introductory Programming

Project Team**:** A/Prof Brendan McCane, Mr Nick Meek, Dr Claudia Ott

Project Snapshot

In 2014 we introduced a mastery learning model in our introductory programming paper, COMP150: Practical Programming. The aim of this project was to fully evaluate the effects of the mastery learning model, to introduce and evaluate the introduction of an explicit self-paced learning model, and to develop software to allow better tracking and feedback of student performance on mastery tests. We have:

- demonstrated that the mastery learning model has had a significant impact on student learning especially for the weaker students;
- discovered that students appreciate some indication of appropriate speed of progress and that fully self-paced learning is not ideal. They need and appreciate some extrinsic motivation to do the work;
- developed appropriate software for tracking student performance on mastery tests;
- developed appropriate content and software for delivering problem based exercises with solution hints that are exposed to students on demand;
- submitted a paper to the ACM International Computing Education Research (ICER) Conference. One of the top conferences in the field and fully peer-reviewed.

Background

Introductory programming courses are infamous for high failure rates, often paired with a bimodal distribution of grades (many A's and many failures). Prof Anthony Robins, from our department, has proposed a promising theory (Learning Edge Momentum) for why introductory programming courses exhibit this bimodal distribution; because programming concepts build on top of each other, failing to understand one concept will hamper subsequent learning. He also proposed mastery learning as a potential solution to this problem.

Our introductory programming paper, COMP150, focuses on practical programming skills. Students are required to attend labs and submit their work at the end of each lab. Prior to 2014, only informal feedback was given regarding work quality. The structure of the paper encouraged students to attempt later labs even if they had not mastered earlier ones. In 2014 a mastery learning model was introduced. In this model, students could not progress to subsequent tests (or labs) until the prior test was passed. There were 7 mastery tests and students could resit (randomised) tests any number of times.

Student evaluations showed that students valued the mastery test model because they knew "where they are" in the course and on what topics improvement was needed. However the assessment of the impact on students' actual learning outcomes is rather difficult as comparison with former years is not appropriate due to the change in assessment. Further, despite our attempt to emphasise self-paced learning, some students still felt they were getting behind.

We proposed to more accurately measure the effect of the mastery model and further develop the model to address student perception of "getting behind". In particular:

- To investigate the impact of the 2014 changes by tracking students through follow-on programming papers, COMP160 and COSC241.
- To evaluate the introduction of an explicit self-paced learning model in 2015.
- To develop software to allow better tracking, and subsequently better feedback, of student performance on mastery tests.

The self-paced learning model structure involved: paper content delivered via screen-casts and course book; labs were problem based (no change); 7 mastery tests as in 2014; lectures were informal and focused on problem areas identified from developed software, student feedback, and demonstrator feedback.

Approach

COMP160 is our compulsory first year programming paper offered in semester 2. It has not changed significantly in several years. COMP150 is an optional first-semester programming paper. Therefore, the student cohort in COMP160 consists of two groups: those who have done COMP150 and those who haven't. This allowed us to evaluate the effect of introducing the mastery learning model by comparing the relative performance of the two groups of students in COMP160 both before and after the introduction of mastery learning in COMP150.

We also developed software (and content) to deliver practice questions. The web-based software produces hints for solving the problem on demand (if the student is stuck), and the whole solution if they cannot solve it at all.

Key Findings and Outputs

1. Mastery learning has a positive effect on student performance in subsequent courses, and hence understanding and skill retention. This effect is much stronger in weaker students.
2. Most students believe the mastery learning model is a positive influence on their learning, although the model is not universally loved.
3. There is a tension between self-paced learning and the requirement to complete a course in a fixed amount of time (one semester), and a fixed lecture schedule. Self-paced learning is inconsistent with content delivery in lectures, but organizing lectures based on the progress of most students is viewed as being disorganized (no fixed schedule). Students still want some extrinsic motivation to get their work done in a timely fashion.
4. There appears to be some tension between course evaluation and student learning. Course evaluation of COMP150 under the mastery model has been less positive than in previous years. Yet we have shown that students have learned more!
5. One research article has been submitted to a good fully peer-reviewed conference on education in computer science (ICER 2016).

Discussion and Implications

For skills-based course, mastery learning produces better learning outcomes for students, especially for weaker students. However, the self-paced nature of mastery learning sits uncomfortably within a rigid university semester schedule. Nevertheless, we believe mastery learning is an appropriate learning mode for skills-based knowledge that can work in a university context. It is also apparent that student evaluations do not necessarily correlate with student learning in a course and this has implications for how we evaluate our teaching.

Other Outputs

1. Practice questions with hints and the software to deliver them. All available at: http://www.cs.otago.ac.nz/comp150/resources.php
2. A paper submitted to ICER2016 (attached).

Attachments

1. Summary of spending
2. Submitted research paper.

Mastery Learning in Introductory Programming

Author Details
Suppressed.

ABSTRACT

In our first year computer science program we offer an optional first semester Python course to prepare our students for a compulsory second semester Java course. In 2014, we adopted mastery learning as the primary teaching mode for the Python course. We show how the introduction of a mastery learning model in the first semester has had a positive impact on student learning especially for weaker students. This is shown by the effect the mastery learning model has on the results in the second semester course. The structure of our first year allows us to ascribe the differences to the mastery learning model, rather than other confounding factors. We also report on the perception of students to the mastery learning model.

Categories and Subject Descriptors

K.3.2 [**Computer and Information Science Education**]: Computer Science Education

Keywords

Introductory Programming, CS1, Mastery Learning, Python

1. INTRODUCTION

In order to more gently introduce programming for beginner programmers, an elective first semester Python course was introduced in 2009 at the University of *blinded*. The course was structured in a traditional format consisting of two weekly lectures and two accompanying laboratory sessions covering the concepts presented in the lecture. The introduction of the Python course resulted in an interesting structure at *blinded* with two introductory programming courses: a Python elective in semester one (COMP-Py), and a compulsory (for CS majors) Java course in semester two (COMP-Java). This structure results in two cohorts in the Java course: those who have taken Python in semester one (group PJ), and those who haven't (group J). It is important to emphasize that the Java course is intended as an introductory course (CS1) and not a follow-on course (CS2). The essential content of the Python course has not changed significantly since 2011, but in 2014 we changed to a mastery learning teaching method. This change was prompted by two facts: from 2011-2013, students in group PJ were conferred no statistically significant advantage in the Java course than students in group J; and the theory of Learning Edge Momentum [11].

Robins [11] published the theory of the Learning Edge Momentum, which explains the typically observed bi-modal grade distribution in introductory programming courses. It identifies the integrative nature of programming concepts that leads to a spiralling effect. Once students fall behind it gets more and more difficult for them to catch up with the course material. However, if basic concepts are mastered students will find it increasingly easier to connect new, higher-level concepts to those solid edges of knowledge. Even though not suggested by Robins, the idea of mastery learning addresses exactly those problems by structuring a course into units of increasing difficulty where students are allowed to proceed to the next unit only if they master the current one. Typically the tests, which need to be passed to demonstrate mastery, can be repeated without penalty. We introduced this structure because we hypothesize that:

HYPOTHESIS 1. *Mastery learning leads to improved knowledge, retention and mastery of important programming skills.*

and that:

HYPOTHESIS 2. *The mastery learning model is more advantageous to lower achieving students than higher achieving students.*

One of the most comprehensive meta-analyses regarding the impact of mastery learning interventions was carried out by Kulik et al. [7] who investigated 108 controlled evaluations. They distinguish two types of mastery learning: (1) Learning for Mastery (MFL) introduced by Benjamin S. Bloom in 1968 and (2) Fred S. Keller's Personalized System of Instruction (PSI) which was published in the same year. MFL acknowledges that students learn at different paces by planning for correctives for those students unable to master the unit tests the first time. Nevertheless, MFL is still reliant on the teacher's presence and a uniform teacher-controlled pace teaching groups of students. In contrast PSI courses are delivered mainly through written material (this translates nowadays to all kinds of digital media distantly available) facilitating individual, self-paced study. When failing a mastery test students are required to review the material and to take further tests until they can demonstrate

ICER '16 Melbourne, Australia
ACM ISBN 978-1-4503-2138-9.
DOI: 10.1145/1235

the level of mastery required [7]. Where in PSI the number of test repetitions is theoretically unlimited, MFL recommends only one repeated formative assessment covering the same concepts and skills before a student can move to the next unit. However rather than proposing a rigid model, Bloom emphasizes flexibility and calls on teachers' creativity to meet students' individual needs [5].

In Kulik et al.'s [7] meta-review 72 of the 108 studies used PSI at college level. The remaining 36 studies used MFL at college as well as high school and primary school level. From the 103 studies reporting aspects of examination performance, only 7 reported negative results. For 67 of the remaining 97 studies the positive results were considered statistically significant. The average effect size of all 103 studies was 0.52, a medium effect size given Hattie's [6] definitions for interpreting effect size estimates in educational settings by considering an effect size as small if d=0.20, as medium if d=0.40 and as large if d=0.60. Kulik et al. [7, p.292] conclude:

> "Even though an improvement of 0.5 standard deviations may fall far below expectations, it is nonetheless a relatively strong one for an educational effect. ... Few educational treatments of any sort were consistently associated with achievement effects as large as those produced by mastery teaching."

Besides other result categories (e.g. instructional time or course completion) the authors also report on effects on students' attitudes toward the instructional method and the subject. In general students' attitudes in the mastery class were more positive when compared with the control group. Sixteen of the 18 studies assessing students' attitudes towards the instructional method reported improved ratings with an overall, average effect size of 0.63. Students' attitudes toward the subject matter were reported to be more positive for the mastery class in 12 out of 14 studies (average effect size 0.40).

Given the impressive positive effects of mastery learning, it is somewhat surprising that relatively few studies have attempted to apply mastery learning to computer science in general and introductory programming in particular. Furthermore those few studies do not report on performance measurements and focus on students' attitudes solely. LeJeune [8] as well as Macedo Morais et al. [10] report positive student ratings towards the mastery model. In Marcedo Morais et al.'s study, students were especially satisfied with the feedback they got and the tutoring aspect of the mastery learning course but least in favour of the unit mastery aspect. LeJeune [8] reports on the introduction of a mastery learning model coupled with contract grading, where the success criteria for each success level were explicitly defined. Students moved gradually from the minimal assessment requirement to higher success levels in cycles of feedback and corrections towards the achievement level they choose. The authors report [8, p.155]:

> "Students indicated that the clear expectations coupled with their opportunity to choose the grade (and corresponding level of effort to achieve their grade choice) was preferred over traditional grading schemes."

A different approach was taken by Engle and Rollins [3] where mastery learning was combined with expert code reviews in a second year software development course. The motivation for change was based on the authors' realization that students passing the course at the C-level had not mastered the key principles and would often fail in follow-on courses. To address this problem a series of projects of increasing complexity was set out and mastery was defined by 100% achievement per project which students could reach by resubmitting their project work until a set cut-off date. Expert code reviews by the instructor were arranged to identify design problems and provide students with feedback. Instead of grading single projects the final grade was proportional to the number of projects mastered. Completing the first three projects guaranteed students a C-level project grade building up to A-level for all five projects. Even though the students did not progress nearly as far with the projects when compared with the traditional delivery of the course the students' mastery of code design and refactoring as well as the mastery of complex concepts such as concurrency improved [3].

Although slightly different all mastery learning approaches discussed above have the following aspects in common: (1) learning outcomes need to be explicitly defined, (2) repeating tests or refining assignments is likely to have a positive influence on the learning outcome, (3) as success levels accrue students gain a sense of achievement, (4) students can decide on the grade they want and feel more in control of their learning and (5) the uncertainty in outcome and the pressure to pass summative assessments can be removed.

2. COURSE DESCRIPTIONS

2.1 COMP-Py

Similar to the findings of Engle and Rollins [3], we found that students' knowledge and experience gained from the first semester Python course from 2011-2013 (COMP-Py) was not an advantage in the second semester Java course (COMP-Java). In the labs, students were exposed to a wide range of small, programming tasks of increasing complexity, but they were not forced to master those because attendance was sufficient to be allowed to sit the final exam. Two practical tests were set at fixed times (week 6 and 11) with one possibility to repeat *blinded*. Passing the first test was not a prerequisite for taking the second test. Test scores were part of the grading which consisted of 20% practical test results, 20% mid-term examination and 60% final examination. Both examinations were paper-based and composed of a set of multiple choice questions (MCQ).

There are at least two possible reasons for no advantage: Python programming skills are not transferable to Java in general (unlikely); or students were acquiring programming skills at a very superficial level only. We believed the latter reason to be more likely. Hence, in 2014 and 2015 we changed the format of the course to a mastery learning model, where 35% of the final mark could be gained by passing 7 mastery tests which we called progression levels. The changes covered the PSI key features as described in [4]: (1) unit mastery, (2) self-pacing, (3) tutoring, (4) emphasis on written word and (5) lectures for motivational purposes.

In 2014 there were two lectures per week (each 50 minutes) and two lab sessions (each two hours) where students learned at their own pace assisted by tutors. In addition to the self-developed textbook *blinded*, podcasts from the lectures were made available for review. Each week a new programming test became available regarding the concepts taught in the lectures and similar to the accompanying lab tasks. During their lab time students had the opportunity to take the test

which took 20 to 30 minutes in a controlled environment (no textbook or online resources). Students passing the test were allowed to move on to the next test whereas students not passing the test were advised to review the lab tasks by using the podcasts or the textbook and to ask for help if needed. Those students could re-sit the test during one of their next lab sessions as often as they liked until the end of the semester. For each test there were variations available which were randomly assigned to discourage rote learning.

With the change to mastery learning it became obvious that the statically paced lectures were irrelevant for most students and in 2015 lecture content was moved to the podcasts only. Students were advised to prepare and watch the material before approaching the task. One lecture per week was held as a lectorial where students had the opportunity to ask questions and discuss concepts. However attendance was low with approximately 40% attendance on average.

In 2015 there were 248 students officially registered in the course. Another 14 students were initially active but withdrew later from the course and hence did not show up in official records. Of the 248 officially registered students 185 (74%) completed the course successfully. 35 (14%) students failed the course because their final mark was under 50% and another 24 (10%) students decided not to sit the final exam. 5 students were enrolled but appeared to be inactive.

For each week of weeks 2 to 8 of the semester (13 weeks in total) one progression level (PL) became available. Of the 243 active, officially registered students 124 (51%) mastered all 7 progression levels. Difficulty increased with PL 5 requiring the most attempts per success (Figure 1). 211 students attempted PL 5 with an average of 2.9 attempts. 195 students mastered the progression level. About half (93) of the successful students needed 2 or 3 attempts and only 43 (22%) students mastered this level during the first attempt. Another 41 (21%) students attempted the progression level four or five times and the remaining 18 students needed six attempts or more to succeed. Of the 16 students who attempted, but did not succeed on PL 5 only three had more than three attempts and all but one had their last attempt in week 13, the last week of the semester.

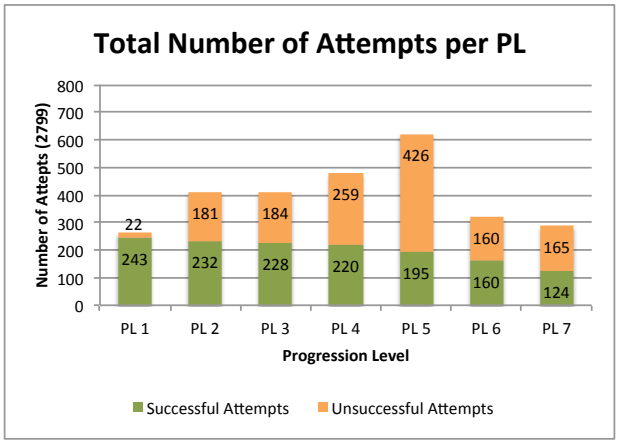


Figure 1: Number of attempts for 243 students in 2015.

The main differences observed between the two offerings of the mastery learning model in 2014 (weekly lectures provided) and 2015 (podcasts provided only) was that students in 2015 were not as active in the first half of the semester. In 2014 62.7% of all 3243 attempts were completed before week 7. In contrast in 2015 only 50.5% of all 2849 attempts were completed before week 7. Where in 2014 the highest weekly number of attempts was recorded by week 5, in 2015 it was the last week accounting for over 10% of all attempts. In comparison in 2014 only 3.8% of all attempts were completed in the last week of the semester. These observations and a lower total number of attempts in 2015 indicate that students were attempting the tests loo late, leaving not enough time to complete as many progression levels compared to the students in 2014. Even though the mean of students' final marks in 2015 (M=60.0, SD=20.80, N=243) was lower than in 2014 (M=63.63, SD=21.78, N=242) this difference was not statistically significant (p=0.06). Regardless we concluded that the missing lectures led to a lack of structure, which we need to compensate for by a clear course outline stating our expectations for sitting the mastery tests in a timely manner.

The change to the mastery learning model had no impact on the completion rate of the course. In 2011 to 2013 88.3% to 93.5% of all students being active initially (attended at least one lab) completed the course by sitting the final exam. In 2014 and 2015 the completion rate was very similar with 88.8% and 90.1%. Success rates as the proportion of students achieving a final mark over 50% of all initially active students were also similar (80.7% in 2011, 82.2% in 2012, 73.4% in 2013) in comparison to 81.0% in 2014 and 75.7% in 2015.

2.2 COMP-Java

COMP-Java is offered in a traditional format of two lectures and two labs a week and based on a standard textbook [9]. There are no prerequisites for this course and students can enter without any prior programming experience. The course has three independent assessment components: (1) mid-semester examination (15% of final grade), (2) final examination (60% of final grade) and (3) the number of lab tasks completed (25% of final grade, 1% for each completed task). Both examinations are paper-based and consist of a short answer part with small programming tasks (approx. 70% of exam score) and a MCQ part (approx. 30% of exam score). Students are allowed to complete the lab task at their own pace in tutor assisted lab sessions or at home. For task submission students need to present their solution to a lab tutor. If the lab tasks are not solved to the specification students are advised on how to improve and can submit their task again. There is no penalty for multiple attempts or late completion. Students are strongly encouraged to solve the tasks in the given order and not to skip tasks because the concepts are interrelated and the complexity increases. Given that each year we encounter cases of students presenting other students' lab task solutions, the final exam must be passed with a minimum of 50% to pass the course.

COMP-Java has been taught in the same way for the last 5 years. Each year approximately two thirds of students are in group PJ and one third in group J. We have not investigated which of the students, if any, have prior experience in programming through means other than COMP-Py.

3. METHODOLOGY

To answer Hypothesis 1, groups PJ and J are compared on all three COMP-Java assessments before and after the intro-

duction of mastery learning. Randomized controlled trials are not practical in a university setting. However, because of our particular first year structure, we are able to compare group PJ with group J in a single year, rather than comparing groups across years. This helps to mitigate (but does not entirely eliminate) demographic changes across years. This is as close to a natural experiment [2] as is likely in this context. The selection variable is the year of study, which is not random, but the size of the class should mitigate other causal factors. We believe we can confidently attribute changes in outcome in COMP-Java to course delivery in COMP-Py and that changes in outcome in COMP-Java are a reasonable proxy for the hypothesis.

Statistical tests are performed in three stages. First, a multivariate ANOVA test is used to test for a difference between group PJ and group J for each year. The dependent variables are mid-semester results (MS), lab completions (Lab), and final examination results (FE). The independent variable is the group label (PJ or J). For those years where there is a difference, we then test if there is a difference in each of the dependent variables using a t-test. For those dependent variables where there is a difference (in the test and exam), we further test whether there are differences in the multiple-choice answers and short-answer questions, again using a t-test. The reason to split the test and exam answers is that short-answer questions typically ask students to generate a program or partial program and these are most like actual programming tasks.

In all cases we use the Benjamini-Hochberg procedure to control the false discovery rate (FDR) of multiple tests [1]. Such a procedure is more powerful than a Bonferroni correction, at the cost of potentially more false discoveries. We set the FDR at 0.05. We also look at effect sizes, and based on Hattie [6], adopt d=0.20 for small, d=0.40 for medium, and d=0.60 for large effect sizes when judging educational outcomes.

To answer Hypothesis 2, first the students are split into an upper achieving group (top 50%) and a lower achieving group (bottom 50%). These groups are then further split into PJ and J groups resulting in four groups (PJU, JU, PJL, JL). The same set of statistical tests are used to compare within the upper or lower groups (PJU versus JU, and PJL versus JL). In this case, only those years for which a significant difference was found in the first set of tests is included.

The cohort used in the analysis of Hypotheses 1 and 2, included students who completed COMP-Java only. Completion was defined as those students who sat the final examination. Students who did not sit the exam were excluded from the analysis. An alternative hypothesis that could explain the results observed is that the mastery learning model might cause weaker students to drop out in COMP-Py and hence act as a stronger filter under mastery learning than previously. This is tested by looking at the dropout rates in COMP-Py and COMP-Java. For these tests, the cohort included all students who were initially active in COMP-Java. Initially active means attended at least one lab session. Dropout students are defined as those that did not sit the final exam. Again the analysis proceeded in stages. First it was tested if there was a difference in completion rates between groups J and PJ for all years. Then further tests were done to see if there was evidence of a change in completion from before the introduction of mastery learning to after in COMP-Java. We also tested if there was a difference in dropout rates in COMP-Py from before and after the change.

To round out the analysis, we include student comments taken from course evaluation surveys for COMP-Py. These surveys were conducted in 2014 and 2015 only, were administered online, and were optional with a participation rate of 42% (107 students) of the class in 2014 and 35% (91 students) in 2015. The evaluations consisted of a questionnaire of 9 Likert-like questions common to both years, and a further 4 Likert-like questions in 2014. Furthermore there were the following open-ended questions to comment on in both years:

- *For me the best aspects of the course were ...*
- *The changes I would most like to see in the course are ...*
- *Any other comments ...*

4. RESULTS

4.1 Hypothesis 1

The results of the statistical tests are shown in Table 1. As can be seen from the table, there is a significant difference only in 2014 and 2015 and subsequent tests are only performed on the results for 2014 and 2015. There is no difference in lab submissions between the two groups and this indicates approximately equal effort for each group. The main difference is on the mid-semester test and in particular on the short-answer section of the test indicating that students in group PJ have better internalized the concepts of programming in Java at the mid-point of the semester. Although there is also some difference in the final exam, it is not strong enough to be considered statistically significant indicating that students in group J catch up somewhat by the end of the semester. The effect size for the short-answer questions is medium in both 2014 and 2015.

4.2 Hypothesis 2

The results for testing Hypothesis 2 are shown in Table 2. As can be seen there is a significant difference between the lower achieving students in 2014 and 2015, but not in the upper achieving students. Again, the main difference is in the short answer section of the mid-semester exam, although there is also a significant difference in the final exam for 2015 but not 2014. Given that there is only one significant result for the final exam, we are not yet confident that result is a true effect. For the short answer section, effect sizes are in the large range (just) indicating that lower achieving students are receiving an educationally significant advantage from the mastery learning model.

4.3 Completion Rates

The results for comparison of completion rates is shown in Table 3. An initial look at the completion rate for COMP-Py indicates that more students are dropping out with the mastery model, but this difference is not statistically significant, and therefore we do not have any evidence that this is the case. We therefore have no evidence that the improved performance in COMP-Java by group PJ is caused by stronger filtering of the group prior to entering COMP-Java. In fact, group PJ exhibits very similar completion

Statistic	2011	2012	2013	2014	2015
J Num	60	58	49	74	98
PJ Num	105	114	123	132	151
J Lab μ	21.6	22.5	22.1	21.8	22.0
J Lab σ	5.0	3.7	4.4	4.8	4.0
PJ Lab μ	22.9	23.4	22.3	22.1	22.5
PJ Lab σ	3.1	2.8	3.7	4.2	3.9
J MS μ	70.70	67.2	70.6	67.6	65.9
J MS σ	19.2	19.4	15.2	21.0	23.1
PJ MS μ	74.3	71.2	70.7	74.5	73.7
PJ MS σ	19.1	15.8	18.6	14.9	18.2
J MS MCQ μ	73.4	69.5	77.6	74.3	71.8
J MS MCQ σ	16.6	17.0	15.1	18.5	20.2
PJ MS MCQ μ	77.0	71.4	77.1	77.8	75.5
PJ MS MCQ σ	15.5	14.7	14.6	15.4	17.1
J MS SA μ	69.5	66.2	67.7	64.7	63.3
J MS SA σ	21.5	21.7	17.5	23.5	25.6
PJ MS SA μ	73.2	71.1	67.9	73.1	73.0
PJ MS SA σ	22.6	18.0	21.9	16.4	20.1
J FE μ	61.8	57.1	65.1	58.4	55.8
J FE σ	21.7	22.4	21.3	22.5	24.5
PJ FE μ	66.7	60.1	64.6	62.6	60.5
PJ FE σ	21.1	19.1	20.5	20.4	20.6
Manova	0.19	0.17	0.97	**0.012**	**0.0069**
t Lab	NA	NA	NA	0.65	0.33
t MS	NA	NA	NA	**0.014**	**0.005**
t FE	NA	NA	NA	0.18	0.12
t MS MCQ	NA	NA	NA	0.17	0.14
t MS SA	NA	NA	NA	**0.0075**	**0.0019**
eff. sz. SA	NA	NA	NA	0.43	0.42

Table 1: Statistical results for Hypothesis 1. First block: summary statistics (number: Num, Mean: μ, standard deviation: σ) for groups J and PJ, for each year and for each assessment item. Second block: multivariate ANOVA test for difference between groups. Third block: t-test for differences in assessment types for 2014 and 2015. Fourth block: t-test for differences in mid-semester test for 2014 and 2015 along with effect size. Significant differences are shown in bold.

Statistic	2014 L	2014 U	2015 L	2015 U
J Num	43	31	54	44
PJ Num	63	69	75	76
J Labs μ	19.8	24.5	20.1	24.4
J Labs σ	5.4	1.1	4.5	1.0
PJ Labs μ	19.8	24.1	20.4	24.6
PJ Labs σ	5.0	1.6	4.5	0.80
J MS μ	53.7	86.9	50.5	84.7
J MS σ	1.6	6.4	18.8	10.7
PJ MS μ	53.7	64.0	84.1	85.8
PJ MS σ	12.6	9.3	16.5	9.7
J MCQ μ	62.8	90.1	59.7	86.7
J MCQ σ	15.0	8.0	18.5	9.7
PJ MCQ μ	68.4	86.2	64.7	86.2
PJ MCQ σ	15.4	9.6	16.1	9.9
J SA μ	49.8	85.4	46.6	83.9
J SA σ	19.3	7.9	21.1	12.1
PJ SA μ	62.1	83.2	60.2	85.6
PJ SA σ	14.8	10.2	18.7	11.9
J FE μ	42.1	81.0	36.8	79.2
J FE σ	13.3	8.5	14.3	9.8
PJ FE μ	44.7	78.9	44.1	76.7
PJ FE σ	13.2	8.8	14.5	10.2
Manova	**0.00089**	0.49	**0.0068**	0.051
t Labs	0.97	NA	0.72	NA
t MS	**0.00078**	NA	**0.00082**	NA
t FE	0.31	NA	**0.0057**	NA
t MCQ	0.06	NA	0.11	NA
t SA	**0.00070**	NA	**0.00025**	NA
eff. sz. SA	0.69	NA	0.64	NA

Table 2: Statistical results for Hypothesis 2. First block: summary statistics (number: Num, Mean: μ, standard deviation: σ) for groups J and PJ, for each of 2014 and 2015, for each assessment item, split into lower achieving and higher achieving students. Second block: multivariate ANOVA test for difference between groups JL and PJL, and JU and PJU respectively. Third block: t-test for differences in assessment types for 2014 and 2015. Fourth block: t-test for differences in mid-semester test for 2014 and 2015 along with effect size. Significant differences are shown in bold.

rates across all years in COMP-Java and we would expect that completion rates would be higher if the mastery model acted as a stronger filter. The only statistically significant difference in completion rates is that group PJ are better completers than group J, but this is a result across all years and not specific to the mastery learning model.

4.4 Students' Perceptions

In both 2014 and 2015 a considerable proportion of students mentioned the mastery test as "the best part of the course" (18% of 71 responses in 2014 and 26% of 65 responses in 2015). The following quotes (punctuation in some cases adjusted) highlight which aspects students liked in particular:

- Self-paced learning style:

  "The way the mastery tests were done, being given multiple attempts and allowing us to work at our own speed."

  "Being able to do the mastery test at my own pace was nice so I was able to get them done and out of the way pretty quickly."

- Being challenged and the sense of achievement:

  "Being challenged i.e. felt good completing the mastery tests."

  "I was able to go into the mastery test not stressed out about passing or not so I could relax and understand fully what I was doing. The mastery tests also allowed me challenge myself with more difficult questions so I could understand the new concepts more."

- Effect of staying focused:

  "Mastery tests kept me engaged and focused from the start."

  "I like that the mastery tests force you to know your stuff beforehand - You are promoting good study habits."

Statistic	2011	2012	2013	2014	2015
COMP-Py compls	88	88	93	89	90
COMP-Java compls	90	88	83	87	84
J compls	86	87	71	80	73
PJ compls	93	89	90	91	92

Statistic	Years	p value
J vs PJ	2011-2015	**0.026**
J vs PJ	2011-2013	0.21
J vs PJ	2014-2015	0.17
COMP-Py	2011-2013 vs 2014-2015	0.50

Table 3: Data and statistical results for completion rates (as a percentage). The top table shows completion rates for the different courses and for groups J and PJ. The bottom table shows t-test results for different comparisons.

- Feedback aspect:

  "The mastery tests, so I know where I am and what I have to learn."

  "I like the idea of the 7 mastery tests throughout the course, which help test you on the course material."

A similar percentage (20%) commented negatively on the mastery tests. Part of the criticism regarded the lack of feedback when tests were failed and insufficient support in general:

"I want to know what I did wrong on the mastery tests when I don't pass. I really struggle trying to pass those tests when I don't know what I did wrong."

"We NEED more practise questions and other study material that doesn't come from the lab book."

"More tutorials available for the people who are struggling with the course."

"Also links to some good self-help resources would be nice. Some times the book and screen casts still don't cut it when your stuck trying to do some lab work outside of your lab times."

However the main criticism in 2014 was connected to students' perception of falling behind given that there was a fixed pace for the lectures:

"The lectures weren't very helpful for me because the purpose of this course is to learn your current material before you progress. At one point the lectures were about three weeks ahead of where I was at so although not completely pointless, there wasn't much to gain from attending the lectures, as it was material I wasn't familiar with."

"The mastery tests are a great way to ensure that the necessary knowledge and skills are embedded first but I found it very difficult to keep up with the lectures that followed when I was working so hard to pass a mastery test."

"Although I have enjoyed trying to engage with the content in this paper, I have fallen victim to the spiral of doom with the mastery tests. ... As mentioned in a previous question, at this point it is impossible to connect to the lecture material because you are so far behind in the understanding of the earlier content, there is no point attending lectures as you cannot learn anything because you have no prior knowledge upon which to build on."

Taking this critique into account we reduced the two weekly lectures in 2015 to one lectorial. The lectorial consisted of either: students requesting in advance a particular topic to be covered; or the lecturer deciding on a topic based on the progress of a significant portion of the class. In terms of students requesting a particular topic, only two or three students ever made a request, and one student requested topics several times. However these sessions were not perceived as particularly useful and the change left students under the impression that there was a lack of organization or effort:

"The lecture was pretty much useless. There was no organization to them, just answering queries if anyone had any. How do you know what to query when you don't understand the material? The fact that the Monday lecture was cancelled right from the start sort of shows you how much effort the lecturer wanted to put into this course."

"The lectures were a bit unstructured and he [the lecturer] seemed to go week by week of where he thought we were up to. I know it is a self-paced course but there should be objectives and tasks we should complete so we know where we have to be up to in the course."

This lack of structure was a re-occurring topic in students' suggestions on how to improve the course when commenting on the topic "The changes I would most like to see in the course":

"More emphasis or feed back on where you should be up to on a regular basis."

"More structure around which lab we should be up to or working on."

"A clearer guideline of where I should be up to each week."

"More help provided and more idea of where in the book you should be at certain times."

These observations are backed up by students' responses to the questionnaire. Regarding the usefulness of the lectures there was a significant drop from 56% finding the lectures very useful or useful in 2014 to 23% in 2015. The statement "The course seemed very well organized / very disorganized" was rated positively by 78% of the students in 2015 with a drop to 59% in 2015. It seems that neither of these lecture structures is ideal. If there is a well structured lecture schedule then students get the feeling of falling behind. If the lectures are less structured and more responsive, then students believe the course is disorganized.

Interestingly and also consistent with our observations of students' comments, the perception of being behind was more pronounced in 2014 than in 2015 given the fixed lecture schedule in 2014. The question of "How well did you keep up with the work in this course?" was positively answered by 40% in 2014 and by 55% in 2015. This is particularly interesting as students were actually completing the mastery tests later in 2015 compared with 2014 (see Section 2.1).

Two questions in 2014 were directly targeted at the mastery tests and indicated general support of the change. 80% agreed or strongly agreed with the statement "The mastery tests encouraged me to understand the earlier material before continuing on to later material." and 74% with the statement "On balance, I found the mastery tests to be a positive influence on my learning." Again these ratings reflect students' positive feedback regarding the mastery test-

ing as shown at the beginning of this section.

5. DISCUSSION AND CONCLUSIONS

We have shown evidence that the introduction of mastery learning in an introductory course on programming in Python has a positive effect with moderate effect size on the performance of students subsequently taking an introductory course in Java. This effect was not seen prior to the introduction of mastery learning. The effect is more pronounced earlier in the subsequent course and there is only weak evidence that the effect persists long term. Such a result is not surprising since a mastery model is likely to produce stronger understanding of early concepts among weaker students, but not of more advanced concepts - largely because the self-paced nature of mastery learning means weaker students will not progress to master advanced concepts.

We have also shown evidence that the introduction of mastery learning is more advantageous to lower performing students than higher performing students; a particularly pleasing result since there is strong evidence in the literature of a bi-modal distribution of results among students [11] and therefore anything that improves the performance of poorer students without harming better students is a step in the right direction. We have not shown that the effect would carry over to a more advanced programming course, but there is no reason we can think of why this wouldn't be the case. We have also shown that most students found the mastery model to be a positive influence on their learning, although the model is not universally loved. Of the comments received in student surveys approximately equal numbers of students were positive as were negative in regards to the mastery model. The main tension appears to be between the supposed self-paced nature of mastery models, and the requirement to complete the course in a specific time frame (one semester in this case).

There is also some tension between student learning and course evaluation. Course evaluation in 2014 and 2015 of COMP-Py has been less positive than in previous years, despite evidence showing that students have learned more. In particular, the reactive lectorial model introduced in 2015 was seen as an indication of disorganization and lack of effort on the part of the lecturer. It is unclear how to resolve this particular problem without doing away with lectures altogether.

It is also worth considering possible alternative hypotheses for the results observed. The most obvious alternative hypothesis is that those taking COMP-Py will naturally have an advantage over those that do not regardless of the format of COMP-Py. However, we have shown that there has been no significant advantage for such students in 2011-2013, but there was in 2014-2015 when the mastery model was introduced. It is also possible that more motivated students enrol in COMP-Py and this explains their advantage, but again, such an advantage should have been clear in 2011-2013. Furthermore, during course advising, weaker students, and those who have not done any programming previously are strongly advised to take COMP-Py whereas stronger students are not. Finally, the mastery learning model may be acting as a stronger filter than the non-mastery model, and may be encouraging weaker students to seek other paths. The raw numbers do indicate that there might be a higher dropout rate in the mastery version of COMP-Py, but as yet the evidence is not statistically significant; perhaps because of the paucity of longitudinal data. However, dropout rates in COMP-Java for group PJ have not changed with the introduction of the mastery model. More data is required to answer this question with any confidence one way or the other.

In summary, based on current evidence, we believe we have shown that the introduction of mastery learning has a positive effect on student outcomes in an introductory programming course and that this effect is more pronounced in weaker students.

6. FUTURE WORK

The course change presented in this paper describes a carefully implemented first step in the direction of a fully-fledged mastery model. In both 2014 and 2015 the 7 mastery tests had a weight of 35% towards the final grade and were accompanied by two other assessment components: a practical test and a final examination, contributing 65%. However as we are now confident that the repeated mastery tests are a fair assessment of our students' programming abilities, in 2016 we have increased the credit for the mastery tests and removed the final examination. In 2016, there are 8 different mastery tests which account for 60% of the final grade. However, we weren't brave enough to remove all summative assessment. There are still two summary/practical tests as targets for students to work towards and to avoid rushed learning at the end of the semester. Both summary tests contribute 20% each towards the final grade and can only be attended once at a fixed time. The first test will be run as a mid-semester milestone testing basic concepts whereas the second test is an incentive to progress through all progression levels and to earn a top grade.

This change is quite radical in the way that students can disengage from the course after they accumulated enough credits for a passing grade of 50%, which is possible by mid-semester. In 2016 we will study how the patterns of mastering the progression levels are influenced when there is no final exam. We hope that most students will continue to study towards a B or A grade by mastering the higher progression levels. Further adjustments of the assessment schedule might be necessary to keep students engaged and motivated. In the best case students will complete the progression levels to a similar or higher degree and we might thus consider a contract grading scheme as proposed by LeJeune [8] where summative assessments are completely obsolete and students can decide on their level of achievement. Such a change would promote self-regulated learning where students work more and more independently in cycles of setting their own goals, self-monitoring their actual performance and adjusting strategies accordingly to reach those goals [12].

In a mastery learning model students study specifically towards mastering certain tasks and it is therefore important that those tasks reflect the intended learning outcome. A lot of work went into reviewing the progression levels and improving the focus of the tasks regarding well-defined topics for the 2016 course offering. The difficulty of single progression levels was adjusted and the hurdle of former progression level 5 was lowered by splitting it into two.

Addressing students' critical remarks about the lack of feedback when tests were failed and insufficient support we introduced online practice questions to assist students' prepa-

ration for the progression levels and their learning when tests were failed. Furthermore we plan for on-demand voluntary tutorials where students struggling with particular parts of the lab work are taught as a group in a room next to the lab.

The critique of the lectorial style was taken on board and has also been changed. They will now serve a dual purpose. Early sessions are very much like traditional lectures and cover the very basic topics (input, output, conditionals, iteration, functions). Later topics will be orthogonal to course content and will instead focus on problem-solving in the context of programming. Importantly, the lectorials are also a point of contact, adding a motivational facet to the course where interesting concepts are discussed by an enthusiastic lecturer to spark students' passion for computer programming and the desire to continue their studies in computer science. For a first year, first semester course the latter should be one of the main goals: introducing students to computer science and sparking a lifetime interest.

7. ACKNOWLEDGMENTS

To be added.

References

[1] Yoav Benjamini and Yosef Hochberg. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society. Series B (Methodological)*, pages 289–300, 1995.

[2] Thad Dunning. *Natural experiments in the social sciences: a design-based approach*. Cambridge University Press, 2012.

[3] Sophie Engle and Sami Rollins. Expert code review and mastery learning in a software development course. *Journal of Computing Sciences in Colleges*, 28(4):139–147, 2013.

[4] E.J. Fox. The Personalized System of Instruction: A Flexible and Effective Approach to Mastery Learning. In D.J. Moran and R.W. Malott, editors, *Evidence-based educational methods*, pages 201–221. Elsevier Academic Press, San Diego, 2004.

[5] Thomas R Guskey. Closing achievement gaps: revisiting Benjamin S. Bloom's âĂIJLearning for MasteryâĂİ. *Journal of Advanced Academics*, 19(1):8–31, 2007.

[6] JAC Hattie. *Visible learning: A synthesis of 800+ meta-analyses on achievement*. Abingdon: Routledge, 2009.

[7] Chen-lin C Kulik, James A Kulik, and Robert L Bangert-drowns. Effectiveness of mastery learning programs: A meta-analysis. *Review of Educational Research*, 60(2):265–299, 1990.

[8] N LeJeune. Contract grading with mastery learning in CS 1. *Journal of Computing Sciences in Colleges*, 26 (2):149–156, 2010.

[9] John Lewis, Peter J. DePasquale, and Joe Chase. *Java Foundations: Introduction to Program Design and Data Structures*. Pearson Education, Limited, 3rd edition, 2010. ISBN 013705534X.

[10] Luiz Augusto De Macedo Morais, Jorge C. A. Figueiredo, and Dalton D. S. Guerrero. Students Satisfaction with Mastery Learning in an Introductory Programming Course. *III Congresso Brasileiro de Informática na Educação (CBIE 2014)*, pages 1048–1052, 2014.

[11] Anthony Robins. Learning edge momentum: a new account of outcomes in CS1. *Computer Science Education*, 20(1):37–71, March 2010. ISSN 0899-3408. .

[12] Barry J Zimmerman and Maria K Dibenedetto. Mastery learning and assessment: Implications for students and teachers in an era of high?stakes testing. *Psychology in the Schools, Âl' 2008 Wiley Periodicals*, 45(3): 206–216, 2008. .

Enhanced learning through virtual dissections

PROJECT TEAM

Dr Rob Wass[a], Andrea Brown[b], Sophie Fern[b], Amanda Valois[b], Adon Moskal[a]
[a] *Higher Education Development Centre, University of Otago;*
[b] *Department of Zoology, University of Otago*

SNAPSHOT

This grant allowed us to develop a web-based resource to complement the existing dissection activities carried out in the first year Animal Biology paper (BIOL112). It also provided an alternative exercise for the small number of students that do not take part in dissections for moral or personal reasons.

The resource was developed using the enhanced teaching platform xOtago which supported the use of high-resolution images, video, and quizzes. No specific technical expertise was required to develop, build, or upload content to the resource.

Post deployment the student survey results were very positive. In particular, the students found the online images and videos helped their understanding of the dissection (89% rated 1-2, where 1 = very helpful). The students also thought that the resource would be useful to view outside of the laboratory as a revision tool (67%, scoring a 1-2) and was easy to work on as a group (85%, scoring 1-2).

Student objector focus groups led to some interesting discussions amongst staff about what should be considered a 'core' activity for a University paper. This led to the following presentation at a national conference:

Wass, R., & Moskal, A. (2015). The ethics of teaching – where is the 'bottom line' in a negotiated curriculum? *Proceedings of the Tertiary Education Research in New Zealand (TERNZ) Conference*, Auckland.

INTRODUCTION

Dissections have traditionally been an integral part of a Zoology students' experience. They are valued by both staff and students for being hands-on, exploratory, and promoting student inquiry (Lalley, Piotrowski, Battaglia, Brophy, & Chugh, 2010). We were interested in optimising this experience with a web-based, interactive resource.

We were quite clear from the beginning that we were not looking for a *virtual replacement* of what the students currently did, but we were also aware that there was room for improvement. For instance, it is difficult for students to understand what is required with respect to performing the dissections. The laboratory manual goes some way; however, there is a large amount of text to read and the images are in black and white to reduce printing costs.

Each year a small number of students (approximately 7 out of a class of 330) opt out of doing dissections for moral and other personal reasons. These students provide a written, reasoned application for why they choose to not take part in dissections and are often not present in the laboratory while the dissections are in progress. The teaching staff have ongoing concerns about the learning experience of these students and feel that all students should be provided with a quality practical learning experience regardless of their moral stand. It was hoped that the interactive nature

of the web application will provide an alternative activity for those that cannot, or will not, take part in the dissection activities.

Project objectives

The objective is to develop a web-based interactive application which is easily updated by teaching staff. The application will be used as a complement to the existing dissection activities (possum and dogfish), and can also be used by students that are looking for alternative exercises to dissections.

METHODS

The project began with focus group interviews (Berg & Lune, 2004) with six students to get a better understanding of how a web-based resource could support the learning of students that opt out of dissections. A research assistant then worked with the project leaders and Educational Technology staff (HEDC) to create a storyboard detailing what the requirements of this project were. We decided to use an existing research-led technology enhanced teaching platform - xOtago. This decision was based on our requirements and the availability of expertise from staff within Educational Technology. The use of video and colour, high-resolution, labelled pictures seemed an ideal solution. We also wished to strengthen the group co-operation element by incorporating questions into the application which the students would complete together. Immediate feedback would be provided to the students to check their understanding.

The research assistant then pulled all of the existing resources together and begin to build content (see Figure 1. below) assisted by HEDC Educational Technology staff, and with consultation with the project leaders.

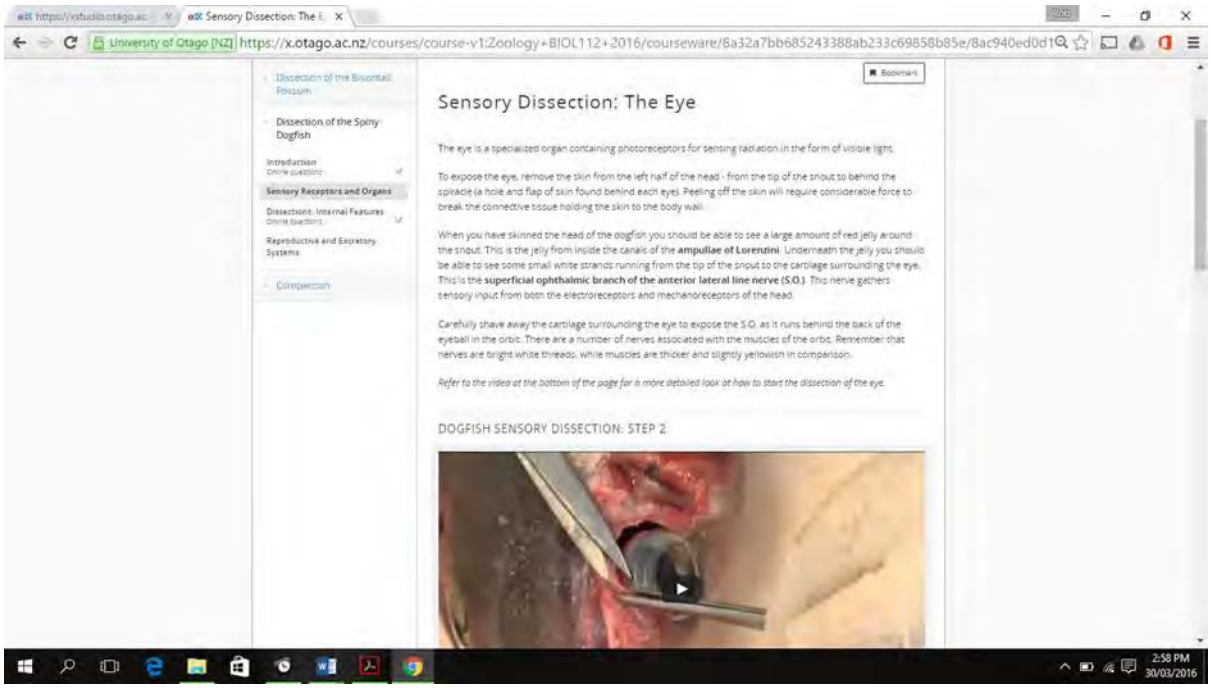


Figure 1. A screen grab of the content being developed in xOtago.

Once a framework had been developed we performed preliminary testing on a small group of volunteer students in the laboratory. The framework was refined based on this preliminary testing and we continued to build content as required. The team met at least monthly to report on progress; more regular meetings were required at different stages of the build.

Our research questions were:

Pre-launch and development research questions

1. What features of online resources are important for all students as an aide for their learning?
2. What are the current learning experiences for students who choose not to partake in laboratory activities that involve dissection of animals?

Post-launch research questions

1. How effective has the online resource been? (Effectiveness will be measured against the results from question 1 above)
2. What were the learning experiences for students who chose not to partake in laboratory activities?

Evaluation of impact

As mentioned, the project leader conducted a baseline focus group interview with eight of the 2014 objectors to find out about their learning experience in the course as it is currently run. Sample questions included background information about their prior knowledge of the use of animals in the course, but also how it felt to be a conscientious objector and how they felt about the current level of support. Another focus group of students who objected to undertaking dissections were asked similar questions for comparative purposes in October 2015.

A paper-based questionnaire using Otago InForm was used with all students to evaluate the resource in terms of how easy the resource was to navigate and the usefulness of the diagrams, videos and the online questions. Further questions were asked to gather information about how well the resource encouraged collaboration, whether the students were likely to use the resource out of class, and whether they thought the resource was a suitable replacement to dissection activities. The survey also allowed for free text comments which were collated and summarised.

KEY FINDINGS AND IMPLICATIONS

Survey results

The survey results (n=159) suggest that the students found the resource easy to navigate with 82% scoring a 1 -2, where 1 is very easy and 5 is very hard (see Figure 2). The online images and videos were helpful for understanding the dissection (89%, scoring a 1-2). The students did not, however, find the online questions as helpful, with only 66% scoring a 1-2. Some of the free text comments suggest that perhaps the reason for this is that they found the questions too challenging (see Table 1). However, the vast majority of the free text comments were very positive with the images and videos being singled out as being particularly helpful.

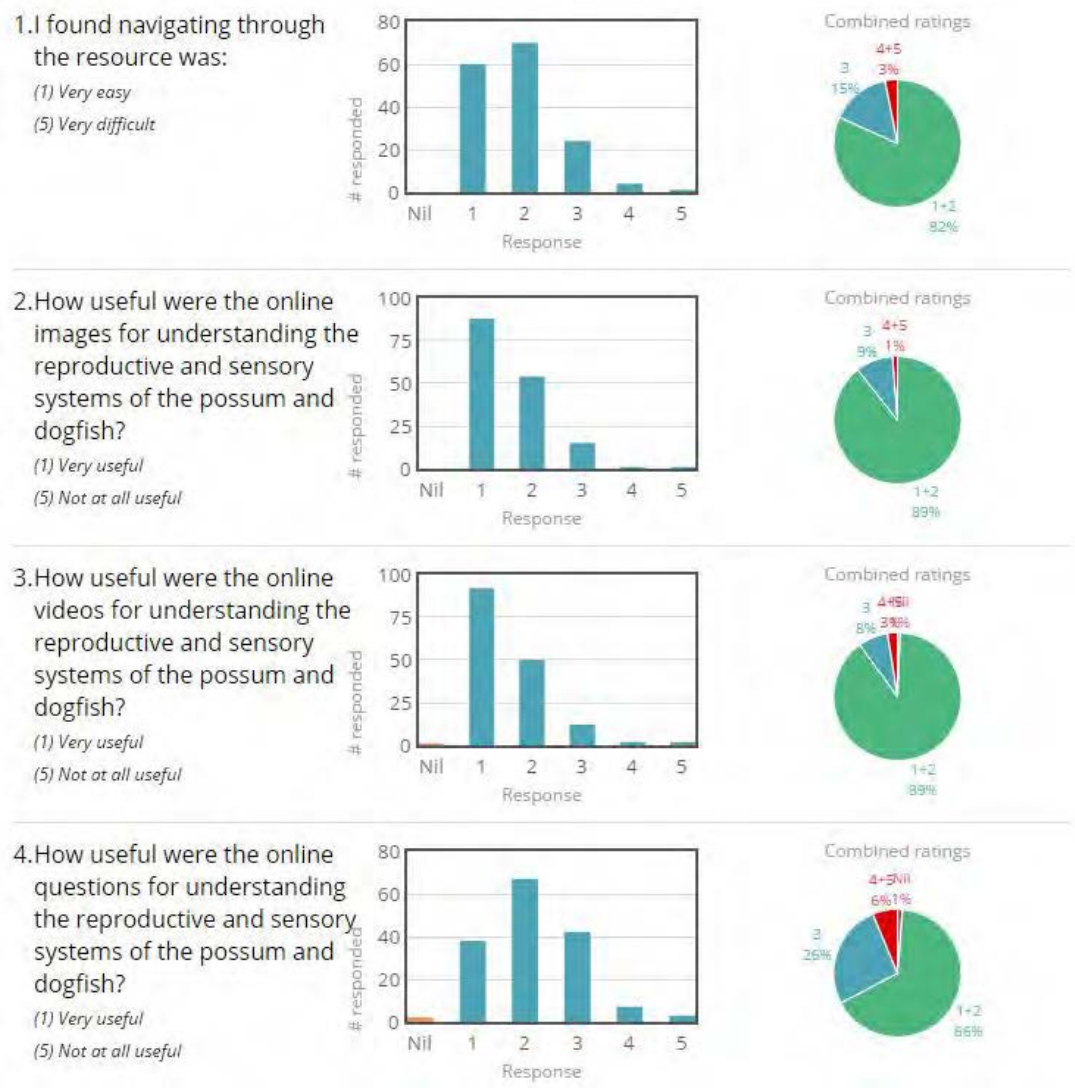


Figure 2. Summary of responses to the virtual dissection survey (questions 1-4)

Table 1. Free text comments from the virtual dissection survey categorised by themes.

Comment	**No. of respondents**
Positive – good, great, found it helpful	76
Found the pictures helpful	45
Found the videos helpful	51
Found it difficult to navigate	13
Confusing	1
Wanted more labelled pictures	5
Wanted more videos	11
Wanted less text	10
Questions too hard	8
Wanted more questions	3
Did not use the module	2

The project team was initially concerned with the logistics of getting a team of four people to perform the dissection while simultaneously working their way through an online resource. This concern did not seem to be a problem. When asked how easy it was to work on the resource as a group, 85% of the students scored this question a 1-2, with 1 being very easy (see Figure 3).

We were also interested to see if students would use this resource to review material outside of the scheduled laboratory times and 67% of the students responded that they would.

Despite dissections receiving favourable ratings in course evaluations, the project team was interested in whether students thought that the resource was a suitable substitute for dissections. Although the resource did receive favourable ratings, it was a fairly even split with 43% thinking that the resource alone could replace the physical dissections and 39% did not see it as a suitable stand-alone substitute. A large number of students entered a nil response to this question (19%).

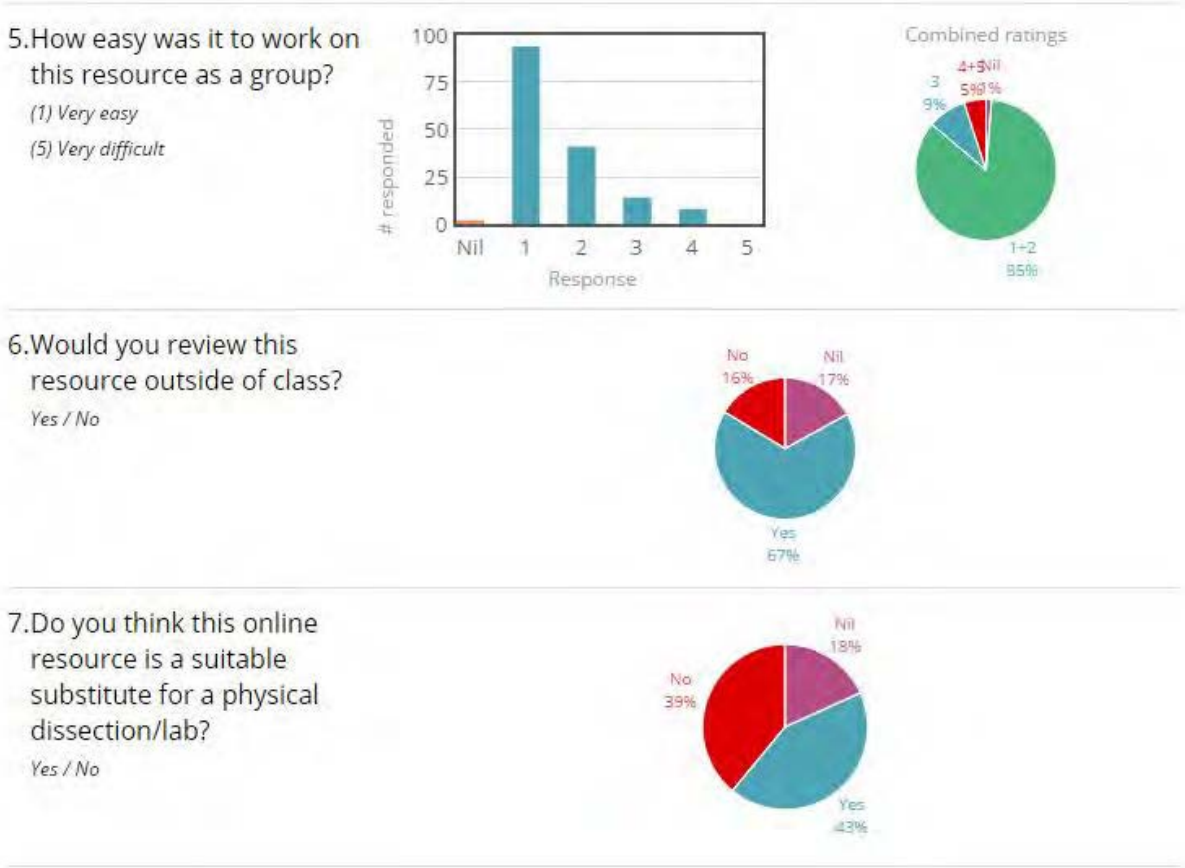


Figure 3. Summary of responses to the virtual dissection survey (questions 4-7)

Focus group interviews results

Focus group interviews took place with eight students that had self-identified as not wanting to take part in dissections. Three of these students were majoring in zoology, while the other students had plant biotechnology, health science, genetics, psychology and neuroscience as their subject major.

The questions were structured around two main themes. In the first we were interested in students' expectations regarding dissections in the course (see Table 2) and the second part explored their experiences of using the online resource.

Table 2 – Focus group data from students that do not do dissections

Questions	Notes
Can you tell me a little bit about why you took BIOL112?	Required for Zoology degree. Fit timetable. Course looked interesting. Heard good things about course.
What had you heard in terms of requirements to do dissections?	Did not know there would be dissections until the labs started. Did not think seriously about dissections until the labs were underway. Knew there were dissections but hoped to be able to opt—out.
How did you feel about the level of support?	Happy that we were allowed to opt-out. Would have liked a follow up after lab to ensure we understood the material. As I was happy to watch but not participate in the dissection, would have liked a demonstrator to facilitate discussion with group members about everyone's most comfortable role in the dissection.
What was your approach to make sure that you understood the material that you would have otherwise missed?	Used the lab book and online resource. Chose not to use the resource due to the videos and instead worked through the lab manual and used Google.
Online Resource	
How did you find watching videos of the dissections?	Enjoyed having videos and found them to be as useful as being there for the dissection. Liked that only one animal would be sacrificed for learning rather than many. Two participants did not feel comfortable watching videos. Would have been keen to have more interactive videos, i.e., demonstrator talking or showing various organs. Wanted sound with videos.
How did you find looking at the still images of the dissected animals?	Would have liked more labelled images. Would have liked to see multiple pictures of organs from different angles. Would have liked to see functions of organs on labels or close by images.
Did you find the assessment useful?	Yes, forced me to read through the lab book. Found it a bit hard. Would have liked more questions throughout instead of mostly at the end.
Any other comments?	Would have liked to have a discussion a week before the lab about where the animals came from and how they were killed to make a more informed decision. Found it difficult to jump back and forth between lab book and online resource. Not enough information on online resource as answers to questions required looking back through book. More videos Would have liked the chance to ask questions based on the online resource.

Discussion and implications

The teaching staff were very pleased with the project outcomes – the xOtago platform was significantly feature-rich, but also able to be easily used by the teaching staff. The students seemed to find the resource helpful for learning the dissection material and it easily integrated into the laboratory without changing the group dynamics of the dissection itself. The project also revealed some interesting data about a small but significant group of students – those that do not do dissections because of their moral or personal stand. Some of these students were not comfortable watching a video of an animal that had been dissected and requested diagrams instead. This raised questions around a negotiable curriculum, tradition, and perhaps more importantly, how knowledge is valued by staff and students.

While some students were only taking part in activities that they were comfortable with, they were clearly getting a different learning experience from the main cohort. These students also questioned the relevance of dissections to a zoology degree and this sparked debate amongst teachers about what they valued in a zoology curriculum and how they wished to be viewed by the wider community. Our study raised questions about what is the negotiable in the curriculum and what is considered the 'bottom line'. For instance, should a student that is anxious about public speaking be excused from a classroom activity requiring an oral presentation? What about students that do not attend lectures because of an approved timetable clash? If the learning experience is inferior to the main cohort of students, is it even fair to suggest an alternative arrangement? Our experience suggests these issues are often not discussed, are personal, and value-laden.

References

Berg, B. L., & Lune, H. (2004). *Qualitative research methods for the social sciences* (Vol. 5): Pearson Boston.

Lalley, J. P., Piotrowski, P. S., Battaglia, B., Brophy, K., & Chugh, K. (2010). A Comparison of V-Frog [C] to Physical Frog Dissection. *International Journal of Environmental and Science Education*, 5(2), 189-200.

OUTPUTS

Wass, R., & Moskal, A. (2015). The ethics of teaching – where is the 'bottom line' in a negotiated curriculum? *Proceedings of the Tertiary Education Research in New Zealand (TERNZ) Conference*, Auckland.

The ethics of teaching – where is the 'bottom line' in a negotiated curriculum?

Rob Wass
Higher Education, Development Centre, University of Otago
rob.wass@otago.ac.nz

Adon Moskal
Higher Education, Development Centre, University of Otago
adon.moskal@otago.ac.nz

The research

This session reports on a research project which investigated the learning experiences of students who chose not to take part in core curriculum activities - animal dissections. The study raised questions around a negotiable curriculum, tradition, and perhaps more importantly how knowledge is valued by staff and students.

Animal dissections are a core part of a zoology curriculum. They are generally seen by students as a valuable learning exercise and rate favourably in annual course evaluations. Some students, however, for a variety of reasons, choose not to take part in dissections. These students are required to provide written documentation outlining what they are prepared to do, and they negotiate with teaching staff on how they will catch up on material missed.

As part of a larger research project, we interviewed a cohort of students to find out what it was like to abstain from dissections. Students appreciated that they did not have to do dissections, but they also felt that they were 'missing out' and this contributed to a lack of motivation with the course in general.

While these students were only taking part in activities that they were comfortable with, they were clearly getting a different learning experience from the main cohort. These students also questioned the relevance of dissections to a zoology degree and this sparked debate amongst teachers about what they valued in a zoology curriculum and how they wished to be viewed by the wider community.

Why the topic is important

Curriculum flexibility is a desirable feature. For instance, students appreciate being able to go to laboratory sessions different to that timetabled in order to meet work or childcare obligations. When ill, they also appreciate alternative ways to 'catch-up' on lectures that they might have otherwise missed. However, some things in the curriculum are not flexible or able to be negotiated; such as the mark needed in order to pass a paper, or the grade-point average in order to obtain a scholarship.

Our study raised questions about what is the negotiable in the curriculum and what is considered the 'bottom line'. For instance, should a student that is anxious about public speaking be excused from a classroom activity requiring an oral presentation? What about students that do not attend lectures because of an approved timetable clash? If the learning experience is inferior to the main cohort of students, is it even fair to suggest an alternative arrangement? Our experience suggests these issues are often not discussed, are personal, and value laden. This presentation gives participants an opportunity to explore their position and that of their colleagues.

How the session will be run

In the spirit of the TERNZ conference, this session will encourage attendants to reflect and share their experiences of what is negotiable in their teaching practice, what they consider the bottom line, and the implications of this.

1. The session will begin by outlining our current situation – the content of the course and the role of dissections. Some example justifications from conscientious objectors will be read to the group to set the scene. We will also talk briefly about the recently implemented xOtago online dissection resource to give an example of an 'alternative' learning experience (10 mins)
2. Spectrum activity –given different scenarios, participants will physically situate themselves along a spectrum. For instance, from a fully negotiated curriculum to completely prescribed curriculum (5 mins)
3. Participants will reflect and discuss the results of that activity (10 mins)
4. Participants will then be assigned to spectrum extremes (and in between) and asked to imagine the scenarios that would result in those extremes. What pressures might lead to these situations? What are the outcomes and implications for Higher Education to be at the extremes? (5 mins)
5. Participants will reflect and discuss the results of that activity (10 mins)
6. Group discussion, reflection, and report back on the results of the session. What was learned? What will you take away? (10 mins)