Cross-Case Analysis

From the Inquiry-Based Learning Project

Contents

Introduction

The objectives of this analysis were to:

1. determine how inquiry contributes to the development of graduate attributes in each institution and to government educational priorities
2. determine factors that promote the effective use of inquiry
3. identify challenges to the effective use of inquiry
4. determine whether the use of inquiry-based learning strengthens teaching-research links
5. reconsider our conceptualisation of inquiry-based learning

Accordingly, this section is structured to address these objectives, with each objective being considered in turn.

Student Learning Outcomes Under Inquiry Approaches

The overriding rationale for adopting an inquiry-based learning approach is to improve student learning outcomes. This is not only of benefit for the students, but also for the institutions, and ultimately for the country as well. As discussed in the "Project Overview", the New Zealand Tertiary Education Strategy advocates for undergraduates to be part of a research culture in which they can take a "research-based approach to their lifelong educational development" (Ministry of Education, 2002:60). Aligned with this notion, is an expectation that undergraduates will become equipped with "the skills, knowledge, attitudes and values... to think critically and adapt to change" (Ministry of Education, 2005:7). In line with government policy, tertiary education institutions have developed graduate profiles that suggest such attributes will be achieved in their students. For example, at the University of Otago the mission aims to "advance, preserve and promote knowledge, critical thinking and intellectual independence to enhance the understanding, development and well-being of individuals and society" (University of Otago Charter, 2003:1). Also the University of Otago "Teaching and Learning Plan" (2005-2010) includes graduate attributes such as:

- Critical thinking – the ability to analyse issues logically, consider different options and viewpoints, and make informed decisions
- Lifelong learning – a commitment to lifelong learning, with the ability to apply knowledge, develop existing skills, adapt to a changing environment, and acquire new skills
- Research – the ability to conduct research by recognising when information is needed, and locating, retrieving, evaluating and using it effectively.

Similarly, the University of Canterbury has in its charter: "To pursue excellence in curricula, teaching and life-long learning to a standard befitting an international research university and in a manner that will challenge and develop the capabilities, potential and intellectual independence of our students" (University of Canterbury, 2003).

The Victoria University of Wellington, states in its mission that: "We will provide transforming and lifelong educational experiences to students from a wide variety of backgrounds and nationalities... Our teaching and learning will be innovative, and invigorated by being informed by a culture of internationally recognised research...In its teaching Victoria University will seek to meet the interests of students and the needs of the community, and to foster generally the exploration and discovery of ideas and knowledge... Its undergraduate courses and first degrees will provide a broad education, a preparation for work and life and a strong foundation for further study" (Victoria University of Wellington, 2003).

The Christchurch Polytechnic Institute of Technology (CPIT) states as its mission that "the provision of applied tertiary education and research contributes to the future social, economic and cultural wellbeing of the people, communities, and organisations particularly of Canterbury (CPIT Guiding Philosophy – Kaupapa, 2007). CPIT also expounds core values including:

- *Mana tangata*: Our teaching and learning approach builds each person's standing enabling them to practise professionally and work responsibly with others for personal and community achievement.

- *Matauranga*: We provide accessible learning opportunities for personal growth, achievement, and vocational success, fostering people's ability to learn independently and modelling best practice in applied learning and research.

Thus all four institutions are aiming to provide an undergraduate education that develops intellectual independence and fosters lifelong learning. All four mention research, but mainly in the context of teaching being informed by research, rather than an undergraduate education that emphasises research-based teaching. Given these guiding government and institutional directions, this analysis aimed to determine if inquiry-based learning was contributing to the development of graduate attributes in each institution and to government educational priorities.

The evidence gathered across the 14 IBL cases is strongly supportive of this mode of teaching leading to desired graduate attributes, particularly in terms of developing independent and critical thinkers as well as lifelong learners. In the IBL survey, an average of 91% of students said that their inquiry courses *always* or *usually* encouraged them to take responsibility for their learning (Figure 1) with all courses rating over 70%. Figure 1 also shows that many of the courses encouraged problem-solving, particularly at upper levels. Figure 2 shows that the majority of the courses were perceived by students to be challenging, especially the stage 3 courses.

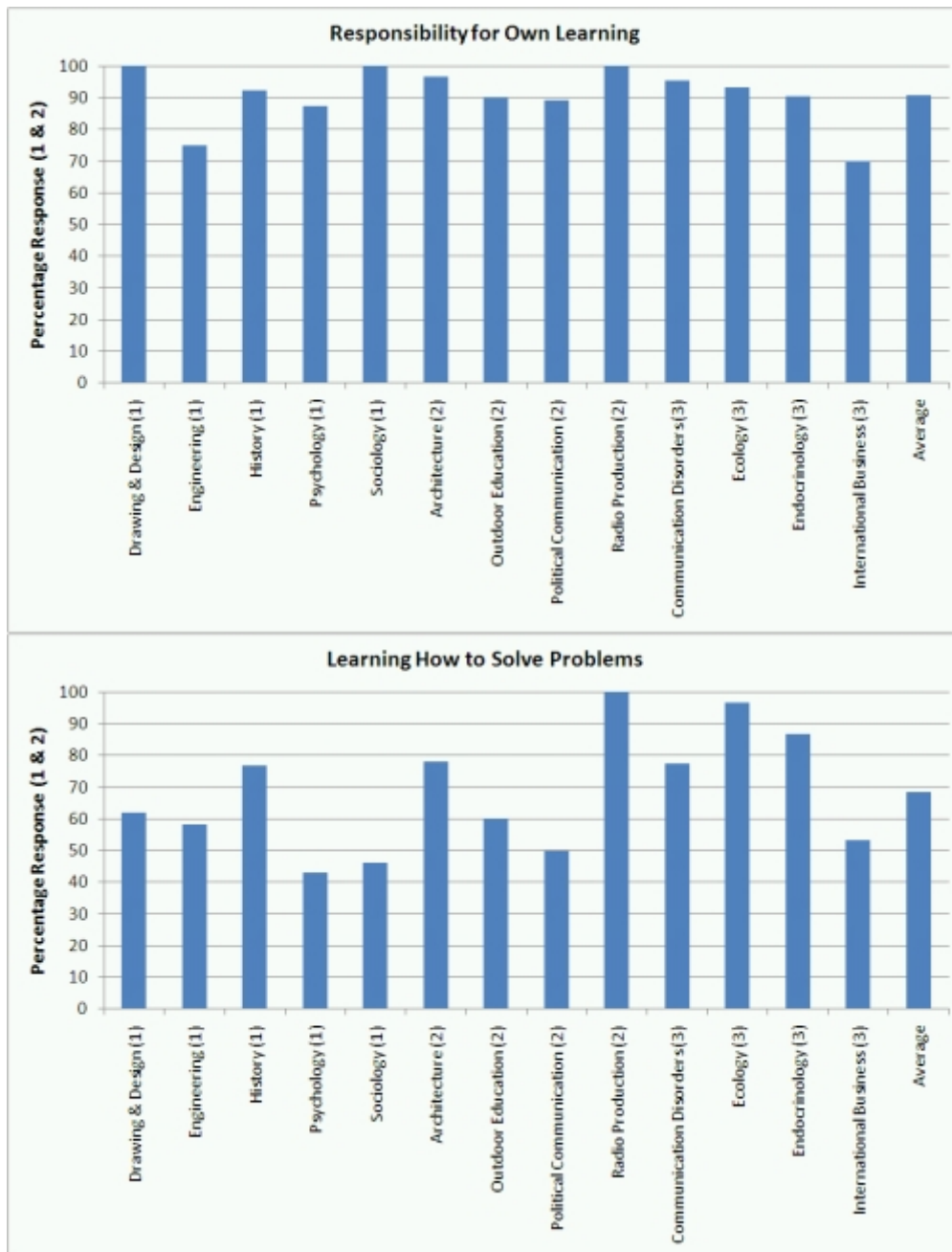Figure 1: Graphs showing student perception of whether they were encouraged to take responsibility for their own learning and whether they learned how to solve problems and/or answer questions. Percentage responses for the combination of *always (1)* or *usually (2)* are shown. The cases (excluding the Ecology Degree as it is a whole programme) are given together with the undergraduate level e.g. stage 1, 2 or 3, in brackets.
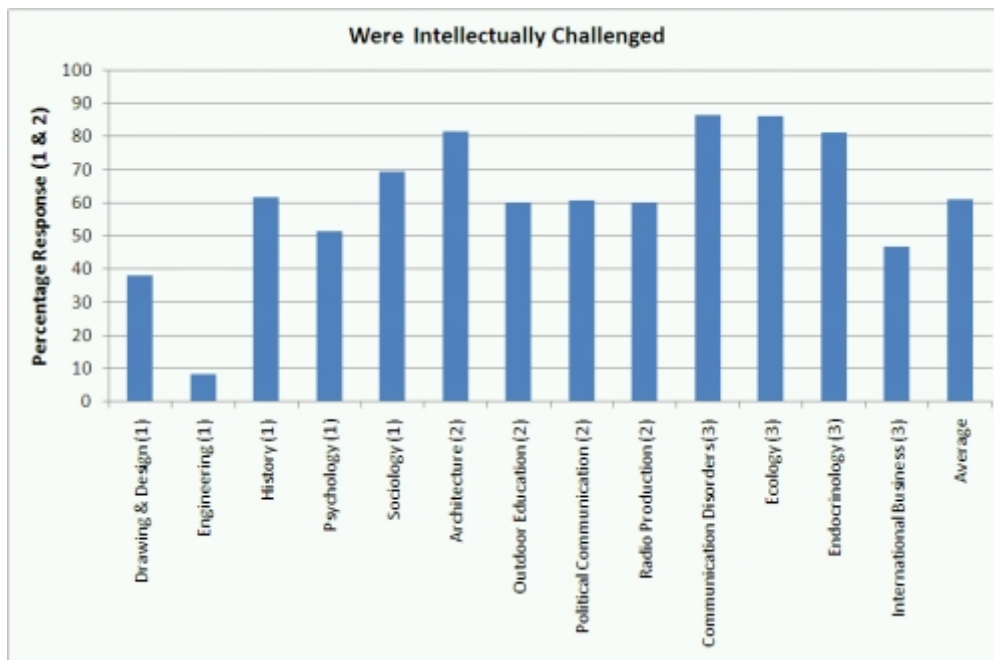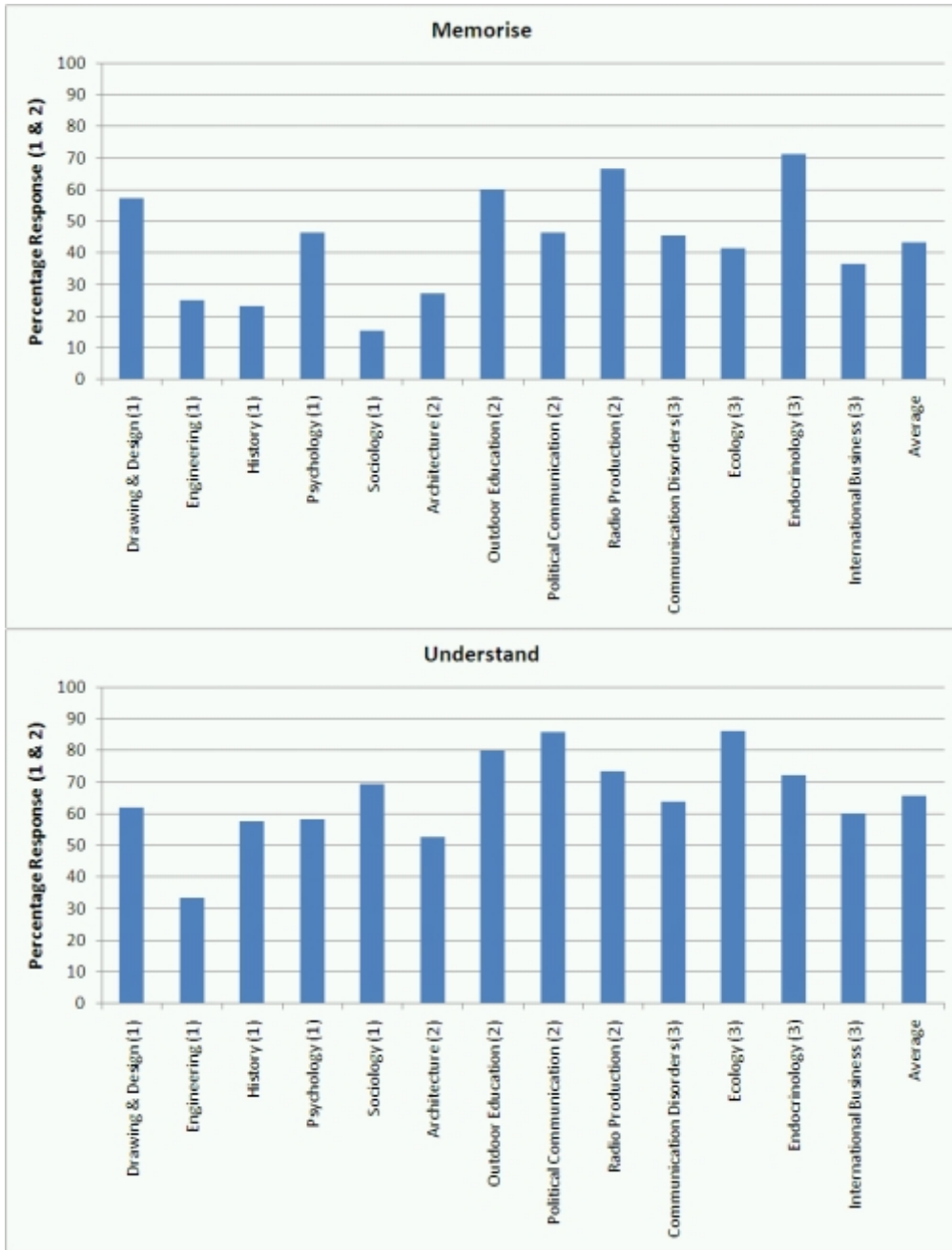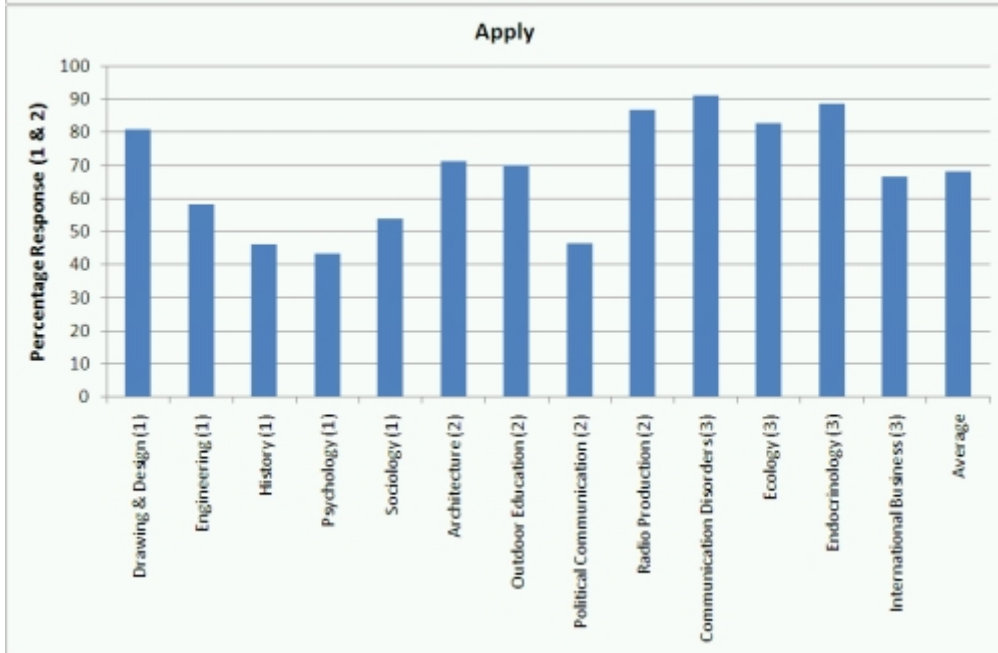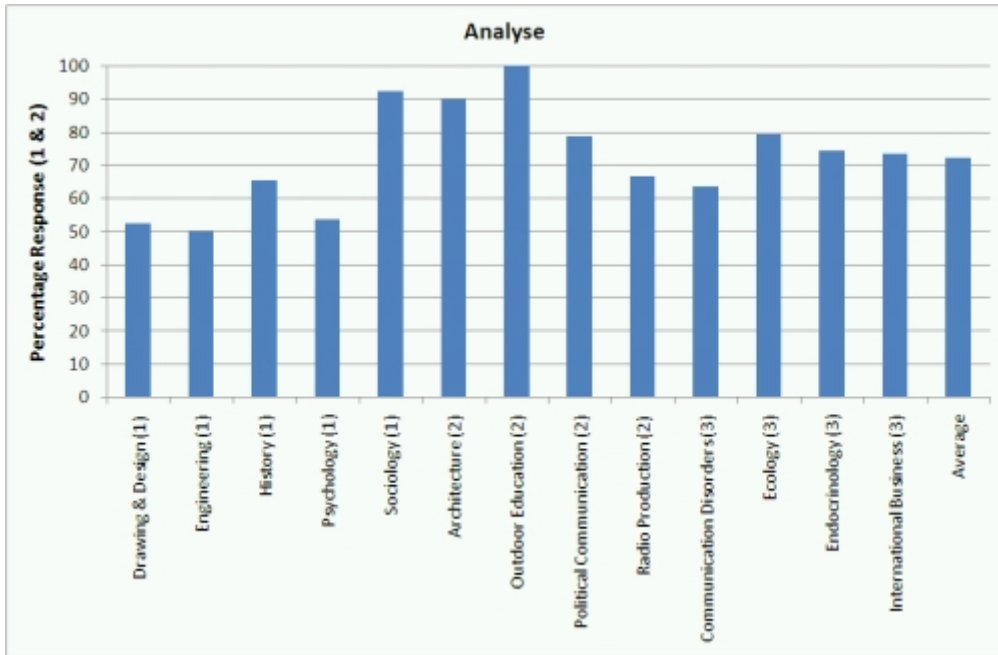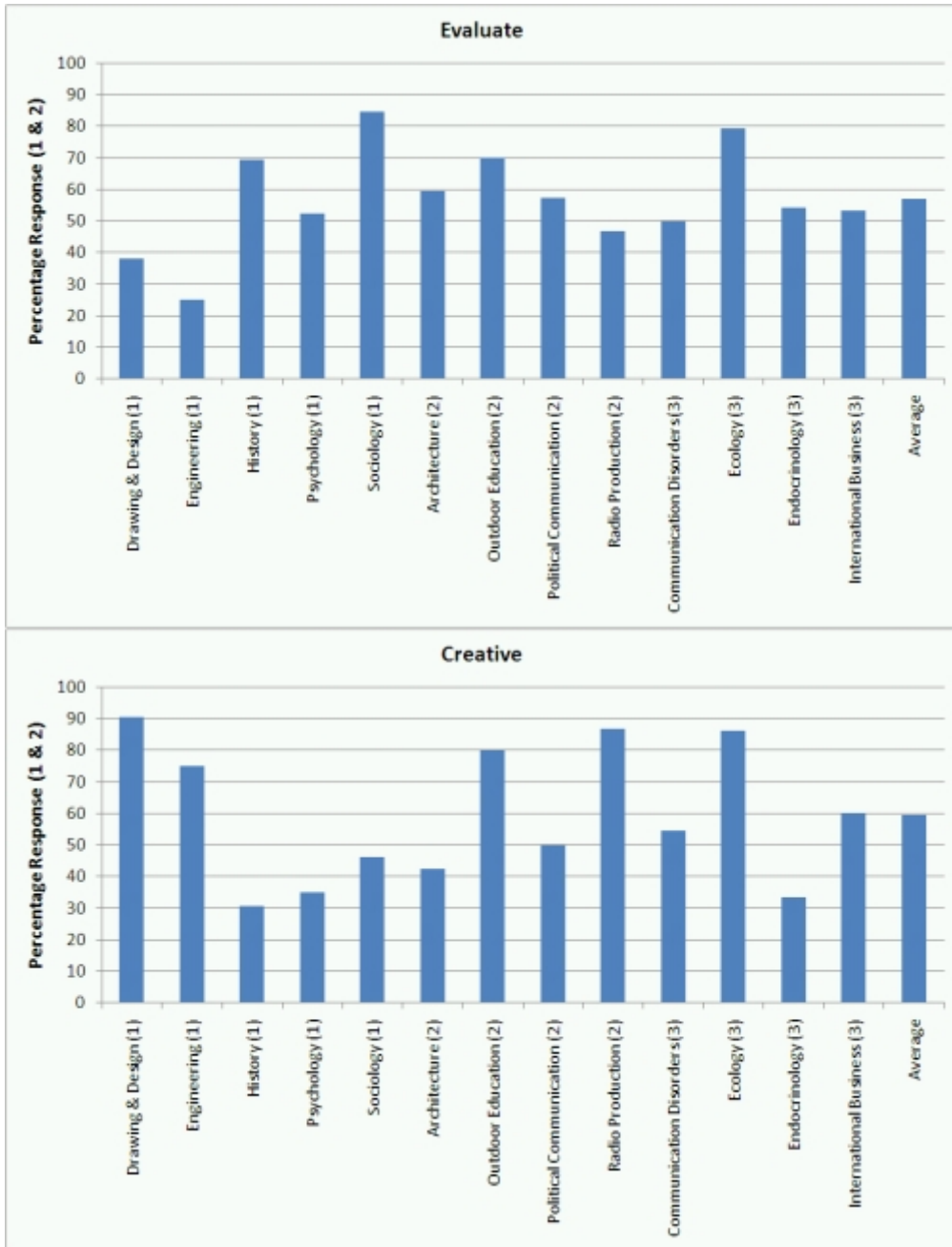
Figure 2: Student perception of whether they were intellectually challenged by the course. Percentage responses for the combination of *always (1)* or *usually (2)* are shown.

Student perceptions of the type of learning encouraged in each of the inquiry courses is displayed in Figure 3, which targets a range of types of learning from memorising through to applying as well as being creative and reflective. As shown in Figure 3, the type of learning least encouraged by these courses is memorising (43%), which is consistent with the philosophy of IBL. Nevertheless the amount of memorising was viewed as important for some courses, particularly Drawing and Design, Outdoor Education, Radio Production and Endocrinology since, for these topics, there was a substantial amount of theoretical or technical (Drawing and Design and Radio Production) material that had to be learned. Most courses rated well on the encouragement of learning for understanding, with an overall average of 66%. Although there is an overall trend for an increase in emphasis on learning for understanding from stage 1 through to stage 3 courses, there was much variability, with two stage courses (Outdoor Education and Political Communication) rating particularly well. The stage 2 courses also did very well on encouraging the development of analytical skills, and the average for all 13 courses was the highest at 72%.

All courses achieved above 40% rating by students for having encouraged application, with an overall average of 68% (Figure 3). With the exception of the very practically oriented Drawing and Design course, the amount of application encouraged was generally higher in stage 3 courses, as might be expected with progression through a degree programme. Overall, students rated less well the ability of the courses to encourage evaluation, creativity and reflection (averages were 57%, 59% and 61% respectively). However, it was encouraging to see that the higher order ability of reflection was being promoted at stage 1 in the History and Sociology courses, but the amount of reflection encouraged was very variable and rather disappointing in the stage 3 courses. It was also notable that the CPIT courses all rated extremely well on creativity, in contrast to most of the university courses.

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Memorise

Percentage Response (1 & 2)

Categories: Drawing & Design (1), Engineering (1), History (1), Psychology (1), Sociology (1), Architecture (2), Outdoor Education (2), Political Communication (2), Radio Production (2), Communication Disorders (3), Ecology (3), Endocrinology (3), International Business (3), Average

Understand

Percentage Response (1 & 2)

Categories: Drawing & Design (1), Engineering (1), History (1), Psychology (1), Sociology (1), Architecture (2), Outdoor Education (2), Political Communication (2), Radio Production (2), Communication Disorders (3), Ecology (3), Endocrinology (3), International Business (3), Average

Analyse

Percentage Response (1 & 2)

Category	
Drawing & Design (1)	52
Engineering (1)	50
History (1)	65
Psychology (1)	54
Sociology (1)	92
Architecture (2)	90
Outdoor Education (2)	100
Political Communication (2)	79
Radio Production (2)	66
Communication Disorders (3)	63
Ecology (3)	80
Endocrinology (3)	74
International Business (3)	73
Average	72

Apply

Percentage Response (1 & 2)

Category	
Drawing & Design (1)	80
Engineering (1)	58
History (1)	46
Psychology (1)	43
Sociology (1)	54
Architecture (2)	71
Outdoor Education (2)	70
Political Communication (2)	46
Radio Production (2)	86
Communication Disorders (3)	91
Ecology (3)	82
Endocrinology (3)	88
International Business (3)	66
Average	68

Evaluate

Percentage Response (1 & 2) by discipline: Drawing & Design (1), Engineering (1), History (1), Psychology (1), Sociology (1), Architecture (2), Outdoor Education (2), Political Communication (2), Radio Production (2), Communication Disorders (3), Ecology (3), Endocrinology (3), International Business (3), Average

Creative

Percentage Response (1 & 2) by discipline: Drawing & Design (1), Engineering (1), History (1), Psychology (1), Sociology (1), Architecture (2), Outdoor Education (2), Political Communication (2), Radio Production (2), Communication Disorders (3), Ecology (3), Endocrinology (3), International Business (3), Average
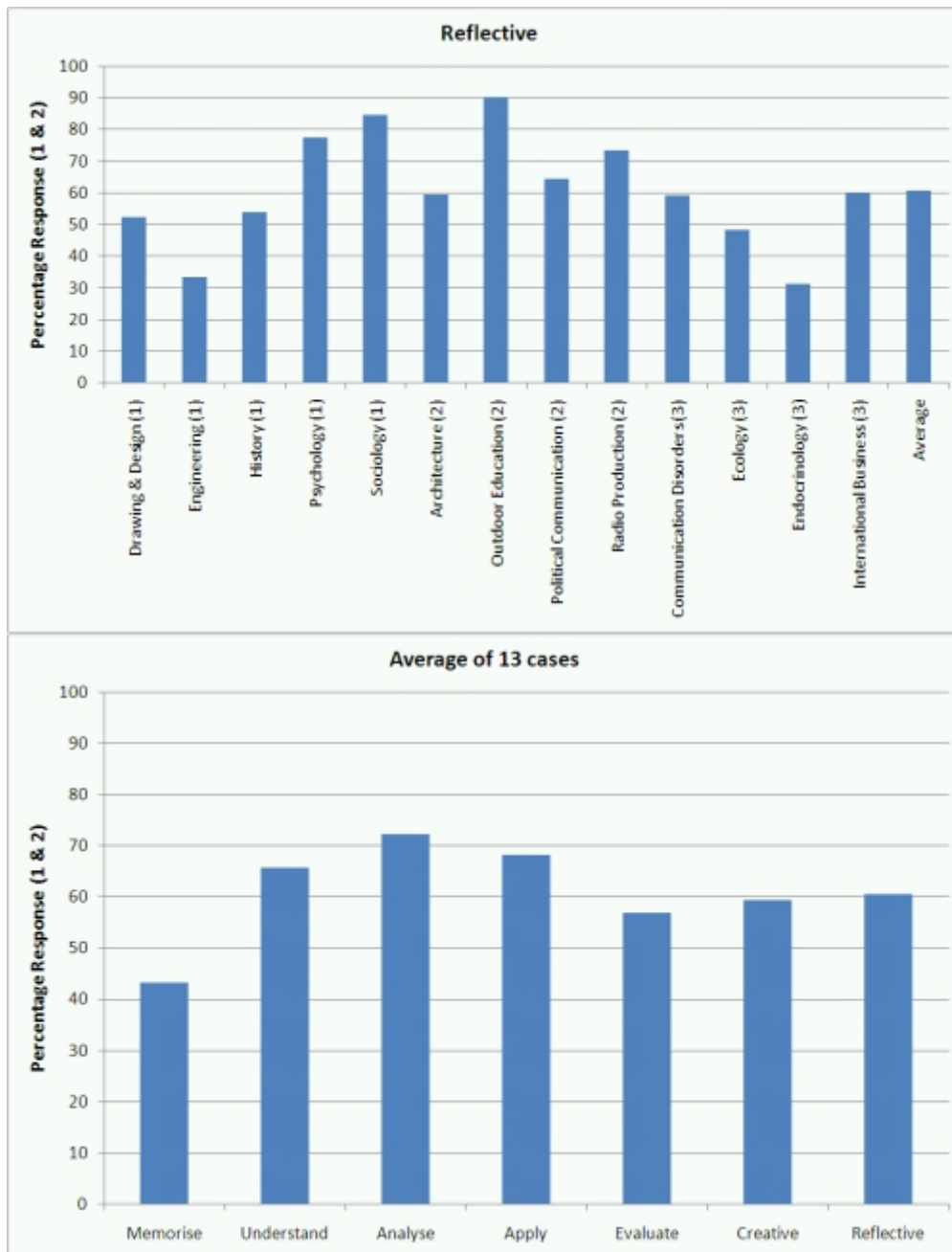
Figure 3: Series of graphs showing the types of learning encouraged by the inquiry course or activity. Only percentage responses for the combination of *a great deal (1)* or *quite a bit (2)* ratings are shown. The final graph shows the average of the 13 inquiry courses (note the Ecology Degree is excluded as it is a whole programme).

In summary, it is clear that in terms of student and teacher perceptions, these IBL courses were contributing strongly to desired graduate attributes in line with institutional and governmental directives.

Factors that Promote the Effective Use of Inquiry

Data from across the 14 cases were used to explore common factors that promoted the effective use of inquiry. There were three categories of attributes identified: those of the

teachers; the course design; and those of the department and institution. Each is considered in turn.

Teacher attributes

In all our cases, the teachers clearly had a student-centred teaching philosophy. Thus they were comfortable, and indeed promoted, teaching through facilitating, rather than transmitting information. They were committed to striving for higher order student learning outcomes and this often motivated them to adopt inquiry approaches. As well as being passionate about student learning, the teachers all managed to develop an excellent rapport with their students, and many knew all their students' names. They were approachable and generally well respected and liked by their students. The teachers were all reflective practitioners, continually seeking feedback on student learning, with a view to improving the course.

In most of our cases, teachers were more concerned with students' learning about processes, particularly disciplinary research, than with learning a set body of knowledge. Ideally teachers wanted students to start to think as disciplinary experts would – as engineers, broadcasters, architects, or ecologists. Thus teachers were trying to imbue a sense of disciplinary identity in students, so that they could start thinking in the way of subject experts.

Some of the teachers, particularly those in departments using more 'traditional' modes of teaching, were quite rebellious. Often, in order to undertake teaching through inquiry, the departmental norms of teaching had to be challenged. This rebellious behaviour involved subverting:

- traditional timetables, since often inquiry courses have fewer contact hours
- physical teaching spaces, as often inquiry activities require discussion, which may mean rearranging furniture to enable students to work in groups
- usual assessment practices, as more innovative types of assessment were introduced.

A defining characteristic of most of our teachers was that they had either undertaken some formal teaching qualification (such as postgraduate certificates in tertiary teaching or adult learning), or had sought the support of academic staff developers when designing their inquiry courses. Furthermore, several had been awarded institutional or national teaching awards. However, there were some who had little pedagogical knowledge, who opted to use inquiry approaches through personal dissatisfaction with traditional lecturing methods and a tacit understanding of teaching that could improve student learning.

Course design attributes

All inquiry courses and activities used open-ended questions and most required collaboration amongst students. In most of our cases, students were undertaking primary research, appropriate to the level of study. While some inquiry tasks were strongly guided by teachers, particularly at lower levels, others were more open. Thus, often there were elements of student choice in selection of questions, and this provided motivation and interest for students to engage in the tasks.

All the inquiry courses and activities demanded active engagement from students. Often students had to prepare for inquiry sessions and teachers had strong expectations that students would do the necessary preparation work. So for example, in group meetings teachers would check to see that this preparatory work had been done by either asking to see written notes or by directly questioning students. Within the inquiry sessions, tasks were also structured to promote engagement. For example, students would be probed about their learning. Also, students were often required to work in small groups, brainstorming ideas or conducting field work. Thus discussion with peers played a very important role in all of the inquiry courses and tasks. Even the researchers in this study found they were engaged in the sessions they observed, with all commenting about the amount they had learnt!

Given the requirement for students to undertake self-directed learning, some of the inquiry courses had low contact hours, thus giving students time to do their own study. These low contact hours often conflicted with departmental expectations of contact time. Furthermore, another problem encountered was that although contact hours were low, students often reported high workloads associated with inquiry courses. This high workload stemmed from the requirement to do self-directed study and also because students often became so absorbed by their study that they would willingly commit more time to the course. A term frequently used to describe student engagement in the course was that they became "immersed" in it. In other courses the contact hours remained the same as traditional approaches but the teachers put more emphasis on "constructively aligning" the tutorials with the lectures to promote and support inquiry and, in order to do so, spent more time with the tutors.

In all the cases studied, there was a strong alignment of course objectives or learning outcomes, with teaching methods and the assessment regime. However, the outcomes were not always clear to students, and indeed sometimes the stated outcomes did not include many of the skills that inquiry-based learning would promote, despite the fact that teachers could articulate these. Ideally teachers should fully describe the range of skills that students should achieve, and communicate these to the students. This helps students to recognise the host of skills they are acquiring, and assists with buy-in to the inquiry approach.

When inquiry approaches were used throughout a degree, there was clear evidence of scaffolding with inquiry skills progressively built upon during the degree, so that by completion of the degree students were equipped to undertake independent research. Even within courses, there was often a progression of increasingly complex tasks, to ensure students were developing foundational skills and then building upon these.

Departmental and institutional attributes

The inquiry approach was more fully embraced, and celebrated, by staff and students when it permeated through the whole degree programme. Thus, ideally there should be promotion of inquiry-based learning at the departmental or school level, including buy-in from senior management.

The cases demonstrated that quality learning through inquiry is resource intensive in terms of staff since it is essential to have excellent staff:student ratios in the relevant settings (e.g. tutorial, laboratory or field). Thus departments must be prepared to appropriately resource inquiry courses and release staff for teaching.

A key role is played by staff developers who inform, inspire and support staff regarding innovative curriculum design. This may occur through formal qualification programmes (such as postgraduate certificates in tertiary teaching), staff development workshops, or through staff developers working with curriculum teams. While staff developers had a role in many of our case studies, this was not the case for all: some teachers opted to use this approach not as a result of education, but through personal dissatisfaction with traditional lecturing methods.

Many of the learning environments utilised in inquiry courses are informal, since students work on tasks outside set contact times. Often this work involves discussion with peers, so departmental spaces with comfortable chairs and availability of hot drinks is welcomed. Flexibility in terms of usage of space is also necessary. These 'inquiry spaces', for example in the Drawing and Design course and the Advanced Radio Production course, were almost taken for granted - they formed a part of the learning process and clearly enabled students to participate in the activities required for such learning. These spaces were part of the student's immediate environment and the tutor offices were located within the same environment. Even when a more 'traditional' classroom space was used, students tended to subvert this (for example in the Outdoor Education course), by bringing in personal items to put around the room, removing desks in favour of sofas and chairs and arranging the furniture in more of a 'living room' arrangement. There was no obvious 'front of class'. Monahan (2002), uses the term "built pedagogy" in describing how the design of spaces can influence what happens within those spaces and how people behave. He suggests that formally arranged classrooms with rows of desks "embodies pedagogies or tacit curricula of discipline and conformity, whereas spaces personifying flexible properties...can be said to embody pedagogies of freedom and self- discovery." Purpose built inquiry spaces such as those in the recently built Centre for Enquiry at Manchester University or the Centre for Active Learning at the University of Gloucestershire (http://www.campus.manchester.ac.uk/ceebl/facilities/ and http://www.glos.ac.uk/ceal/building/index.cfm), demonstrate the interior design that facilitates student learning, particularly for tasks involving group work.

Discussion

Although there are many articles that discuss the attributes of particular teachers and courses that underpin effective inquiry, this research has the benefit of analysing common themes across 13 courses using a range of inquiry approaches and in varying degrees. Many articles on the use of inquiry describe the way the course is taught and student feedback on the inquiry approach, but few go on to discuss teacher experiences of the course. The findings from this cross-case analysis are, for the most part, in keeping with those found by other researchers focussed on particular inquiry courses. Certainly, as with past research, there is an awareness that teachers comfortable using this approach typically have a student-centred teaching philosophy (e.g. Spronken-Smith et al. 2008) and have an excellent rapport with their students. Often implicit, rather than explicit in the literature, is the finding that inquiry teachers are reflective practitioners, continually seeking to improve the learning experience for their students. The finding that some of the teachers were rebellious in order to teach using inquiry, is less well established in the literature. However, undercurrents of rebellious behaviour are apparent in Carter's (2007) account of teaching inquiry at McMaster, whereby, despite institutional initiatives supporting inquiry, there are still departments resisting the initiative, and hence the need for inquiry teachers to contest departmental culture and norms.

Another finding was the role of staff developers in promoting and supporting innovative teaching through IBL. Certainly, where IBL has been promoted more widely, such as at McMaster University (Knapper, 2007) or where the capacity to teach inquiry has been deliberately built through funding initiatives (e.g. the funded Enquiry-Based Learning project for Universities in the northwest of the United Kingdom (Kahn and O'Rourke, 2004)), there is frequent acknowledgement and appreciation of the role of staff developers.

In terms of course design attributes, the findings from this cross-case analysis echo those of other studies. The features central to inquiry, such as questions being the stimulus for learning, the central role of collaboration and the development of research skills have been found in many other studies (e.g. see case studies in Kahn and O'Rourke, 2004; Knapper, 2007; Lee 2004). Whilst most studies discuss the fact that students become more self-directed in their learning, few explicitly mention courses requiring students to prepare for group sessions as being a key ingredient in an inquiry approach as found in this study. Similarly, although the high workload for students is often mentioned (e.g. Justice et al., 2002; Mather, 2007; Spronken-Smith, 2005, 2006; Spronken-Smith et al. 2008) there is little mention of the lower contact hours that may result from the increase in self-directed learning. Yet surely this is a selling point for teachers! There is a flip-side though – often teaching through inquiry leads to more preparation time and more feedback to students, which can result in more time marking. In all the 13 cases there was clear evidence of constructive alignment (Biggs, 2003) between outcomes, teaching methods and assessment, but there was an issue of many typical inquiry outcomes not being articulated to students. Furthermore, a feature lacking in our inquiry courses, was an emphasis on developing skills in self-evaluation and reflection, arguably central to the inquiry process (Hunt, 2007; Justice et al., 2002). This lack of reflective skills has been drawn to the attention of the teachers, and no doubt will be addressed in the future development of their inquiry courses.

Of note in this study, was the difference in teaching culture between the Christchurch Polytechnic Institute of Technology (CPIT), and the Universities. At CPIT, the teaching culture was one based around inquiry and hence there were few perceived problems by staff trying to teach using this approach. In contrast, in the three universities, teaching using IBL was seen as different to the 'normal' approaches and resulted in some difficulties trying to resource courses appropriately. The issue of having departmental and institutional support has been raised by several researchers (e.g. Hunt, 2007; Mather, 2007; Maurer, 2007). If there is support from senior management and indeed a culture embracing inquiry, then the implementation will be easier for both staff and students. As Hunt (2007) suggests, to foster institutional change may require a two-pronged approach – both top-down with institutional leadership, and bottom-up, with teachers ready to engage.

Challenges to the Effective Use of Inquiry

Data from across the 14 cases have identified several barriers and challenges for those practitioners wishing to adopt inquiry approaches. These challenges are outlined here, together with some suggestions for overcoming them.

Gaining philosophical buy-in to inquiry approaches

This mode of teaching requires a teaching philosophy that is student-centred, as well as a high degree of teacher confidence. Research (e.g. Bond et al., 2006; Entwistle and Walker, 2000) has shown that as teachers become more experienced, they are more likely to have a

student-centred philosophy and thus may be more amenable to inquiry approaches. Some though, will resist such teaching approaches, instead wanting to remain in a "teaching as transmission" mode. This means it may be more difficult for newer teachers to embrace, and also very hard to convince some seasoned teachers to try teaching through inquiry.

Thus teachers in IBL need to be oriented towards the purpose, method and outcomes of this approach. Ideally, if new inquiry courses are being created, as many of the teaching team as possible should be involved in the planning stages, so that there is widespread ownership of the course. Fortunately there are several options available to help shift teaching beliefs towards more student-centred approaches. Staff developers can play an important role here through formal (e.g. postgraduate certificates; workshops; teaching portfolio development) and informal (working one-on-one with staff or curriculum teams) education. Also, more experienced colleagues can provide mentoring support for less experienced staff members, particularly where inquiry courses involve a team of tutors. Roy (2007: 37) suggested that inquiry courses are best developed by a diverse team of teachers that includes "sympathetic colleagues". He also noted success with the use of "learning triads" (p. 41), which include a teacher, students, and a peer mentor for the students. This triad was found to be beneficial for all parties in terms of students observing the modelling the use of good inquiry skills, the teacher gaining feedback on class dynamics and progress and, for the peer mentor, important professional learning about teaching and the development of ongoing mentoring relationships.

Supporting the transition to inquiry teaching

In most of our cases teachers had been teaching using inquiry for several years, and thus were not new to the approach. However, some were part of teaching teams that often had new tutors coming on board to teach in the inquiry course. Reactions to teaching inquiry for the first time can include fear, anxiety, stress, uncertainty and discomfort (Maurer, 2007; Spronken-Smith and Harland, 2008). These reactions typically stem from those teachers holding a more teacher-centred approach or those in transition to more student-centred approaches, since they are unused to relinquishing control and the anxiety that can be associated with this mode of teaching. However, many teachers already use elements of inquiry in their teaching (often more structured and guided types), but may not term it as such. Thus as Mather (2007) suggests, there should be a recognition of the inquiry practices teachers may currently use and subsequent building upon this platform. Particularly as teachers move to use more open inquiry approaches, the level of support needs to be increased. Furthermore, at more advanced levels, as students' abilities to undertake independent research increase, teachers may find they become more of a mentor in the learning process, with less need to intervene. Whilst this is clearly an excellent outcome in terms of student learning, it can be unsettling for teachers. Thus teachers are moving from a teaching situation which focuses attention on the teacher as expert and giver of knowledge, to one where the teaching role becomes more facilitative and then one of mentoring or coaching. Also, for teachers who enjoy the close interaction with students through the facilitation of small group work, the 'cutting of the strings', as it were, can be difficult.

Spronken-Smith and Harland (2008) found that teachers new to open inquiry approaches, struggled with a perceived set of 'rules' about how to teach in this mode. This was also noted by Carter (2007:92) who commented it was incongruous that: "a first year course designed to cultivate self-directed learning and independent research skills on the part of students requires the instructors to adhere to a largely fixed approach in terms of course delivery."

To assist teachers in making the transition to inquiry teaching it is advised that support is made available. This could be through mentoring by more experienced colleagues, support group meetings for teachers new to inquiry, learning triads as described above, or, if team teaching is involved, through the development of a community of practice (CoP) amongst the teaching team. Spronken-Smith and Harland (2008) have shown that the creation of a teaching team CoP, with regular meetings throughout the course, can help lessen the anxieties of teachers new to teaching as facilitating. However, they caution that ideally the teaching team should discuss explicitly how the CoP will operate, so that there is legitimate participation by all, avoiding the marginalisation that is implied by Carter (2007).

Preparation time in inquiry courses

Carter (2007) raises a valid concern in relation to preparation time for inquiry courses. She discusses the need for teachers new to inquiry to undertake professional development in order to help develop the necessary confidence and skills to teach using inquiry. As a minimum she suggests that teachers should find out what inquiry is, and how to plan, deliver and evaluate an inquiry course.

Teaching through inquiry involves a different emphasis in terms of teaching time – a finding reiterated by Maurer (2007). For IBL courses, rather than spending time preparing lectures and laboratories, teachers are instead devoting more time to the preparation and framing of inquiry tasks, particularly the first time an inquiry course is taught. Thus there may be more time spent in planning, and less in delivery mode – especially since contact hours may be lower.

Inducting students into inquiry approaches

Similar to teachers, students engaged in IBL also need to be oriented to the purpose, method and outcomes of this approach. This is particularly the case when inquiry courses occur within otherwise traditionally taught curricula. Students can struggle to cope with the new expectations being placed on them to take increasing responsibility for their learning. As Taylor (1986 cited in Roy, 2007) suggests, students can go through a similar process to the 'grief curve', when being confronted with the challenge of directing their own learning. The anxieties may be compounded if students are also working in groups for the first time. Tuckman (1965) discussed the series of steps that groups tend to go through, from initial unease and lack of trust of peers to a fully functioning group focused on the task, in a progression of 'forming, storming, norming and performing' phases. So in addition to being oriented to the features of IBL, students should also be oriented to the purpose and function of group work.

It is important to scaffold learners through the progressive development of inquiry skills until they are capable of independent inquiry. If a desired graduate outcome is for students to be able to undertake independent research, then inquiry tasks need to be incorporated throughout the degree programme, with increasing expectations of expertise and independence.

Difficulties with collaborative learning in competitive courses

In the Fashion Design case, there was a tension between working collaboratively and as individuals. Students were required to work collaboratively and indeed the tutor felt very strongly that not only did this contribute to the learning process, but that it also helped the

students to cope with the assessment workload. However at the same time students were also competing for limited places in the Diploma course the following year. Because of this some students felt that working collaboratively resulted in the group needs taking precedence over their individual needs and goals. In addition, some students felt that the collaboration process sometimes stifled their individual creativity. Whilst creativity was not a desired learning outcome for this particular course, as the focus was on learning technical skills, these students felt that they should have had their creativity acknowledged. These feelings may have been compounded by the fact that, as a result of the IBL approach taken, students were inherently creating new ideas but there was no scope for recognition of these. When using an IBL approach in courses that have the potential for more creative outcomes it may be worth considering how these might be acknowledged.

Coping with varied assessment products

A potential characteristic of an inquiry course is that students might be encouraged to complete the same assessment task in topics and formats of their choosing. In other words, if the intention of an assessment task is to provide an opportunity to demonstrate inquiry-based learning outcomes (self-directed learning, self-reflection, etc), then students' topics and formats do not need to be the same. For this to work effectively for both students and teachers, there needs to be a focus on the learning outcomes through rubrics or "explicit guidance to students on these types of assignments" (Lee, 2004, p. 264).

In most of our cases, students were led to create assessment products in similar formats (such as posters, research proposals, essays, research reports, etc), but the specific topics often varied widely since there was some choice in the areas of inquiry. For example, students in both Sociology and Communications Disorders completed assessment tasks that were essentially the same for everyone (an essay in Sociology and a learning contract in Communications Disorders), but the specific topics of the tasks were chosen by the students. As was evident from the classroom observations and student comments about those tasks, this was unfamiliar territory for the students and they, as suggested in the above quote from Lee's book, required a lot of guidance and scaffolding from the teachers. Within this guidance and scaffolding for students is also the need for clear criteria for markers in order to evaluate products that are designed to be both individualistic and moderated in the class context.

Developing skills in self-reflection

Developing skills in self-evaluation and self-reflection is a central tenet of inquiry experiences. However, there was considerable variation in the extent to which students developed these skills in the case studies. Often the requirement for reflection on their learning was not incorporated explicitly into the coursework. As Spronken-Smith (2006) found, students may welcome learning about approaches to learning and this helps them to be more reflective about their own learning in the course. However, to facilitate reflection it is necessary to build reflective elements into the coursework, such as the use of reflective diaries or learning logs, and an expectation that there will be a reflective critique, not only of their research, but of their learning in the course (e.g. Spronken-Smith, 2005).

Departmental and institutional barriers

This research showed that there are systemic issues to address to enable IBL to be more widely implemented. Many inquiry practitioners felt they had to subvert institutional norms

to teach in this innovative way. The issues identified included the perceived barriers of institutional norms for timetabling and room allocation; the difficulty of the approach gaining acceptance by staff; and the difficulty of recruiting sufficient tutors in an environment focussed mainly on research and Performance-Based Research Funding (PBRF) outputs. This is a particular issue for interdisciplinary inquiry courses that draw staff from a range of departments. Maurer (2007) discussed the issue of recruiting tutors and noted a disturbing trend for the use of sessional, rather than departmental staff, for inquiry teaching. She also found that some senior managers and colleagues mistrusted the approach and accused teachers of taking an "easy course". Often inquiry courses were not counted in departmental workload formulas, which led to inequities in workloads.

To address some of these rather entrenched barriers, it is important to showcase good practice and highlight achievements of IBL courses, so that senior management and departmental colleagues will become more sympathetic and, hopefully, enthusiastic about the approach. The PBRF issue could be tackled by pointing out to staff how such inquiry courses can be fertile grooming ground for future postgraduate research students. This research has found that IBL can indeed strengthen teaching-research links, as discussed in the following section. The issue of providing suitable learning spaces is more of a challenge, and this may require further research to determine what is suitable for inquiry learners in a New Zealand context.

Can Inquiry Strengthen Teaching-Research Links?

Background

Inquiry-based learning is being promoted as a way to strengthen teaching-research links (see literature review in "Project Overview"). Thus this analysis aimed to determine if in fact this was occurring. Several sources of data were gathered to explore the teaching-research nexus. These data included:

- IBL checklist, which had a series of questions about teaching-research links
- IBL survey, which probed students on types of skills gained through inquiry tasks
- IBL course evaluation, which included a question asking students whether the course helped develop their ability to engage in research-related activities
- Interviews with teachers, which probed how teachers saw the relation between their inquiry teaching and their own research
- Focus group or small group instructional diagnosis with students, which probed students' understandings of the relationship between their teacher's research and teaching and their learning, as well as the extent of their awareness of participating in a community of practice/inquirers
- Course documentation
- Observation of teaching and learning.

Given the varied data sources, it was possible to triangulate evidence. Three of the 14 cases were analysed in depth to explore aspects of the teaching-research nexus. These cases were from the University of Otago and included the stage 2 Political Communications course, the stage 3 Endocrinology Module, and the stage 3 Ecology Field Course. These cases were selected since they represented three different modes of inquiry: structured inquiry (in this example case-based learning); guided inquiry; and open inquiry, respectively. Each of the courses is described briefly together with an analysis of the teaching-research nexus. This is followed by a synthesis across the three cases.

Endocrinology Module, CBL; Structured Inquiry

The stage 3 Endocrinology Module used a structured inquiry approach involving case-based learning (CBL) in which students worked in small groups on a series of cases and scenarios. The class of 230 was split into 16 groups of about 14 students. Each group of 14 met once a week with their tutor. Students had to prepare for the weekly session by undertaking background reading and learning factual material. In the group session, students were introduced to series of cases that they had to solve in teams of about seven. Although the inquiry questions were open-ended, the tutors were seeking one "right" answer, i.e. knowledge was not being contested. Students were given a combination of formative (on-line tests) and summative assessment (a final exam that involved an endocrine case).

Data from the IBL survey and checklist showed that the students and teachers respectively, thought the module was encouraging skills and learning typical of inquiry courses (see details under "Endocrinology" case). There was a signal though, that this module was not necessarily involving open-ended questions. Although the teachers said the questions were *usually* open-ended, they added the caveat that they were seeking the one "right" answer. Furthermore, in terms of inquiry strengthening the teaching-research nexus, this was not found to be the case. The evaluation data showed that only 9% of the respondents *strongly agreed*, and 25% *agreed*, with the statement that the course helped develop their ability to engage in research-related activities – by far the lowest rating for any of the evaluative questions. Also, as Table 1 shows, only rarely was the inquiry aligned with teachers' research interests in medicine. In this case the only alignment was for one of the tutors who had research interests in medical education. Thus, with the exception of this tutor, teachers were never there as co-learners. There was rarely any teaching of research process.

The interview and focus group data provided an opportunity to further probe aspects of the teaching –research nexus. The three members of the course design team all commented there was no disciplinary link between their teaching in this module and their pathology research. One commented "not for me", while another said:

"This is service teaching, and we actually don't even aim to, to teach them advanced kind of current stuff because that's not particularly relevant and, and it would be very distracting, in fact, from what we think they need to know."

Similarly, the link was not there for the students. They commented "not sure what his research is" and "doesn't really apply". There was a sense of community in the tutorial groups, but not a sense of a community of inquirers or researchers.

While many inquiry courses explicitly engage students in research to develop research skills, this module did not set out with this aim. Rather the aims of this module were more content and clinically oriented. Thus in this case, the links between teaching and research were not strengthened either for the students or the teachers. Given the findings, this case has brought into question the issue of whether this module really is an example of IBL, and this is considered further below. Nevertheless, this case-based approach certainly met the teacher's aims and provided students with a rich and engaging learning environment. This was especially significant given the diversity of the students in this class - only about half were of New Zealand, Māori or Pasifika ethnicity. Despite the diversity evident within the class, students were unanimous in applauding the student-centred approach adopted in the module.

Table 1: Comparison of course design aspects for the Endocrinology case-based learning (CBL) module, the guided inquiry Political Communications course and the open inquiry Ecology Field Course.

Feature	Endocrinology - CBL	Political Communications – guided inquiry	Ecology Field Course – open inquiry
Open-ended questions?	*usually*	usually	always
Challenging questions?	usually	usually	usually
Elements of student choice in study?	rarely	sometimes	usually
Alignment of outcomes, methods and assessment?	always	always	always
Transparent assessment scheme?	always	always	always
Student collaboration in learning?	always	sometimes	always
Student reflection on process of constructing knowledge?	sometimes	rarely	sometimes
Move to self-directed learning?	always	always	always
Students working through process of constructing knowledge?	always	always	always
Teachers as facilitators?	always	always	always
Teaching of relevant transferrable skills?	always	usually	usually
Aspects of the teaching-research nexus			
Emphasis of learning?	existing body of knowledge	process of generating new knowledge	process of generating new knowledge
Breadth of study?	narrow and focussed	wide but prescribed	wide and varies according to student interest
Inquiry aligned with teachers research interests?	rarely	usually	usually
Teachers as co-learners?	never^	usually	usually
Teaching of research process?	rarely	sometimes	always

^ except for one tutor with medical education interests

Political Communications in New Zealand, Guided Inquiry

This stage 2 course used a guided inquiry approach whereby students covered a series of prescribed topics, but these were framed through a series of questions. Students had to prepare for weekly group meetings (half the class – 15/30 – met at a time for one hour). The preparation included accessing online resources and undertaking reading as well as listening and watching media clips. Based on this preparatory material, the group discussions focussed on the key questions and the teacher used a series of brainstorming and task-oriented methods to get the students to cover the broad content areas. Students were assessed via a series of learning logs, an in-class test and an essay.

The range of data collected showed that this course was encouraging skills and learning typical of inquiry courses (see details under "Political Communication" case). As Table 1 shows, students were addressing challenging, open-ended inquiry questions and sometimes working through the process of constructing knowledge. Students usually had choice in elements of their study focus and sometimes collaborated in their learning – particularly during the group sessions.

Regarding the teaching-research nexus, it was apparent that this was key to the course, particularly for the teacher. For example, the teacher commented: "It's very interesting because I can actually set them tasks or problems which are mini versions of what I am, myself, doing." He has a strong belief in students learning through doing.

"That's when I think students will only ever learn techniques of research by actually doing it. You can tell them to do something, you can describe content analysis until the cows come home but only when they do it and start saying, well, how in the hell do I code this article? Is this article really anti-Labour or pro-National or whatever? .... and I want to involve them and get them to participate because I think that's the only way they'll understand... I think involving them in, not just going out and doing the readings, but actually doing some mini research programmes, teaches them a whole host of things about working with other people, overcoming problems, dealing with things that don't work out how they should..."

Despite the high value he places on close ties between research and teaching and his strong belief in developing research skills in his students, he is not explicit about his research to students. For example, he commented:

"To read what I've done and published because I can see they'll be saying, 'ohh, well Rudd said this and Rudd said that' and I don't want them to sort of think,' well this is how he did it. This is what they've said they did'. I want them to do it, find out themselves rather than just trying to follow a format that I've come up with."

Given this teacher's philosophy about wanting students to develop independent thought, and his reticence to openly discuss his own research, it is perhaps not surprising that his students struggled to answer questions about teaching-research links in this course. There was little awareness of the link, although they valued the research skills they had acquired but did not often explicitly recognise these as such. In the course evaluation 33% of the respondents strongly agreed with the statement that this course helped them engage in research-related activities, while another 33% agreed. In the small group instructional diagnosis, the students thought that their teacher was enthusiastic about the topic and used his textbook – these aspects were both seen to result from the teacher's research.

Ecology Field Course, Open Inquiry

This stage 3 Ecology course adopts an open inquiry approach, whereby students develop research questions and then complete research projects, thus going through the full inquiry cycle. The inquiry-based learning begins in the field on a week-long residential fieldtrip where students learn to question ecological patterns and processes in the landscape and subsequently work with one or two peers to generate a research question to be tackled. Field data are gathered on the trip and analyses are completed once back on campus. Students have to give an oral presentation and a written report, on their research.

The wealth of data gathered confirmed that this course was encouraging skills and learning typical of inquiry courses (see details under "Ecology Field Course" case). As Table 1 shows, students were always addressing open-ended questions that were usually challenging, and they were always constructing knowledge that was usually new to the teachers.

In terms of the teaching-research nexus, the topics of inquiry were usually aligned with the teachers' interests, teachers were usually co-learners, and there was always teaching of research process (Table 1). In the interview one of the teachers commented: "For me personally, it's a two-way process" both through guiding students in the research process and for teaching informing her research… "it's [student research] challenging me to actually challenge my own perspectives". The students also picked up on a strong teaching-research nexus. In the course evaluation, 72% of the respondents strongly agreed with the statement that the course helped develop their ability to engage in research-related activities, and another 22% agreed with this. Feedback from students in the IBL survey and the small group instructional diagnosis found that students thought the most valuable part of the course was learning about the research process. They knew about their teachers' research interests (one commented that that they had "gained insight from casual conversations"), they knew they were being explicitly taught research skills, many felt part of a community or researchers/inquirers and some talked about the notion of this course being like an "apprenticeship in research".

Synthesis across the cases

As demonstrated by Table 1 and the preceding discussion, there were clear differences in the manifestation of the teaching-research nexus across the three cases. In our analysis, the case-based learning Endocrinology module allowed little opportunity for elements of the teaching-research nexus to be developed. In contrast, the Ecology Field Course that was premised on an open inquiry approach had a very strong teaching-research nexus – for both teachers and students. For open modes of inquiry there is likely to be more student choice regarding the topic of study, an increased capacity to do research, and an increased capacity for a Community of Practice as students identify with a community of inquirers/researchers. Thus, if teachers are planning to use IBL as a means to strengthen teaching-research links, they must be cognisant of the different manifestations of the links, depending on the mode of inquiry adopted. It is possible that if CBL is appropriately designed to focus on the development of research skills, rather than primarily focus on students learning a set body of knowledge, it could strengthen teaching-research links. However, from the cases gathered, the best chance of strengthening teaching-research links was found to occur when open inquiry was used as a basis of course design. Nevertheless there is likely a place for more structured and guided forms of IBL, particularly to progressively develop inquiry skills to the

level where students have the confidence to undertake independent research at an advanced level in an open IBL course.

Reconceptualising Inquiry-Based Learning

The discussion above has covered commonalities and differences amongst three different modes of inquiry-based learning manifest in the Otago cases – case-based learning, guided and open inquiry. Although the process of student learning in the CBL Endocrinology module was very similar to that in guided and open inquiry courses, certain aspects of the module rendered it very different (see Table 1). In terms of the learning process, the features of commonality between this case-based approach and the others were that a problem or question was a trigger for learning, it adopted a student-centred approach with teacher as facilitator and the students had to do independent work. However, the differences arose mainly in relation to the breadth of study, the view of knowledge and differences in the teaching-research nexus. Whereas the guided and especially the open inquiry courses had typically strong teaching-research links, this was not apparent in the CBL module. Importantly the Endocrinology module was mainly focussed on students learning a set body of content. Although this module arguably provided an excellent learning environment for students, it was not an exemplar of IBL. The incorporation of this case, however, enabled the research team to elucidate more clearly the features of IBL!

The working definition for IBL at the outset of this project was that IBL was a pedagogy which best enables students to experience the processes of knowledge creation. The core ingredients of an IBL approach included:

- learning stimulated by inquiry, i.e. driven by questions or problems;
- learning based on a process of seeking knowledge and new understanding;
- a student-centred approach to teaching in which the role of the teacher is to act as a facilitator;
- a move to self-directed learning with students taking increasing responsibility for their learning; and
- the development of skills in self-reflection.

Furthermore, we defined IBL as an approach that encompassed problem-based learning (PBL) and case-based learning (CBL). Thus we saw IBL as an umbrella term, that included structured and guided activities (such as CBL) through to independent research, where students generated the questions and determined how to research them.

We now see the key to IBL as being **an approach which effectively enables students to experience the *processes* of knowledge creation**, with new emphasis added. This then would define it as something different from CBL, or various forms of PBL, which may focus on students learning an existing body of knowledge. So following this research, we would now reword the second criterion to state:

- Learning is primarily focussed on developing research skills, rather than on learning a set body of content.

Thus IBL is different from case-based learning (CBL), or various forms of problem-based learning (PBL), which may focus primarily on students learning a set body of knowledge (Figure 4). However, this definition does not eliminate CBL or PBL as possible modes of

IBL providing they are designed in an intentional manner to construct new knowledge and to develop research skills. Students engaged in IBL should develop valuable research skills and be prepared for life-long learning. Particular learning outcomes should include critical thinking, the ability for independent inquiry, responsibility for own learning and intellectual growth and maturity.

It is also helpful to identify which type of IBL is being used in teaching, and here we expand upon the earlier defintions:

- *Structured* inquiry – where teachers provide an issue or problem and an outline for addressing it. The timescale for this type of inquiry is quite short – typically occurring within a class, laboratory or tutorial session. For example, it may be a laboratory exercise that begins with a question and students are told a procedure to follow in order to get to an answer. Student learning outcomes typically include acquiring procedural skills, as well as communication skills.
- *Guided* inquiry – where teachers provide questions to stimulate inquiry but students are self-directed in terms of exploring these questions. Here teachers may wish to cover particular content areas, but these are framed through questions that students will pursue in order to explore particular content areas. Research skills are often taught and/or developed as part of this mode of inquiry. The timescale is longer than for structured inquiry, with questions framing learning that may occur over days or weeks. Student learning outcomes typically include a range of research skills especially in terms of locating and evaluating secondary data, as well as communication skills.
- *Open* inquiry – where students formulate the questions themselves as well as going through the full inquiry or research cycle (identify question, gather and analyse data, evaluate evidence, communicate findings, generate more questions). The timeframe of the inquiry is generally longer with one question leading to research over several months, a full semester, or even a year. Teachers are often co-learners in this mode of inquiry and there is typically a very close relation between the teacher's research, their teaching and their students' learning. Student learning outcomes for this open mode of inquiry typically include more advanced research skills such as the ability to ask a good research question, a sound understanding of research design, an ability to undertake independent research, and effective communication skills.
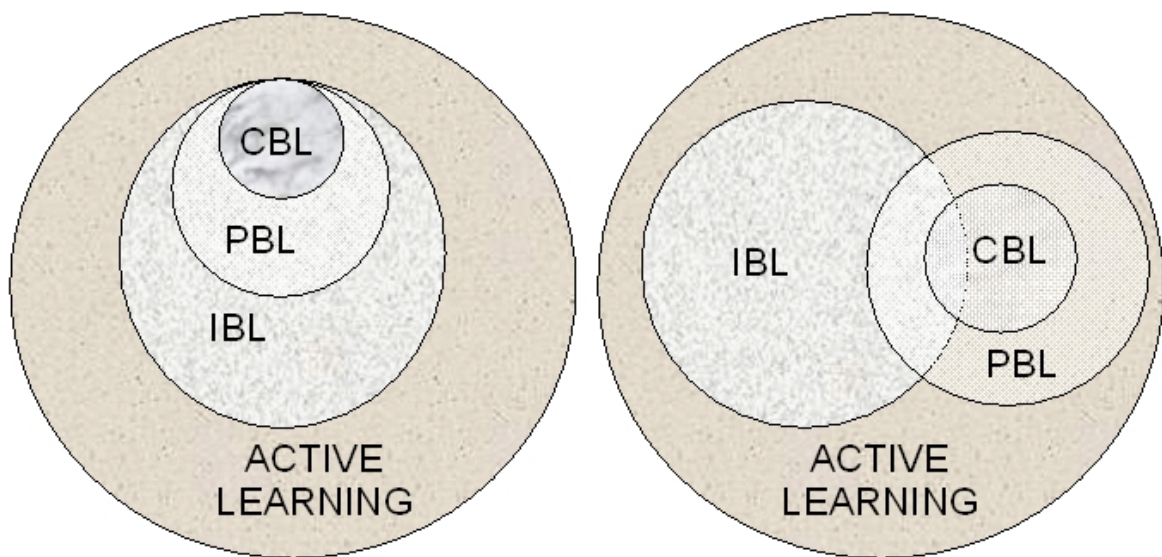
Figure 4: Initial and new model of relations between IBL, PBL and CBL. In the new model, although inquiry can incorporate problem- and case-based approaches, some types of PBL and CBL fall outside the philosophy of inquiry, especially if they are focussed on students learning an existing body of knowledge, rather than on the research process.

A further important distinction is whether the inquiry approach is used as the design principle for the course, or whether inquiry activities are embedded in a more traditional lecture-based curriculum. Although the best student learning outcomes appear to derive from an open inquiry course, the use of structured and guided inquiry activities or courses throughout the qualification (certificate, diploma or degree) can provide a useful means to progressively develop inquiry skills until the students are capable of undertaking more advanced and independent open inquiry. Indeed, given the logistical constraints of large first year classes, the use of inquiry activities embedded into a tutorial or laboratory programme can provide a means to enhance student learning outcomes. Thus it is not necessary to have small classes in order to provide a quality inquiry experience for students; inquiry activities can be incorporated with success into large classes.

An alternative design principle for a degree (or Certificate or Diploma) programme, in use at some institutions, such as McMaster University in Canada (which has a four year undergraduate degree), is to begin with open inquiry (but this is heavily scaffolded), and then include more structured and guided forms at second and third year, before returning to open inquiry (much less scaffolded) in a capstone course in the fourth year. Proponents of this model suggest that the use of this more spiral curriculum, allows the early development of a range of research and transferrable (e.g. time management, teamwork, communication) skills that stand students in good stead for the remainder of their university study (Dale Roy, *pers. comm.*).

We suspect there will remain ambiguity around definitions of IBL, PBL and CBL, since there are numerous definitions and understandings of each approach. However, we feel it is

important to make the distinction between learning approaches which help develop research capability in students, as opposed to those which focus on learning prescribed bodies of knowledge. Thus, these new definitions of IBL will help add weight to the proposition that IBL can indeed be used to strengthen teaching-research links, particularly when open IBL is utilised.

Concluding Comments

This project had four overriding aims:

1. To identify, explore and share with the tertiary community, a variety of examples of inquiry-based learning at undergraduate level across a range of faculties and institutions.
2. To determine how inquiry contributes to the development of graduate attributes in each institution and to government educational priorities.
3. To determine the factors that both help and hinder the effective use of IBL.
4. To determine if the teaching-research nexus can be strengthened through IBL.

Central to the research was a shared understanding of the meaning of IBL. The working definition was derived from an extensive literature search and IBL was viewed as an umbrella term that encompassed more prescriptive forms such as problem-based and case-based learning. Accordingly 14 cases of IBL were selected covering a range of disciplines, levels, and modes of inquiry. While it was hoped that some cases would allow an in-depth exploration of how IBL can cater for diverse groups, particularly including Māori and Pasifika students, the constraints of the timing of this research and the willingness of departments to participate, precluded such cases being included. However, some courses were notably diverse (e.g. the Endocrinology Module and the Business Course), but mainly in terms of students from ethnic groups outside New Zealand and the South Pacific.

The cases of IBL studied in this research have illustrated that, in terms of student and teacher perceptions, IBL is successful in promoting higher order learning outcomes that will equip graduates well for further study or for the workforce. Thus the evidence presented here suggests that this teaching approach is effectively contributing to the development of graduate attributes in each institution, as well as generating the type of graduate attributes desired by government educational priorities. However, it should be noted that this study was targeting IBL courses alone, so a comparative analysis with more traditional courses could not be undertaken. Nevertheless, the findings are in accord with previous research that suggest IBL is generally more effective than traditional teaching for achieving a variety of student learning outcomes such as academic achievement, process skills, analytical abilities and critical thinking.

The cross-case analysis enabled identification of the factors (individual, departmental and institutional) that promote the effective use of inquiry-based approaches. The key findings echoed previous research in terms of teachers needing to have a student-centred teaching philosophy, and an excellent rapport with students. The finding that teachers were reflective practitioners, and often quite rebellious, since they had to subvert institutional and departmental norms (in the university environments) is less well established in the literature. In terms of course design, the findings from the cross-case analysis are in accord with previous research. The features central to inquiry-based approaches include questions being the stimulus for learning, the central role of collaboration and the development of research

skills. However, unlike previous studies, this research found that required student preparation for IBL sessions was a key ingredient of effective inquiry courses. Although there was clear evidence of constructive alignment of course objectives or learning outcomes, with teaching methods and assessment, it was noted that in many cases typical learning outcomes associated with IBL were not being explicitly articulated to the students. Rather, teachers were adhering to a traditional hierarchy of outcomes. Thus it is recommended that teachers ensure these inquiry outcomes are made explicit for students, and staff developers have a role here to help assist in this articulation of outcomes. Another important finding was the success of a model that scaffolded the progressive development of research/inquiry skills throughout a degree programme, culminating in a 'capstone' open IBL course. A feature lacking in many of our inquiry cases was a focus on developing skills in self-evaluation and reflection, despite these skills being central to IBL. Thus sound course design should incorporate mechanisms to ensure students have the opportunity to develop and practice these skills. At the department and institutional level, IBL was more fully embraced and celebrated, by staff and students, when it permeated through the whole degree programme. A key role is played by staff developers who inform, inspire and support staff regarding innovative curriculum design. This support was apparent through a range of mechanisms including both formal qualification programmes and more informal processes such as staff developers working with curriculum teams.

The cross-case analysis also enabled identification of the barriers and challenges to teaching inquiry-based courses. Again, most findings were in accord with previously reported challenges for teachers such as gaining philosophical buy-in to inquiry approaches, the need to support teachers in transition to teaching through inquiry, the increased preparation time for inquiry courses, how to develop student skills in self-reflection, and coping with varied assessment products. For students, particular issues were the need to be inducted into inquiry approaches and the difficulties with collaborative learning in competitive courses. Departmental and institutional challenges involved the traditional timetable and room allocation (more informal and flexible learning spaces may be required), the difficulty of the approach gaining acceptance by staff and the difficulty of recruiting sufficient tutors in a university environment focussed mainly on research and Performance-Based Research Funding outputs. To try and overcome these challenges it is suggested that IBL is showcased within institutions to highlight the achievements of these courses in an attempt to generate wider enthusiasm for the approach. The issue of providing suitable learning spaces is a challenge and may require further research to determine what is suitable for inquiry learners in a New Zealand context. The issue of inadequate staffing resources for IBL was more noticeable in the university contexts, where class sizes were often large. To provide a quality inquiry experience it is necessary to have excellent staff:student ratios, but this is often incompatible with current government funding policies. Inquiry was far easier to implement in the Polytechnic environment, which had typically small classes. Thus the government needs to address the issue of wanting to promote research-based teaching but failing to provide adequate resources for widespread implementation in the university sector.

The next two stages of analysis were to explore whether IBL can be used to strengthen teaching-research links, and to reconsider the initial definition of IBL adopted in this project. The case studies showed that the teaching-research nexus can be strengthened, particularly when courses are designed using an 'open' IBL approach, in which students generate a research question and complete the full inquiry cycle, with teachers alongside as co-learners. In fact, it was the close relation between teaching and research that served to distinguish IBL from other student-centred forms of learning such as problem-based learning (PBL) and case-

based learning (CBL), particularly when these approaches focused on students' learning an existing body of knowledge. This is not to say that PBL or IBL cannot be used to strengthen teaching-research links; they can if they are designed in an intentional manner to develop research skills.

Defining IBL continues to be troublesome and the relations between different modes of inquiry, and PBL and CBL are somewhat messy. We have found 'structured', 'guided' and 'open' inquiry to be a useful categorisation of IBL but one could ask why bother to categorise? We have found it important to articulate what IBL is in order to promote the approach and to analyse the potential benefits and barriers associated with different types of IBL. A broad brush approach, simply talking about "inquiry" may miss the nuances associated with the different modes of IBL. For teachers new to IBL, trying more structured forms may be advisable, but arguably the most benefit for student learning comes from open inquiry approaches.

Future Research

The inquiry process inherent in this research project has generated, in typical IBL form, further questions for future research. In this project we had originally hoped to address the issue of how students from diverse backgrounds and with varying learning needs experience IBL. In particular we wanted to explore how IBL approaches meet the needs of Māori, Pasifika and international students. However, due to the available case studies, we could not delve into these issues and future research could well pick up on this. Furthermore it may be that for students who come from more didactic, authoritarian education systems, there is a greater need for scaffolding of inquiry skills until students have the ability and confidence to undertake independent research.

In one of the cases (Endocrinology Module) there was a difference in teacher opinion about the philosophy of the module. One teacher was advocating the module was about "doing" rather than "knowing", while another was saying that it was also important to "know". Perhaps these should not be seen as opposites, but as interwoven, interconnected complementarities. The relation between knowing and doing in an inquiry context would also be worthy of future investigation.

The issue of adequate resourcing for IBL approaches should also be explored. If government is advocating such approaches, but resourcing is a barrier, then how can this be overcome? Resourcing issues should be explored in terms of staffing – particularly the impact of Performance-Based research Funding and high student enrolments, as well as the provision of suitable learning environments, which may have impacts on building programmes in institutions.

Given the confusion surrounding the terminology, should we be promoting the use of the term "research", "undergraduate research" or "research-based teaching" instead of inquiry or IBL? What is the difference between research and inquiry? Is there a difference? It was clear through this study that just as there are different conceptions of inquiry, so too are there different conceptions of research, ranging from research focussing on the creation of new knowledge, through to research as a way of thinking, an inquiring process. Do these differences matter? Furthermore if we are advocating close relations between teaching and research as a cornerstone of IBL approaches, what implications does this have for teachers not engaged in research? The fact that inquiry was well embedded in the polytechnic

environment, but struggled in the university environment, is curious given the emphasis on research within the current university context. Further exploration of the different conceptions of research and relations between teaching and research in both environments might help elucidate the different modes of IBL and probe the core tenets of inquiry approaches.

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