Investigations into Students' Information Sourcing Patterns in a Postgraduate Blended Learning Course

Garry Miller[a] ; Claire Donald[a]
University of Auckland[a],
Corresponding Author Email: g.miller@auckland.ac.nz

Structured Abstract

BACKGROUND
A blended learning approach has recently been implemented for a taught postgraduate course on Project Management in the Faculty of Engineering at the University of Auckland, New Zealand. The course attracts engineering, science and business studies students from a range of disciplines, with circa 80-student enrolment per intake. Approximately a third of the class study part time whilst employed in professional roles in industry.

PURPOSE
The goal of our research is to improve student learning outcomes by implementing a programme of successive teaching innovations and review, thereby aiming for continuous, research-informed improvement. The research reported here forms the second iteration of data collection and course improvements that commenced in 2012. In particular data was collected in 2013 with the goal of gaining a deeper understanding of student preferences for accessing information in a blended learning environment.

APPROACH (DESIGN/METHOD)
The teaching innovations include the development and integration of a course website, lecture recordings, online case studies and discussion forums with the university's learning management system (LMS), coupled with a combination of traditional and participatory lectures, and tutor- and student-led tutorials. Following these innovations we have investigated how students access information from a myriad of different data sources when they make decisions on course assignments in the blended course environment. A mixed methods research approach has been used to identify information flows and students' preferred channels of accessing relevant information via a combination of people and documentary sources.

RESULTS
We present our findings of students' preferred information sources based on quantitative survey data and website analytics, together with qualitative data recorded during focus groups and class observations. We find that students use a very wide range of information sources and channels but still value face-to-face forms of communication. We also find that students will draw on their peer network, with fellow students being a particularly important information source. We compare these results with similar data obtained from industry practitioners and find similar trends in information preferences.

CONCLUSIONS
Our results so far show the importance of student peer networks and of developing effective information sourcing skills in the modern data rich environment. We outline the implications for course design and blended learning initiatives that support the up-skilling of professionals.

KEYWORDS
Blended learning; Information Flow; Postgraduate Engineering Education.

Introduction

New and innovative educational approaches are increasingly being enabled by use of information and communication technologies (ICTs), supporting teaching delivery, student learning and assessment (Johnson, Adams, & Cummins, 2011). Substantial investment in resources is being made globally in ICTs to support social and educational reform (Kozma, 2005). In the tertiary sector ICTs are shifting the expectations of students and educators, enabling new ways for participation and information sourcing by learners (Daniel, 2012).

Against this background we previously published our experience in adopting an innovative approach to teaching experienced and professional engineers using ICT's in a postgraduate course on project management (Donald & Miller, 2013). We concluded that such an approach increases student satisfaction, improves productivity of course delivery and increases flexibility for student learning. We also outlined a proposed further research design to investigate a modern challenge for students in the tertiary education environment, namely that students have access to a vast array of knowledge sources, which are accessible via numerous communications channels (Bennett, Maton, & Kervin, 2008). Hence this current paper seeks to gain deeper insight into student learning patterns via examination of information flows for student decision-making.

In this paper we firstly provide some contextual background about the course, followed by a brief description of previous innovations, leading to a synopsis of our current research. We outline the mixed methods research design we have used, and present our findings, comparing our student cohort with engineers and project managers in professional practice in New Zealand. We conclude with a discussion of these findings and implications for future course design, teaching and elearning.

Background and Brief Details relating to the Course

Since its inception the Master of Engineering Studies (MEngSt) programme (Construction Management specialisation) has been offered on campus only. This taught programme attracts students typically with 3-10 years or more of industrial experience who are looking to return to university to undertake advanced level studies as part of their career progression planning. Our research focuses on one of the core courses in the programme, Civil 703 Project Management, which is seen as successful and vibrant.

A significant portion of students on the course are enrolled part-time. Student cohorts are typically diverse in terms of background discipline, industry experience, prior qualifications and maturity. Hence the student profile ranges from students who are recent graduates to experienced professionals, from busy, part-time domestic students to full-time international students immersed in study. Ultimately the course needs to cater for different student cohorts: full-time cf. part-time and on-campus cf. distance.

A Programme of Teaching Innovations towards Blended Learning

Our goal is to improve student learning outcomes by implementing a programme of successive teaching innovations and review, using a design-based research approach (Anderson & Shattuck, 2012) to achieve continuous, research-informed improvementStarting in 2012 a series of blended learning innovations using ICTs were introduced, each aligned to the intended learning outcomes. The innovations are described in detail in Donald and Miller (2013) with the following key features:

- A course website made available to students in advance at the start of the semester, incorporating all lecture materials, case studies, self tests and a Question and Answer (Q&A) forum

- Online case studies with a threaded discussion forum for student comments and discussion
- Lecture recordings, posted immediately following the face-to-face lectures

In 2013 additional innovations were introduced including a team-based assignment, the use of Notable, (a social annotation tool for collaborative student note-taking during lectures), and Peerwise (a collaborative learning tool for students to create, share, evaluate and discuss questions relevant to the course.

Purpose of Current Research

The research reported here describes the second iteration of data collection and course improvements that commenced in 2012. In particular the goal of the research in 2013-2014 is to gain a deeper understanding of student preferences for accessing information in a blended learning environment. Whilst our innovations to date have largely changed the course into a blended learning environment, achieved via a number of small innovations, none of the innovations alone are particularly radical. However the new learning environment provides a platform for further innovations, but we required more comprehensive data in order to make well-informed innovations. We are interested not only in how students assimilate knowledge via consumption of information and data, but also on how students use information for decision-making. March (1987) asserts that the engineering of information should profit from conceptions of decision making and information that blend the traditions of theories of choice. Choo (1996) identifies that information is used strategically in three areas: to make sense of change; to create new knowledge; and to make decisions about courses of action. As such we are interested in understanding possible linkages between information, decision making and knowledge.

We were particularly interested in who students communicated with for their decision-making, and how. We identified two types of information source, namely people sources and documentary sources. We also identified several types of communication channels (e.g. face to face, email, LMS etc.)

In a separate study we recently obtained data on how professionals access information, which indicated that the most useful information sources are work colleagues. We hypothesised therefore that in the tertiary context learning is likely to arise more predominantly from student peer-to-peer learning than previously acknowledged.

Hence we designed our research methods to identify information flow patterns for student decision-making during assignments. Thereafter our objective is to identify possible means of improving teaching methods and elearning technologies that support student learning in light of a deeper understanding of student preferences for information.

Research Approach and Methods

This is a limited scope study comparing information sourcing and preferences for the target tertiary sector population with similar data from practising engineers. Data was collected using a “mixed methods” approach (Reeves & Hedberg, 2003). This practical research approach typically involves using a mix of qualitative and quantitative methods to collect and triangulate data on an issue, and find solutions. In this study we used classroom observations, a questionnaire, and two focus groups to meet our research aims.

The questionnaire was administered to students at the end of the course, to identify information sources that students used during their assignments, and how they accessed this information. The questionnaire was credit-bearing to maximise the response rate. The university ethics committee approved this approach, ensuring that the necessary measures were in place to protect student anonymity and confidentiality, and voluntary participation with no possible impact on student grades. The questionnaire response rate was 63%.

The credits for successfully completing the assignment promoted student learning, in that the questionnaire encouraged students to reflect on the sources they used to obtain information for decision-making. The process of thinking through the various options for accessing information from a range of sources is a key skill for academic and future workplace endeavours. This skill is linked to one of the learning outcomes of the course, namely to identify and manage factors that influence the successful outcome of projects.

Classroom observations were conducted by one of the authors (Donald), who attended a selection of lectures and tutorials that were representative of the different parts of the course. Sources of information used by students during class times were noted by direct observation and participant observation methods.

Focus groups were used to obtain qualitative feedback from students. Two focus group sessions were conducted by the same author, each lasting approximately 30 - 45 minutes. Students were invited to provide comments and feedback about the effectiveness of the course innovations using a semi-structured interview protocol. Their responses were captured on anonymous feedback forms distributed at the end of the focus group discussion.

Results

We obtained a significant amount of data for both 2013 and 2014. In this paper we present preliminary findings from 2013 survey and focus groups only. More findings from our larger data sets will be published in the near future.

Demographics

The demographics of the participant cohort are summarised in Figure 01:

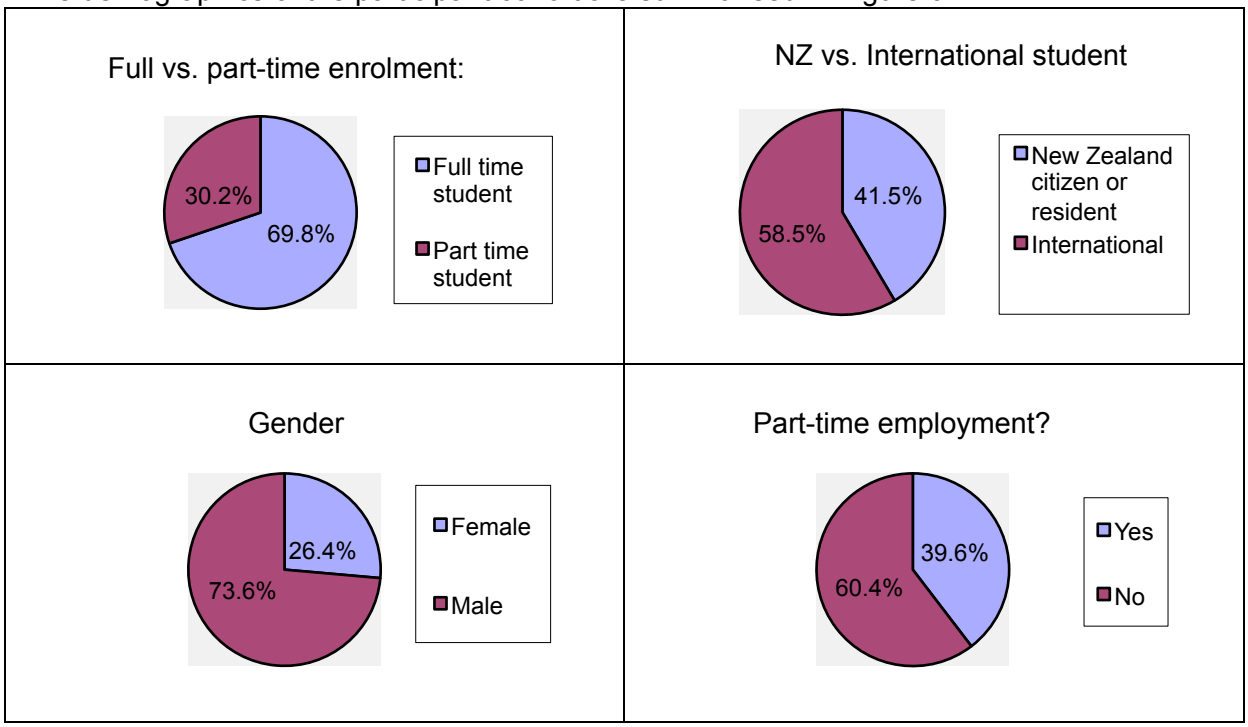


Figure 01: Demographics of the Questionnaire Participants

The demographics show a wide range of experience, with a significant percentage of students working part time. Although we didn't ask questions specifically about levels of responsibility in the survey, we know from class discussions that some students have responsible roles as project managers leading significant teams, design professionals undertaking professional engineering services, and general managers responsible for cost centres. Other younger students may have only 1-2 year's previous work experience before commencing their postgraduate studies.

Decision Descriptions as a means of Framing the Questionnaire

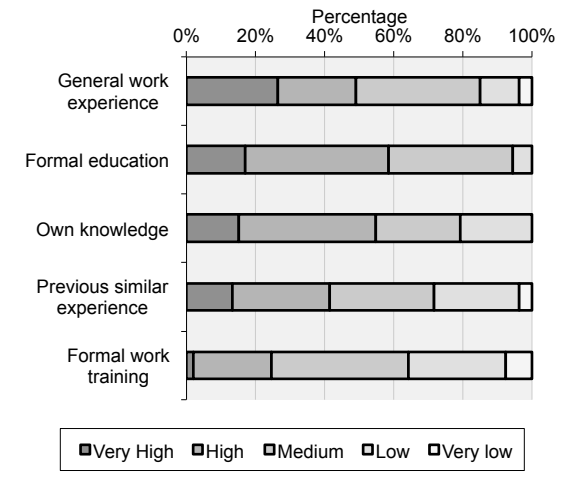
The first question in the questionnaire asked students to identify a decision they had made on one of the course assignments, qualifying that it should be something in which the students had to gather some information before making their decision. The course is assessed by a series of assignments, with no exam. In each assignment students are given a number of options to choose from (e.g. to select a case study set by the lecturer or focus on a case study from their own work experience). A qualitative analysis of the answers indicates that the majority of the decisions relate to the student's selection of an assignment option. Other decision points in students' answers relate to deciding on what data to collect for an assignment, or to choice of methodology and analysis. All subsequent questions about information sources related to the specific decision point. Some examples of students' answers are given in Table 01. These illustrate the wide variety of decisions being made by students on the course.

Table 01: Examples of the types of Decisions Made by Students

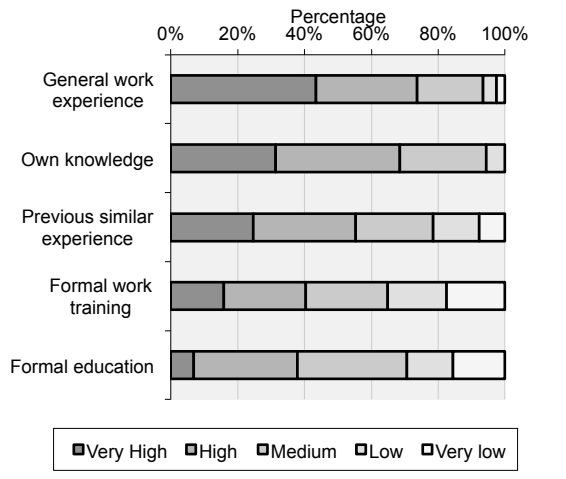
Assignment 1 required some deep knowledge of processes and their sequences. Before starting on this assignment, a decision had to be made about the type of project to document and detail.
Selecting the subject for Discussion Paper 3.
Gathering information about sequence of building timber framed houses in NZ and the duration of each sequence. Also the consent form and legal documents.
While answering to the question in discussion paper 1, I had to gather lots of informaiton on the critical success factors for project implementation.
Deciding on suitable, and appropriate, project activities to be included in Work Breakdown Structure.
One of the outputs required for Assignment 2 is to develop an evaluation report. To do this, I had to gather information around the possible tools and techniques that we can apply in evaluating project management.

On the basis of this decision point we asked students to reflect upon the contribution made to the decision from personal knowledge and experience. The findings are illustrated in Figure 02. In a separate survey we also asked industry practitioners (professional engineers and project managers) the same question about a decision they had made in practice. The findings are presented here for comparison.

Question: Reflecting upon the contribution you made to the decision from your personal knowledge and experience please rate the following:



Student Response (sample size 53)



Industry Practitioner Response (sample size 84)

Figure 02: Contributions of knowledge and experience to decision making

The students' answers to this questionnaire are somewhat equivocal, but general work experience appears to be rated similarly to formal education. Comparisons with the findings from industry practitioners show a difference in the value placed upon formal education. It is not surprising that professionals should draw upon their work experience for decision-making, and less so on their formal education which they may have completed several years previously.

The different age profiles of the two survey samples may account for some of the differences. Figure 03 shows that the industry age profile is very different from the student cohort, with double the proportion of students being in the younger age brackets (20-24 and 25-29 years of age).

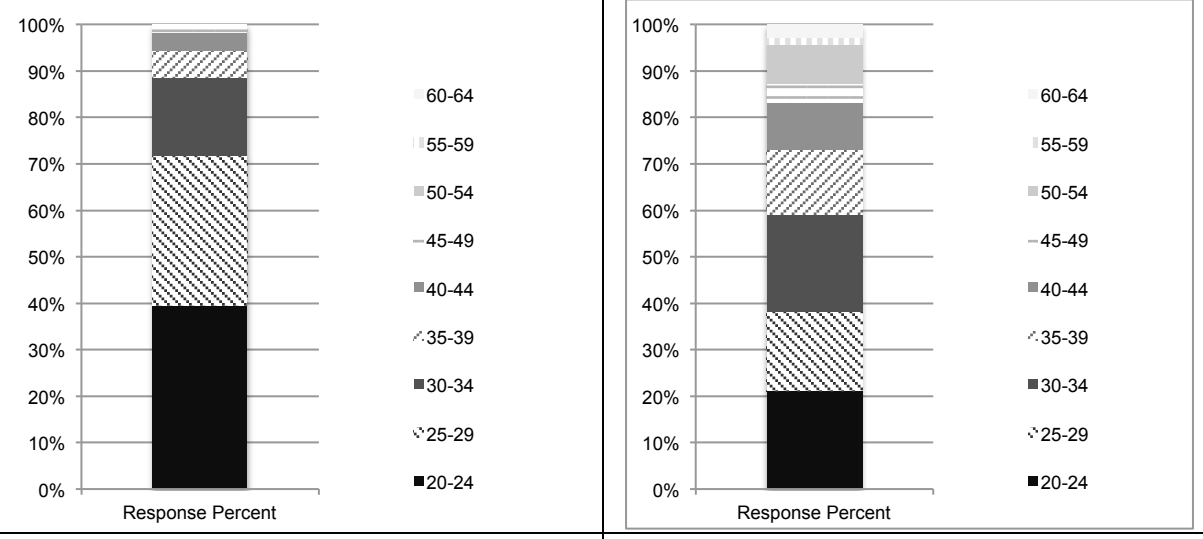


Figure 02: Age profile

These results serve to highlight the importance of learning from the professional experience brought to this community of learners by both the lecturer and the students. It was clearly evident when observing the lectures and tutorials that there was much "experience in the room", whether face-to-face or online, that was directly applicable to the course content. In focus group interviews and participant classroom observation sessions a number of students talked about the value of the case studies and simulations used in group work in the course, and requested that more be incorporated to support their learning about project management principles in practice. For example, from the focus group interview: "*More application of PM (project management) principles to industry practice during the course would be very welcome*." and *"(include) more case studies for practical examples in the industry".*

Student's answers to the focus group question on the value of the online Question and Answer (Q&A) forum were unanimous in stating the value of reading *other* students' questions and answers. "*This is an excellent method of communication with the lecturer outside of class. I felt like I had the class and the lecturer was talking to everyone. Also everyone can have some information*" and "*It is helpful to read others' questions and answers for me to find solutions to my questions".* Other researchers report similar "pedagogical lurking" and claim that it has a positive impact on student learning, engagement and reflection (Dennen, 2008).

Preferred information sources and channels:

As noted in the introduction we were particularly interested in who students communicated with for their decision-making, and how. Our findings are summarised in Figure 03 (People Information Sources) and Figure 04 (Documentary Information Sources)

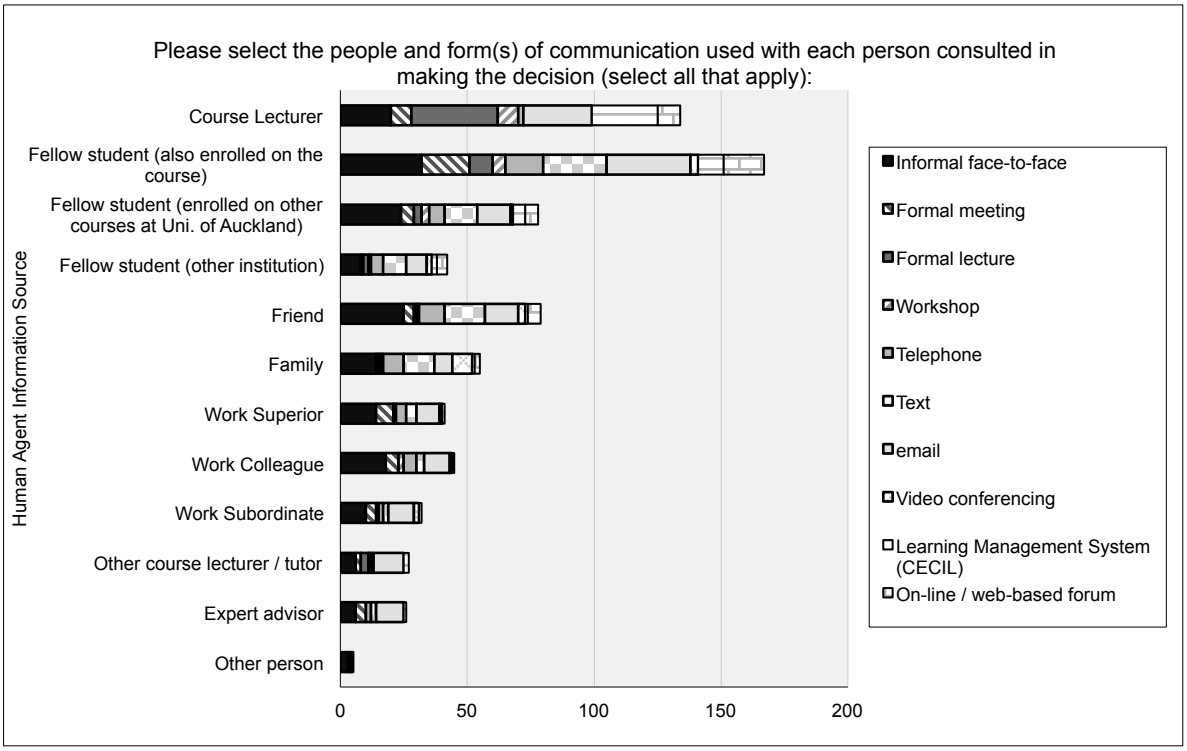


Figure 03: People Information Sources

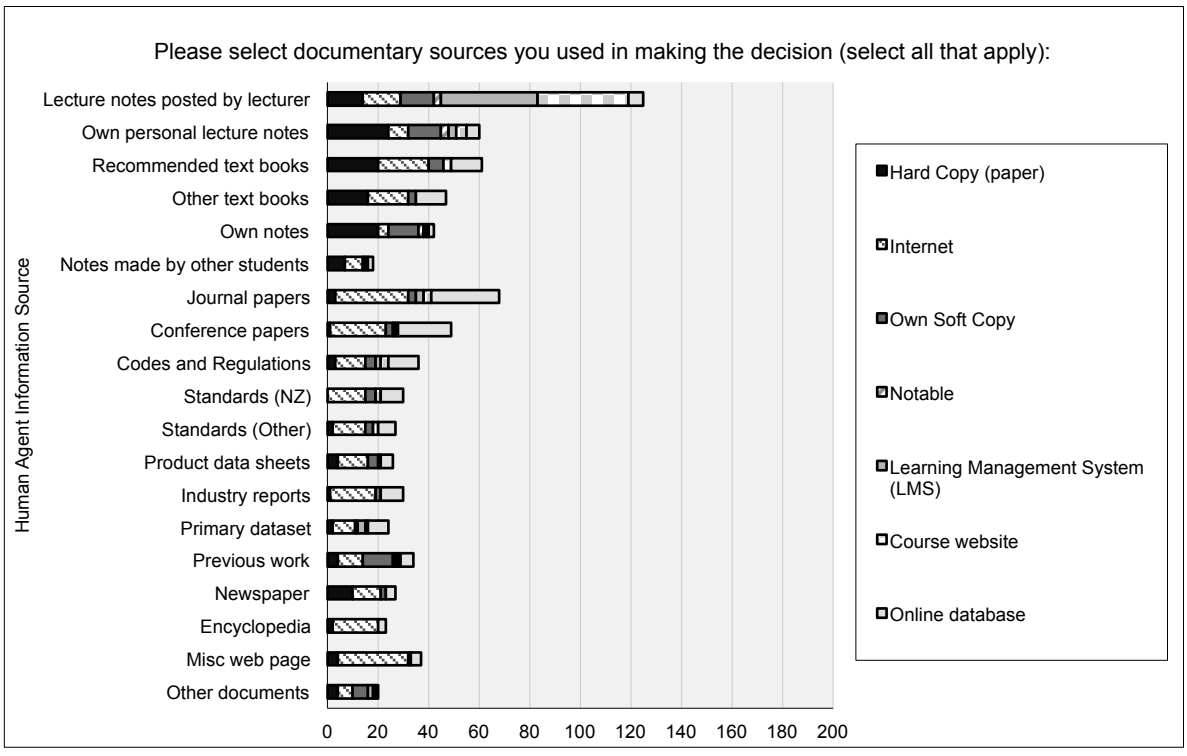


Figure 04: Documentary Information Sources

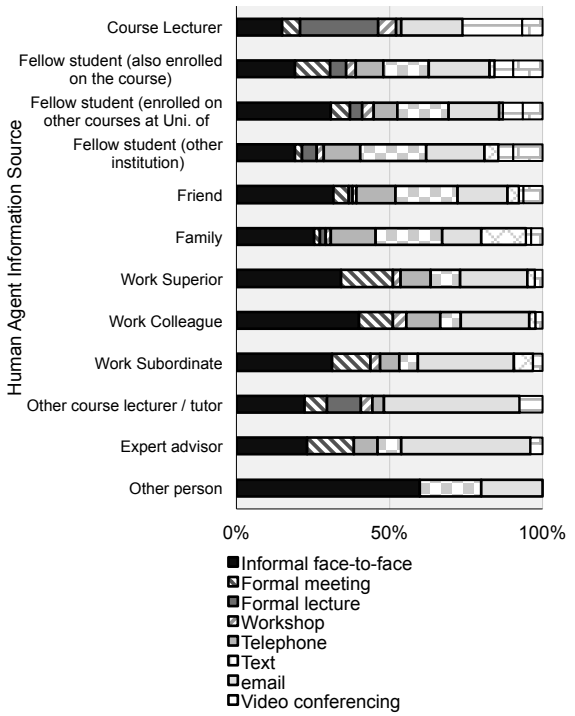
These findings indicate the prevalence of drawing information from a very wide range of sources using a range of communication channels in the student decision-making process.

Of particular interest is the significance of face-to-face interactions, and reliance upon networks of friends, colleagues and family. In a recent UK study of 23 postgraduate students enrolled in taught Master's programmes, Masterman and Shuyska (2012) report a similar finding: Students engaged with digital technologies with more research expertise as their programmes progressed, while non-digital learning networks remained important. Keeping in mind that the course has been designed to be delivered in flexible mode, with students having the option to access all materials online (lecture recordings, website, etc.) there is still a significant reliance on face-to-face communications, probably indicative of a preference for this mode of communication. This suggests that blended learning approaches should give postgraduate students flexible learning options, but still provide for a preference for face-to-face information flows.

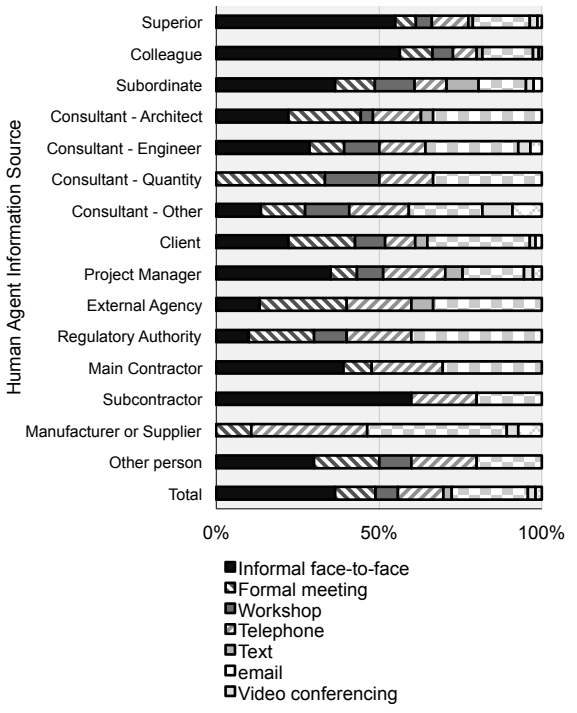
Students' responses to the focus group interview reflect the importance of supporting their access to the lecturer with modern communication channels during the course. As one student noted: *"This course has been very informative, attractive and useful for me mostly because the use of new communication devices made it easier to be in contact with lecture(r).*

We asked similar questions of the industry professionals, with results normalised and presented in Figure 05 for comparison:

Question: Please select the people and form(s) of communication used with each person consulted in making the decision (select all that apply):



Student Response (sample size 53)



Industry Practitioner Response (sample size 84)

Figure 05; Information Sources and Channels used by Students and Industry Professionals

Although a direct comparison between the people information sources in the two surveys cannot be made, (as they relate to different contexts), the comparison is still informative in understanding information source and channel preferences. They indicate that when making a decision both students and industry professionals use a range of sources; but face-to-face communications and drawing information from immediate peers are both particularly

important. Hence in the context of blended course design the lecturer should be cognisant of such preferences.

Further support for the importance of peers to student learning in this course is evident in their ratings of the best information sources, as given in Figure 06:

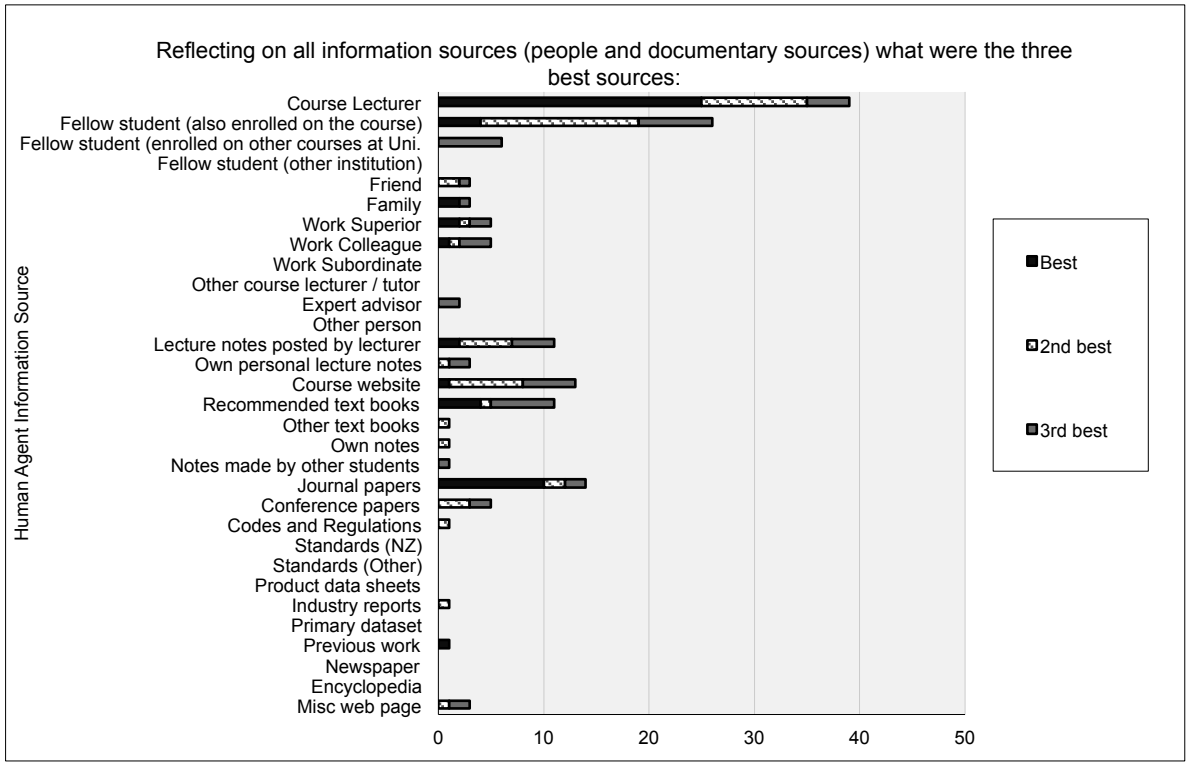


Figure 06: Student Ranking of Best Information Sources

Whilst the student results indicate a high ranking for the course lecturer they should be interpreted with care as students may have felt somewhat obliged to give a favourable ranking to the lecturer, despite repeated notifications that their responses were anonymous. What is of interest is the high ranking given to fellow students who are enrolled on the course. In alignment with our interpretation of other results the importance of student peer networks is evident.

Focus group interviews at both the start and end of the course in 2012 and 2013 showed a consistently positive response to the new features of the course, particularly the way the new course website was structured, the provision of and prompt lecturer responses to the Q&A forums, the provision of all the lecture material for the entire course made available during the first week, and the lecture recordings. A consistent request made by students was for more case studies and simulation games to apply the principles of the course to practice.

CONCLUSIONS

Our results so far show the importance of student peer networks and of developing effective information sourcing skills in the modern data rich environment. The comparison with the similar dataset obtained from industry professionals is also informative: in a post-graduate course preparing students for professional practice it is important to educate students not only in the subject domain, but also in development of information gathering skills for decision making.

We presented the findings together with development of some arguments, and hence conclude:

1. In blended learning courses face-to-face communications remain very important. This is informative, in that given a choice between a range of channels, students elect to use a mix of face-to-face and other channels. Hence, courses delivered either entirely online or entirely via traditional face-to-face mode may diminish the learning experience by restricting the availability of communication channels.
2. Students pull information from very wide range of sources using multiple channels and as such part of students' education should address the effective use of different information sources and channels.
3. The importance of student peer learning. Whilst the lecturer is an important information source for students, overall the results show a significant amount of student learning is occurring from their wider networks, particularly from student peers.

Student peer learning is an area that is underdeveloped in our course, but it is an aspect of student learning that is being more fully promoted in scholarly literature for taught postgraduate courses pedagogy. One form of student peer learning reporting improved learning outcomes in postgraduate courses is the Contributing Student Approach (Hamer et al., 2008). This has been implemented and researched in a variety of learning contexts, for example in clinical education (Blake & Doherty, 2008) and in computer science (Luxton-Reilly & Denny, 2010). This approach incorporates learning processes from industry and research, where the roles and responsibilities of 'teacher' and 'student' are re-defined as students co-create parts of the course. Traditionally, universities have placed significant priorities on individual learning from the lecturer and undervalue student experiential learning with their peers. Our findings indicate some support towards increased leverage of student peer learning along the lines of this growing body of literature.

In future we will endeavor to develop our blended learning courses seeking innovative ways of promoting learning between student peers. We outline some ideas as follows, and would be interested in sharing our learning with other postgraduate course lecturers and tutors (feedback is welcome):

- Running a series of café-style informal face-to-face meetings to facilitate more face-to-face learning opportunities for students.
- Design of assignments in which students prepare and present materials for sharing with peers.
- Student-run workshops and case studies, designed to draw on the professional knowledge, skills and experience of students (along the lines of the Contributing Student Approach (Hamer et al., 2008).
- In-class group work on case studies from students' own professional experience. Many students requested more case studies to be included in the course. The feasibility of using student-written cases for discussion in lecture or tutorial time is being considered.

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