

The influence of work-integrated learning on motivation to undertake graduate studies

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There has been concern around the lack of postgraduate qualified scientists and engineers (e.g., Gago et al., 2004; Koslow, 2005; Lovitts & Nelson, 2000). However, to be effective in increasing the number of science postgraduates, a greater understanding of why students go on to do graduate studies must be developed. Presented here is a study on the views held by science graduates from a cooperative education (co-op)/work-integrated learning (WIL) degree, who are currently undertaking graduate studies, on how their work placements influenced their decision to do further studies. These graduates cited greater awareness of career prospects and the experience of doing research during their work placement as motivators to carry on with graduate studies. These graduates also indicated an awareness of hierarchy within the workplace and were motivated to undertake graduate studies so they can obtain careers at these higher levels. The research findings suggests that the perhaps traditional views held by some co-op practitioners and faculty, where co-op students are directed readily into the employment sector, may be a too limiting view of co-op/WIL. (*Asia-Pacific Journal of Cooperative Education*, 2014, 15(1), 13-28)

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Over the last several years there have been numerous governmental reports from OECD countries raising concern about declining numbers of science and engineering graduates (e.g., European Commission, 2010; Koslow, 2005; Lovitts & Nelson, 2000; Roberts, 2001, 2002; Scott, 2003, 2005). The significance of the decline is compounded by the expected increase in scientists and engineers taking retirement in the next 20 years (Gago et al., 2004; MoRST, 1998). Furthermore, there has been concern expressed by most OECD countries about the migration of science and engineering graduates to other countries (Mogu  rou, 2006; MoRST, 1998), however, it is suggested that emigration for these countries is, at least for now, being balanced by immigration of similarly skilled graduates from other countries (Mogu  rou, 2006; MoRST, 2006).

After a succession of European summits, a target was set to increase research and development to 3% of the GDP by 2010 (European Commission, 2002). An increase to 3% of GDP equates to an extra 0.5 to 0.7 million research (PhD level) scientists and engineers in Europe (European Commission, 2003; Gago et al., 2004). However, achievability was questioned at the start (Gago et al., 2004) and completion of this target has now been set for 2020 (European Commission, 2010).

There have been mechanisms proposed to increase enrolments in science and engineering at undergraduate and graduate level, including increased funding availability, scholarships and other initiatives. However, there has been little investigation on what influence undergraduate experiences, in this case exposure to relevant workplaces, have in motivating undergraduate students to continue on to do graduate studies (e.g., Masters and PhD).

Presented here is a study on science graduate and postgraduate students' perceptions on how their undergraduate work placement experiences influenced their decision to continue on with graduate studies. During their undergraduate studies, these students undertook

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work placements (being contextualized and relevant experiential learning projects), which gave them an insight to the science workplace, where they can observe, and practice, to be a professional scientist (Zegwaard & Laslett, 2011). The intent of these work placements was not limited to providing a 'work experience' to these students, rather it is to facilitate guided and structured experiential learning (Cooper, Orrell, & Bowden, 2010). These work placements often expose the students to potential employers and may offer a direct mechanism to move from the tertiary educational institute into employment upon graduation (Braunstein, Takei, Wang, & Loken, 2011; Calway & Murphy, 2000; Howard, 2009; Wessels & Pumphrey, 1995). However, despite these potential opportunities, a significant portion of these students decided to come back to university to complete graduate and postgraduate studies, suggesting that the work placement experience may have influenced their decision. The literature has previously identified numerous benefits to students that work placement afford, such as career clarification (Giles, 2010; Parks, 2003), realistic career goal setting (van Gyn, Cutt, Loken, & Ricks, 1997), and understanding workplace expectations (Calway & Murphy, 2000; Cooke & Brown, 2006), however, little has been discussed around how work placements influence further study direction. Therefore, an investigation was carried out to determine if and how placements influenced the students' decision to do graduate studies.

THEORETICAL CONTEXT

This paper uses sociocultural views of learning, where epistemological development occurred by way of situated learning. The sociocultural framework has been useful for researching student learning during work placements (Eames & Cates, 2011; Eames & Coll, 2006). Early development of this framework was by Piaget (1950) and Vygotsky (1978), with later contributions focusing on broadening the application (Wertsch, del Rio, & Alvarez, 1995). Contributions to the framework by Lave and Wenger (1991) included social aspects of learning, and introduced the concepts of 'situated learning' and 'legitimate peripheral participation'.

Situated learning assumes that learning is a function of the activity, environmental context, and culture. The concept of legitimate peripheral participation assumes that 'new-comers' to the community of practice begin on the outer periphery and, over time with guidance (Rogoff, 1995), becoming actively engaged with the community, adopting its behaviors and beliefs, and eventually become 'old timers' or the experts (Lave, 1991). Brown, Collins, and Duguid (1989) expanded this view further by empathizing the idea of cognitive apprenticeship, where new-comers learn 'the language' and more cognitive skills (hard skills), as the new-comer moves in from the periphery.

Situated learning, thus, is a concept applicable to students engaged in experiential education (learning by doing, or learning through direct experiences). This concept was developed for practical concept largely by John Dewey and David Kolb (Kolb, 1984; Kolb, Rubin, & MacIntyre, 1984), and has students doing 'concrete experiences', involving observation and reflection. Students then develop concepts that are eventually tested or applied.

Work placements, then, are a form of experiential learning where the students (new-comers) are placed on the periphery of a relevant community of practice, working alongside practicing professionals (old timers), where over time the students learn (by way of situated learning) the community's behavioral norms in addition to some frequently used cognitive skills. The process of being incorporated into the community of practices and adopting its

norms is often referred to as enculturation. A key component of situated learning is that the environmental context must be authentic (Lave, 1991). Bruner (1968) points out that having authentic experiences in relevant contexts will result in students more willing to learn new concepts.

DEMOGRAPHICS AND METHODS

The research was carried out on science students undertaking either a four year cooperative education (co-op)/work-integrated learning (WIL) science degree or a three year non-co-op science degree. The co-op science degree has two compulsory work placements, providing a total of 9-12 months of work experience. The non-co-op science degree essentially has the same degree requirements as the co-op degree, however, without the two compulsory work placements and two management papers (Kirk & Chapman, 1992; Zegwaard & Laslett, 2011). Neither the BSc or the BSc(Tech) degree has a significant final year research project.

After graduating with a bachelor's degree, students that have chosen to carry on with graduate studies usually undertake a two year non-co-op research master's degree, consisting of academic papers and a comprehensive research project with write up (thesis). Students who have chosen to carry on with studies after a masters degree can then undertake a PhD in science (usually taking 3-5 years), which consists of a comprehensive original piece of research along with written report(thesis) and oral defense.

There were 18 participants identified for this research (8 males and 10 females) by way of contact via graduate paper conveners and faculty staff, with 10 participants enrolled in a MSc, seven having completed masters and enrolled in a PhD, and one having completed masters and recently commenced working full-time. All of the participants had completed an undergraduate science degree (either a BSc or BSc(Tech) at the University of Waikato. Twelve of the participants had placements of varying durations (co-op participants) while six did not have work placements as part of their undergraduate degree (non-co-op participants). The placements completed by the 12 co-op participants were at different organizations and mostly project-orientated placements rather than routine, with each having a research element to the project. These projects were mostly a sub-project of a larger research and development undertaking, and seen as a support type research project, based either at a Crown Research Institute or a commercial company which had a significant research and development division. All students were at varying stages of completion in their graduate study. Pseudonyms are used in the reporting of this work.

Interviews were semi-structured and of 45 – 60 minutes duration. The interviews consisted of a list of specified questions established before the interview, however, being semi-structured allowed enough flexibility in the interview protocol to further explore responses and interesting comments further (Coll & Chapman, 2000; Wiersma & Jurs, 2005). Therefore, set questions such as "Before you did your placement, were you considering doing a masters degree?" were asked and then followed up with explorative questions depending on the type of response given by the participant. Being a naturalistic inquiry, the wording of the questions have varied depending on the interview progress (Guba & Lincoln, 1994; Lincoln & Guba, 1995). The interviews were recorded and transcribed verbatim. Data was analyzed using a thematic analytical approach (Cohen, Manion, & Morrison, 2011). This research has ethical approval granted by the human ethics committee at University of Waikato.

RESEARCH FINDINGS

Prior Considerations of Graduate Studies

Responses given by participants indicates that at the commencement of their undergraduate studies about half of the participants were at least open about doing postgraduate studies, however, only one student had specially planned to do so.

All non-co-op participants indicated that they did not decide to do postgraduate studies until their final year of their bachelor's degree. Co-op participants gave variable responses, where some indicated they decided on postgraduate studies early in the 3rd year (usually in response to the experiences from the work placement at the end of 2nd year) and others nearing the end of their degree. However, all indicate that the decision to do postgraduate studies was one that evolved slowly during their undergraduate studies.

All 12 co-op participants indicated that the work placement had at least some, and eight indicating a strong, influence on their decision to do graduate studies. Comments made by one co-op participant (Paul) best reflect the findings in brevity "I probably won't have considered masters as much if I had not done the second work placement". The research presented here will explore why the work placement had influence on their decision to undertake graduate studies. Co-op participants saw several influences from the placements on their decision to undertake graduate studies. These were career clarification, advice from workplace supervisors, opportunities, and confidence (self-efficacy), each of which will be discussed.

Career Clarification

All co-op participants thought the work placement gave an insight to career options and job requirements. A common theme amongst co-op participants' views transpired in relation of their perception of the role of technician and scientist in the science workplace. Several co-op participants referred to a hierarchy between technicians and scientists. After noting that technician were not as highly qualified as scientist, they observed that the level of responsibility and independence corresponded to the level of tertiary education. For Mandy it was made clear early in the placement that there was a distinction between technician and scientist:

There was a definite hierarchy. I felt like a technician. My [work supervisor] made it quite clear that the technicians were not scientists. So I guess I was made aware that there was a difference between the technician and the scientist – they were quite snobby about it.

Co-op participants had developed some negative views about the technician position, where participants noted that a technician role was "tedious, repetitive, and boring", and thought it was "just working in a lab rather than actually doing research". John comments suggested that he thought technicians lacked autonomy; "scientists tell the technicians what to do", while Emma thought that being a technician meant not having one's contribution to science well recognized; "...basically technicians do all the grunt work. You get no recognition for it what so ever. When there is a major breakthrough, the senior researchers get the credit".

Co-op participants then went on to reason that to avoid becoming a technician they needed to complete further qualifications. For example, Maree explained that "...I think without a masters degree you're pretty much limited to ending up a technician – in research circles

anyway." Maree went on to explain her reasons for doing a graduate degree and her thoughts on her employability:

Because I want to be paid more. And plainly it is because you have got a higher chance of employment for this sort of job. And I would be a bit bored I think carrying out the sort of work that I would do with just a bachelors.

Advice and Opportunity

Whilst on placement, students commonly seek advice from their work supervisors, including the level of education they would require depending on what the student is pursuing as a career. Samantha, for example, got advice from her placement supervisor, who herself had carried on to do masters, and she reflected back by saying "she said you want to go on and do a PhD because otherwise you sort of end up being a research assistant or technician, you are not right up there".

Hendrick recalled being told during the work placement of the benefits of higher qualifications, and noticed during his placement higher qualified employees had better job positions than those with lower-level qualifications.

...something along the lines of whoa, I've been told the more education you get, the better your job prospects are. [Then, during the placement], seeing that some of the guys had done degrees and where they were at, in respect to the company, to others. They essentially were another level up in the hierarchical chain. [It gave] the general impression that they were doing a little better.

Some co-op graduates in the program are offered funded masters research projects by their co-op employers. In Paul's case, the work he was involved with during his placement led to the opportunity of doing a master's research project with the same company:

While I was there doing a placement, they were talking about some hydrology problems they were having in another quarry, and [they wanted] to extend the quarry but didn't know if they could do this without encountering ground water problems. I made mention that I was thinking of doing a masters and basically it flowed on from there. My work placement supervisor enquired with his manager, everyone was quite supportive. That all come from my second placement.

Paul went on to explain that:

My first placement gave me the appropriate credentials to carry on with a second placement, doing geological study for the [current] company, and then the second placement led onto a masters. So it's just been a really exciting and interesting follow-on effect.

Career Direction

All co-op participants indicated that the work placement helped give career direction, and obtained valuable insight of what science was like outside the university environment. Such experience often helps refine their career ambition and assisted in their decision-making. For example, asked if the work placement influenced the decision to carry on with postgraduate studies, Erik explained:

I guess the placement did it for me, it opened my eyes and clinched the idea, that's the beauty of work placements. You see science in action, real science, and what it is doing. I had quiet an incomplete view of science and an unrealistic view of science beforehand, and certainly the placements allowed me to see what science was really

like, and also of scientists and people that work in science globally and New Zealand wide, in CRI [government funded research institutes] and CRI-like companies.

I think what it also showed me was that if I wanted to do real science I'd have to do more than where I was at now. However, if you want to do more than just the lab work, day to day running of things.... I felt I needed to get my masters as well. One because I got inspired to do it, and two because it will help me not to be doing science on the level that I was. And the PhD was a continuation of that.

Similarly, the work placement gave Peter valuable insights on the level of education he required in order to pursue the career he wanted:

Well I think my work placements were quite important from the point of view that I got to see what sort of jobs a person with a bachelors gets to do and I got to see what sort of jobs a person with a masters or PhD gets to do. Which was really the main reason why I didn't particularly want to work at a bachelor's level science.

Some students talked about wanting to have more control of their future job environment or direction. For example Peter thought that when he gets his PhD he will have freedom to explore or discover things. You will be] "your own person, with funding, and you can go about finding out things. So there is a bit of freedom in that, a bit of discovery".

Helen indicated that the exposure to research during her work placement had prepared her for postgraduate studies:

The second placement was, as helping me out for my masters, a huge advantage. Suddenly I was having to read huge piles of published literature and paper and stuff, just to get an idea of what they are talking about. I was fully immersed in that kind of research. It was a full-on research environment. That was everything anyone spoke about – always to do with what they were doing research on, problems they were facing, and how they were overcome. So it was a huge learning experience.

Heidi was also very clear on her definition of scientist and that the work placement gave her career clarification:

I could see the differences [between scientist and technician] and I could see that I was doing a lot of technical work, and I could see that this wasn't what I wanted to do for the rest of my life. I wanted to get up there and be one of the scientists. It reinforced that I wanted to go on [with postgraduate studies]. If I hadn't done a placement I might not have known what was out there. The second placement was the crunch for doing a masters. Getting to have my own project and do all the research on it, that really helped. And I decided, OK, this is what I want to do.

Mandy had an experience that made her realize that not having postgraduate qualifications could possibly limit her career progression. She based this view on what she perceived was happening to her work supervisor (who did not have postgraduate qualifications) during her placement:

[My work supervisor] was getting quite up in the seniority now, but because in genetics now they do have PhD people there, so it meant that it's like the ceiling for her. She cannot really go much higher without a doctorate.

In similar vein, Heidi's comments regarding career direction perhaps summed the co-op participant's views best:

Predominantly for me the placement was about finding out that I didn't want to be a technician for the rest of my life. I enjoyed the research,after the placement I

decided I wanted to carry on [with further studies], I knew that I wouldn't stop at a masters.

Confidence

Being exposed to an applied science environment, and particularly a science research environment, improves students' perception of their capability (self-efficacy) of doing a major research project such as a master's thesis. The boost in confidence helps students realize the feasibility of doing postgraduate studies. For example, Peter said:

I think that my work at [the research institute] gave me a good introduction into the masters because there I am doing science and now I am expected to do science as well. I've got a little bit more understanding as a result because it's one thing to swat for exams and cram a whole lot of knowledge into you head, and other completely different kettle of fish to actually picking up a test tube and doing science.

Helen has a placement in a research group at an Australian university, where staff members either had PhDs or were completing PhDs. She indicated that it was her second work placement that gave her skills in research "I think it was specifically the second placement that inspired me or that really changed me, and gave me a huge amount of skills and stuff in research". The experience of working alongside these people, and working closely with another young female undertaking her PhD, Helen indicated that her confidence in completing a postgraduate degree (masters) was also boosted:

I felt like it wasdefinitely more achievable than before because I saw people doing PhDs and I thought it is a very long and drawn out, but you can do it. I could see how it worked and it is, OK, that's not too bad. All you have to do is learn stuff. So yeah, it made me more confident that I was able to do it.

Heidi talked about how her placement gave insight to the process of research and that it developed skills she would need to do a masters degree "I learnt about research, you have to do a research topic yourself, do literature reviews, I'd never done that before. So it was really really handy for my masters".

Why did Non-Co-op Participants Undertake Postgraduate Studies?

Apart from one non-co-op participant (Marc, who had a part-time position at a Crown Research Institute [CRI; NZ government research organizations] doing menial laboratory work), non-co-op participants had not had any exposure to a relevant science workplace outside university. When querying about their knowledge of relevant institutes/organizations that would likely employ them, their knowledge was limited. For example, Marc said "I think I have a pretty bad idea of what jobs are available [for those with] a PhD. I am not sure where I'm going to go or do." Peggy and Emily were not aware of CRIs, and the non-co-op participants that were aware of CRIs did not have a good understanding of them, for example Johan said "I know about them, I just don't know much about them." The lack of knowledge of the employment sector indicates that non-co-op participants had a general uncertainty of career possibilities available to them. The uncertainty may have directly influenced at least one non-co-op participant in deciding to do postgraduate studies. Emily said "I didn't know what I wanted to do at the end of my bachelor's degree, so I thought I might as well keep going [and] do a masters". Emily went on to explain that "I thought I might as well [go on to a masters degree] cause lots of people have got bachelors these days, so I need something to distinguish myself, maybe easier to get a job hopefully." Johan, not being sure on what opportunities were available to him, sought advice from a faculty member and said he was

told “you know you’ll get a job with your bachelors, but it’ll be easier and you get more well paid if you have a masters.”

Similarly, several other non-co-op participants indicated that they were approached by faculty staff, who encouraged or advised them to do postgraduate studies. Interestingly, Emily also felt an obligation to carry on with postgraduate studies because she had a strong academic record “I kind of felt that I should because I’d been one of the top students in the Chemistry Department, so I felt it was kind of expected to go on and do a masters degree”.

Non-co-op participants also indicated peer support as being an influential reason for doing postgraduate studies. Ariana, a New Zealand indigenous person (New Zealand Maori) belongs to a science support structure, which was set-up to mentor Maori undergraduate students during their studies to address the high failure rate within this group (see details in Paku & Coll, 2005; Paku & Leech, 2001). Ariana with five other students with a similar focus within their science major formed a closely bonded group that carried on with postgraduate studies, as Ariana explained, “They all did their masters degree as well. Well, four of the five that I was close friends with. So that was quite good”.

One non-co-op participant (Adrian) undertook a ‘directed study’ in his final year. A directed study is a small research project carried out within a small group of people at the university, has a large practical component, and a substantial element of realism, which is an important part of motivating student learning (Bruner, 1968; Lave, 1991). As Adrian reflects back on why he was doing a PhD degree, he indicated that the directed study had a significant influence:

I went out and researched something, got into the field and collected some data and made some graphs and put a little story together.....which I enjoyed and I thought ‘hey, this could be where I’m heading’.

Marc provided an interesting insight, but yet still generalized understanding of the science research world, largely because he had (semi) relevant work experience outside the co-op program. His reason for carrying on with postgraduate studies was because he did not want to be a technician, and he said that:

When you’re actually a technician...you’re doing what you’ve been told, you’re not directing the research at all....you’re getting all your feedback and being told exactly what to do from the person who is heading up the research. You’re there to fix their problems...

DISCUSSION

All the co-op/WIL participants indicated that the work placement had at least some influence on their decision to carry on with postgraduate studies. Perhaps the most commonly stated reason by co-op participants for doing postgraduate studies was that they desired a job position higher than that of technician, based on their observations of technician activities during the work placement. They all noted that a degree higher than a bachelors would be required if they wanted a higher job position.

Perspective on the Employment Market

Perhaps the most prevalent reason given for co-op participants to carry on with postgraduate studies was the impression of what type of position they could obtain with only a bachelors degree. It is typical of undergraduate students to desire hands-on type positions, however, that view seem to change after being exposed to the employment sector.

The hierarchy in the science workplace seemed to build the view by co-op participants that the technical jobs were lower positions, unrewarding, and even undesirable. Most co-op participants interacted mainly with their work supervisors, who usually were staff at a technical level, and little with semi-management level people. Therefore, the negative views of the role of technician developed during the placement cannot be explained by enculturation into the 'senior' sphere of the organization.

Co-op participants discussed income prospects, where, based on their experiences in the workplace, higher qualifications correlated with high paid positions (perhaps a view most students already had before being exposed to the employment market). Co-op participants discussed that one of their motives for pursuing higher education was better job prospects, and then observed during their placements that work colleagues with higher degrees were doing "a little better". These motivations seems common, as Koslow (2005) reports that the underlying primary motive for science students to carry on with postgraduate studies is to improve their career prospects and potential salary they may earn. However, Koslow (2005) also found that a key motivator to study science in the first instance was because it was of interest to the student, which remained a primary motivator when deciding to do postgraduate studies.

It is likely that during the work placements co-op participants developed better views on the prospects of employability and potential salary. Realizing that higher education could result in better-paid positions, it seems to have become at least one of the primary variables in deciding to do further studies for these participants.

Career Direction and Clarification

All co-op participants indicated that the work placement gave career clarification. Co-op participants that had research projects during their work placements talked about the experience of doing 'real' research where project outcomes were used for decision-making. The experience of doing a research project invoked a greater interest for science research (e.g., Erik, Peter, Heidi). But co-op participants realized that to have a research career, one must complete a higher degree, most probably a PhD. As indicated earlier, it was common for participants doing masters to state that the reason for undertaking a higher degree was in the hope of obtaining a higher paid position. However, the participants undertaking PhDs mostly referred to the freedom of doing research and having control of one's career and everyday activities.

It should be pointed at that, in general, there are students that pursue technician positions. Even though the view of 'not wanting to become a technician' was prevalent amongst our participants, the sample pool may be biased towards ambitions of higher-level positions, as the participants were already pursuing graduates studies.

Development of Research Opportunities

An advantage of work placements for students is the development of contacts with people who potentially could have employment opportunities for them after graduation (Braunstein, 1999; Weisz & Chapman, 2004; Young, 1997). However, often overlooked is that the same mechanisms within co-op education that results in the development of valuable employer contacts also develops valuable contacts for potential supporters for masters or PhD research projects (e.g., availability of a project backed with finances or/and resources). Indeed, Coll and Eames (2000) found that, at the time, up to 30% of masters research projects

at the University of Waikato were funded by employer collaborators of the co-op program. Paul's situation reflects best how a project being undertaken during a work placement evolved into a well-resourced and financial backed master research project.

Perception of Ability

Having undertaken an experience where students were required to complete practical tasks as well as having observed tasks being carried out by others to meet the research requirements can increase students' confidence (Coll, Zegwaard, & Lay, 2001). The exposure of the student to the employment sector would have resulted in some enculturation into a workplace of practice (Eames, 2003a; Lave & Wenger, 1991). The student would have learnt behavioral characteristics as well as terminologies normal to such workplaces (Lave, 1991). For example, Eames (2003b) reported on a case study of a student who had taken research orientated work placements, where after two work placements, the participant showed evidence of a greater understanding of research processes, knowledge, and ideas shared in the scientific community. The participant of the Eames (2003b) study was adamant that the work placements gave him much clearer perspective of the research community, enabling him to make better informed decisions (and he is now enrolled in a PhD program). Familiarity with workplace cultures and behaviors, especially if the workplace had a research ethos, may have removed some anxiety that the student could have had of doing research. In effect, having had some enculturation into the practice of research, by way of work placements, can enhance students' self-efficacy of their ability to do research (Coll et al., 2001).

Evidence from this research suggests that these students thought, after having observed research being carried out and having had applied involvement with the research, their confidence of their abilities to do a large research project had increased. Comments from Helen, Heidi, and Sophie (and to some extent Peter) indicated that the work placements had indeed given them more confidence in their ability to do graduate research, particularly as they saw they had gained useful skills for the masters research component.

Having to complete a substantial report on the placement, including analytical, descriptive, and interpretive discussion of some results/outcomes during the placement also seemed to build self-efficacy in students' ability to complete thesis level writing. As part of the placement report, some literature needs to be reviewed, which may be a major undertaking for these students and will also make a considerable part of the master's thesis. Having completed a major report, such as that of a placement report, seems to build the perception within the student that perhaps writing a master's thesis is also achievable.

Several students indicated that they wanted to be in control of their career path. After experiencing essentially a technical role during their work placements, they perceived that the position of a technician means not having much control of one's day-to-day responsibilities or even career direction.

Similarly, it seems that participants wanted recognition for their involvement with the work. For example the view by Emma clearly gave the impression that she thought a technician or lower-level staff member would not receive the same (or any) recognition for scientific discoveries or work outcomes as compared to higher-level staff. If having completed a research project invoked the interest in research, it seems also to conjure up the desire to be recognized for achievement obtained from the research.

Non-Co-op Views Compared to Co-op Views

In general, non-co-op participants gave more varied explanations and often talked about how a faculty member had advised them to do postgraduate studies or of being offered a good research project by the eventual graduate research supervisor rather than career direction.

Non-co-op participants expressed greater uncertainty of the employment sector, for example the lack of knowledge of CRIs (a major employer of science graduates in New Zealand). Lack of knowledge of the employment sector causes students to be uncertain about potential employment prospects. Such uncertainty can lead to poor decision making regarding further studies and study direction. The fact that most non-co-op participants cited faculty advice rather than employment prospects or job types indicate that their decision to do postgraduate studies was not well-informed with knowledge of the employment sector. Albeit these non-co-op participants had already decided to do postgraduate studies, their study/research direction, as well as key motivators, may have been different had they had workplace experience.

Interestingly, one non-co-op participant (Adrian) cited the directed study (a short university course consisting entirely of a research project, which is not widely offered to students) he carried out as one of the main reasons why he chose to do postgraduate studies. The experience, albeit not situated in the employment sector, helped Adrian realize that he had an interest in research. Therefore, he decided to pursue research as a career, but he knew he would need a PhD in order to obtain a career in research. The reasoning that Adrian gave was similar to reasons given by co-op participants who had research elements to their work placement.

Comparing co-op participants' reflections on the employment sector compared to non-co-op participants, it appears that co-op participants gave more confident and elaborate explanations of their perception of employment potentials. Having a greater understanding of the employment sector, and the educational requirements one would need in order to obtain a desired job, may result in a more motivated and aware postgraduate student. In effect, decisions based on well-informed knowledge, supported by experience and observation will result in greater impetus to see the decision through to completion. Given the high rates of attrition (up to 50%) of postgraduate students from graduate programs (Scott, 2005; UMBC, 2003), the experience of having been in the employment sector and having been involved with the research process, may give these students the additional motivation needed to help endure through a demanding postgraduate degree such as a PhD.

Progressing from Masters to PhD

A direct link between work placements and PhD studies was weaker than compared to the link with masters' studies. Five of the co-op participants had completed their master's degree and were undertaking PhD degrees at the time of this research. These PhD co-op participants made less reference to the work placement as a source of motivation for doing a PhD. Rather they thought that the experiences during their master's research was the primary motivator for doing further research. It seems then, for these co-op participants, the work placements initiated a progression of events that ultimately resulted in them enrolling into a PhD program. Erik's views perhaps gave the best indication of the process of thinking he went through. He said that it was during his work placement that he was inspired to do a masters degree, however, he saw his enrolment into a PhD program as a continuation of this masters research.

Do Work Placements Result in Students Pursuing Job Positions Below their Full Capability?

One often quoted advantage of co-op degrees for students is the rapid rate of employment, often by their co-op employers, after graduation (Abel & Love, 1988; Braunstein & Loken, 2004; Weisz & Chapman, 2004). Some literature points out that co-op degrees provide graduates with a mechanism of direct entry into the labor market (Braunstein, 1999; Villeneuve & Grubb, 1996). Given that co-op students have had relevant work experience and exposure to the job market, it would be expected that co-op graduates uptake by employers would be more rapid compared to graduates who have not had work experience (Calway & Murphy, 2000; Weisz, 2000; Wessels & Pumphrey, 1995).

However, there is evidence (McCurdy & Zegwaard, 2009) that suggests that some faculty members hold concerns about academically strong students undertaking co-op degrees. The concern holds that greater exposure to the job market, via work placements, will likely result in academically strong students being offered, and end up pursuing, technical-support type careers when these students' talents were best suited for postgraduate studies. If these academically strong students are not pursuing postgraduate studies, because of tempting but lower-level job offers, then their full potential in academia, resultant higher positions they may later hold, and perhaps their greater contribution to society, is never fully realized.

However, evidence from this research shows that for these participants the work placements became a source of motivation to carry on to do further studies rather than a mechanism to pursue a lower-level but readily available position. In fact, the contextualization of job types, and what it entails in the workplace, developed some negative opinions about certain job roles (e.g., views on work requirements of technicians and their position in the workplace). It seems then that students who are academically able to do postgraduate studies became to see further studies as a mechanism of improving their prospective job roles, which was one of the variables these participants considered when deciding on postgraduate studies.

Using Experiential Learning as a way to Increase Postgraduate Enrolments

Students perception on their career options, and the choices they make, can be influenced by societal attitudes – even if these are inaccurate (Dawson & Schibeci, 2001; Schibeci & Lee, 2003). Roberts suggests that declining interest in science and engineering amongst students is partially due to poor experiences during their studies, negative image of science, and inadequate information about career options (Roberts, 2001, 2002). Dalgety and Coll (2004) found that secondary school students choices on enrolments may predominantly be based on their past experiences. Having students interact with science practitioners may help form perceptions of science careers that are more based in reality. However, in a secondary school study having visiting scientists was found to be unsuccessful in creating better perceptions of science (Koballa, 1988). Therefore, Dalgety and Coll (2004) suggested that the development of closer and on-going relationships, rather than a mere one-off interactions, will be more successful in beginning the process of enculturation into science.

The participants in this research were university based, which would have resulted in some contextualizing of students' perception of what it means to do science from a university perspective. However, their perception of the process of science and what one needs in order to do science in the workplace may still be influenced by inaccuracies portrayed by the media or uniformed social peers (Dawson & Schibeci, 2001). Therefore, applying the suggestions by Dalgety and Coll (2004) in the context of tertiary education, it is proposed that tertiary education institutes look at using workplace situated experiential learning projects as a

mechanism of informing (additional to extra skills students may learn) students of the employment sector. Students can develop an awareness of the level of qualifications they are likely to require in order to obtain their ideal career as well as gain a better awareness of the competencies employers seek in graduates (for discussion on disparity in views of desired competencies see Coll & Zegwaard, 2006). Indeed, the Dearing report (1997) and the Department of Education Skills report (2003) recommended that work experience placements be implemented for all tertiary education degrees. Perhaps for degree programs without work experience placements, high achieving students can be selected for specially arranged work experience projects, situated in an authentic environment, so they can make better-informed decisions on career direction and further studies.

CONCLUSIONS AND IMPLICATIONS

The findings of this research indicate that work placements can have an important positive influence on students deciding to do graduate studies. All co-op/WIL participants indicated that the work placement provided career direction, and gave a valuable insight of what the practice of science was like outside the university environment. The placement experience helped contextualize and refine their current study ambitions. The most commonly stated reason by co-op participants for doing graduate studies was so they were able to obtain a higher-level job position. In fact, co-op participants reflected back on the placement experience as a primary source of motivation to continue with their higher degree research. These co-op students also received career advice from workplace supervisors, including undertaking further studies. Interestingly, non-co-op participants also received advice to do further study, however, from university academic staff. These two sets of advice are contrasting in that that advice from university academic staff would potentially include a biases in that it is in the university's interest, and perhaps also directly to the individual staff member, for students to continue to do further studies, however no such bias would be present in advice from workplace supervisors. This may be further supported by the observation that non-co-op participants also referred to being provided an interesting opportunity to do higher degree qualification, with little mention of career clarification or goals.

An implication for co-op practitioners is that even though work placements can provide students with readily available employment opportunities and valuable contacts, it is important to recognize that it may also create career clarification that motivates students to undertake graduate studies. Co-op practitioners should be aware that this type of career clarification occurs, however, they should also go further by actively engaging students reflection around this awareness, to enable students to make better-informed decisions in regards to career direction and the possible need for further studies. It is also important for faculty to broaden their view on co-op students progressing through to postgraduate studies from work placement programs, and to have clear pathways to identify these students to capture them into higher degree qualification studies where possible.

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