Analyzing student and employer satisfaction with cooperative education through multiple data sources

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This paper reports on the analysis of three years research of undergraduate cooperative work term postings and employer and employee evaluations. The objective of the analysis was to determine the factors affecting student and employer success and satisfaction with the work-integrated learning experience. It was found that students performed better and found co-op placements with an increasing emphasis on leadership in their senior years; however, students rated their first employer the highest. Furthermore, senior students were more successful than junior students in work placements abroad, and extended work terms at the same employer did not increase student satisfaction. *(Asia-Pacific Journal of Cooperative Education, 2015, 16(4), 225-240)*

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INTRODUCTION

This paper examines the work-integrated learning process of a large Canadian institution to determine the factors affecting the success and satisfaction of students and employers. The data analyzed in this report consists of three years of cooperative education (co-op) job postings and work term evaluations. The data set includes 36,615 evaluation pairs (an evaluation of the student by the employer and an evaluation of the employer by the student) from 19,093 placements with 4,709 unique employers. These placements are located globally in 1,817 cities and 76 countries. This paper investigated whether evaluations and placement titles change over time as students progress through their undergraduate program; and it studied the impact of working abroad; taking classes for one versus two academic terms before starting the first work term; returning to the same employer for multiple work terms; the length of the work term; and the performance of students whose academic programs does not match the target programs specified in the posting.

Previous studies have investigated cooperative education from three perspectives: of the student, of the employer and of the institution (Haddara & Skanes, 2007). They studied important attributes that a student should have for a successful work term and compared various cooperative program formats. The uniqueness of this paper lies in correlating multiple data sources (job descriptions and detailed student and employer evaluations) and applying novel data analysis techniques (e.g., text analysis of job titles) to gain new insight into what contributes to the success and satisfaction of students, employers and the educational institution. The dataset used in this paper is over ten times as large as those used in previous work.

The main findings are as follows. Students' overall evaluations improved from one work term to the next, and senior students tended to find work placements that have an increasing emphasis on leadership. On the other hand, students tended to rate their first employers

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higher than subsequent employers. Furthermore, senior students were more successful in work placements abroad, junior students were less satisfied with their positions when starting their first work term after two academic terms instead of one, extended work terms at the same employer did not increase satisfaction, and there was no significant differences in the evaluations of non-engineering students hired for engineering positions or vice-versa.

RELATED WORK

Closely related work to this paper assesses the effectiveness of engineering curricula in the context of student work performance (Cedercreutz et al., 2011). It studied 42 parameters within seven aspects of performance evaluations, ranging from communication to work habits. Based on data about civil and environmental engineering students, it was found that performance evaluations increased over time. Similar conclusions are reported in this paper based on a much larger and more diverse sample of students and programs. Furthermore, this report provides new insight into student and employer satisfaction by correlating student evaluations with employer evaluations and co-op postings.

From the student's perspective, previous work focuses on finding characteristics that determine the success of the cooperative experience based on survey results (Coll, Zegwaard & Hodges, 2002a, 2002b; Hodges & Burchell, 2003; Ferns & Moore, 2012; Rainsbury, Hodges, Burchell, & Lay, 2002; Rodney, 2011; Young, Stengel, Chaffe-Stengel, & Harper, 2010; Zegwaard & Hodges, 2003) and employer evaluations (Hodges & Burchell, 2003). There has also been work on the effect of cooperative education on specific traits such as self-efficacy (Raelin et al., 2011). For this paper, 19 detailed evaluation criteria were analyzed and the importance of leadership and continuous learning in the context of cooperative education is confirmed. Additionally, this report investigated traits that employers did not find relevant by analyzing the distribution of "not applicable" ratings for various evaluation sub-categories.

From the educational institution's perspective, there has been work on modifying the curriculum to improve the cooperative experience (Ungerleider, 2008). Providing scheduling flexibility and sufficient personnel was found to be important. Other studies focus on assessing the effectiveness of cooperative programs (Coll & Chapman, 2000; Donkor, Nsoh, & Mitchual, 2009) and improving cooperative programs (Cates & Jones, 1999; Hays & Clements, 2011; Ralph, Walker, & Wimmer, 2009). Some of the analysis presented in this report (the effect of work term length and first work term timing on student and employer evaluations) also relates to curriculum issues and provides new insight into the factors affecting student and employer satisfaction by correlating co-op posting and evaluation data.

From the employer's perspective, there have been survey-based studies on job market trends; see, for example, (Ministry of Training, Colleges and Universities, [MTCU], 2005), and one study on the effectiveness of the cooperative system also analyzed students' evaluations of employers (Hayden, Dowell, & Saenger, 2001). There have also been studies on various cooperative formats such as e-co-op versus physical co-op (Markham, 2003), and studies on understanding employer expectations, (see, for example, Moletsane, 2011). From the employer's point of view, the novelty of this work arises again from correlating co-op posting, student, and evaluation data. This paper studies the performance of students whose academic programs differ from the target programs advertised in the co-op posting, and it compares evaluations of students who find a co-op placement through the regular interview

process versus those who approach employers on their own and those who arrange to return to the same employer for multiple work terms.

Finally, there has been a great deal of work on designing effective evaluations for cooperative placements (Coll, Taylor, & Grainger, 2002; Ram, 2008; Richardson, Jackling, Henschke, & Tempone, 2013; Sturre et al., 2012; Winchester-Seeto, Mackaway, Coulson, & Harvey, 2010; Zegwaard, Coll, & Hodges, 2003). This paper focuses on data analysis to understand student and employer satisfaction, but it also gives some suggestions for improving the evaluation forms.

DATA AND METHODOLOGY

Cooperative Education Process

This paper has researched a cooperative program of a large Canadian institution. The academic year is divided into three 4-month terms, and students alternate between school and work every term, for a total of six work terms. Some students start their first work term after one academic term, while others spend two academic terms in school before their first work term; these two scenarios are referred to as different "co-op streams". Some academic programs require one 8-month work term, where students can stay with one employer or work at two different employers back-to-back.

Employers advertise co-op postings in a centralized on-line recruiting system. A posting includes, among other things, the job title, the targeted academic programs, and location. There are three ways a student can be matched with a position: through the regular interview process ("regular process"), by approaching an employer on his or her own ("student arranged"), or by returning to a previous position ("returned"). At the end of every work term, there is an evaluation process. It includes an overall evaluation of the student as well as separate scores for 19 sub-categories, as listed in Table 1, in the order in which they appear on the evaluation form. Additionally, the student gives an overall rating of the employer.

TABLE 1: Nineteen sub-categories of employers' evaluations of students

Interest in work	Judgment
Initiative	Problem-solving skills
Planning and organization	Dependability
Setting goals	Interpersonal behavior
Ability to learn	Handling conflicts
Quality of work	Response to supervision
Quantity of work	Written communication
Creativity	Oral communication
Reflection & integration from prior learning	Leadership qualities
	Adapting to organizational rules & policies

Data

The following datasets are examined, spanning over three years and ten academic terms: co-op postings (consisting of several thousand unique co-op placements), hiring data (including, for each student hired for a position, the program, academic term, work term number, and

work status, that is, whether or not the student found the co-op placement through the regular interview process), evaluations of students by their employers, and evaluations of employers by students. For privacy reasons, the hiring data set does not include student identifiers (only the academic program and term), and no access is given to other information about students such as grades, gender, or first job after graduation.

The datasets cover ten terms over three years from January 2009 to December 2011. They contain 36,615 evaluation pairs (of the employer by the student and of the student by the employer), 4,709 employers, and 19,093 unique positions. The placements are located globally in 1,817 cities and 76 countries.

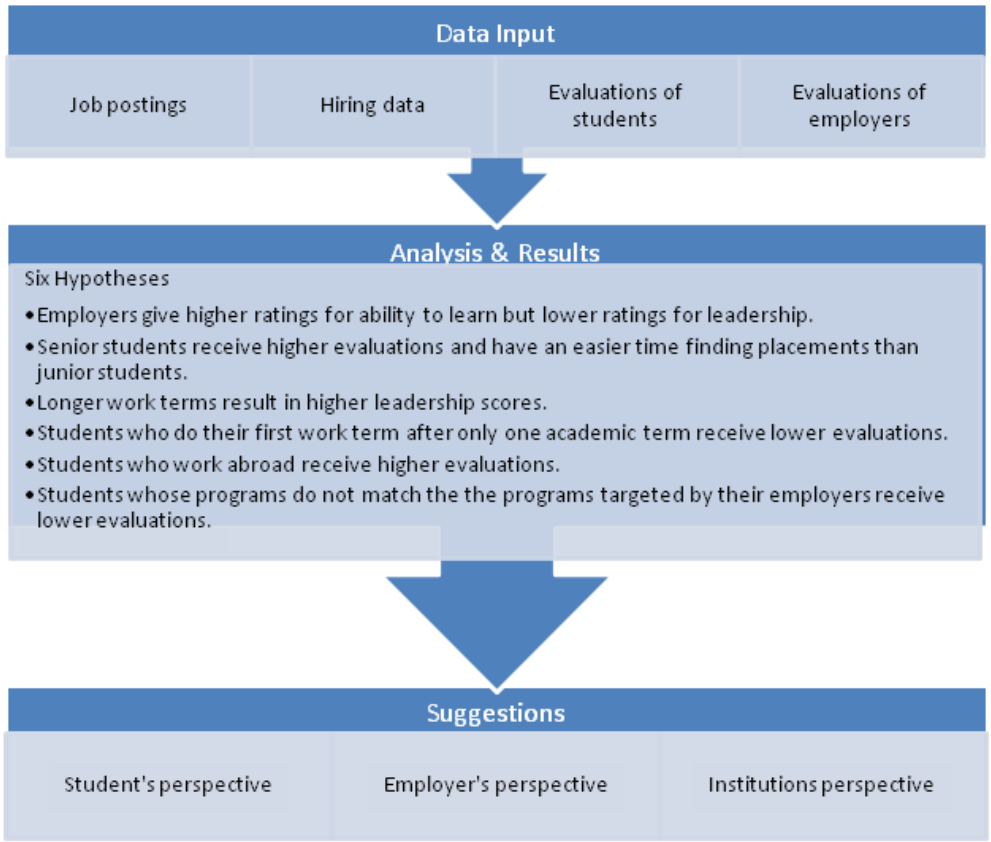

FIGURE 1: Overview of the methodology including data input, hypotheses, and suggestions in three perspectives.

Methodology

As outlined in Figure 1, this paper correlates multiple data sets to understand the factors affecting the effectiveness of cooperative education from three perspectives: of the student, the employer and the institution. Six hypotheses were investigated. The first states that students are generally willing to learn new skills but may not have much leadership experience. The second is that senior students with more work experience should receive higher scores. The third hypothesis tests the claim that students on longer work terms are more likely to be placed in leadership roles. The fourth hypothesis is that taking two

academic terms instead of one before the first work term helps. The fifth is that generally only the strongest students are interested in and can obtain international placements, and the last hypothesis is that students should choose placements that target their particular academic programs in order to be successful. The unique aspects of the analysis include a detailed examination of student evaluations, including the significance of marking an evaluation sub-category as "not applicable", text analysis of common job titles and company names for junior versus senior students, and a comparison of academic programs targeted in the co-op postings with the programs of hired students.

The focus was on engineering students, all of whom were enrolled in mandatory cooperative programs. There are 16,723 evaluation pairs of engineering students, which is 45% of the total dataset; the remainder comes from the other five faculties: Arts, Environment, Health, Mathematics and Science. Students from the same academic program within engineering, such as Chemical Engineering, have the same school and work term schedules (modulo the "co-op streams" as described earlier). Thus, students from the same program form a class that stayed together throughout their school and work terms.

RESULTS AND DISCUSSION

General Statistics

Co-op postings: In total, over 60% of the advertised co-op placements had at least one engineering target program. Students were encouraged to apply for placements that targeted their particular academic programs, and only 3% of first-year engineering students obtained non-engineering placements. This number grows to nearly 10% by the sixth and final work term, indicating that senior engineering students acquire non-engineering skills that qualify them for a wider variety of placements, or perhaps senior engineering students have more experience with the recruiting system and have noticed that they may qualify for some non-engineering placements. Overall, 72% of work term placements were found through the regular process, 17% were returning students, and 11% were student-arranged. This illustrates the students' preference to seek different employers for their six co-op terms rather than returning to the same employer, and the preference to choose from the advertised placements rather than approaching employers on their own.

Students' evaluations of employers: Students evaluated their employers on a scale from one to ten (higher is better). On average, engineering students gave their employers a score of 7.55 with a standard deviation of 2.51. Thus, students were generally satisfied with their co-op experience.

Employers' evaluations of students: Employers evaluated students by choosing one of the following overall levels: outstanding, excellent, very good, good, satisfactory, marginal and unsatisfactory. These correspond to a number from one to five, with outstanding equal to five, excellent equal to four, very good equal to three, good equal to two, and the remaining three levels equal to one. The average overall score for engineering students is 3.74 (i.e., between very good and excellent) with a standard deviation of 0.90.

In addition to an overall score, employers gave individual scores for each of the 19 sub-categories listed in Table 1. These scores were numbers from one to four (higher is better), but employers also had the option of specifying "not applicable" for any sub-category. Figure 2 shows the average score and standard deviation for each sub-category for engineering students. They tended to receive the highest scores on response to supervision

(3.65), followed by ability to learn (3.59) and interpersonal skills (3.54). The lowest-rated sub-categories are leadership (2.92) and creativity (3.01). Furthermore, conflict management scores have the lowest standard deviation (0.54) and initiative scores have the highest standard deviation (0.76).

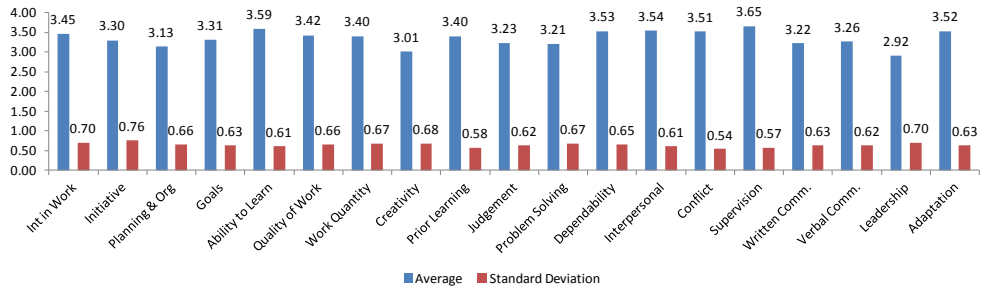

FIGURE 2: Average and standard deviations of the scores of the 19 sub-categories of employers' evaluations of students in the co-op program

Previous research indicates that the ability and willingness to learn is the most important characteristic of a successful co-op student and that leadership skills are usually not crucial (Coll et al., 2002a; Coll et al., 2002b; Hodges & Burchell, 2003; Zegwaard & Hodges, 2003). Thus, the relatively low leadership scores should not be a cause for concern as there may not be many opportunities to display leadership on a short 4-month work term. Similarly, it may be difficult to demonstrate creativity as employers often give co-op students well-defined tasks that can be completed within four months. This may discourage students from "thinking outside the box" as their focus is on completing their tasks before they leave. Furthermore, Cedercreutz et al. (2011) report an inverse relationship between creativity and other attributes of student evaluations, which is consistent with the observation that the average creativity score is lower than other scores.

On the other hand, the high ratings on response to supervision indicate professionalism of the students; all co-op students must take an online professional development course, which helps them prepare for work terms and encourages them to learn as much as they can while they are working. Additionally, students are keen to make a good impression on their employers in the hopes of obtaining full-time employment after graduation.

Co-op Placement and Evaluation Progression over Time

Employers' evaluations of students: Figure 3 plots the average overall score for engineering students and the percentage of students in each category (O = outstanding, E = excellent, etc.) for each of the six mandatory work terms. The average score increases over time, mainly because more students received the best outstanding score while fewer students received a very good or lower score. The number of excellent evaluations stays relatively constant over time. Notably, very few students were rated satisfactory or below regardless of the work term number. The consistent improvement over time is in agreement with the findings of Cedercreutz et al. (2011).

Similarly, individual scores corresponding to the 19 evaluation sub-categories all increased over time. The sub-category with the highest relative increase from the first work term to the last is problem solving: it increased from 3.07 to 3.23, which is statistically significant at the 95% confidence interval.

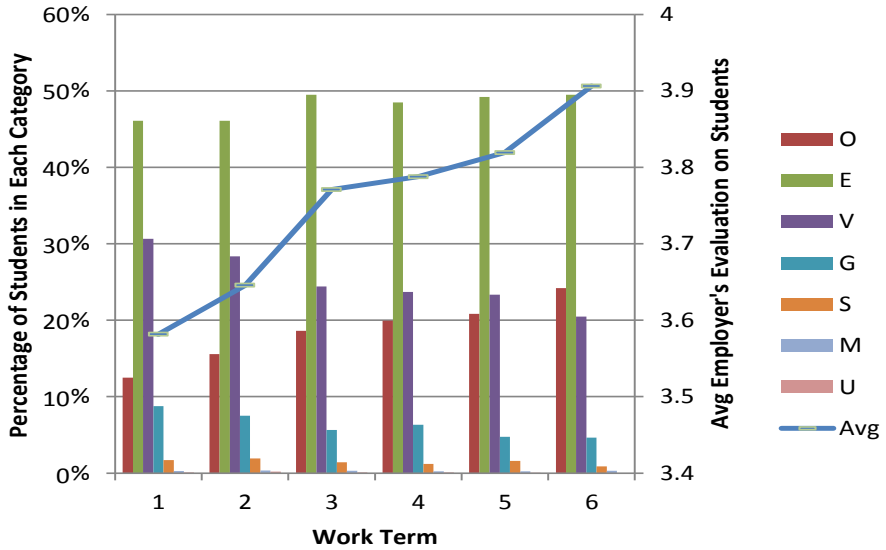

FIGURE 3: Percentage of co-op students in each evaluation category from outstanding to unsatisfactory and average of employer's evaluation over first to sixth work terms

This is not surprising given the technical nature of the engineering curriculum and its emphasis on problem solving, especially in upper years. On the other hand, the average scores for verbal communication, response to supervision, and ability to learn improved the least (but the improvement is still statistically significant at the 95% confidence interval). In particular, these three sub-categories all improved by 0.09 from the first work term to the last. However, recall that response to supervision and ability to learn are the two highest-rated categories, and these scores are already high in the first work term.

Employers have the option of entering a score of "not applicable" (N/A) for any number of the 19 sub-categories. The frequency of occurrence of N/A is under 5% for most sub-categories. Exceptions include creativity, written communication, reflection, integration of prior learning and setting goals (all of which have between 5% and 20% of N/A ratings), and conflict management and leadership (approximately half the ratings are N/A). As mentioned earlier, there may not have been many opportunities for leadership on work terms.

The percentage of N/A ratings for integration of prior learning, setting goals, leadership, and written communication decreases significantly over the six work terms: by 8.2, 6.7, 5.9, and 4.2%, respectively. On the other hand, the N/A percentage for other sub-categories does not vary from one work term to the next. Moreover, students returning to a previous employer were less likely to have N/A ratings for conflict management, leadership and integration of prior learning than those who found a new co-op placement through the regular interview process (by 10, 9, and 8%, respectively). This suggests that returning students were given more leadership opportunities.

Co-op postings: Having found that (overall and sub-category) evaluations improved over time and that the number of N/A ratings for leadership decreased over time, the next issue that will be investigated is whether entry-level jobs give way to more advanced positions over time. Table 2 shows the most frequent keywords occurring in the employer names and job titles of first-year Engineering students. Employer name keywords indicate

placements at academic institutions (university) as well as government-based co-op placements (Ontario, Toronto, city). In particular, the university itself often hires junior students who find it difficult to obtain placements elsewhere. Job title keywords are related to information technology (Software, Web, IT, developer) and to the "junior" or "assisting" nature of entry-level positions, indicating that junior Engineering students often obtain computer programming placements regardless of their program (and all Engineering students do in fact take a computer programming course in their first term).

TABLE 2: Top 10 keywords from employer names and job titles for first-year engineering students

Employer Name Keywords	Job Title Keywords
University	Engineering
Ontario	Assistant
Toronto	Developer
General	Software
Research	Junior
System	Architectural
Engineering	Web
Canadian	Technical
City	Research
Environment	IT

The job title keywords for subsequent engineering work terms are shown in Table 3. Information technology positions (software, developer) continue to appear, as do keywords indicating student and assistant positions. However, the keyword junior is no longer in the top-10 list and the keyword support only made it to the second term's top-10 list. By the third work term, job titles including the words project, analyst and development started to appear. This trend is consistent with earlier findings that as students gain more experience over co-op terms, they have more opportunities to take leadership and problem solving roles.

Work term status: Most students found co-op placements through the regular interview process. The percentage of returning students increased over the six work terms, while the percentage of self-arranged co-op placements was the highest in the first term. First-term students may have needed to arrange their own placements because they did not qualify for many advertised positions due to lack of experience, an observation consistent with Hodges and Burchell, 2003.

Students' evaluations of employers: The average student satisfaction with the employer ranged from 7 to 8 out of 10. As shown in Figure 4, students were less satisfied with their employers when students find co-op placements themselves, especially in later terms. This is likely because most students who found their own placements do so because they were not able to find a position through the regular process. Though the difference across work terms is not large, students tended to give higher evaluations in the first two work terms (this is statistically significant at the 95% confidence interval). This is more visible in student-arranged co-op placements.

TABLE 3: Top 10 job title keywords for 2nd through 6th engineering work terms out of six total work terms

Second Term	Third Term	Fourth Term	Fifth Term	Sixth Term
Engineering	Engineering	Engineering	Engineering	Engineering
Assistant	Assistant	Assistant	Student	Assistant
Developer	Developer	Developer	Assistant	Software
Software	Software	Software	Software	Student
Student	Student	Student	Developer	Developer
Research	Analyst	Research	Research	Research
Support	Research	Analyst	Design	Mechanical
Technician	Co-op	Intern	Mechanical	Co-op
Web	Intern	Systems	Analyst	Project
Co-op	Project	Mechanical	Project	Development

Comparison of student and employer scores: Each evaluation pair was examined to determine if there were instances in which a student rated an employer highly but the employer rated the student poorly, or vice versa. There were very few such cases (under 0.5%) and they appear to be randomly spread out across different employers, work term numbers and academic programs.

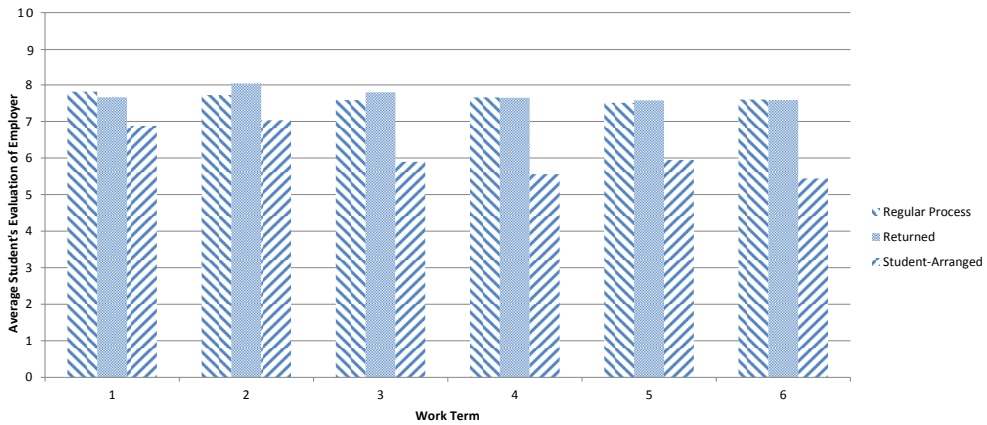

FIGURE 4: Average students' evaluations of employers over six work terms and separated by work term status, including regular application, returning students, and self-arranged jobs.

Effect of Work Term Length

Some engineering programs require an 8-month co-op term as the third and fourth work term, which may be spent at the same employer or at two different employers back-to-back. Other programs require an academic term between the third and fourth work terms.

Work term status: Figure 5 shows the proportion of students who found co-op placements through the regular process, on their own, and by returning to a previous employer; the two bars on the left compare the regular third work term (for programs with

alternating academic and work terms) with the first half of an 8-month term 8(1), while the two bars on the right compare the regular fourth work term with the second half of an 8-month term 8(2). Nearly 70% of students spent both halves of their 8-month work term with the same employer. This was appealing for at least two reasons: students hoped that longer work terms lead to interesting and challenging projects, and they appreciated not having to interview for a new job halfway through their 8-month work term.

Employers' evaluations of students: No significant differences were found in the overall evaluations of students who returned to the same employer for the second half of their 8-month work term versus those who found new placements. However, some differences were found when examining the detailed evaluation sub-categories. Students who stayed with the same employer for eight months were rated higher at goal setting, judgment, conflict management, initiative and leadership. Moreover, the proportion of N/A ratings for goal setting and integration of prior learning was lower for 8-month work term students. These observations are consistent with previous work, which reports that longer work terms are beneficial for students' learning and self-efficacy and beneficial for employers (Tang et al., 2004; Mihail, 2006). On the other hand, students who worked for two different employers during their 8-month work terms were rated higher on their ability to learn, quality of work, quantity of work, creativity, problem solving and reliability. These students need to re-establish themselves to the new employer and may work harder as a result.

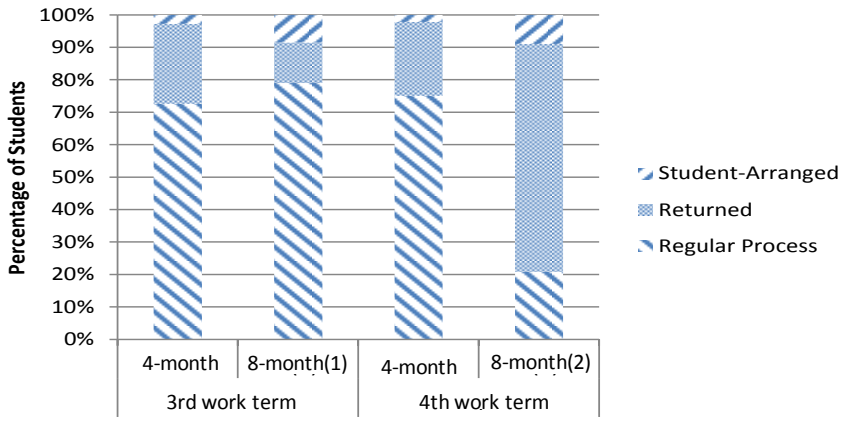

FIGURE 5: Percentage of students in each work status for 4-month and 8-month work terms over 3rd and 4th work terms

Students' evaluations of employers: Students who spent the entire 8-month work term at the same employer were 10% less happy with the employer than students who worked at two different employers back-to-back. The difference is statistically significant at the 95% confidence interval. It is possible that the tasks assigned to students in 8-month work terms become repetitive, and employers may have higher expectations, which causes additional stress for the students.

Timing of First Work Term

Some academic programs within Engineering have two co-op streams: Stream-4 students spend their first term (4 months) at school before starting their first work term, while Stream-8 students spend two terms (8 months) at school before starting work. For students from these programs, Stream-4 students were happier with their first employer than Stream-8 students; the corresponding average ratings were 7.83 and 7.5 respectively, with the difference being statistically significant the 95% confidence interval. This is likely because Stream-8 students have higher expectations, thinking that an additional academic term will help them find a challenging first placement. The difference in employers' evaluations of Stream-4 and Stream-8 students is not statistically significant.

Effect of Co-op Placement Location

Co-op postings: Overall, 10% of positions for engineering students were outside North America. Table 4 compares the most frequently occurring job title words of domestic and international postings. International job titles include the words "trainee" and "intern" rather than "student" and "co-op" and the international placements appear to focus on architecture, design and development. Further analysis revealed that architecture and civil engineering students tend to work internationally more than students from other programs. In particular, architecture students account for over 50% of students working abroad in Central America and over 60% of those working in Europe. Civil engineering is the predominant discipline in the Caribbean and South America.

TABLE 4: Top 10 keywords from job titles for international and domestic co-op placements

Abroad Job Title Keywords	**Domestic Job Title Keywords**
Engineering	Engineering
Assistant	Student
Intern	Assistant
Software	Developer
Design	Software
Research	Analyst
Architectural	Research
Developer	Co-op
Trainee	Mechanical
Development	Design

Timing and work status: Table 5 shows the percentage of students who worked abroad in each work term. Ten percent of students worked abroad in their first work term; this percentage dropped to 5% in the second work term and increased steadily from the third through the sixth term. In the first work term, most of the international positions were self-arranged, typically corresponding to international students with no Canadian work experience who have to go back to their home country for their first work term. However, in later terms, the percentage of international positions obtained through the regular interview process increased, corresponding to students who desired international work experience. In the sixth and final work term, there was an increase in the number of students who returned

to a previous international employer. This suggests that students are interested in careers abroad after graduation.

TABLE 5: Percentage of students working abroad vs. domestic out of the total number of students per work term

Term	1	2	3	4	5	6
Abroad	10.27%	5.46%	7.44%	9.28%	11.81%	13.13%
Domestic	89.73%	94.54%	92.56%	90.72%	88.19%	86.87%

Evaluations: In the first work term, students working abroad were rated slightly worse by their employers than those who do not leave the country. However, the opposite was true in subsequent work terms. Furthermore, students working abroad in the first term were less satisfied with their employer than those who worked abroad in later terms. Working internationally is considered to be more difficult and rewarding (Coll et al., 2003; Reeve, 2001); while some junior students may have to work abroad because they cannot find domestic placements, most senior students who work abroad do so because they want to, and they are usually strong and motivated.

Co-op Placement Targeting

Employers' evaluations of students: Figure 6 shows the average overall evaluation of engineering students (blue) and non-engineering students (red) hired for positions advertised to engineers (left) and non-engineers (right). The differences among the average scores are not statistically significant. In terms of detailed evaluation criteria, engineering students hired for engineering positions received higher evaluations than non-engineering students in quality of work, creativity, problem solving, integration of prior learning and judgment. This suggests that engineering positions do indeed require the problem-solving skills that engineering students learn in their programs. However, engineering students working in non-engineering positions received slightly higher supervision scores than those working in engineering positions. Additionally, non-engineering students received better problem solving scores in non-engineering positions than in engineering positions.

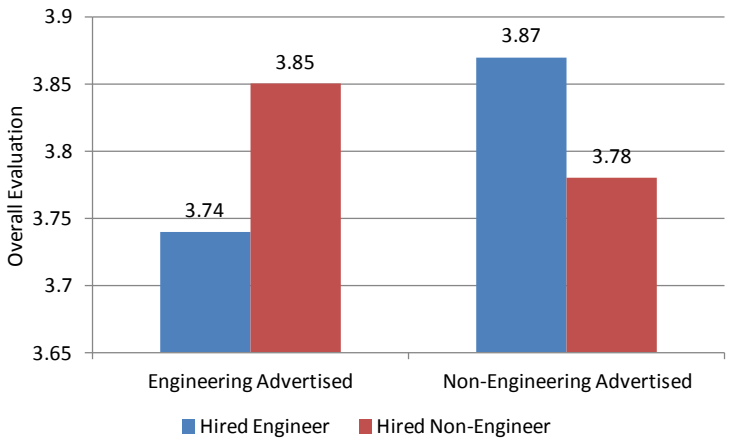

FIGURE 6: Average overall evaluations for various hiring scenarios

Co-op placement postings: Table 6 shows the most common job title keywords for positions advertised to engineering and non-engineering students, as well as common job title keywords for "mismatched" work terms, where the target program of the posting was different to the academic program of the student. It appears that many positions in the mismatched categories are related to computer software development and information technology. Further analysis revealed that the mismatch was largely due to the overlap between co-op placements advertised to computer science students (which are not in the Faculty of Engineering) and computer engineering students, as well as those advertised to environmental science and environmental engineering students. Thus, it may be helpful for the university to better educate the employers about these related academic programs; similar observations were made by Coll and Chapman, (2000).

TABLE 6: Top 10 job title keywords for various hiring scenarios

Engineering Advertised	**Non-Engineering Advertised**	**Engineering Advertised, Hired Non-Engineer**	**Non-Engineering Advertised, Hired Engineer**
Software	Research	Software	Research
Engineering	Actuarial	Business	Software
Junior	Student	Junior	Undergraduate
Research	Junior	Technical	Junior
Web	Assistant	Web	Project
Mechanical	Pharmacy	Research	Business
Project	Accounting	Project	Engineering
Technical	Business	Environmental	Lab
Architectural	Project	Quality	Nanotechnology
Business	Software	Programmer	Architectural

SUGGESTIONS AND FUTURE WORK

Student's Perspective

Based on job title keyword analysis and the distribution of "not applicable" ratings, it appears that students initially worked in entry-level co-op placements, but they eventually obtained more advanced and independent positions with a greater emphasis on leadership and goal setting. However, further study is required to interpret the student satisfaction results. Students should expect to see "not applicable" ratings in certain categories. When they cannot obtain placements through the regular process and must find their own placements, they should be optimistic and try their best to learn during self-arranged work terms.

In terms of work term length, students who have a choice between an 8-month work term with a single employer and two back-to-back 4-month work terms with different employers should make their decision carefully. Choosing the former may lead to lower satisfaction, but the latter may give more opportunities for leadership as evidenced by fewer "not applicable" ratings in the leadership sub-category.

As for working abroad, it may be better to wait till later work terms, as junior students were found to be less satisfied with international employers and they also received lower evaluations.

Employer's Perspective

In this context, results of this analysis are quite positive in that employers' evaluations of students (overall evaluations as well as sub-category scores) increased from one work term to the next (Figure 3); moreover, the proportion of returning students increased over the six work terms. Further data collection and analysis are required to determine whether returning students eventually receive permanent job offers upon graduation.

The analysis of targeted disciplines versus the academic programs of the hired students suggests that there was a great deal of overlap between co-op postings aimed at computer science and computer engineering students and environmental science and environmental engineering students. Additionally, hired students who did not match the target discipline received equally good (sometimes better) evaluations. An interesting direction for future work is to implement a data-driven recommender system that suggests which academic programs an employer should target based on the job description and the required skills.

Institution's Perspective

One interesting curriculum issue is that of the timing of the first work term. The results presented here indicate that students who take one semester of classes before their first co-op placement are more satisfied than those who take two semesters of classes, with no significant difference in employer evaluations of these two populations. Further analysis is required to understand why this is happening; perhaps students with only one semester of academic experience have lower expectations.

In terms of international co-op postings, an interesting result was that senior students are likely to find work abroad through the regular interview process whereas junior students need to arrange international work placements on their own. As mentioned earlier, this is likely due to foreign students who cannot find a domestic placement and must arrange to return to their home country for their first work term. However, this could also suggest a possible shortage of entry-level international co-op opportunities. Further study is required to confirm these hypotheses.

In terms of data collection, it would be helpful to keep track of the reasons why students find their own co-op placements (i.e., whether they were unable to find a position through the regular process or whether they wanted to work for a particular employer who ordinarily does not hire co-op students). To implement this, in addition to grading the employer on a scale from one to ten, a question about how and why the co-op placement was found could be added to the employer evaluation form.

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