

**AC 2009-2479: THE IMPACT OF COOPERATIVE-EDUCATION INTERNSHIPS  
ON FULL-TIME-EMPLOYMENT SALARIES OF STUDENTS IN COMPUTING  
SCIENCES**

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# Relative Impact of Cooperative Education Internships on Computing Sciences' Students Full-Time Employment Salaries

## Introduction

Studies have shown that a cooperative education internship provides at least a starting salary advantage to its participants<sup>1, 2, 4, 5, 7, 8, 11</sup>. However, no study was found wherein the cooperative education internship program was in an urban institution with both commuter and residential traditional and non-traditional students. Many students work in various types of employment ranging from varying degrees of part-time to full-time. These different employment arrangements make cooperative education internship only one of several options of work-based learning experiences, including students who attend college full-time while employed full-time at one extreme to students who attend college full-time without engaging in any employment activity, as well as students who work because they need money to assist with the payment of their educational expenses<sup>8</sup>. These may include part-time students who work full-time or part-time.

While many authors associate cooperative education interns with at least a starting salary advantage over non-interns<sup>2, 3, 4, 5, 10, 11</sup>, none of their studies seem to capture the complexity of today's urban university student populations and the diverse working arrangements that some of them are involved in while in attendance. Additionally, Gardner and Motschenbacher<sup>4, 5</sup> found that work experience had little impact on the starting point that a new employee enters an organization: "the size of the company and the engineering discipline" are the main determinants. They also found that computer science graduates tend to enter organizations at positions above entry level, with the main advantage of cooperative education participation being salary upon full-time employment. While cooperative education internships seem to provide a salary advantage under some situations, this advantage may be influenced by several factors including the quality and quantity of non cooperative education work experiences.

The purpose of this research is to investigate the relative impact of cooperative education internships on students' full-time employment salary upon graduation under myriad circumstances of student employment arrangements. While this work is inclusive of all the computing (computer science, information systems, technology systems, etc.) students who used the *Cooperative Education and Career Services* office of the university between 1998 and 2006, it will highlight undergraduate students with particular emphasis on computer science majors. During the eight year period of the study data, a total of 285 computing students used the services of *Cooperative Education and Career Services*, 67 of whom had cooperative education internship experiences. Of the total number of computing students, 130 were undergraduates with 42 having internship experiences. The findings of this study showed that the range of salaries for students who experienced cooperative education internships is smaller than that for those who did not participate in any known cooperative education internship. In fact, while at the low end of the salary range coop undergraduate students had a full-time employment starting salary advantage of about 8:5, at the high end of the range those students who were not known to participate in coop internships had a salary advantage of about 4:1. For graduate students, the non-coop participants maintained the salary advantage at both the low and high end of the salary range reaching 2.4:1 at the high end. This is an interesting finding since it seemingly contradicts

the findings of some other researchers<sup>4, 5, 11</sup>. However, Gardner and Motschenbacher<sup>4, 5</sup> did say that the salary advantage of cooperative education participants over "nonparticipants appeared to be closing." Furthermore, the Wilcoxon rank sum test revealed no statistically significant difference in full-time salaries for undergraduate coop participants and non-coop participants at the 5% significance level.

### **Cooperative Education Internships Advantage**

Relatively few studies try to investigate the complex makeup of the population of undergraduate students who do not engage in a university's formal cooperative education (coop) internship program. Most studies seem to use a simple model for the population of non-coop internship participants. A model that does not include non-coop participants who engage in structured and meaningful discipline related work experiences or who may be *well-connected*. In fact, the model seems to suggest that if a student does not take part in a coop internship, he or she does not work while attending college. Jagacinski et al<sup>8</sup> reported that science and humanities students who "participated in internship programs or had other types of work experience obtained better job placements after graduation than those graduates with no work experience." They further reported that non-coop participants were inclined to be more affluent than coop participants. In their study of coop and non-coop engineering students, they confirmed that coop participants and non-coop participants engaged in non-engineering related work experiences came from both relatively less educated and affluent families than those non-coop participants who engaged in engineering related work experiences and non-coop participants who did not work. They also found that although non-coop participants with engineering work experience were given relatively greater "technical responsibility" on their first full-time position, there was no statistically significant difference in starting salaries of the groups involved. However, six years later the coop participants and the non-coop participants with engineering work experiences were essentially earning the same average salaries, which were "significantly higher than the mean salary of engineers with no work experience." Their work suggests that profession related work experience while in college was critical to developing a successful career in terms of better salary and increased job responsibility. Gardner and Motschenbacher<sup>4</sup> confirmed this finding by asserting that "experience is an asset during the formative first few years in the workplace."

Related work experience in one's discipline prior to graduation, has potential benefits beyond the mere work experience that may also influence a higher starting salary upon full-time employment. This benefit may be learnt skill in salary negotiation gained from relevant workplace exposure. Because these prospective new employees will likely be more informed on the price of labor in their profession, they are better able to negotiate a relatively higher starting salary at the entry level or beyond with their coop or non-coop employer. This is based on the assumption that "[t]he higher [one's] wage demands, the higher the wage he/[she] can expect."<sup>6</sup>

"Cooperative education has long been regarded as one of the most effective educational vehicles for linking theory with practice as well as preparing the professional for the work place."<sup>12</sup> In addition, it provides a well-rounded education that could neither be accomplished in a strictly academic or experiential setting as well as provides opportunities for "personal development and maturity."<sup>7</sup> While there is plenty research available to suggest that cooperative education is fulfilling its experiential promise, the evidence is not convincing that it is fulfilling its academic

promise and its potential for developing and nurturing well-rounded students grounded in theory and practice with the ability to transfer learning between them. Van Gyn<sup>12</sup> stated that there was “[a] lack of educational orientation and a lack of concern for [the] importance” of cooperative education as evidenced in some earlier research on the topic.

## Data Preparation and Preprocessing

Four data sets were received from the university’s office of *Cooperative Education and Career Services*. One data set contained 501 full-time and other types of placements from 2001-02 through 2005-06, another contained cooperative education student placements covering the same period while two other data files covered the period from 1998-99 through 2001-02 -- one file contained 601 cooperative education placements and the other contained 424 full-time employment placements. Each data set was compared to the other to determine which variables they shared and which were unique. All data sets were combined in a Microsoft Access database and then matched on student first and last names. The data elements that were shared were coded in a consistent way and the unique data points were used to provide additional detail where appropriate. Of the 501 placements in the 2001-02 through 2005-06 data files, only 340 included salary information. In addition, the coop students’ data were processed so that each student was only counted once while retaining instances of multiple cooperative education internships for each student. This procedure was also followed for full-time employment entries to ensure that students who obtained more than one full-time job were accurately represented in the data. A subsample of undergraduate computer science students were selected to gain insights into non-university sponsored student employment patterns. Note that some undergraduate students in the university obtain internships through their academic department course offerings and that these data are not reported to the Cooperative Education program. Therefore, the academic departments’ internship data were absent from the coop internship data, where coop internships are those offered through the university-wide Cooperative Education program. Coop internships are optional non-credit bearing study related pre-professional employment that are open to all undergraduate and graduate students who meet the minimum eligibility requirements for participation. For undergraduate students, minimum eligibility criteria are successful completion of the freshman year and a grade point average of 2.5. The coop program offers three types of mostly paid internship work schedules: parallel where students work *15 to 20* hours per week while attending classes part-time or full-time, summer where students work *two to three* months full-time, and alternating where students work *four to six* months for one semester. Most students prefer the parallel option, which can rollover into the summer option and vice versa. The coop program provides coop interns with relatively stronger support services in the form of workshops and seminars (e.g., resume writing, mock interviews, research of companies and industries, correspondence preparation, and placed student meetings) as well as access to over 500 employers in different sectors of the economy. Academic department internships are elective credit bearing study related pre-professional employment courses usually reserved for juniors and seniors. They typically last for one semester compared to up to *three* years for coop internships in a combination of parallel and summer options. Since academic department internships typically last only one semester, we believe that the work experience gained by these interns would be small compared to the longer lasting coop internships and other prolonged study related non-coop student secured work experiences and therefore would translate into relatively smaller salary advantages that approach the salary levels for students without any work

experience<sup>8</sup>. Therefore, the impact of academic department internships on the results of this study is likely to be minimal.

The cooperative education data did not have consistent information regarding the start and end dates of students' internships therefore certain assumptions were made regarding the duration of students participation in an internship. Since the majority of students who enroll in the university cooperative education internship program participate in the parallel/part-time coop model where they attend college while working in their internships, this model was assumed in all cases where the data did not provide sufficient information to suggest another coop model -- summer or alternating/full-time. Moreover, since cooperative education program participation is reserved for sophomore level and beyond, and the university permits three terms of the school year for coop internship participation, no more than nine terms of coop was assumed and coded for any undergraduate student unless the data contained information to the contrary.

Some students had more than one major. In those cases where computer science was one of the majors, the student was considered to be a computer science student.

## **Results**

Over the eight year period of the study data, 285 computing students used the services of *Cooperative Education and Career Services*. Sixty-seven of these students had coop internships and 130 were undergraduates with 42 having coop internships. Of these 42 undergraduate students with internships, 76% of them had one coop, which accounted for 56% of the undergraduate coop internship experiences and 7% had more than two coops – 11% of the coop internships (see Table I). The 25 graduate coop students had roughly an equal number of one and two coop internships: 44% and 48% respectively. Furthermore, 98% of the undergraduates and 96% of the graduates who were coop interns obtained one full-time job placement upon graduation. Their mean salaries were essentially the same with the graduates' salaries showing a larger standard deviation by \$2,040. Of the 218 non-coop students, 88 were undergraduates and 130 were graduates. Ninety-nine percent (216) of the non-coop students obtained one full-time job placement upon graduation. For this group, the mean salary of the graduates was higher than that for undergraduates by about \$3,940, but undergraduates' standard deviation about their mean salary was larger by about \$13,320. When the ranges of salaries for the students were examined, it was found that those who experienced coop internships generally had a smaller range of salaries than that for those who did not participate in any known coop internship. In fact, while at the low end of the salary range coop undergraduate students had a full-time employment starting salary advantage of about 8:5, at the high end of the range those students who were not known to have participated in coop internships had a salary advantage of about 4:1. For graduate students, the non-coop participants maintained the salary advantages at both the low and the high end of the salary range reaching 2.4:1 at the high end. Although the coop interns' ranges of full-time salaries were typically contained within the ranges of full-time salaries of non-coop students, the overall median salaries for coop and non-coop students were the same and the undergraduate non-coop students' median salary exceeded the coop students' median salary by only \$3,000.

The coop and non-coop students majored in several computing disciplines (see Table I & II). Most of the non-coop students majored in Information Systems. The second most frequent major was computer science: 30% of the undergraduates and 23% of the graduates. For the coop students, a relatively smaller number of the undergraduates were Information Systems majors; most of them were computer science majors -- 23 (64%) had computer science in their majors. Of these students, 91% were in coop experiences that were related to their majors and the correlation between the coop and full-time codes<sup>9</sup> of the total sample of computer science undergraduate students that obtained full-time jobs in the study period of 1998-1999 to 2005-2006 was weak to moderate (0.49). Of the 23 computer science students who experienced coop internships, 70% of them had one coop with 88% of the coop experiences directly related to computer science and the remaining 12% generally related to computer science. In addition, the correlation between the coop and full-time codes for this sample of computer science students that obtained one coop and a full-time job placement was moderate to strong (0.78).

A close examination of a subsample of 19 undergraduate computer science students revealed that six had coop experiences and 13 did not (see Table III). Nine of the 13 who did not participate in the coop program were documented to be working: six worked part-time and three worked full-time. The mean salary of this subsample was less than that of the non-coop group by \$6,385 and the standard deviation was smaller.

The Wilcoxon rank sum test revealed no statistically significant difference in full-time salaries for undergraduate coop participants and non-coop participants at the 0.05 significance level (see Table IV). In fact, the difference in the median salary was insignificant for undergraduate computer science students with and without coop internships. This condition holds regardless of the number of coops that were involved in the statistical test or the size of the company in which the student was employed.

## **Discussion**

A key finding of this study is that there is no reasonable statistical difference in the median starting full-time salaries for computing coop and non-coop students. In particular, it holds for undergraduate computer science students. However, since the undergraduate computer science student samples of those who experienced coop internships and those who did not were small, the finding tends to be more suggestive for undergraduate computer science. For example, it suggests that the non-coop sample of students engaged in complex work related arrangements that in its simplest form involve no work experience and at the more complex end involve full-time work while attending college. A number of computer science students who did not participate in coop internships worked part-time. This finding is consistent with that of Jagacinski et al<sup>8</sup> who stated: "work experience relevant to engineering is the important factor and whether it is obtained through a co-op program or not doesn't matter." Moreover, Gardner and Motschenbacher<sup>4</sup> said that discipline and firm size were critical factors that affect the point at which a new employee is likely to enter a company. Both Jagacinski et al and Gardner and Motschenbacher claimed that no work experience prior to graduation, negatively impact a new employee's full-time starting salary. The fact that non-coop participants yielded a wider range of salaries and have more variability about their mean salaries tends to suggest a complexity of the non-coop population that may include a great mix of different types of work experiences

including those related to the students' major. The overall relative salary achieved by this population indicates that a greater number of them were working in major related work experiences.

### **Conclusion and Future Work**

The main finding in this study is that comparing coop and non-coop participants is not a simple matter. The non-coop students may not be representative of students who do not work but may include a large percentage of students who engage in various types of major related and unrelated work experiences. Although overall the non-coop participants received higher salaries, there was no significant difference in the median salaries for coop and non-coop participants. In a future study, the type of industry in which students were employed upon graduation and the extent and type of work non-coop participants engaged in will be explored for their impact on post-graduation starting salary.

**Tables**

Table I  
Distribution of Undergraduate and Graduate Students that Obtained Cooperative Education Internships and Full-time Jobs  
between 1998-99 and 2005-06

Number of coops	Number of Undergraduate Coop Students	Percentage of Undergraduate Coop Students	Number of Undergraduate Coops	Percentage of Undergraduate Coops	Number of Graduate Coop Students	Percentage of Graduate Coop Students	Number of Graduate Coops	Percentage of Graduate Coops	Total Number of Coop Students	Total Percentage of Coop Students	Total Percentage of Coops
1 coop	32	76%	32	56%	11	44%	11	26%	43	64%	43%
2 coops	7	17%	14	25%	12	48%	24	57%	19	28%	38%
3 coops	1	2%	3	5%	1	4%	3	7%	2	3%	6%
4 coops	2	5%	8	14%	1	4%	4	10%	3	4%	12%
<b>Totals</b>	<b>42</b>	<b>100%</b>	<b>57</b>	<b>100%</b>	<b>25</b>	<b>100%</b>	<b>42</b>	<b>100%</b>	<b>67</b>	<b>100%</b>	<b>100%</b>



Table IIa

Distribution of Students' Majors who Solely Obtained Full-time Jobs between 2001-02 and 2005-06

Type of Major	Number of Undergraduate Students in the Major	Percent of Undergraduate Students in Each Major	Number of Graduate Students in the Major	Percent of Graduate Students in Major	Total Number of Students in Each Major	Total Percentage of Students in Each Major
Computer science	26	29.5%	30	23.1%	56	25.7%
Information Systems	33	37.5%	70	53.8%	103	47.2%
Telecommunications	6	6.8%	21	16.2%	27	12.4%
Technology Systems	4	4.5%	0	0.0%	4	1.8%
Professional Computer Studies	18	20.4%	0	0.0%	18	8.3%
Doctorate in Professional Studies	0	0.0%	3	2.3%	3	1.4%
Information Technology	0	0.0%	2	1.5%	2	0.9%
Internet Technology/E-Commerce	0	0.0%	3	2.3%	3	1.4%
Software Development and Design	0	0.0%	1	0.8%	1	0.5%
Professional Technology Study	1	1.1%	0	0.0%	1	0.5%
<b>Totals</b>	<b>88</b>	<b>100.0%</b>	<b>130</b>	<b>100.0%</b>	<b>218</b>	<b>100.0%</b>

Table IIb						
Distribution of Students' Majors who Obtained Cooperative Education and Full-time Positions between 1998-99 and 2005-06						
Type of Major	Number of Undergraduate Students in the Major	Percent of Undergraduate Students in Each Major	Number of Graduate Students in Each Major	Percent of Graduate Students in Each Major	Total Number of Students in Each Major	Total Percentage of Students in Each Major
Computer Science	17	47.2%	4	20.0%	21	37.5%
Computer Science & Information Systems	4	11.1%	0	0.0%	4	7.1%
Computer Science & Mathematics	1	2.8%	0	0.0%	1	1.8%
Computer Science, Information Systems & Mathematics	1	2.8%	0	0.0%	1	1.8%
Information Systems	10	27.8%	10	50.0%	20	35.7%
Information Systems & Marketing	1	2.8%	0	0.0%	1	1.8%
Computer Science & Accounting	0	0.0%	1	5.0%	1	1.8%
Telecommunications	0	0.0%	4	20.0%	4	7.1%
Internet Technology/eCommerce	1	2.8%	1	5.0%	2	3.6%
Technology Systems	1	2.8%	0	0.0%	1	1.8%
<b>Totals</b>	<b>36</b>	<b>100.0%</b>	<b>20</b>	<b>100.0%</b>	<b>56</b>	<b>100.0%</b>

Table III

Summary Full-time Job Information of the Sub-sample of Undergraduate Computer Science Students that Obtained Cooperative Education Positions and Full-Time Positions between 1998-99 and 2004-05

Feature	Sub-sample that Obtained Coop and Full-time Positions	Sub-sample that Solely Obtained Full-time Positions
Number of Students	6	13
Percentage of Computer Science Undergraduates	26%	50%
Number of full time Jobs	6	14
Average Full-time Salary	\$43,000	\$49,385
Standard Deviation of the Full-time Salaries of the Sub-sample	\$8,343	\$15,793

Table IV	
Summary of Wilcoxon Rank Sum Tests	
Type of Comparison	P Value
Full-time salaries of undergraduate computer science students with and without coop internships	0.2881
Full-time salaries of undergraduate computer science students with one and more than one coop internship	0.3765
Full-time salaries of undergraduate students with and without coop internships	0.0716
Full-time salaries of undergraduate students with one and more than one coop internship	0.3509
Full-time salaries of undergraduate computer science students with one coop in a large* company and those with one coop in small - medium** size companies (including companies with unknown sizes)	1.0000
Full-time salaries of computer science undergraduate students with more than one coop in large and small - medium size first coop companies	0.2778
Full-time salaries of computer science undergraduate students with more than one coop in large and in small - medium size (including companies with unknown sizes) companies for their last coop internship	0.8571
Full-time salaries of computer science undergraduate students who obtained full-time jobs in large or small - medium size companies, (including companies of unknown size)	0.3613

\*In this study large companies are defined as those with greater than 500 employees

\*\*In this study small -medium companies are defined as those with less than 500 employees.

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