The Effect of Long Term Placements on the Academic Performance of Co-op Students

M. Javed Iqbal
Director Science Co-op Programs and Adjunct Professor
University of British Columbia, Vancouver, BC

Abstract
In this paper a comparison of the academic performance of co-op and non-co-op students in two, full-year, required pharmacology courses is presented. Both of these groups have similar academic backgrounds. The co-op group, however, takes a 16 month co-op between the two principle pharmacology courses while the non-co-op students have no experiential experience between the courses. Findings show that a sixteen-month internship has no negative impact on academic performance of co-op students in the second course; thus mitigating concerns about the time gap between the two courses.

Keyword: Cooperative education, academic performance

Cooperative education programs have existed in North America since the early 20th Century. The major aim of these programs is to enhance students' education by integrating academic education (classroom based learning, CBL) with practical work experience (work based learning, WBL). Cooperative education programs offer many additional benefits. These benefits include: the development of communication and interpersonal skills, enhanced self-confidence, a better sense of educational goals, financial stability, improved job prospects, and job satisfaction (Lampe and Rothman, 2004). These benefits have been identified and studied by various researchers including Smith, (1965), Lindenmeyer (1967), Davie and Russell (1974), and Fletcher (1988) who have also explored the impact of participation in cooperative education programs on students' academic performance. In this paper we add to this literature by exploring the effect of a long-term placement on students' academic performance upon returning to campus.

A typical co-op model alternates study and work term periods in monthly blocks that correspond to the academic term. A typical co-op schedule is illustrated in Table I (see Appendix A). A student in co-op will begin their first work assignment in the winter term of their second year in college. Subsequent work assignments alternate with academic course work at the home campus. There are several variations on this typical co-op schedule. A trend toward work term periods that are longer than four months has become evident. Lengthened work terms maybe necessitated by the fact that the research-based projects are increasingly becoming more complicated and a four-month period is not sufficient for a student to be able to make any significant contribution to a project. A co-op schedule that involves an eight-month (two consecutive four-month placements) is shown in Table 1. Again, several variations on this model can be undertaken by students.

An extreme example of longer work term periods is the 12 to 16 month internship program described by Brian Welch (1981). In this arrangement all the work-terms are joined together. Students are placed for three or four consecutive work-terms, usually after completing their third academic year. This approach accommodates researched based programs or where students can benefit from a long-term exposure to professional practice. These consecutive work-terms may be with a single employer or with several employers. A typical 16 month schedule, that involves four consecutive work terms at the end of the third academic year, is outlined in Table 1.

Although the 16 month model offers the advantage of student availability for long-term projects, they may also inhibit a better integration of CBL and WBL. In such programs students have only one chance to apply the knowledge gained through work experience to their academic education. Also, normally at the end of the third academic year, students have advanced far enough in their academic studies that, upon returning to school, it becomes very difficult for them to modify their academic programs without adding an extra year to their graduation.

Another perceived disadvantage of the 16 month model is students who are absent from school for a long period of time may have a negative impact on their academic performance when they return. The *common wisdom* is that students either lose interest or *forget how to study* when they are away for the classroom for an extended period. One could argue that, in fact, the effect could be the opposite. After finishing a long work-term period and armed with a wealth of practical experience, students could be eager and excited to come back to school. This renewed focus could actually result in improved academic performance. We test the hypothesis that extended work experiences will not negatively impact the academic performance of a group college students by comparing the academic performance of co-op students enrolled in the Pharmacology co-op program at the University of British Columbia (UBC) with that of their peers who chose not to enroll in a co-op program.

The Pharmacology Program at UBC

The Faculties of Medicine and Science at UBC offer an undergraduate program in pharmacology. This program has several distinguishing features. The program starts in the third year of college and annual admission to the program is restricted to approximately 18-20 students. Admission is based solely on students' academic performance in their first and second academic years of college. The competition is tough and the entrance grade point average is above eighty percent, which at UBC means an "A" average. Once admitted, students work closely as a group. Most of the pharmacology courses are taught by dedicated professors who have taught these courses for a number of years.

In general, students admitted to the pharmacology program intend to pursue a career in medicine and related disciplines. In order to expose these students to career opportunities available in research within the pharmaceutical industry and university research labs, a pharmacology cooperative education program was initiated in the Fall of 1996.

The pharmacology curriculum is anchored by two year-long (September - April) required courses. The first PCTH 300, is offered in the third year and covers the basic concepts, language and techniques of scientific pharmacology. The second, PCTH 400, is offered in the fourth year and concentrates on the scientific aspects of the pharmacology of neurohumoral transmission, cardiovascular and clinical pharmacology, and mathematics of pharmacology. It was determined that splitting these full-year courses into smaller components to accommodate short work-based learning opportunities was not feasible. The best option for the co-op schedule was the 16 consecutive months of co-op at the end of the third academic year.

Admission Criteria for Pharmacology Co-op:

As the minimum entrance grade point average (gpa) for entrance to the pharmacology program is around 80% (an average grade of "A"), which is higher than the 70% entrance gpa requirement (an average grade of "B") for admission to the science co-op programs of which pharmacology is a part. Thus, pharmacology students are immediately eligible to apply to the co-op program upon admittance. Each applicant is asked to attend a half-hour orientation interview. The interview is designed to help the coordinator assess student's background and educational and vocational goals. This interview aids in determining if the co-op facilitates meeting these goals.

Since its inception in 1997, the number of pharmacology students pursuing a co-op option has steadily increased. Currently over 50% of the students are enrolled in the co-op program. In the past five years only two students, admitted to the pharmacology program, were declined admission to the pharmacology co-op. Table 2 below shows the number of students admitted to pharmacology program and pharmacology co-op.

Table 2 : Number of Students Admitted to Pharmacology and to Pharmacology Co-op

Academic Year	Admitted to Pharma-cology Program	Applied and admitted to Pharma-cology Co-op	No. of non-Co-op students in this group	Not included in the analysis
1998/99	18	8	10	0
1999/00	18	10	8	0
2000/01	18	7	8	3
2001/02	18	9	6	3
2002/03	18	14	2	2
2003/04	18	8	9	1
2004/05	22	17	5	0

A common reason given by the students for not applying to the co-op option is that they would like to finish their degree in four years. Some also indicated they planned to attend professional schools at the end of their third academic year. Since co-op participations will require an extra year to complete their graduate requirements (see Table 1), it is not practical for these students to commit to the co-op program.

Pharmacology Co-op Placements

Placements in the pharmacology co-op are selective and closely monitored. Some salient features of pharmacology placements are as follows.

- All pharmacology postings are pre-screened to ensure the quality of the placement.
- Most of the placements are within the field of pharmacology with some of the leading pharmaceutical companies across Canada, the USA and Europe, as well as with some of the leading researchers in various universities around the world.
- Students are required to write a progress report after the first four months of a work-term, followed by a comprehensive report at the end of the work term.
- About half of the students do two eight-month work terms with two different employers. The remaining students spend 12 to 16 months with a single employer.
- Faculty members in the Department of Pharmacology and Therapeutics do on-site visits and mark students' work term reports.
- The quality of many co-op reports is scholarly enough to be published in scientific journals.

Upon the completion of the work assignment students are asked to evaluate their work terms. On a satisfaction scale that ranges from 1 to 5 (5 being extremely satisfied), the average students rating is 4.5. Students also report their work as challenging (a score of 3.86 on a 1 to 5 scale where 1 is not challenging at all and 5 is most challenging) and useful (a score of 4.45 on a 1 to 5 scale where 1 is not useful at all and 5 extremely useful) to their future career.

Comparison of Academic Performance of Co-op vs. Non-co-op students:

Pharmacology students form a set of student where one can compare the academic performance of co-op and non co-op groups in the same courses. Both groups have performed very well during the first two years of university. For comparing the academic performance of these two groups we have chosen two compare the grades in the two full-year required courses. The third year course, PCTH 300, is taken jointly by both the co-op and the non-co-op groups. During the next academic year the co-op group is on a sixteen-month internship and the non-cCo-op group continues with PCTH 400. When the co-op group return to campus they complete PCTH 400. This study compares the academic performance of these two groups in PCTH 300 and PCTH 400. During the time frame for this study the courses where taught by the same faculty members and the content has remained unchanged.

Academic grades were obtained from course grade reports for both classes for the pharmacology graduates between 1998 and 2004. Over this six-year period 56 students, admitted to the pharmacology co-op program, completed their internships. This group is identified as the co-op group. In addition, 43 students admitted to the pharmacology program, who did not choose the co-op option, completed the pharmacology program. This is the non-co-op group.

To compare the performance of these two groups in the two courses, the Z-score was computed for each student, where Z- score for the i-th student in a group, is defined as

$$Z_i = \frac{x_i - \bar{x}}{\sigma}$$

Where $\bar{x}$ is the mean score and σ the standard deviation of all the students in the class. In comparing the six-year data for PCTH 300 and PCTH 400, $\bar{x}$ was taken to be the mean score of all students (co-op and non co-op) and σ the corresponding standard deviation. It is instructive to compare the difference in the z-scores of PCTH 300 and PCTH 400 for co-op and non-co-op students. We thus define

$$Z_d = Z_{PCTH\,400} - Z_{PCTH\,300}$$

as the difference of the PCTH 400 and PCTH 300 z-scores. Denoting by $\bar{Z}_d$ as the mean of Z_d for a group (co-op or non-co-op), the confidence interval (C.I.) of the $\bar{Z}_d$ is given by

$$\text{C.I.} = \bar{Z}_d \pm 1.96\frac{\sigma}{\sqrt{N}}$$

where N is the number of the students in the group. The mean standard error is given by the quantity $1.96\frac{\sigma}{\sqrt{N}}$.

Values of the various variables used in the above equations are given below.

N (Co-op) = 56 number of co-op participants
N (non-Co-op) = 42 number of non-co-op participants
$\bar{x}$ (PCTH 300) = 84.89 mean grade all students first class
σ (PCTH 300) = 6.39 standard deviation first class
$\bar{x}$ (PCTH 400) = 86.07 mean grade for all students second class
σ (PCTH 400) = 4.56 standard deviation second glass

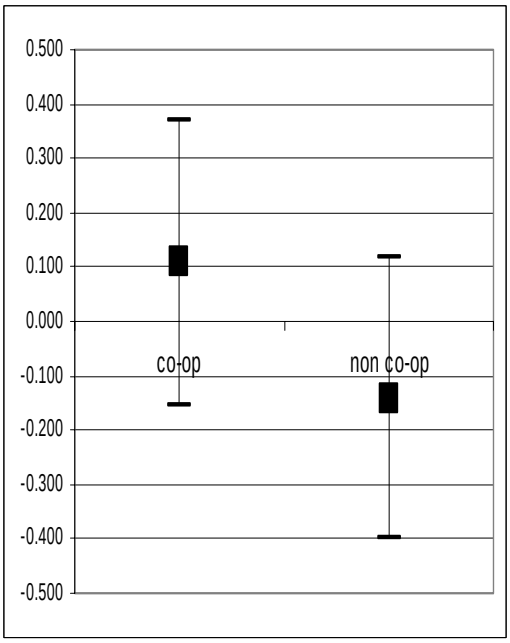
Using these numbers the values for the remaining variables can be calculated and are given in Table 3.

Table 3 : $\overline{Z}_d$, Error, and Confidence Interval for Co-op and Non-co-op Students

	Co-op	non-Co-op
$\overline{Z}_d$	+0.108	-0.141
error	±0.262	±0.259
C.I.	(-0.154,0.370)	(-0.400,0.118)

A plot of $\overline{Z}_d$ with the error bars, for both the groups is shown in Figure 1. The plot clearly shows that the sixteen-month work experience has no negative impact on the academic performance of co-op students in PCTH 400. In fact, they tend to do better when compared to the non-co-op students. However, the confidence intervals, for the average change in PCTH 400 score, of the two groups overlap. More data are needed to reduce the error bars to separate the groups significantly.

Figure 1: Plot of $\overline{Z}_d$ with corresponding confidence intervals, for co-op and non-co-op groups



Another informative way is to examine the difference in grade distribution between the two groups. A histogram showing the difference between PCTH 400 and PCTH 300 marks for co-op and non-co-op students is shown in Figure 2 (see Appendix B).

From the histogram the median grade difference is +2 for the co-op students and is -1 for the non-co-op group. The average grade difference for the co-op students is 1.64 and is 0.58 for non-co-op group. So, in general, co-op students tended to perform better in PCTH 400. Two (out of 56) co-op students had their grade drop by 8 and 9 points. From the records it is not clear what happened in these two situations that would cause them to perform so differently from their peers in co-op.

Scatter plots of PCTH 300 grade vs the grades difference between PCTH 400 and PCTH 300 for both groups are shown in Figures 3 and 4 respectively (see Appendix C). It is clear from these plots that the co-op students who perform below the average level in PCTH 300 have the most improved class performance in PCTH 400. This effect, that the students who perform below the average level before going out on co-op work terms tend to perform better in the classroom (compared to non co-op students with similar grade point average) after the co-op experience, has been noted by other researchers as well (Lindenmeyer ,1967).

To summarize, the following conclusions may be drawn from the above analyses.

- Performance of co-op students in PCTH 400 does not suffer by taking a 16-month break (while they are on their internship) from academic studies.
- In comparing the grades for PCTH 400 vs. PCTH 300, co-op students seem to do slightly better than their non-co-op counterparts. The median grade difference between PCTH 400 and PCTH 300 for co-op students is +2, compared to a value of -1 for non-co-op students. However, more data is needed (to reduce the error bars for $\overline{Z}_d$) to make a definitive statement .
- Improvement in PCTH 400 grades is highest for those co-op students whose performance was below average in PCTH 300.

CONCLUSION

From the six years of data that has been presented above it is clear that a sixteen-month placement period has no negative impact on the academic performance of co-op students. In fact, the indication is that the co-op students might do slightly better then their non-co-op counterpart. However, more data are needed to reduce produce truly significant results.

These students enter the pharmacology program on equal footing. They have comparable academic records from their first two years, maturity and commitment to academic studies. Thus the differences flushed out in the grade comparison, using Z scores, can be attributed to the students participation in the co-op program or not.

Several obvious questions need to be addressed in future research. Are there any courses for which a 16-month break from academic studies would have a

negative impact on students' academic performance? Would the above results be true, for example, for mathematics courses? Is there an optimal length for a work-term that would result in enhanced academic performance? To answer these and related questions, similar studies need to be carried out for other groups of students. At the University of British Columbia the biochemistry and computer science internship programs follow the same work-study schedule as the pharmacology program. Therefore, a similar comparative study for these groups would be informative. One of the complications that arises for the biochemistry and computer science co-op groups is that the students are selected from a large group of applicants. Such a pre-selection, common to most of the co-op programs, may make it difficult to draw meaningful conclusions by comparing academic performances of co-op and non-co-op students without controlling for pre-existing differences.

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APPENDIX A

Table 1. Various Co-op Schedules Based on Length of Work Terms (WT) and Study Terms (ST)

Typical Alternating Term Program: Work Term Four Months

Year 1			Year 2			Year 3			Year 4			Year 5		
F	W	S	F	W	S	F	W	S	F	W	S	F	W	S
ST	ST		ST	WT	ST	WT	ST	WT	ST	WT	ST	WT	ST	-

Programs with Eight Month Placements

Year 1			Year 2			Year 3			Year 4			Year 5		
F	W	S	F	W	S	F	W	S	F	W	S	F	W	S
ST	ST		ST	WT	WT	ST	ST	WT	WT	ST	WT	ST	ST	-

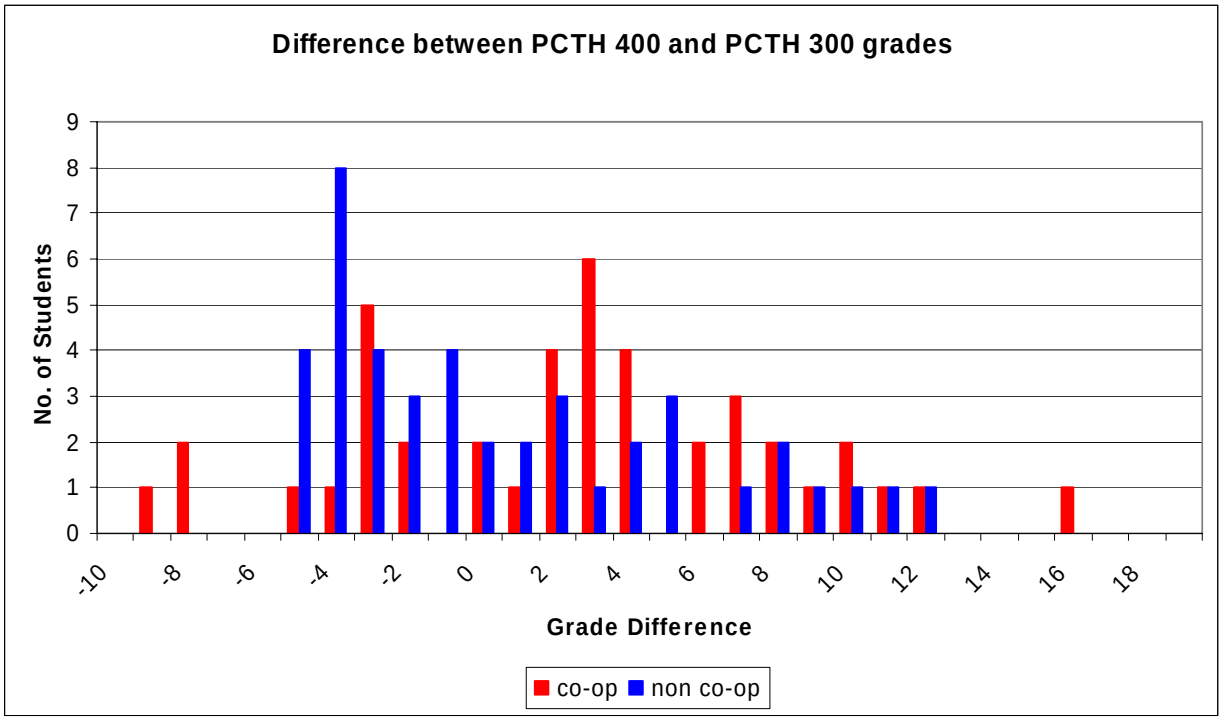
Programs with 16 Month Placements

Year 1			Year 2			Year 3			Year 4			Year 5		
F	W	S	F	W	S	F	W	S	F	W	S	F	W	S
ST	ST		ST	ST		ST	ST	WT	WT	WT	WT	ST	ST	

F= Fall term, W = Winter term, S=Summer term

APPENDIX B

Figure 2 : A plot of PCTH 400 and PCTH 300 grade difference for co-op and non-co-op students



APPENDIX C

Figure 3 : A scatter plot of PCTH 300 grade vs. PCTH 400 and PCTH 300 grade difference for co-op students.

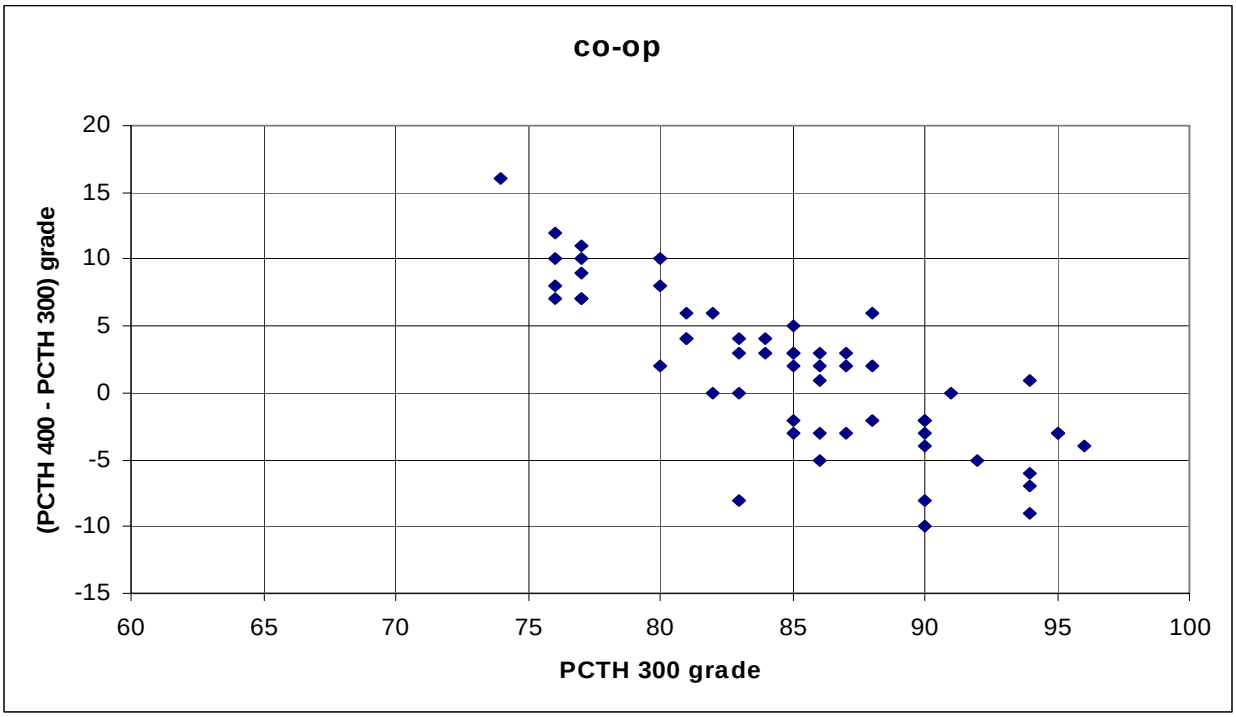


Figure 4 : A scatter plot of PCTH 300 grade vs. PCTH 400 and PCTH 300 grade difference for non-co-op students.