SELECTED DIFFERENCES BETWEEN CO-OP AND NON CO-OP ENGINEERING GRADUATES

by

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Chapter 1

INTRODUCTION

Although it is generally accepted (though not always proven) that graduates of cooperative education programs receive higher salaries for their first job after graduation than do other graduates, there is no consensus as to why this is true. The obvious reason is that cooperative education, with its alternating periods of study and work, has given students experience that makes them more valuable to employers. There are other possible reasons. Differences in age, grades, even socio-economic factors--all have been advanced as being related to the higher salaries earned by cooperative education graduates. If such factors have significant relationships to salary levels, the importance of the relationship between the co-op program and salary is lessened. Related to the issue of initial salary differences is the question of whether or not differences remain several years after graduation.

Statement of the Problem

The first problem was to determine the average initial salaries of cooperative education and non-cooperative education graduates. The second problem was to determine if differences in average salaries existed between these two groups after a period of several years.

Hypotheses

Three hypotheses were tested.

(1) Students graduating from the cooperative education program will receive starting salaries significantly higher than those of non-cooperative education graduates.

(2) Students graduating from the cooperative education program will be earning salaries significantly higher than those of non-cooperative education graduates after a six-year period.

(3) Some other variables will have significant relationships to salaries, either initial or current. An attempt was made to see if several variables besides the co-op experience might account for differences between co-ops and non co-ops. These included (1) undergraduate major, (2) grade point average, (3) graduate study, (4) socio-economic factors: educational level and occupation of parents, (5) age, (6) participation in extracurricular activities, (7) collegiate honors, (8) prior work experience, (9) type of employer, location and job function for both first and current positions and (10) consistency of employment. Previous research (i.e., Astin, 1978; Jencks, 1972) suggested that some of these variables are related to salary. Rather than formulate a separate, repetitive hypothesis for each one, they were all grouped under this general hypothesis.

Scope and Limitations

This study examined one graduating class in engineering at Virginia Tech. A small-scale study of one class at one university cannot be generalized to all co-op graduates.

There was another inherent limitation. Although every effort was made to match cooperative and non-cooperative education graduates

as closely as possible, one important factor remained largely untouched. If the students who enter cooperative education are inherently different from those who do not, different results in their careers after graduation would not be surprising. There was no way to go into this possibility thoroughly. Although some pre-existing conditions were examined, this study did not assess possible causes but rather the relationships among specified variables.

Definition of Terms

(1) Cooperative education. Cooperative education at Virginia Tech is a five-year program. Academic work is interspersed with periods spent working on a full-time job. Each student has an individualized program; the number of work periods may vary because of particular circumstances. Each student must complete his/her own program to be considered a cooperative education graduate. Except for unusual circumstances, each student works for one employer for the entire program, although each may work at different jobs for that employer. Students pay tuition only when they are actually on campus attending classes. A small administrative fee for each work period is the only additional cost of co-oping, even though the program takes an additional year. Although students in many different major areas of study enroll in cooperative education at Virginia Tech, this study dealt only with engineering graduates. Graduates of the cooperative education program will be referred to as "co-ops" or "co-op graduates" throughout this paper.

(2) Non co-ops. Engineering graduates who were not graduates of the cooperative education program will be referred to as "non co-ops" or "non co-op graduates."

(3) Virginia Polytechnic Institute and State University (Virginia Tech). A land-grant university with enrollment of approximately 20,000 students in eight colleges, located in Blacksburg, Virginia. Also referred to as V. P. I. & S. U.

(4) Quality Credit Average (QCA). The term used at Virginia Tech for grade point average.

Organization

Chapter 2 reviews relevant literature, especially on cooperative education, as well as research dealing with such factors as location or grades that may have an effect on income. Chapter 3 explains the methodology used; Chapter 4 presents the findings; and Chapter 5 discusses the findings and summarizes the study.

Chapter 2

REVIEW OF LITERATURE

It has long been a truism among those involved in cooperative education that co-op graduates receive larger salaries upon graduation than do non co-ops. This is attributed to the experience that co-op students gain in the work periods they spend on their co-op jobs; when they graduate, they are not usually considered raw beginners and are hence paid higher starting salaries. This differential is expected to diminish gradually and to disappear entirely after about five years. However, until recent years little research had been done to investigate this belief.

Although cooperative education was begun at the University of Cincinnati in 1906, it was not until the late 1950's that any comprehensive research was done on co-op programs. As Wilson and Lyons (1961) put it:

> It has been largely by faith and perhaps by the testimonial evidence of graduates and others, that these programs [co-op] have persisted and even flourished....There has been a glaring lack of basic research properly documenting the philosophic advantages and disadvantages of this approach as part of an educational process. (pp. 3-4)

Their pioneering study surveyed graduates of 38 institutions, both co-op and non co-op. Graduates were from five different years: 1958, 1955, 1953, 1950 and 1939; disciplines investigated were engineering, business and liberal arts. They found no statistically significant differences as far as salary level was concerned. However, employers

surveyed in this study estimated that co-ops had an employment advantage over non co-ops for anywhere from two to five years.

Beginning in the late 1960's, more studies on co-op salary levels began to appear. Miller (1967) reported that "little statistical evidence was available...[which showed higher salaries for co-ops] until the College Placement Council stepped in with its pilot study which, after two years, was followed in the 1966-67 school year with a broader survey in which 20 schools participated..." (1967, p. 22). Miller reported that this survey showed co-ops were offered higher starting salaries than non co-ops (2.5% higher for technical graduates and 5% higher for non-technical students). By the following year, Miller (1968) reported data from the College Placement Council that showed these differentials had widened slightly, to 2.9% and 5.5% higher starting salaries for technical and non-technical co-op graduating seniors, respectively.

In the last 10 years several research studies reported financial data for cooperative and non-cooperative students, often as one of several issues examined, with differing conclusions on the question of salary levels. In a doctoral dissertation at the University of Michigan, Yensco (1970, cited in Brown, 1976) studied engineering graduates and found that the co-op graduates had higher starting salaries than non co-op graduates.

Gore (1972) conducted a survey of graduates of the College of Business Administration at the University of Cincinnati. He surveyed graduates of the years 1964 to 1969 and found, contrary to his

expectations, that co-op graduates had slightly lower starting salaries than non co-ops. In addition, he found that five years after graduation, salaries of co-op graduates had passed those of non co-op graduates (also contrary to his expectations). He concluded that, instead of the co-op experience providing an initial advantage, the co-op experience was one with a longer-term payoff, with an increasing salary differential over a five-year period. This was also borne out by the job positions and titles given by those surveyed. This study included only graduates of the College of Business Administration.

Brown (1976) surveyed the graduates of twelve cooperative and twelve non-cooperative schools in a study of various facets of career development. The schools chosen were comparable in such areas as size, location, etc. The sample was comprised of graduates of three separate years: those who had been out of school one, five and ten years. She found that a statistically significant proportion (26.67%) of co-op graduates earned more than $10,000 per year. The percentage of non co-op graduates earning over $10,000 was 21%. She also found that the differential between co-ops and non co-ops remained for a period of years for males only. A statistically significant percentage of male co-ops earned over $16,000. In addition, she found that co-op graduates who accepted full-time jobs with their co-op employers earned higher salaries than those who took different positions. Because of the limited sample size of graduates in other major fields, she used only business and engineering graduates for this particular analysis. Forty-five per cent of graduates who had remained with their co-op

employers were earning more than $11,000 per year. Of those who had changed employers, only 23% earned more than $11,000 per year. Thus, her results showed that co-ops earned more than non co-ops, and co-ops (in business and engineering) who remained with their co-op employers earned more than those who changed jobs.

A study conducted in the United Kingdom showed much the same results as many of the U. S. studies. Hanson and Marshall (1977) compared salaries, not of beginning graduates, but of engineers who graduated from the University of Bradford in Chemical Engineering between 1963 and 1973 with data obtained by the Institution of Chemical Engineers in a national survey. Salaries of graduates of the "sandwich courses" (the British name for cooperative education) averaged 15% more than the national norm for chemical engineers at age 27. The authors felt it was clear that the sandwich course graduate was being paid more than the average for his age group, and that the gap appeared to widen with increasing years. They concluded:

> The latter [the widening gap] is not necessarily irreconcilable with the conventional view that university training becomes subordinate to other qualities and experiences after a few years. If the sandwich course graduate has demonstrated particular qualities in the early years of employment, these may have given him an earlier start on the promotional ladder and such a start could continue to have an influence on his subsequent career. (p. 91)

Alwell (1977) studied the cooperative education program at a small, liberal arts college (Marymount College) and found that the co-op students who graduated in 1973 and 1974 earned an average of $1,561 more per year than non co-op graduates of the same period.

This difference was significant at the .01 level. The salaries were those for entry-level jobs, since those surveyed had been out of school for only one or two years. Co-op at Marymount consists of either part-time work or a one-term full-time experience, and students receive academic credit for either type. Hence, the time enrolled in the total program is no longer for co-op students than for non co-op students.

A research project that studied co-op salaries and performance from another viewpoint was conducted by Phillips (1978) at the Lockheed-Georgia Company. The company's co-op program had existed for over 20 years. Ninety-five (35%) of the co-ops had returned to the company as permanent employees. Each co-op graduate was matched to a non co-op graduate who entered the company in the same classification at the same time, chosen randomly for use as a control group. The careers of both groups were then traced from the time they joined the company until June 1, 1973, or until they had left the company. Since employees entered the company continuously over the 20-year span studied, length of employment varied. Salaries and promotions were used to measure the performances of the two groups, and an adjustment was made for the fact that returning co-op graduates received starting salaries 10% higher than those offered to regular beginning employees. Percentage differences were given after three, six, nine, twelve and fifteen years. The author warns that, as the sample size decreases over time through attrition, the results for the longer time periods must be taken with caution. Adjusted for the salary differential explained above, the

figures showed that co-ops outpaced regular graduates. After three years, co-op graduates averaged increases of 38.1% to non co-ops' 32.8% (over adjusted starting salary). After nine years, salaries of co-op graduates had increased 143%, those of non co-op graduates, 124.1%. After fifteen years, these figures were 316% and 224% for co-ops and non co-ops, respectively. Figures for promotions also showed a consistent advantage for co-op graduates. Phillips' research showed that co-op graduates at Lockheed-Georgia not only started off at higher salary levels, but that the differential increased for at least a fifteen-year period.

Breen and Freeman (1978a) studied graduates of Macomb County Community College in Warren, Michigan, for the years 1970-75 and found that non co-ops had higher salary levels than co-op graduates in the fields of Design and Mechanical Technology. Since 61% of the non co-op graduates had either previous related work experience or had entered the program to upgrade existing skills, compared to 31% of the co-op graduates, the greater experience level of the non co-op graduates may have accounted for the difference in salary levels. Another possible contributing factor was that co-op students were younger than non co-op students (Breen & Freeman, 1978b).

Another community college study was done at the Northern Virginia Community College at Annandale by Hamlin (1978). He used salaries and promotions of graduates in three programs--Engineering, Public Service and Business--to measure career development. He found that co-ops had larger salaries and greater salary increases than non

co-op graduates. Results may be somewhat confounded because some graduates went on to further study at a four-year school and others did not. He found that, though Business graduates had lower starting salaries than either Engineering or Public Service graduates, they received larger increases in salaries than the other groups.

Hayes and Travis (1976), studying cooperative education from the point of view of the employer, surveyed 70 employers who are members of the Cooperative Education Association. They reported that co-op graduates received more merit increases and promotions than did non co-op graduates. Co-ops "moved faster and further than did other recent college graduates" (p. 8).

Cohen, Dean and Frankel (1978), in a national study of cooperative education, used a Fisher's Rate of Return Analysis to compare all costs and benefits of cooperative education to those of regular college courses. This analysis projects lifetime earnings and compares them with all costs incurred, at varying rates of interest. They found that, unless interest rates exceeded 35%, the benefits of a cooperative education program outweighed the costs for students of both sexes in all discipline areas, even when a five-year co-op program was compared with a four-year regular program. The extra year invested by the student had a financial payoff. In salary figures for the years 1970 to 1973, co-op graduates were ahead of non co-op graduates. The mean figure for co-ops was $23,811, for non co-ops, $16,942. This was a cumulative figure for all three years. Cohen and associates found the initial salary differential co-ops received was maintained over a three-

year period and remained stable over that time. Overall, they found that previous experience was the most important factor in salary differential; either co-op or other previous work experience could provide it. But the two were not additive; hence a student who had comparable previous work experience would not benefit financially from participating in a cooperative education program.

Although the literature shows variance in results and much greater variance in groups studied and methods used, most of the studies confirmed that the cooperative education experience does have a financial payoff, initially as well as over a period as long as 15 years.

Many of the studies examined showed a common flaw. They examined only the results of co-op and non co-op education--salary differences--without attempting to show whether there were basic differences between co-op and non co-op graduates, or if other factors contributed to salary differentials. If, for example, students in the co-op program had higher grades, that fact might help to account for the differences in advancement and salary levels. If students were different to start with, it would not be surprising that their career patterns would be different.

Several studies did address the possibility that cooperative education students and non-cooperative students had inherent differences. Baker (1969) studied engineering students at Tennessee Technological University and attempted to determine if there were differences between co-op students and non co-op students. He matched co-ops and

non co-ops on the basis of ACT scores and then administered the Edwards Personal Preference Schedule, which shows the relative importance of various needs or motives. He also checked grade point averages over six quarters of study. He found a significant difference in academic achievement (GPA mean for co-ops was 2.76 vs. 2.36 for non co-ops, for a group matched by ACTs). He attributed this difference to co-ops gaining in motivation through their on-the-job experiences. Three personality indexes also showed significant differences. Co-ops scored higher in measures of Order (the need to organize things) and in Intraception (understanding of own and others' feelings and motives). Co-ops scored lower in the need for Succorance (support by others). In summary, co-ops had a greater need to organize their work, more empathy and self-understanding and were more self-reliant.

Harris (undated, cited in Brown, undated) tested for differences between co-ops and non co-ops in developing colleges and universities. He found that co-ops had lower levels of feelings of powerlessness and alienation than did non co-ops. Co-ops also had higher regard for the work ethic and the importance of interesting and challenging work.

Martello and Shelton (1981) found inherent differences in co-op and non co-op liberal arts students. They tested students before and after one term--a work period for co-ops and an academic term for non co-ops. The tests included Crites' Career Maturity Inventory (Attitude Scale and Competence Test), Crites' Career Certainty and Major Certainty Scale and other tests. Co-ops scored significantly higher on the

Attitude and Competence scales. Both groups showed an increase in career certainty but not in other variables after the intervening term. The authors concluded that a self-selection factor is involved in the decision to enter the co-op program; students with greater career maturity and increased career decision skills are more likely to enter a co-op program.

There are other factors which may affect salary levels. One possible relationship is the one between socio-economic level and salary. Jencks (1972) confirms that one exists, "that men with upper-middle class parents earn about 28% more per year than the national average, while those with lower-class parents earn about 25% less" (p. 213). What connection does this have with cooperative education? Wilson and Lyons (1961) measured co-ops and non co-ops on several attributes and found only one significant difference between the two groups: social class. Co-ops were of lower social class to a degree that was statistically significant. The authors expected this difference, for two reasons. The obvious one was that co-ops could earn money to help pay college expenses, enabling many of lower income levels to attend college. The other was that the "practical" aspects of cooperative education would appeal to parents of a lower educational level. If co-ops are of lower social class, this might lessen the chances of co-op graduates having higher salary levels, particularly in the long run.

However, two coordinators in the Virginia Tech Cooperative Education Department have a different view.[1] From their many contacts with students, they suspect that co-op students today are of a higher socio-economic level than non co-ops. They believe this is due to the vagaries of federal financial aid. Students can receive aid only for the academic year proper (three quarters at Virginia Tech); no aid is given to attend summer classes. This is true even if the student attends only two of the three regular quarters. Co-op students usually work during some of the academic quarters and attend summer school; they must pay all fees for summer school and also lose financial aid for regular quarters they do not attend. In addition, salaries for co-op jobs count as income and may lessen the amount of financial aid a student receives. For these reasons, students entitled to financial aid sometimes choose not to enter the co-op program. On the other hand, the co-op program is attractive to students from families with incomes too high to qualify for financial aid but who are still in need of additional funds to complete their educations. Hence, the coordinators' belief is that co-ops may be of a higher socio-economic level than non co-ops.

Wilson and Lyons did their research in the late 1950's and early 1960's, before the impact of federal aid programs was felt. The first of these, the National Defense Act, enacted in 1958, provided loans. The Higher Education Act, with grants, loans and work study

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[1] Hedgepeth, R. E. and Tate, C. T., Personal communications, 1981.

programs, was enacted in 1965 ("Determining awards," undated). Perhaps one effect of these financial aid programs has been to change the socio-economic composition of co-op students.

Astin's nationwide study of college students (1978) did not deal with cooperative education, but discussed certain factors that have an impact on salary levels--in particular, grades and location. From his analyses of the incomes of engineers after five years of employment, he found an increase of approximately $900 per year for each letter grade. An "A" student earned $900 more than a "B" student and $1800 more than a "C" student. Location also affected income. Engineers in the midwest earned almost $900 per year more than those in the rest of the country; those in the northeast made $700 less than the nationwide mean. Presumably, this was the result of varying demand for engineers in different parts of the country.

Summary of Literature

The literature showed mixed results as far as salary differences between co-op and non co-op graduates were concerned. Although a majority found co-ops to have higher salaries, several did not. One (Wilson and Lyons, 1961) showed no differences between the groups. Two studies (Breen and Freeman, 1978a; Gore, 1972) found co-ops to have lower starting salaries. (In Gore's study, co-ops had lower initial salaries and higher ones after five years.)

There was also much variance as to groups studied. Some used one discipline (Gore, 1972; Yensco, 1970); some surveyed graduates

in various disciplines (Brown, 1976; Cohen et al, 1978). Alwell (1977) studied recent graduates; Brown (1976) surveyed graduates of several programs after one, five and ten years.

Methodologies also varied. Several used employer data (Hayes and Travis, 1976; Phillips, 1978) Two used data gathered by third-parties (Hanson and Marshall, 1977; Miller, 1967, 1968). Cohen et al (1978) used cumulative three-year salary figures for their analyses.

Because of the many differences in these studies in subjects, time periods and methodologies, a clear-cut picture of salary differences between co-ops and non co-ops did not emerge, especially concerning how many years any differential between the groups lasted.

Several issues arose from the literature review that merited further investigation. One was the possibility suggested by Baker (1969); Harris (cited in Brown, undated); and Martello and Shelton (1981) that inherent differences existed between students who entered co-op programs and those who did not. One difference suggested was connected with socio-economic factors. Wilson and Lyons (1961) had found co-ops to be of lower socio-economic level than non co-ops; several of the Virginia Tech coordinators thought the opposite was true. This issue could be investigated and then examined to see if it related to salary levels.

Chapter 3

METHODOLOGY

Introduction

The purpose of this study was to investigate the relationship between salaries for co-op and non co-op graduates and to determine if any other variables were related to any differences that were found. Specifically, the following hypotheses were tested:

(1) Students graduating from the cooperative education program will receive starting salaries significantly higher than those of non-cooperative education graduates.

(2) Students graduating from the cooperative education program will be earning salaries significantly higher than those of non-cooperative education graduates after a six-year period.

(3) Some other variables will have significant relationships to salaries, either initial or current. Specifically, these variables include (1) undergraduate major, (2) grade point average, (3) graduate study, (4) socio-economic factors: educational level and occupation of parents, (5) age, (6) participation in extracurricular activities, (7) collegiate honors, (8) prior work experience, (9) type of employer, location and job function for both first and current positions and (10) consistency of employment.

Sample

A survey research design was chosen for this study. The class

graduating in 1975 was used. One reason for limiting the study to graduates of one year was that they all faced the same economic conditions. The inflation of the last few years has made comparisons of even successive years almost meaningless. The original plan was to survey the entire cooperative education class of 1975 (n = 156) and a slightly larger number of non co-ops. Almost 70% of the co-op graduates of that year (n = 109) were from the College of Engineering. The remaining graduates were scattered among 13 departments, with some having only one or two graduates. In order to have a cohesive sample, it was decided to limit the survey to engineering graduates.

The composition of both the College of Engineering and the co-op program has changed since students entered Virginia Tech in 1971. Both have a larger proportion of women and minorities. The number of co-op program areas also increased, and the proportion of engineers decreased. Study of a later class would have included more women and minorities but would not have a long enough interval since graduation. A tradeoff had to be made; the homogeneous group with a six-year interval since graduation was chosen.

It was intended that co-ops would be matched to non co-ops on a number of variables, so that the two groups would be as identical as possible. A closely matched sample would eliminate some of the doubts that different results might have been caused by inherent differences between the groups.

The Registrar's office supplied a list giving the final class standings, grade averages and departments for the College of Engineering for 1975. This made it possible to match graduates by grade average and

department. Since no further information (i.e., SAT scores, high school grades) could be obtained, it was decided to proceed with the information available.

First, co-op graduates were identified. Co-op records showed when students were scheduled to finish their programs. Some students may have had a course or two to complete and hence would have appeared on the graduation list the following year. Fifteen students were missing from the graduation list and were apparently in this category. The number of co-ops was therefore reduced to 94.

Each of these graduates was paired with a non co-op graduate of the same department, with grade averages matched as closely as possible. The co-op class included 93 males and one female. Several non co-op females were on the original list of non co-ops but could not be located on the address list, possibly because of name changes. Substitutions were made for them, but as a result, the sample was almost entirely male. Graduates were not identified by race, either by the co-op department or the Registrar's graduation list; hence, there was no way to know if minorities were surveyed.

Survey Instrument

A questionnaire was prepared, using design principles suggested by Dillman (1978). A copy of the questionnaire is in Appendix B. In addition to salary data, questions were asked about employer, job function, location, etc., for both first and current employment. Respondents were also asked about what type of work experience they had had during college, how many times they had changed jobs and how they

felt about their current jobs. A series of questions about graduate education was also included.

Since the major purpose of this study was to determine if salary differences existed between co-ops and non co-ops, questions about salary levels were considered to be central. Ranges of salaries are often used for demographic information on surveys. Since salary information was needed for far more than demographic purposes in this study, ranges did not seem adequate. Unless there was an unusually large number of ranges, very real differences between the groups could easily be lost. Hence, it was decided to ask for actual salary figures, both for the first position after graduation and for the present job.

The question arose as to how accurate these figures would be. Can people remember accurately what their salary was six years ago? If it was their first full-time job, they seem to. In a highly informal poll of acquaintances, every one questioned knew the salary he/she had received for his first job; it appeared to be a memorable milestone. Some remembered the monthly figure and others the yearly one. Hence, this questionnaire asked for either figure.

Several questions were intended for co-op graduates only. One asked if respondents had stayed with their co-op employer after graduation. The other questions for co-ops requested feedback on their feelings about the co-op program. They were asked if they felt it had given them an advantage in full-time employment. This question was deliberately ambiguous, to free respondents to answer the next question as they chose. It asked respondents to state in what particular ways

They considered co-op had been an advantage to them. The final question in this group asked if respondents would recommend co-op to beginning students.

Additional information was requested to see if there were differences in the two groups. Included were questions on age, sex, race, participation in extracurricular activities and collegiate honors and awards received. A series of questions about respondents' parents provided socio-economic information--parents' occupations and educations. No questions were asked about parents' incomes. Hauser (1977) maintains that answers to income questions tend to be unreliable, due to lack of knowledge and bad memories. Jencks (1972) defines class entirely in terms of fathers' educational attainments and occupational status, not in terms of actual income, since income has little effect by itself, independent of the other factors.

The final item on the questionnaire was an open-ended question, which gave respondents an opportunity to comment on how they felt their college experiences did or did not help them prepare for a career.

The questionnaire was pre-tested for clarity by administering it to several young adults who were in approximately the same age and career brackets as the subjects.

The Alumni Association supplied address labels for the Engineering class of 1975. Some graduates were missing, among them several co-ops. It was possible to substitute for lost non co-ops, but the number of co-ops was reduced to 90. One hundred and eighty-three

questionnaires were sent, 90 to co-ops and 93 to non co-ops.

In addition to the questionnaire, a covering letter signed by Dr. H. E. "Chip" Bowling, Director of the Virginia Tech Cooperative Education Department, and a stamped envelope were sent to each survey participant. To facilitate follow-up, each questionnaire was given an identifying number.

A follow-up letter and another questionnaire were sent approximately four weeks later to 76 non-respondents. (Copies of both letters are in Appendix A). Seven questionnaires were returned as undeliverable by the post office. This reduced the actual number contacted to 176; of these, 143 completed questionnaires were returned, a response rate of 81%. As suggested by Dillman (1978), the letter asked that respondents interested in receiving a summary of the results of the survey put their names and addresses on the back of the envelope; 96 of the respondents did so.

Preparation of Data

When questionnaires were received, names were checked off the list, QCAs were added to the questionnaires and identifying numbers were torn off.

To facilitate data processing, answers to several open-ended questions were coded as follows:

1. Work experience while in college: Career-related, i. e., Engineering Assistant; non-career related, i. e., fast food restaurant; both; none.

2. Employer: Large corporation; federal government; state and local governments; small firm; educational institution; military; graduate school. In addition, employers were

further subdivided into sub-categories such as consulting, research, highway and public works departments, etc.

3. Location: Virginia; Southeastern U. S.; Elsewhere in U.S.; Overseas.

4. Job function: Technical; Managerial; Other.

5. Graduate work: Engineering; Business; Other.

6. Employer training programs: Management; Technical; Communications; Combinations of these; Unspecified.

7. Extracurricular activities and Collegiate honors: Respondents listed specific activities and honors; only the number of these were coded.

8. Fathers' and mothers' occupations: Answers were coded using the Occupational Classification System and the Duncan Socio-Economic Index (SEI) given in Hauser (1977).

Some answers had to be reclassified. Several respondents who attended graduate school immediately after graduation had recently completed their Ph.D. programs and had just become employed. What may have been their first job was considered more comparable to others' present positions and was included in that category. In addition, graduate stipends were not included as the first salary of those who continued their educations full time.

After coding and keying, data were analyzed using SPSS procedures as given in Nie, Hull, Jenkins, Steinbrenner & Bent (1975). The level of significance was set at .05. After frequency distributions were obtained, t-tests were performed on salary data to determine if statistically significant differences existed between the two groups. A series of cross tabulations were made and examined by Chi-square analysis, to see if the groups differed, and if so, what factors were related to salary levels.

Chapter 4

FINDINGS

This chapter presents findings, frequency distributions and results of the statistical tests.

Ranking of Graduates

The first findings of this study occurred before the questionnaires were sent out. The list of the 1975 Engineering graduating class supplied by the Registrar showed that co-op graduates ranked very high in their class. The top five ranking graduates were all co-ops; eleven of the top 17 were co-ops. Approximately 18% of the class (n = 532) were co-ops; 25% of the top fifth were co-ops and only 7% of the bottom fifth.

When departmental rankings were examined, co-op graduates ranked in their departments as follows:

Electrical Engineering	1, 2, 5
Industrial Engineering--	
Operations Research	1, 2
Aerospace Engineering	1, 4, 5
Chemical Engineering	1, 3, 4
Mechanical Engineering	1, 2, 3
Civil Engineering	2
Mining Engineering	2, 4, 5
Metallurgical Engineering	2
Engineering Science--	
Mechanics	3

These findings emphasized the importance of choosing a carefully matched sample.

Frequency Distributions

Frequency distributions yielded the following information about the sample of co-ops and non co-ops:

Category	Co-op No.	Co-op %[1]	Co-op Mean	Non Co-op No.	Non Co-op %[1]	Non Co-op Mean
Respondents	77	53.8		66	46.2	
QCA at graduation			3.12			3.19
Present age			28.90			28.52
Sex						
Male	76	98.7		66	100.0	
Female	1	1.3		0	0.0	
Race						
White	76	98.7		64	98.5	
Non-white	1	1.3		1	1.5	
Major						
Civil Eng.	18	23.4		13	19.7	
Mining Eng.	5	6.5		4	6.1	
Electrical Eng.	16	20.8		13	19.7	
Mechanical Eng.	14	18.2		17	25.8	
Industrial Eng.-- Operations Res.	7	9.1		9	13.6	
Chemical Eng.	10	13.0		5	7.6	
Aerospace--Ocean Eng.	5	6.5		2	3.0	
Eng. Science-- Mechanics	2	2.6		1	1.5	
Materials--Metals	0	0.0		2	3.0	
Participation in extra-curricular activities						
No	30	39.5		16	24.6	
Yes	46	60.5		49	75.4	
No. of extracurricular activities[2]			1.54			1.65
Honors received						
No	43	57.3		30	46.2	
Yes	32	42.7		35	53.8	

[1] % of those who responded to question.
[2] For those who answered "yes" to question above.

Category	Co-op No.	Co-op %[1]	Co-op Mean	Non Co-op No.	Non Co-op %[1]	Non Co-op Mean
No. of honors received[2]			1.67			1.43
Fathers' SEI			53.30			61.02*
Did mother work?						
No	40	52.6		35	53.0	
Yes	36	47.4		31	47.0	
Mothers' SEI			50.29			50.31
Fathers' educational level			3.60[3]			3.82[3]
Mothers' educational level			3.55[3]			3.79[3]
Work experience before graduation[4]						
Career related	11	14.3		25	38.5	
Non-career related	24	31.2		27	41.5	
Both of above	6	7.8		13	20.0	
None	35	45.5		0	0.0	
First employer						
Corporation	50	64.9		34	52.3	
Federal government	9	11.7		7	10.8	
State & local govn.	4	5.2		6	9.2	
Small firm	12	15.6		13	20.0	
Graduate school	1	1.3		3	4.6	
Military	1	1.3		2	3.1	
Location of first job						
Virginia	24	31.6		19	30.6	
Southeast	34	44.7		26	41.9	
Elsewhere in U.S.	16	21.1		16	25.8	
Overseas	2	2.6		1	1.6	
First job function						
Technical	69	90.8		56	90.3	
Managerial	4	5.3		5	8.1	
Other	3	3.9		1	1.6	
Salary of first job/ month			$1204.39			$1135.68

[1] % of those who responded to question.
[2] For those who answered "yes" to question above.
[3] 3 = High school graduate; 4 = Some college.
[4] Other than co-op experience.

* The difference between these means had a t-value of 1.97, significant at the .051 level.

Category	Co-op No.	Co-op %[1]	Co-op Mean	Non Co-op No.	Non Co-op %[1]	Non Co-op Mean
Do you still work for same employer?						
No	30	39.5		31	49.2	
Yes	46	69.5		32	50.8	
If not, how many employers have you had?			2.55			2.18
Present job function						
Technical	45	59.2		39	60.0	
Managerial	23	30.3		19	29.2	
Other	8	10.5		7	10.8	
Present salary/month			$2877.39			$2483.81
Have you taken graduate courses?						
No	34	45.3		25	38.5	
Yes	41	54.7		40	61.5	
Were you working toward a degree?						
No	7	16.7		7	17.1	
Yes	35	83.3		34	82.9	
In what field?						
Engineering	21	60.0		24	70.6	
Business	13	37.1		8	23.5	
Other	1	2.9		2	5.9	
Degree obtained						
M.S. or M.B.A.	21	95.5		20	83.3	
Ph.D.	1	4.5		3	12.5	
Other	0	0.0		1	4.2	
Participation in employer training						
No	22	29.7		15	24.6	
Yes	52	70.3		46	75.4	
How do you feel about your job?						
Very satisfied	21	28.8		24	36.9	
Fairly well satisfied	40	54.8		29	44.6	
It's all right	10	13.7		10	15.4	
Unhappy with it	2	2.7		2	3.1	

[1] % of those who responded to question.

Questions for co-op graduates only

	No.	%[1]
Was first employer your co-op employer?		
No	54	71.1
Yes	22	28.9
Was co-op an advantage in fulltime employment?		
No	5	6.6
Yes	71	93.4
Would you recommend co-op to beginning students?		
No	0	0.0
Yes	74	100.0

[1] % of those who responded to question.

Findings re Sample

A larger proportion of co-ops returned the questionnaire; they represented almost 54% of the entire sample of 143.

QCA and undergraduate major. Since one graduating class was surveyed, and co-ops and non co-ops were matched by departments and grades, it was not surprising that differences were small. Examination of the returned questionnaires showed that the lowest rate of return came from the lower half of the non co-op sample (by grade average). The result was to raise the overall QCA level of the non co-op group slightly above that of the co-ops. The varying percentage of majors represented in the sample was also an artifact of those returning the questionnaire; it was sent to identical numbers of co-ops and non co-ops in each major.

Age. Since the co-op program is a five-year one, it was expected that co-op graduates would be older. Although the mean difference was not great (28.90 for co-ops, 28.52 for non co-ops), a closer look at the frequency distributions showed one major difference. Only one co-op graduate was 27 years old (the youngest age), while 13 (20%) of the non co-ops were 27.

Race. The sample was overwhelmingly white and male. Of the 143 respondents, only two were non-white, and one was female. Hence, it was not possible to run analyses differentiating by race or sex.

Extracurricular activities. It was expected that, since their careers on campus are broken up by periods of work experience, co-op graduates would have a lower rate of participation in extracurricular activities than did non co-ops. This was indeed the case, but even so, over 60% of the co-ops did participate in activities. Over 75% of the non co-ops listed activities. A wide variety of activities were listed by both groups; they ranged from the New Virginians musical group and varsity sports to religious organizations and the campus radio station. Most frequently listed were departmental organizations, fraternities and intramural sports.

Collegiate honors. More non co-ops than co-ops reported receiving collegiate honors and awards, but co-ops had more honors per person. Those most frequently named were graduation honors and election to honorary societies.

Socio-economic factors. Based on the Virginia Tech coordinators' perceptions of the socio-economic level of co-op students (discussed in Chapter 2), it was expected that co-op graduates would have higher means on questions regarding parents' occupations and educations. This did not prove to be the case. Non co-op graduates had higher means on all four of the socio-economic variables (fathers' and mothers' educational levels and occupational prestige scores), although the means for mothers' SEI were almost identical. Since fewer than half of all mothers had paying jobs, the numbers involved here were much smaller.

Prior work experience. It was notable that all graduates had jobs of some kind while they were in school, and some had a great many. Over half of the co-ops had jobs of some variety in addition to their co-op positions. All of the non co-ops held some kind of job while they were in college.

Location. For their first jobs, co-ops and non co-ops located in various places in almost the same proportions, and both tended to stay close to home. (76.5% of co-ops and 72.5% of non co-ops had their first jobs in either Virginia or the southeastern United States). Those currently located overseas ranged from Europe to South Africa and Saudi Arabia.

Graduate work. The summary of responses showed that a majority of graduates, both co-op and non co-op, had taken at least some graduate courses. The majority of graduate work was done in engineering, but over a third of the co-ops and almost a quarter of the non co-ops were working towards degrees in business. The studies covered by "other" encompassed a wide range: dentistry, medicine, Russian history and divinity.

Although the vast majority of graduates remained in the engineering field, the graduate studies listed above showed changes in interests and activities. For example, one was a Mormon missionary in Japan, one a radio station owner, one the president of a construction company and one an officer in an accounting firm.

Differences between the groups. On some of these factors, percentages for co-ops and non co-ops were very close together, and it was obvious that there were no significant differences in response patterns between the groups. On others, where percentage differences were greater, analyses were performed to see whether these differences were statistically significant. Chi-square analysis was used where data were nominal for the following variables: degree of job satisfaction, number taking graduate courses, number still working for the same employer, type of employer for first and current jobs and job function for first and current jobs. For fathers' and mothers' education and fathers' SEI, t-tests were used. All of these tests showed only one significant difference between co-ops and non co-ops. Fathers of non co-ops had a mean SEI of 61.02, co-op fathers, 53.30. This difference had a t-value of 1.97, a two-tailed probability level of .051.

Salary Differentials

First salary--Hypothesis 1. The first hypothesis of the study was that students graduating from the cooperative education program would receive starting salaries on the first job that were significantly higher than those of non-cooperative education graduates. Salaries for the first job after graduation showed a mean of $1135.68 per month for non co-ops and a mean of $1204.39 per month for co-ops (co-op salaries averaged $68.71 higher). t-tests were performed on the data. Using a pooled variance estimate, this difference produced a t-value of 1.61, significant at the .0545 level (Table 1). Since this missed the level

Table 1

Salary Differential Between Co-ops

and Non Co-ops for First Job

	Co-ops	Non co-ops
Mean Salary/Month	$1204.39	$1135.68
Standard deviation	241.10	249.92

$t = 1.61$ $p = .0545$

of .05 set for this study, the first hypothesis was rejected. The salary difference between the groups was in the hypothesized direction. Forty-two per cent of co-ops had salaries over $1200 per month; twenty-seven per cent of non co-ops had salaries over this figure.

Current salary--Hypothesis 2. The second hypothesis was that co-op graduates would be earning salaries significantly higher than non co-op graduates after a six-year period. Present salaries (six years after graduation) showed means of $2483.81 and $2877.39 per month for non co-ops and co-ops, respectively (co-op salaries averaged $393.58 higher). A separate variance estimate yielded a *t*-value of 1.42, which has a probability of occurring by chance of .0845 (Table 2). The data for current salaries were then adjusted to eliminate extreme salaries in both groups. One very high salary ($20,833 per month) was removed from the co-op group, and one low salary ($915 per month) was removed from the non co-op group. All remaining salaries were four-figure amounts. Means were now $2508.95 for non co-ops and $2620.01 per month for co-ops, a difference of $111.06 per month more for co-ops. Variance was reduced to a level justifying use of the pooled variance estimate, yielding a *t*-value of 1.10, which has a probability of occurring by chance of .1375. Since the differences between the groups were not significant at the .05 level in either test, the second hypothesis was rejected. Again, the salary difference between co-ops and non co-ops was in the hypothesized direction. Forty-six per cent of co-ops had salaries over $2600 per month vs. forty-one per cent of non co-ops.

Table 2

Salary Differential Between Co-ops

and Non Co-ops for Current Job

(Six Years After Graduation)

	Co-ops	Non co-ops
Raw data		
Mean Salary/Month	$2877.39	$2483.81
Standard Deviation	2235.59	625.67
	$t = 1.42$	$p = .0845$
Adjusted data*		
Mean Salary/Month	$2620.01	$2508.95
Standard Deviation	575.35	597.83
	$t = 1.10$	$p = .1375$

* One very high co-op salary and one low non co-op salary were removed. All remaining salaries were four-figure amounts.

It was notable that the difference between the groups actually increased over the six-year period. Co-ops had first salaries that averaged $68.67 per month higher than those of non co-ops. This difference increased to $393.58 for current salaries and was $111.06 after data were adjusted to eliminate several extreme salaries. The lower level of significance for the difference in current salaries can be explained by the fact that current salaries were spread out over a wider range. Even after the adjustments had been made, the standard deviation for current salary was more than double that for first salary for both groups.

Relationships of Salary and Other Variables--Hypothesis 3.

The third hypothesis was that some other variables would have statistically significant relationships to salaries. Variables were (1) undergraduate major, (2) grade point average, (3) graduate study, (4) socio-economic factors: educational level and occupation of parents, (5) age, (6) participation in extracurricular activities, (7) collegiate honors, (8) prior work experience, (9) type of employer, location and job function for both first and current positions and (10) consistency of employment.

Results of tests which showed relationships that were statistically significant at the .05 level are summarized in Table 3 and then presented in detail in Tables 4-10. Several tests showed significant relationships for only one group; in those cases, the corresponding information for the other group is given for purposes of comparison. (A summary of tests with non-significant results is presented in Appendix C.)

Table 3

Relationship of Salary with Selected Variables

	First Salary		Current Salary	
Mean Salary/Month				
Co-op	$1204.35		$2877.39	
Non Co-op	1135.68		2483.81	
Variable	X^2	Level of Significance	X^2	Level of Significance
Undergraduate Major				
Co-op	38.51	0.0891	26.61	0.5398
Non Co-op	48.84	0.0287*	65.41	0.0004*
Father's Job - SEI[1]				
Co-op	2.44	0.9646	9.77	0.2815
Non Co-op	5.36	0.7182	16.20	0.0396*
Type of Employer				
Co-op	29.16	0.0229*	36.30	0.0026*
Non Co-op	26.15	0.0520	24.47	0.2224
Location of First Job				
Co-op	24.49	0.0174*		
Non Co-op	43.97	0.0000*		
Present Job Function				
Co-op			14.84	0.0623
Non Co-op			20.44	0.0088*

[1]Means for Fathers' SEI--Co-op, 53.30
Non Co-op, 61.02

* $p < .05$

A total of eight tests showed statistically significant relationships to salary levels. Four of these were for first salary: location for both groups, type of employer for co-ops and undergraduate major for non co-ops. Four were for current salary: type of employer for co-ops and fathers' SEI, job function and undergraduate major for non co-ops. Therefore, the third hypothesis was upheld; some variables did have significant relationships to salaries.

Location of first job. Table 4 shows how much difference location can make in salary level. The farther away the graduates moved from Virginia, the more likely they were to receive higher salaries. It was not possible to see whether location was related to current salary. The questionnaire did not ask the current location of those who remained with their first employers. Several casual comments on replies mentioned relocation; hence, meaningful results could not be obtained from the available data.

Type of first employer. The type of employer had a significant relationship with the first salary for co-ops only (Table 5). The significance level for non co-ops was .052, which must be considered non-significant, but which was a close relationship. Table 5 shows clearly that those working for private industry tended to earn higher salaries, those working for government lower ones. A look at salaries paid those working for government--federal, local and state--shows a difference between co-ops and non co-ops. No co-ops were in the lowest salary bracket; no non co-ops were in anything above the two lowest

Table 4

Percentages of Graduates in Various Locations
by Salary of First Job

Salary/Month	Location: Virginia	Southeast	Elsewhere--U.S.	Overseas
		Co-ops		
Under $1000	27.3%	6.1%	0.0%	0.0%
$1000 to $1199	50.0	36.4	50.0	50.0
$1200 to $1399	9.1	33.3	28.6	0.0
$1400 to $1599	9.1	21.2	21.4	0.0
Over $1600	4.5	3.0	0.0	50.0
Total	100.0	100.0	100.0	100.0
Number	22	33	14	2
	$X^2 = 24.49$ df = 12		$p = .0174$*	
		Non Co-ops		
Under $1000	31.6	19.2	18.8	0.0
$1000 to $1199	63.2	50.0	25.0	0.0
$1200 to $1399	5.3	19.2	18.8	0.0
$1400 to $1599	0.0	11.5	31.3	0.0
Over $1600	0.0	0.0	6.3	100.0
Total	100.0	100.0	100.0	100.0
Number	19	26	16	1
	$X^2 = 43.97$ df = 12		$p = .0000$*	

* $p < .05$

Table 5

Percentages of Graduates Working for Various Types of Employers by Salary of First Job

Salary/Month	Corporations	Federal govern.	State & local governments	Small firms	Other
			Type of Employer		
			Co-ops		
Under $1000	6.4%	0.0%	0.0%	36.4%	100.0%
$1000 to $1199	34.0	87.5	75.0	45.5	0.0
$1200 to $1399	31.9	0.0	25.0	9.1	0.0
$1400 to $1599	21.3	12.5	0.0	9.1	0.0
Over $1600	6.4	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0
Number	47	8	4	11	1

$X^2 = 29.16$ $p = .0229*$
$df = 16$

			Non Co-ops		
Under $1000	5.9	42.9	66.7	23.1	100.0
$1000 to $1199	47.1	57.1	33.3	53.8	0.0
$1200 to $1399	23.5	0.0	0.0	7.7	0.0
$1400 to $1599	17.6	0.0	0.0	15.4	0.0
Over $1600	5.9	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0
Number	34	7	6	13	2

$X^2 = 26.15$ $p = .052$
$df = 16$

* $p < .05$

brackets. Seniority is an important determinant of salary in government; co-ops who worked for government during college acquired seniority, which probably accounted for this particular difference between the groups.

Undergraduate major: First salary. The final significant relationship to first salary was for undergraduate major, which was significant for non co-ops only (Table 6). There are very small numbers in several of these majors. When they are grouped at one end of the table, as are metallurgical engineers in the non co-op group, they may have distorted the findings, particularly for non co-ops. There are only two majors in Metallurgical Engineering; both are in lower salary brackets. The four mining engineers are concentrated towards the higher end of the scale. The co-op table does not have a similar grouping at the bottom of the scale, but four mining engineers are in the two top brackets. The relationship for co-ops, although not significant, was close ($p = .0891$). When numbers are this small, it is impossible to know if they are typical. This may have affected both groups and may have helped produce the high degree of relationship for non co-ops. One other group contributed to this result; all of the non co-op civil engineers ($n = 13$) are in the two lowest salary brackets. Co-op civil engineers were more spread out. This also probably contributed to the high degree of relationship of major and salary for non co-ops.

Four variables had significant relationships to current salaries; none of these were significant for both groups. Two relationships were associated with variables that also had significant

Table 6

Percentages of Graduates in Various Majors by Salary of First Job

Salary/Month	Undergraduate Major: Civil Eng.	Mining Eng.	Elect. Eng.	Mech. Eng.	IEOR[1]	Chem. Eng.	Aero. Eng.	ESM[2]	Metal. Eng.
Co-ops									
Under $1000	11.8%	0.0%	21.4%	7.7%	14.3%	0.0%	20.0%	0.0%	0.0%
$1000 to $1199	70.6	0.0	50.0	23.1	57.1	33.3	40.0	0.0	0.0
$1200 to $1399	17.6	0.0	21.4	38.5	14.3	33.3	20.0	50.0	0.0
$1400 to $1599	0.0	75.0	7.1	23.1	0.0	33.3	20.0	50.0	0.0
Over $1600	0.0	25.0	0.0	7.7	14.3	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Number	17	4	14	13	7	9	5	2	0

$X^2 = 38.51$ $p = .0891$
$df = 28$

Non Co-ops									
Under $1000	53.8	0.0	18.2	6.7	33.3	0.0	0.0	0.0	50.0
$1000 to $1199	46.2	0.0	63.6	60.0	44.4	20.0	50.0	0.0	50.0
$1200 to $1399	0.0	25.0	9.1	13.3	11.1	40.0	50.0	100.0	0.0
$1400 to $1599	0.0	75.0	0.0	13.3	11.1	40.0	0.0	0.0	0.0
Over $1600	0.0	0.0	9.1	6.7	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	13	4	11	15	9	5	2	1	2

$X^2 = 48.84$ $p = .0287*$
$df = 32$

* $p < .05$

[1]Industrial Engineering--Operations Research. [2]Engineering Science--Mechanics.

relationships with first salary; they were undergraduate major and type of employer.

Undergraduate major: Current salary. Undergraduate major (Table 7) was significantly related to current salary for non co-ops only, the same as it was for first salary. Some of the reasons mentioned above may also have contributed to this result. The relationship between major and salary has increased for non co-ops from a significance level of .0287 for the first salary to one of .0004 for current salary. By contrast, the relationship for co-ops has lessened from a significance level of .0891 to .5398 for first and current salaries, respectively.

Type of current employer. The other variable with prior significance was type of employer, which was related to first salary for co-ops. For current salary, also, type of employer had a significant relationship for co-ops only (Table 8). As before, the higher salaries were concentrated in the private sector. For this variable, the degree of relationship between salary and type of employer increased for co-ops and decreased for non co-ops from first salary to current salary.

The other two variables with significant relationships with current salary showed closer relationships to current than to initial salary, where they were non-significant. They were fathers' SEI and job function, both significant for non co-ops only.

Table 7

Percentages of Graduates in Various Majors by Salary of Current Job

Salary/Month	Undergraduate Major: Civil Eng.	Mining Eng.	Elect. Eng.	Mech. Eng.	IEOR[1]	Chem. Eng.	Aero. Eng.	ESM[2]	Metal. Eng.
Co-ops									
Under $2000	11.8%	25.0%	15.4%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%
$2001 to $2500	35.3	0.0	23.1	30.8	57.1	20.0	40.0	100.0	0.0
$2501 to $3000	47.1	50.0	61.5	46.2	14.3	50.0	40.0	0.0	0.0
$3001 to $3500	5.9	25.0	0.0	15.4	14.3	10.0	0.0	0.0	0.0
Over $3500	0.0	0.0	0.0	7.7	14.3	20.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Number	17	4	13	13	7	10	5	2	0

$X^2 = 26.61$ $p = .5398$ $df = 28$

Non Co-ops									
Under $2000	45.4	0.0	15.4	29.4	11.1	0.0	0.0	0.0	0.0
$2001 to $2500	36.4	0.0	38.5	41.2	55.6	0.0	100.0	0.0	0.0
$2501 to $3000	18.2	25.0	23.1	11.8	22.2	75.0	0.0	0.0	50.0
$3001 to $3500	0.0	25.0	23.1	17.6	11.1	25.0	0.0	0.0	50.0
Over $3500	0.0	50.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	11	4	13	17	9	4	2	1	2

$X^2 = 65.41$ $p = .0004*$ $df = 32$

*$p < .05$

[1]Industrial Engineering--Operations Research. [2]Engineering Science--Mechanics.

Table 8

Percentages of Graduates Working for Various Types of Employers by Salary of Current Job

Salary/Month	Type of Employer: Corporations	Federal govern.	State & local governments	Small firms	Educational institutions	Other
Co-ops						
Under $2000	2.2%	25.0%	66.7%	0.0%	100.0%	0.0%
$2001 to $2500	32.6	12.5	33.3	46.2	0.0	0.0
$2501 to $3000	45.7	62.5	0.0	46.2	0.0	0.0
$3001 to $3500	13.0	0.0	0.0	0.0	0.0	0.0
Over $3500	6.5	0.0	0.0	7.7	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	0.0
Number	46	8	3	13	1	0
	$X^2 = 36.30$ $p = .0026$* $df = 16$					
Non Co-ops						
Under $2000	6.5	18.2	25.0	46.2	50.0	50.0
$2001 to $2500	29.0	63.6	50.0	30.8	0.0	50.0
$2501 to $3000	32.3	18.2	25.0	7.7	0.0	0.0
$3001 to $3500	22.6	0.0	0.0	15.4	50.0	0.0
Over $3500	9.7	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number	31	11	4	13	2	2
	$X^2 = 24.47$ $p = .2224$ $df = 20$					

* $p < .05$

Current job function. The cross tabulations of current salary and job function for both groups (Table 9) show clearly that managers tended to have higher salaries than technical people, although results were significant only for non co-ops. For co-ops, the relationship was close but missed significance ($p = .0623$). The relationship between job function and salary increased considerably from first salary to current salary. For co-ops it went from a significance level of .1316 to .0623; for non co-ops, from a practically nonexistent level of .9264 to a significant .0088. Entry-level managerial jobs probably have salary levels not too different from those for technical positions. This is probably especially true for non co-ops, most of whom had less prior experience than co-ops. In addition, frequencies showed that more graduates had managerial positions at the time of the survey than they had on their first jobs. The number of those holding technical positions decreased correspondingly, although they were still in a majority for both groups.

Fathers' SEI. Sixteen individual tests were performed on the four socio-economic variables. Each was tested for relationship to both first and current salaries for both co-ops and non co-ops. Since the frequency data had already shown that fathers and mothers of non co-ops had higher means for SEI and educational levels than did co-ops' fathers and mothers, these factors could not account for co-ops having higher salaries. However, cross tabulations could show if relationships existed within the groups. Of these tests, only one showed a relationship statistically significant at the .05 level; fathers' SEI

Table 9

Percentages of Graduates with Various Job Functions
by Salary of Current Job

Salary/Month	Job Function: Technical	Managerial	Other
	Co-ops		
Under $2000	9.5%	0.0%	28.6%
$2001 to $2500	33.3	36.4	14.3
$2501 to $3000	52.4	36.4	28.6
$3001 to $3500	4.8	13.6	14.3
Over $3500	0.0	13.6	14.3
Total	100.0	100.0	100.0
Number	42	22	7
	$X^2 = 14.84$ df = 8	$p = .0623$	
	Non Co-ops		
Under $2000	18.4	11.1	57.1
$2001 to $2500	52.6	16.7	0.0
$2501 to $3000	18.4	27.8	28.6
$3001 to $3500	7.9	33.3	14.3
Over $3500	2.6	11.1	0.0
Total	100.0	100.0	100.0
Number	38	18	7
	$X^2 = 20.44$ df = 8	$P = .0088$*	

* $p < .05$

and current salary were related for non co-ops (Table 10). Of the tests used to see if differences between co-ops and non co-ops were statistically significant (p. 33), the only one that showed significance was for fathers' SEI, where fathers of non co-ops had higher SEI levels than did fathers of co-ops. Perhaps the results of the relationship tests reflect that difference.

Notable Non-significant Results.

No other Chi-square analyses showed results that were statistically significant at the .05 level. Trends and "near misses" in significance levels can be noted on the summary sheet in Appendix C. However, study of the cross tabulations of the non-significant tests showed several findings that might be noted.

Grades (QCA) had only slight relationships to salary, either initial or current. However, the tables for co-ops for both first and current salaries showed that none of those with the highest level of grades (above 3.31) were in the lowest salary bracket; none of those with grades below 3.0 were in the highest bracket. There was no similar anomaly for non co-ops.

It might be expected that those who had done graduate work would have higher salaries. There was a fairly close relationship (but one missing statistical significance) between the two. The pattern of the table showed a rather complex relationship that was approximately the same for both co-ops and non co-ops. Graduate work seemed to be associated with salaries up to a certain point, the middle salary bracket. But in the highest brackets, those who had not taken

Table 10

Percentages of Graduates at Various Levels of Fathers' SEI by Salary of Current Job

	Fathers' SEI		
Salary/Month	Below 32.9	34.0 to 65.7	Over 66.0
	Co-ops		
Under $2000	7.1%	2.8%	16.7%
$2001 to $2500	21.4	36.1	38.9
$2501 to $3000	57.1	52.8	27.8
$3001 to $3500	14.3	5.6	5.6
Over $3500	0.0	2.8	11.1
Total	100.0	100.0	100.0
Number	14	36	18

$X^2 = 9.77$ $p = .2815$

$df = 8$

	Non Co-ops		
Under $2000	18.2	28.0	16.0
$2001 to $2500	54.5	44.0	24.0
$2501 to $3000	0.0	12.0	40.0
$3001 to $3500	9.1	16.0	16.0
Over $3500	18.2	0.0	4.0
Total	100.0	100.0	100.0
Number	11	25	25

$X^2 = 16.20$ $p = .0396*$

$df = 8$

$p < .05$

graduate courses outnumbered those who had.

Since co-ops acquire seniority during their college years, it was expected that co-ops who remained with their co-op employers after graduation would earn higher initial salaries than those who changed employers. Brown (1976) and Phillips (1978) had found this to be true. However, remaining with the co-op employer did not relate to salary level to a degree statistically significant at the .05 level (see Appendix C).

Opinions of Co-ops about the Co-op Program

No statistical analyses were done on data obtained from a series of questions for co-op graduates only. These questions asked if respondents considered co-op gave them an advantage in full-time employment, and if so, why. The final question in this group asked if respondents would recommend the co-op program to beginning students. The answers to these questions were so overwhelmingly in favor of the co-op program that statistical analyses were unnecessary.

Advantages of Co-op. Of 76 responses to the question asking if co-op gave them an advantage in full-time employment, over 93% said "yes," and only five said "no."

The comments made in response to the open-ended question asking in what ways respondents considered co-op had given them an advantage covered a wide range. (All comments are given in their entirety in Appendix D.) Probably most cited was the experience they had gained, not only in technical aspects, but also in human relations and in how

a business operates in the "real world," as several called it. They felt this experience not only increased self-confidence but gave them the opportunity to obtain higher-level positions and higher salaries upon graduation.

Several said co-op increased their motivation for classroom work; several others said, not quite the converse, that it removed academic pressures. As one put it, "it relieved me to know that math and physics weren't used every day."

Some felt it was an advantage in a negative way; they learned what kind of job they did not want. Others stressed that their co-op salaries had enabled them to attend college.

Whatever reasons they gave as personally most advantageous to them, almost all agreed that co-op was a worthwhile experience.

Of the five who responded that they felt co-op had not given them an advantage in full-time employment, two were not really negative answers. The respondents explained:

(a) Co-op experience is useful in two ways:

(1) provides income for education expenses.
(2) promotes self-confidence.

(b) While my co-op job didn't help me in my chosen full-time employment, I did benefit in two ways from co-oping:

- I discovered a place where I definitely did not wish to work.
- I financed most of my college education.

The other three who answered "no" gave no explanations for their responses.

Recommendation of Co-op. When asked if they would recommend to beginning students that they enroll in the co-op program, the answer was a resounding "yes." Not one co-op respondent answered "no," although three did not check a response and gave a qualified answer. One said, "but pick company carefully - some companies don't use co-ops well." Another said, "it is not for everyone," and a third said, "only if they need it for funds." Conversely, several added exclamation marks to their "yes" answers; one said, "And I do [...recommend the co-op program...] every chance I get."

It is obvious from the above that this group of graduates felt that their co-op experience had been worthwhile. Their feelings might be summed up by the statement of one, "...without co-op experience I would not have the job I have today and my future would not be as bright."

Co-op dropouts. Several of those in the non co-op sample were what might be called co-op "dropouts," who left the program without completing it. Although the questions concerning perceptions of the co-op program were intended for co-op graduates only, four of these "dropouts" answered them. Three considered that even their limited co-op experience had given them an advantage, and they would recommend it; only one gave a negative answer to these questions. The comments of the other three were as enthusiastic as those of the co-op graduates.

In addition, several other non co-op graduates commented that they wished they had entered the co-op program.

Answers to Open-ended Question

The final question of the survey was totally open-ended. It asked respondents to say anything they liked about how they felt their college experiences did or did not help prepare them for careers. Sixty-six (46.1%) answered this question.

Responses naturally covered a wide spectrum. (All answers are given in their entirety in Appendix E.) Many of the co-op graduates expanded on their earlier comments about co-op. Others talked about their education generally. Many made thoughtful suggestions about curriculum. Most were satisfied, generally with the education they had received. Several statements can be summed up by this comment by one, "Just the mention of Tech in conversation establishes respect."

Chapter 5

SUMMARY AND DISCUSSION

This chapter includes a summary of the study and a discussion of the findings. It also includes suggestions for further research.

SUMMARY

Graduates of the Virginia Tech Engineering School class of 1975 were surveyed to determine if salary differentials existed between cooperative education graduates and non-cooperative education graduates for the first job after graduation and after a period of six years. Variables such as grade average and socio-economic level were examined to see if they were related to salaries.

Hypotheses

It was hypothesized that (1) salaries of cooperative education graduates would be significantly higher than those of non-cooperative education graduates for the first job and that (2) salaries of cooperative education graduates would be significantly higher than those of non-cooperative education graduates after six years. The final hypothesis was that (3) some of the selected variables would have significant relationships to salaries, either first or current. Specifically, these were (1) undergraduate major, (2) grade point average, (3) graduate study, (4) socio-economic factors: educational level and occupation of parents, (5) age, (6) participation in extracurricular activities,

(7) collegiate honors, (8) prior work experience, (9) type of employer, location and job function for both first and current positions and (10) consistency of employment.

Survey

A survey research design was used; co-ops and non co-ops were matched by undergraduate major and grade point average. Questionnaires were returned by 81% of those surveyed (n = 143), 77 by co-ops and 66 by non co-ops. The data were analyzed using SPSS procedures (Nie et al, 1975). Only one significant difference was found between the groups; fathers of non co-ops had higher SEI levels (a measure of occupational prestige), to a degree that was statistically significant.

Results

Hypothesis 1. Salary differentials were examined by t-tests. The first hypothesis, that co-op salaries for the first job would be higher than those of non co-ops, was rejected ($p = .0545$). Co-ops had a mean first salary of $1204.39 per month, non co-ops, $1135.68 per month.

Hypothesis 2. The second hypothesis, that co-op salaries would be higher than those of non co-ops after six years, was also rejected. Co-ops had current mean salaries of $2877.39 per month and non co-ops, $2483.81 per month. This difference was not significant at the .05 level. The data were adjusted to eliminate outliers; means were then $2620.01 for co-ops and $2508.95 for non co-ops, a difference of

$111.06 per month. This difference was not statistically significant at the .05 level.

Hypothesis 3. The third hypothesis was upheld; some of the selected variables were significantly related to salary. A total of 58 cross tabulations were made and examined by Chi-square analysis to determine if any of the variables specified in the third hypothesis had statistically significant relationships with salaries. Each variable was tested for co-ops and non co-ops, for both first and current salaries (six years after graduation). Eight of these tests had results that were significant at the .05 level. Four tests showed relationships with first salary: (1, 2) location for both groups, (3) type of employer for co-ops and (4) undergraduate major for non co-ops. The four remaining significant results were related to current salary: (1) type of employer for co-ops and (2) fathers' SEI, (3) job function and (4) undergraduate major for non co-ops.

Other findings. A large majority of co-op graduates reported that they felt the co-op program had given them an advantage in employment, and all would recommend it to beginning students. Overall, graduates' comments on their education at Virginia Tech were favorable.

DISCUSSION

Salary Differential: First Salary

In this study co-op graduates had salaries for the first job after graduation that were higher than those of non co-op graduates,

but not to a degree reaching statistical significance ($p = .0545$). The relatively small sample size (62 non co-ops, 71 co-ops) may have affected this result. Blalock (1972) says that the larger the sample size, the more likely the chance of reaching a given statistical significance. Since the salary differences were in the hypothesized direction, the addition of a very few cases could have made this result significant at the .05 level. Rejection of the hypothesis may very well have been a Type II error.

Several studies discussed in Chapter 2 (Yensco, 1970; Brown, 1976; Alwell, 1977; Hamlin, 1978) reported higher starting salaries for co-ops. In my opinion, for a first job, if graduates are inexperienced, it is logical that those with co-op experience could be expected to receive higher salaries. For example, Phillips (1978) stated that the Lockheed-Georgia Company paid returning co-ops starting salaries 10% higher than those paid non co-op graduates hired at the same time. Brown (1976) reported that over 26% of co-op graduates had first salaries greater than $10,000, vs. 21% of non co-ops. In my study 42% of co-ops had salaries for their first jobs over $1200 per month; 27% of the non co-ops had salaries over this figure. Although less than statistical significance, the results of this study tended to confirm previous research that showed graduates of cooperative education programs receiving higher salaries for their first jobs.

Salary Differential: Current Salary

The initial financial advantage of the co-ops actually increased over the six-year period examined in this study, although the difference

between the groups was not statistically significant at the .05 level. As discussed above, sample size may also have affected this result to a degree that may have made rejection of the hypothesis a Type II error.

Several researchers reported that a differential between co-ops and non co-ops persisted over a period of years, but most of these were for a shorter time interval (Cohen et al, 1978; Hamlin, 1978). Only Phillips (1978) and Hanson and Marshall (1977) reported increasing differentials over such a long time period. Phillips showed a differential over a 15-year period for employees at one company; Hanson and Marshall's figures were for 27-year olds and 32-year olds in the United Kingdom. Although the results of my study were not statistically significant, they tended to confirm the prior research that the differential in favor of co-op graduates did not disappear, but remained for a fairly long interval. Compared with Brown's figures given above, 46% of co-ops had current salaries over $2600 per month vs. 41% of non co-ops.

A difference of $111 per month (almost $1335 per year), even after the lowest non co-op and the highest co-op salaries were removed, has practical significance, in spite of the fact that it did not meet the standards of statistical significance set for this study.

Relationships of Other Variables with Salaries

One major purpose of this study was to determine whether other selected variables had relationships to salaries. Some did; therefore, the third hypothesis was upheld. Only a few of the many variables

tested had relationships to salaries that were significant at the .05 level. Only location of first job had an across-the-board effect for both co-ops and non co-ops. Type of first employer had a statistically significant relationship with salary for the first job for co-ops. Undergraduate major was significantly related to salary for non co-ops only, for both first and current salaries. The type of employer was significantly related to current salary for co-ops only and job function and fathers' SEI (in addition to undergraduate major) were related to the current salary of non co-ops.

The next question was whether any of these factors could help explain the fact that co-ops had higher salaries, both for the first job and the current one. Each will be discussed with this point in mind. To determine whether any of these variables did have an impact on the salary difference between the groups, it was necessary to examine not only the significant relationships, but the nature of the non-significant relationships paired with them and also to examine trends in relationships over the six-year period of the study.

One caution must be made in reference to the relationship tests. Five of the seven relationship tables had large numbers of empty cells. This applied to location for first salary and type of employer and undergraduate major for both first and current salaries. Only a few respondents worked overseas or for "other" employers; several small departments had only a few graduates represented in the survey. The results may have been distorted by this uneven distribution, since the presence of many empty cells tends to raise the magnitude of figures for Chi-square. This could have affected all of the results, with the

exception of tables for fathers' SEI and job function. Both of these had significant relationships to current salary; respondents were spread out fairly evenly over all levels for these two variables.

Location of first job. Astin (1978) reported that the location of employment made a difference in salary. This study also found it to be important; salaries were lowest in Virginia and highest outside of the southeastern United States. However, location can probably be ruled out as contributing to differing salary levels for co-ops and non co-ops. Both groups settled in various locations in almost the same proportions; location may be an important factor in salary level, but one that had an almost identical impact on both groups.

Type of employer: first and current salaries. The results of this study showed that the type of employer one chooses is obviously an important determinant of salary level. Those working in the private sector, either for large corporations or small firms, tended to have higher salaries than those working for any level of government. For the first job, the relationship between type of employer and salary was a significant one for co-ops and just missed statistical significance for non co-ops ($p = .052$). As for location, salary and type of employer were related fairly equally for both groups. Therefore, like location, type of employer probably did not contribute greatly to the difference between the groups for the first job. For current salary, the relationship of salary and type of employer increased for co-ops and decreased for non co-ops from the levels for first

salary. The type of employer had a far stronger relationship with salary after six years for co-ops than for non co-ops. It is useless to speculate as to why this was so, but it does suggest that this variable contributed something to the difference in current salary levels between the groups.

Undergraduate major: first and current salaries. Undergraduate major had a statistically significant relationship with salary of both first and current jobs for non co-ops only. This relationship may have been magnified by the small numbers in several majors, particularly in the non co-op group. For first salary, co-ops showed a fairly strong relationship between salary and major ($p = .0891$), showing that major was also an important factor in salary for them.

It is possible that this variable is related to type of employer. As discussed in Chapter 4, non co-op civil engineers were concentrated in the lower salary brackets. Also mentioned there was that non co-ops started in lower salary brackets for state and local governments than did co-ops, probably because of the seniority co-ops had earned previously. Examination of the questionnaires showed that the first job of many civil engineers was with state highway and local public works departments. Considered together, these facts may help account for the stronger relationship that undergraduate major had with first salary for non co-ops.

For current salary, the relationship between salary and major lessened considerably for co-ops ($p = .5398$). For non co-ops it increased from $p = .0287$ to $p = .0004$. It is unclear why the effect

of undergraduate major should be so different for the two groups after six years have passed. Apparently, undergraduate major had a delayed relationship with salary for non co-ops only, and this may be a factor in the differing salary levels between the groups. Possible reasons explaining this are beyond the scope of this research.

Job function: current salary. The relationship between salary and job function increased from first job to current one for both groups, particularly so for non co-ops (from $p = .9264$ to $p = .0088$). The direction of the change was the same for both groups, and co-ops came close to statistical significance for current job ($p = .0623$). Approximately the same proportions of co-ops and non co-ops were managers or technical people. For these reasons, it is probable that this variable did not contribute a great deal to salary differential.

Fathers' SEI: current salary. The information previously acquired about socio-economic factors and their relationship to co-ops was conflicting. Wilson and Lyons (1961) found that co-ops were of lower social class than non co-ops. Two of the Virginia Tech coordinators felt this had changed; their perception was that co-ops were of a higher socio-economic level than non co-ops. This research confirmed the findings of Wilson and Lyons. On all four socio-economic variables (fathers' and mothers' SEI's and educational levels), non co-ops had higher means than did co-ops.

The tests on fathers' socio-economic attributes showed a notable trend. Three of the four (fathers' SEI's and educational levels for

co-ops and non co-ops) showed an increasing relationship to salary over a period of six years, much closer relationships to current salaries than to first ones. The increases were large enough to be called dramatic: from p = .9646 to p = .2815 for co-ops for relationship between fathers' SEI and salary, from p = .7182 to p = .0396 for this variable for non co-ops. The relationship between salary and fathers' educational level for non co-ops increased from p = .8540 to p = .1327 over six years. The only relationship that did not follow this trend was for fathers' educational level and salary for co-ops; it declined slightly from p = .3248 for first salary to p = .3954 for current salary. The effect of socio-economic attributes of fathers appears to increase with time. Conversely, mothers' SEI's and educational levels had no significant relationships with salaries or consistent trends. The increasing relationship of salary to fathers' SEI's and educational levels over time would seem to agree with Jencks' contention (1972) that salary is related to socio-economic background of fathers. This was particularly noticeable for non co-ops, where the relationship between fathers' SEI and current salary reached a statistically significant level.

The fact that fathers' SEI's had a significant relationship to current salary for non co-ops can, however, probably be excluded as an explanation for the higher salaries of co-ops. Fathers of non co-ops had mean SEI's significantly higher than those of co-op' fathers. The fact that non co-ops salaries had a closer relationship to their

fathers' higher SEI's would seem irrelevant to the fact that co-ops received higher salaries.

Conclusion. All variables having significant relationships with first salaries--location, type of employer and undergraduate major--had significance levels that were similar for both groups, even when the .05 level was reached for only one. Therefore, it is fairly safe to assume that they did not contribute greatly to the salary differential between the groups for the first job. The difference in favor of co-ops ($p = .0545$) was probably due largely to participation in the co-op program.

It is not so easy to dismiss all of the variables that had significant relationships with current salary, though several can probably be eliminated as contributors to the salary differential between co-ops and non co-ops. As discussed above, the relationship of salary and fathers' SEI's increased considerably over the six-year span for both groups and is probably irrelevant to the salary differential. For job function and salary, the relationship also increased for both groups, and significance levels are similar. Job function can probably also be eliminated as a contributor to the difference between groups. The relationships with salaries of the remaining variables--undergraduate major and type of employer--did not change in the same direction over time for both groups. For undergraduate major, relationship with salary increased for non co-ops and decreased for co-ops; the reverse is true for type of employer. Because of this differing impact, it is possible that these two

variables did contribute to the salary difference for current jobs between co-ops and non co-ops. As discussed above, it is possible that their effects may have been increased by a relationship between the two. Unfortunately, it was beyond the scope of this study to determine precisely what effect these relationships had on salary levels.

Comments

Although this study did not find statistically significant differences in salary levels for co-ops and non co-ops, either for the first job after graduation or after six years, it did find that the average co-op salaries were higher on the first job and that this difference increased over a period of six years. There is a possibility of a Type II error, and the differences in average salaries between co-ops and non co-ops may actually be greater than shown by this sample. The difference between the groups has practical, if not statistical, significance.

Several variables had possible effects on the differential for current salary, particulary the relationships of job function and undergraduate major to salaries.

The increasing relationship of salary with the socio-economic level of respondents' fathers for both groups was especially notable, although this probably had little effect on differences between them.

Suggestions for Further Research

This study left some loose ends; it was not within its scope to explain the importance of several factors that may have affected the

salary levels of co-op and non co-op graduates. A study designed to delve more deeply into factors affecting salaries would carry this research further and make an important contribution to the literature.

This study touched only lightly on one important question: are co-ops and non co-ops different to start with? If they are in fact two separate populations, differing results in their careers would not be surprising. Some research suggested this to be true. Baker (1969) found co-ops to have higher motivation, greater sensitivity to others and more self-reliance. Harris (cited in Brown, undated) found co-ops to have a higher regard for the work ethic and a greater desire for challenging work. These qualities are ones valued and rewarded by employers. If co-ops exceed non co-ops in them, success on the job is bound to be affected. Apparently, no longitudinal studies, examining possible differences in co-ops and non co-ops in undergraduate years and then measuring differences in salaries after a period of years on the job, have been done. Such a study would look at both inherent differences and results and would provide valuable findings.

Another project which would have value would be to follow up on the group studied in this paper in another five years. The determination of current salary data after another period of years would show whether the present substantial but non-significant differential between co-ops and non co-ops is maintained or not. A follow-up on the same group would be a simple way of collecting further salary data.

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APPENDIX A

DIVISION OF STUDENT AFFAIRS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

UNIVERSITY COOPERATIVE EDUCATION PROGRAM (703) 961-4491

Finding a job after graduation is one of the most crucial events in a person's life; and the first few years in a professional job witness significant trends in a person's career development. The Virginia Tech Cooperative Education Department is conducting an in-depth study to learn more about the experiences of Tech graduates in the first few years on the job.

You are one of a sample of 1975 graduates chosen to participate in this survey. The questionnaire is very short; please take five to ten minutes to complete this and return it in the enclosed envelope. The survey is completely confidential. The number on the questionnaire will be used to check your name off the list when your questionnaire is received (thus avoiding unnecessary follow-up). It will then be torn off.

A few of the questions are directed toward co-op graduates only; however, the survey is intended for all graduates.

If you would like a summary of the results, please write your name and address on the back of the return envelope. I will be happy to send you a copy when the results have been tabulated.

If you have any questions about the survey, feel free to call me at .

Thank you very much for your help.

Sincerely,

H. E. "Chip" Bowling
Director

HEB/sws

DIVISION OF STUDENT AFFAIRS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

UNIVERSITY COOPERATIVE EDUCATION PROGRAM (703) 961-4491

September 8, 1981

Dear 1975 Graduate:

Several weeks ago I sent you a questionnaire asking for information about your employment experiences since your graduation from Virginia Tech. As of today we have not yet received your completed questionnaire.

Virginia Tech seeks to prepare its graduates for satisfying, productive careers; this survey is an attempt to see if its graduates feel it has succeeded in this effort.

I am writing to you again because of the significance each questionnaire has to the usefulness of the study. You are one of a small sample chosen to participate in this survey. In order for the results to be truly representative of the class of 1975, it is important that each person in the sample return his questionnaire.

In the event that your questionnaire has been misplaced, a replacement is enclosed.

Your cooperation is greatly appreciated.

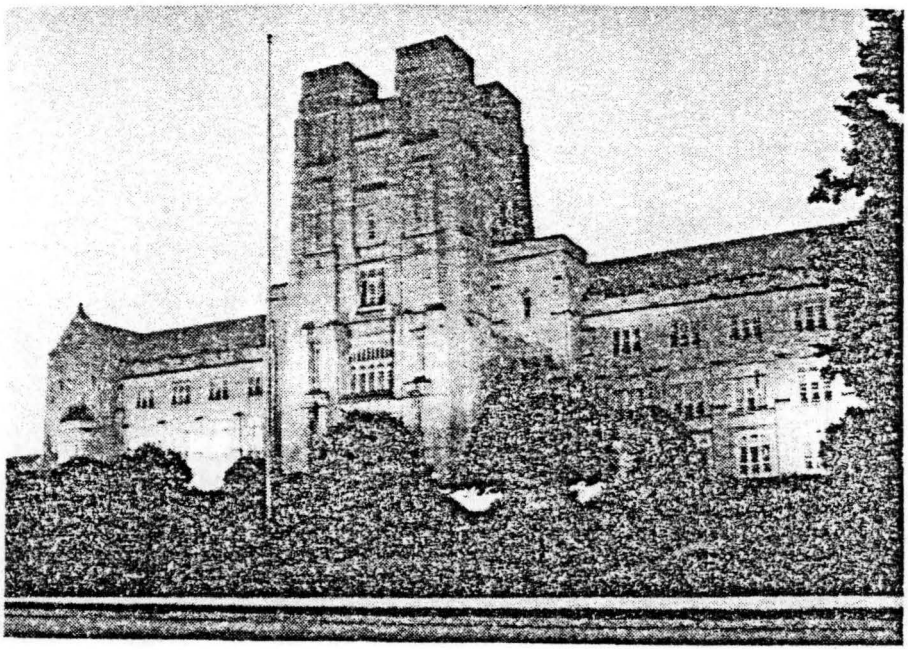
Sincerely,

H. E. "Chip" Bowling
Director

cw

APPENDIX B

VIRGINIA TECH
GRADUATE EMPLOYMENT SURVEY



The purpose of this survey is to learn more about the employment experiences of Virginia Tech graduates. Please answer all of the questions. If you wish to comment on any questions, please feel free to use the space in the margins or the back page.

Thank you for your help.

Cooperative Education Department
Virginia Polytechnic Institute & State University
Blacksburg, Virginia 24061

VIRGINIA TECH GRADUATE EMPLOYMENT SURVEY

1. What was your undergraduate major department?

_____

2. Did you participate in the Co-op program by having at least one quarter of work experience? CIRCLE THE NUMBER OF YOUR ANSWER.

1 NO
2 YES

3. Did you receive a co-op certificate?

1 NO
2 YES

4. What work experience (other than co-op) did you have between high school graduation and college graduation? List your jobs.

Next, a few questions about your first job after graduation from Virginia Tech.

5. What was the name of your first employer after graduation from Tech?

_____

6. What type of business or agency was it?

_____

7. In what city and state was your first job located?

_____

8. What was your initial job title?

_____

9. What was your major responsibility in this job?

10. What was your starting salary?

$_____PER MONTH OR $_____PER YEAR

11. If you participated in the co-op program, was this your co-op employer?

1 NO
2 YES
3 DID NOT PARTICIPATE IN CO-OP PROGRAM

12. Do you still work for the same company mentioned in answer to Question #5?

1 NO → IF YOU HAVE CHANGED EMPLOYERS, SKIP TO QUESTION 16
2 YES

13. If you are still with your original employer, what is your present job title?

_____

14. What is your major responsibility?

15. What is your present salary?

$_____PER MONTH OR $_____PER YEAR

AFTER RESPONDING TO QUESTION 15, PLEASE SKIP TO QUESTION #23

16. If you have changed jobs, how many employers have you had since graduation from Tech?

_____

17. What is the name of your present employer?

_____

18. What type of business or agency is it?

_____

19. In what city and state is your job located?

_____

20. What is your present job title?

_____

21. What is your major responsibility?

22. What is your present salary?

$_____PER MONTH OR $_____PER YEAR

23. How do you feel about your present job? CIRCLE THE NUMBER OF YOUR ANSWER.

1 VERY SATISFIED
2 FAIRLY WELL SATISFIED
3 IT'S ALL RIGHT
4 UNHAPPY WITH IT

Next, a few questions about graduate work.

24. Have you taken any college graduate courses?

1 NO → IF YOU HAVE NOT TAKEN ANY COURSES, SKIP TO QUESTION 27
2 YES

25. If you have taken graduate courses, were you working toward a graduate degree?

1 NO
2 YES IN WHAT FIELD?_____

26. Have you obtained a graduate degree?

1 NO
2 YES WHAT WAS IT?_____

27. Have you participated in any training programs sponsored by your company?

1 NO
2 YES WHAT KIND?_____

Next, a few questions for co-op graduates only. IF YOU ARE NOT A CO-OP GRADUATE, PLEASE SKIP TO QUESTION #31.

28. Do you feel your co-op experience gave you an advantage in full-time employment?

1 NO
2 YES

29. If you answered YES, in what ways was it an advantage?

30. Would you recommend to beginning students that they enroll in the co-op program?

1 NO
2 YES

Finally, we would like to ask a few questions to help us in analyzing the data for statistical purposes.

31. What is your sex?

1 MALE
2 FEMALE

32. What is your race?

1 WHITE
2 NON-WHITE

33. How old were you on your last birthday?

_____

PLEASE TURN OVER

34. Did you participate in any extra-curricular activities while you were at Virginia Tech?

1 NO
2 YES

35. If you answered YES, list the ones you consider most important.

36. Did you receive any honors or awards at Virginia Tech?

1 NO
2 YES

37. If you answered YES, list the ones you consider most important.

38. What was your father's primary job while you were growing up?

_____

39. Did your mother work for pay while you were growing up?

1 NO
2 YES

40. If you answered YES, what was her primary job?

_____

41. What is the highest level of education that your parents have completed? CIRCLE THE NUMBER OF YOUR ANSWER

FATHER	MOTHER	
1	1	EIGHT YEARS OR LESS
2	2	SOME HIGH SCHOOL
3	3	HIGH SCHOOL GRADUATE
4	4	SOME COLLEGE
5	5	COLLEGE GRADUATE
6	6	GRADUATE WORK

Is there anything you would like to tell us about how you feel your college experiences did or did not help prepare you for a career? Do you have any other comments? If so, please use this space for that purpose.

Your contribution to this effort is very greatly appreciated. If you would like a summary of the results, please print your name and address on the back of the return envelope (NOT on the questionnaire). We will see that you get it.

APPENDIX C

Tests with Non-significant Results

Relationship of Salary with Selected Variables

	First Salary	Current Salary
Mean Salary/Month		
Co-op	$1204.35	$2877.39
Non co-op	1135.68	2483.81

Variable	Mean	X^2	Level of Significance	X^2	Level of Significance
QCA at Graduation					
Co-op	3.12	10.69	0.2199	7.60	0.4730
Non Co-op	3.19	7.65	0.4688	6.81	0.5571
Age					
Co-op	28.90	7.25	0.8405	5.44	0.9417
Non Co-op	28.52	11.89	0.4548	9.72	0.6403
Graduate Work Undertaken					
Co-op				7.15	0.1281
Non Co-op				9.02	0.0606

Variable	Mean	First Salary X^2	First Salary Level of Significance	Current Salary X^2	Current Salary Level of Significance
Participation in Extra-Curricular Activities					
Co-op	1.54[1]	3.81	0.4321	2.95	0.5661
Non Co-op	1.65[1]	1.83	0.7678	1.92	0.7507
Collegiate Honors					
Co-op	1.67[1]	8.91	0.0633	0.62	0.9613
Non Co-op	1.43[1]	3.93	0.4160	6.32	0.1762
Mothers' Job--SEI					
Co-op	50.29	9.24	0.3229	8.13	0.4209
Non Co-op	50.31	2.14	0.9765	7.23	0.5117
Fathers' Education					
Co-op	3.60[2]	22.29	0.3248	21.03	0.3954
Non Co-op	3.82[2]	13.52	0.8540	27.09	0.1327
Mothers' Education					
Co-op	3.55[2]	17.75	0.6039	11.33	0.9372
Non Co-op	3.79[2]	22.25	0.3271	22.28	0.3253

[1]Mean number of activities or honors.

[2]3 = High school graduate; 4 = Some college.

Variable	Mean	First Salary X^2	First Salary Level of Significance	Current Salary X^2	Current Salary Level of Significance
Prior Work Experience					
Co-op		12.81	0.1187	13.62	0.0922
Non Co-op		9.90	0.2723	7.38	0.4964
First Job Function					
Co-op		12.47	0.1316		
Non Co-op		3.12	0.9264		
Still working for first employer?					
Co-op				1.46	0.8332
Non co-op				4.47	0.3462
Was first employer your co-op employer?					
Co-op only		8.46	0.0761	4.43	0.3507

APPENDIX D.

RESPONDENT ANSWERS--OPINIONS ABOUT CO-OP

Do you feel your co-op experience gave you an advantage in full-time employment? If so, in what ways was it an advantage?

1. Valuable training in construction methods. Helped to define career goals and especially what engineering jobs to avoid.

2. Higher starting salary, more job opportunities, ability to step into a management position immediately upon graduation.

3. Good background for career interests and planning. Excellent practical experience.

4. I gained work experience in how to work with individuals with other backgrounds. My co-op employer provided no work experience related to my field of study.

5. Longevity and seniority with federal government.

6. Experience, both technical and workplace etiquette. Earned larger starting salary in first job and qualified for more fringes, i.e., leave time and retirement points.

7. Advance knowledge of ways requirements of large industrial corporations.

8. Design experience, confidence in working with other people, insight into organizational hierarchies.

9. Quicker start. Able to apply job knowledge immediately. Easier to learn. Helped identify area I wanted to work in.

10. Broader background.

11. Provided me a sure job opportunity when economy was slumping. Put me approximately one year ahead in career level.

12. I co-oped with [company name], which gave me a good background in railway engineering and terminology, as well as a good feel for the "real" world.

13. Major exposure to the industrial environment. Learned some human relations. Gave me a jump on my fellow industrial engineering graduates.

14. Provided insight into "real" world. Financed college.

15. Exposure to work situations. Experience in working with people. It also provided an opportunity to receive written evaluations, which are useful in obtaining employment.

16. Participation in an industrial organization.

17. Practical experience as a co-op helped me get up on the "learning curve."

18. It showed me one of the things I do not want to do. It showed me what the real world is like. I learned a lot about piping systems.

19. Experience in professional relations; one also gains the knowledge of office operations.

20. Taught me that I did not want to be an engineer.

21. Experience in working environment.

22. Practical field experience.

23. It helped in selecting starting positions. It also gave me an advantage over equivalent non co-ops in obtaining offers.

24. Learned about the working world.

25. Better background, broader experience, greater motivation in school course work.

26. Work is easier because of familiarity with procedures, etc., from job (co-op) experience.

27. Financially. Dealing with people. Real world as opposed to text book conditions.

28. I co-oped with [company name], so I was familiar with many aspects of electric utility operation.

29. Exposure to several different types of work within the profession. Builds self confidence. For me it took all academic pressure off, because I realized that I could do the job whether I finished school or not.

30. Helped buffer the change from college life to work. Provided experience that I have used constantly and could not have gotten anywhere else. Without the co-op experience, I would not have the job I have today and my future would not be as bright.

31. I was hired in my present position because of co-op experience, in spite of degree in an unrelated field.

32. Access to better assignments as a result of more experience.

33. You know what type of work you will be doing, as you see what people in those positions do.

34. Experience problems and tasks in a real setting.

35. Co-op experience was with a firm of similar structure to employer. This prepared me for working "world."

36. More maturity in what to expect at work, more confidence.

37. Industry experience prior to graduation.

38. To experience industrial work atmosphere and learn more from the motivation it generated.

39. It probably helped me get a good job and it helped prepare me to budget my time and finances.

40. Exposed to varied areas and methods.

41. Gave a reference for previous work experience. Helped me to know what kind of job I would and would not like. It made the adjustment to full-time work easy.

42. Understanding of how to get things done.

43. It gave me experience in work areas not covered in college.

44. I was hired during a recession by having knowledge of departmental structure and personnel.

45. Gained "hands-on" experience in a business organization and gained maturity through it.

46. Strengthened learning experience with work experience. Provided a break in the education and work routines. Financial supplementation.

47. Hired as experienced employee. Co-op experience complements classroom education and better prepares one for employment.

48. Helped me determine what kind of job I did not want. Helped me deal with engineers.

49. Higher salary offers and better job selection after graduation.

50. By familiarizing me with corporate procedures.

51. Obtained "real world" exposure to the working environment, and gained working knowledge of academic applications, gained self confidence.

52. Let me know what engineers do - relieved me to know the math and physics weren't used every day. Also, it gave me a five year draft deferment (Vietnam).

53. It helped me decide what types of work I liked. Helped me plan my career. Gave me some practical experience that let me get off to a good start in my job.

54. Larger salary.

55. Background awareness of operations in several areas.

56. Experience was viewed as most beneficial by prospective employers.

57. Prior application of design theory in industrial work. Learned of company procedures.

58. It gave me some practical experience in labs, pilot plants, and plants.

59. I had already been exposed to an engineering environment and was able to handle myself better because of it.

60. It got me my present job.

61. Understanding of the real world.

62. Exposure to responsibilities to full-time employment. Exposure to practical applications of engineering.

63. I was already trained for the work I was to do after graduation. It also helped me decide what courses to take while in school.

64. I was more aware of the demands that would be made of me and felt more confident to meet the challenges I would face after graduation.

65. Provided knowledge prior to graduation of work situations.

66. It provided experience and a means for the development of professional maturity.

67. Additional job experience before graduation.

68. Started first job needing little supervision or guidance, something many supervisors do not know how to give.

69. Higher starting salary and position accelerated development.

70. Practical experience, appreciation of usefulness of academic learning in terms of solving engineering problems.

71. The basic knowledge of the different functions related to mining coal was obtained prior to full-time employment, therefore giving greater confidence in the actual engineering work.

72. A background in laboratory work.

73. Better prepared for work environment. Received better starting salary. Only way I could have finished school. Better prepared for job interviewing.

APPENDIX E

RESPONDENT ANSWERS--GENERAL

Is there anything you would like to tell us about how you feel your college experienced did or did not help prepare you for a career? Do you have other comments?

1. I majored in mechanical engineering. I would have liked to have taken more elective courses in my major to better prepare me for work. However, this was not possible due to the requirements for irrelevant courses like physics (nuclear) and the many humanities electives required. My co-op experience did enable me to better focus my interests during job interviewing and as a result, I obtained a job that fully met my needs. I highly recommend the co-op program.

2. Knowledge of what working in private industry would be like as my co-op job was with the federal government.

3. In general aspects - motivation, maturity, independence, growth - college was very worthwhile. However, technically, few of the courses I took have any direct bearing on my professional career, with the exception of preparing me for the Professional Engineer's License, which I recently obtained. My technical education was superior to that of other college graduates, but I just do not need to use it that often. I wished I had taken more writing, speaking and management courses.

4. VPI&SU is an excellent engineering school. I would suggest and recommend it to anyone entering the field of mining engineering. In my field of study, I was more prepared or as well prepared to enter the employment forces as a mining engineer as any person entering from any other school. I passed both the EIT and PE examinations in Kentucky without much difficulty due to the broad spectrum of study required at VPI&SU. The co-op program was great, but the time accumulated as a co-op student does not count toward vacation time at [company name]. It does count toward retirement.

5. Co-op experience is useful in two ways: provides income for education expenses and promotes self-confidence.

6. While my co-op job did not help me in my chosen full-time employment, I did benefit in two ways from co-oping: I discovered a place where I definitely did not wish to work and I financed most of my college education.

7. VPI&SU provided excellent training. Math instruction should have been more rigorous, however, at least for those who went onto graduate school as I did.

8. Co-oping on the schedule assigned to me (work - fall & spring, school - winter & summer) made me feel less involved with school activities (football, etc.) and have less school spirit.

9. The college experience did a great deal to prepare me for my career. There were two periods of time in my academic life. First, there was the undergraduate years. A considerable amount of mental growth occurred during these years. Second, there was my year in graduate school. At this time, the knowledge received was as important as the knowledge received as an undergraduate. As a graduate student, my thinking patterns matured as a result of the higher level of study. It is my opinion that an education at a college level can be more than the minimum required to obtain a degree.

10. As with most professional people, I look good, smell good and am broke. The education did not prepare me to supervise people effectively or to be successful. It only prepared me to perform a job.

11. VPI&SU and other schools should do a better job during freshman and sophomore years informing students of projected market opportunities, salaries, etc., for their chosen area of study. My wife was never able to secure a job in her area of study, elementary education.

12. I am very happy with how my college education and my co-op experience helped me start my career. I had confidence and competence to go overseas and was able to progress normally within my company, which in fact is not the norm. The type of work and training required by my company demands more than the average graduate is likely to have.

13. I would highly recommend the co-op program for anyone entering college because it helped decide on my career while I was in school and structure my school work to that goal. My regret is that I did not learn better how to study and how to learn.

14. Academia, especially engineering sciences, train one to find correct answers. Engineering professionals are most often required to make things happen and get things done. It is generally assumed that academia provides the tools to get the right answer is sufficient and that no training in getting things done is needed.

15. I was well prepared from a technical standpoint, but completely unprepared from a business position, i.e., the maneuvering of power in an engineering office. I would like company recruiters barred from campus who consistently make no offers to students for jobs. I am well aware of this practice. I feel you could do

an indispensable service in providing your graduates seeking employment with company's "track record," how they have treated previous Tech graduates. I feel a new graduate is very marketable, much more so than he will be a few years down the line, and he must not get trapped in a deadend first job.

16. Engineering students should be exposed to more general business concepts and also to some management techniques.

17. I feel I was well prepared for my career in that I was given the basic "tools" with which I could build my career. However, I feel additional practical application type courses would have been extremely helpful, even if it required extra time in college.

18. My college experience prepared me technically for a career. It did not do an adequate job in the important area of communication. You can have brilliant ideas, but if you cannot communicate (write/speak effectively) you will not be a success.

19. ESM does not prepare the student for applied, operational (practical) engineering. I suggest stronger emphasis on communication skills, both oral and written. ESM did provide the engineer with a strong analytical and computer background.

20. I wish I had been forced to take some writing courses.

21. My education at VPI&SU more than adequately prepared me for my engineering career. Resentful of the fact that Engineering Technicians who have a less rigorous educational background are achieving similar salary levels in the engineering field.

22. One of the real highlights of my college experience was co-oping. The co-op program gave me a chance to get out and use the information I was learning. It gave me a much better feeling for the usefullness of my courses. It also gave me some practical knowledge about the types of work that were available after graduation. I felt that because I co-oped, I had a much better feel for my job interests. There were a lot of side benefits to co-oping, I was from a large family and this allowed me to pay 100 per cent of my college expenses. I also found that because of my job experiences, my interest in classes increased and so did my GPA. I co-oped with [company name] a company with an excellent co-op program. I know many other companies did not have as good a program and students got a lot less out of it. So I guess what I am saying is, it is very important to pick a co-op program, not necessarily one that is close to home.

23. Courses on the psychology of dealing with corporate management would be useful.

24. Co-oping was the smartest thing I did in school. Cadeting was the dumbest. I feel that I received a very good basic education at Virginia Tech. I learned more in the four years after graduation than while in college. The electrical engineering department needs more labs with open hours for electrical engineering students. A designer gets bored without a lab.

25. In the engineering department, I was not given credit for business courses I took; consequently after business statistics I took none. I wish I would have been able to receive a minor in business.

26. The Placement Office was very helpful in locating a job.

27. I find the general undergraduate education I received as helpful, but the free electives and special studies I took were most helpful since it allowed me to study computer hardware and software, which was my primary interest and was not part of the curriculum. My graduate research assistantship and thesis prepared me for my job much better than any other course I took.

28. Just to explain some of my responses. I went directly into Graduate School upon completing my B.S. I obtained my PhD in July 1981 and have been at my NEW (and first real) job for less than one month. If you have any questions, etc., feel free to contact me.

29. Too much theory, not enough practical information.

30. Cooperative Education gave me a chance to make my goals in life come true to life. The industrial experience received from co-op taught me the wrong ways and the right ways to get the job done. This experience motivated me to learn what I would have otherwise called details. Details are food for industrial growth.

31. I have returned to VPI&SU three times in the last six years interviewing graduates for my present employer. Co-op experience is always highly rewarded.

32. An engineer's task is to apply scientific knowledge. I have had co-op students from MIT, Univ. of MD, and other schools work for me. From this experience, one thing is clear - schools must concern themselves with teaching hands-on, practical down-to-earth, knowhow. I have discussed this point with professors, who, from their viewpoint, feel that the hard thing to learn is the "THEORY" and that any Joe can learn to apply it. But, history shows this just is not true. The theory behind most of our "high technology" has been around a long time. It's making this theory work for us that is tough. Do not allow VPI&SU to cut their lab time. If at all possible, it should be increased. It is very valuable and worthwhile time spent.

33. Prepared me very well technically. Majority of engineers are in supervisory positions and therefore management techniques should also be taught. (This probably holds true for all college graduates.)

34. Deciding to participate in the co-op program was the best move I ever made. This one program helped prepare me for my career more than all other programs put together. If there is ever anything I can do to promote co-oping, please do not hesitate to call on me.

35. I was not able to participate in co-op due to ROTC involvement. Had it not been for mandatory armed forces service, I would probably have continued with electrical engineering. Overall, my college experience was valuable in helping me determine priorities in my life.

36. Work experience, both co-op and several part-time jobs, provided an extremely broad background. It also helps you to learn early on, that there is nothing magic about a degree; but that the magic is in how much of the knowledge offered you actually stays with you. Work experience during school helps you to differentiate between important and trivial material presented in classes.

37. I feel that the education I received at VPI&SU did a very good job of preparing me for my career. However, I was very disappointed with my co-op experience. The company I worked for had a very poorly organized program. The Co-op Office at Tech did not seem to know or care how the program was run at this employer. I feel that this could be a very valuable experience, but Tech must take a very active role in employers' programs.

38. Except for co-op, college did not prepare me much at all; especially in the area of mental health.

39. Technical preparation for an engineering career was excellent, however, counseling for job interview techniques and interview opportunities were quite poor in 1975. Some friends with cooperative education experience have expressed similar views to me. If I knew then what several years of experience have now taught me, I would have approached job searches very differently. I considered the cooperative education program, but scheduling and financial restrictions precluded participation.

40. Learning engineering fundamentals gave me the knowledge and confidence I needed to become competitive. I strongly recommend the co-op program or a work break between high school and college to allow a person to select his career field. Counseling is better than nothing, but trying different jobs for the first couple of years is more effective.

41. Coal Preparation and Strength of Materials should be stressed. Both have been very important. Economics has also been important; however, the engineering economics course was superior.

42. To evaluate the quality of an education at VPI&SU, one should compare himself with an LSU or Southern Grad. It was this comparison that got me a 26 per cent increase my first six months at [company name]. There is no comparison, we are so much further educated. A 300 level chemical engineering course was a 500 level graduate course at LSU.

43. I wholeheartedly hope that the civil engineering curriculum did not change to the more theoretical basis that it was leaning toward during my senior year. Courses in structural engineering, such as steel and concrete should always require the use of the AISC & ACI design criteria. The labs required during the years I attended (1970-1975) were excellent. I still use many of my civil engineering notes from my junior and senior year. I feel my most valuable professors were those that had worked in industry-most notably, Dr. Walker, Professor Hammer, and Instructor D. Garst.

44. The graphics courses we had as freshmen were not really relevant to the drawings I have had to read as an engineer. I would recommend some structural drafting, piping drafting and process flow sheets. I also wish one of my advisors had suggested I take marketing, accounting and business courses for electives so that I would not have to take so many undergraduate prerequisites to start on an MBA.

45. Good job by college Placement Services.

46. The co-op program is an excellent program which I am glad I participated in.

47. I am responsible for the recruiting of industrial engineers. Things I found of most value and what I look for in applicants are:
    1) extracurricular activities
    2) work experience (helpful if within field)
    3) good personal relations
    4) moderately good grades (this shows intelligence or the willingness to work hard.

    I have supervised outstanding engineers who both were and were not co-ops. However, I always promote the many advantages of the program to high school students. It also helps our recruiting effort if we can hire our own co-ops. I will be glad to help in any way I can.

48. My college experiences did prepare me for the position I hold by introducing concepts, technology and thought process that has helped in areas both technical and personal.

49. I am strongly in favor of the co-op program and I believe consideration should be given to making it mandatory for engineering students. As a railroad engineer with a strong belief in the future, I would like to see Tech offer at least one undergraduate course in railroad engineering. In my contacts with consulting firms, I find few civil engineers with any understanding of railroads. I feel more emphasis should be placed on professional and legal education for engineers along with business management.

50. Mechanical engineering department courses provided an environment to attain skills required to solve real industrial problems. This paid off monetarily quite quickly.

51. I did not take full advantage of the Placement Services at Virginia Tech in seeking employment after completion of degree requirements.

52. There should be courses in real world company and factory operations. For example: handling company red tape, and occasionally using informal means to get around obstacles; how to play successful politics and move ahead, how to change plans in mid-stream and follow the best leader (jump on the proper band wagon); debating, how to sell ideas and programs; dealing with conflicts, maintaining forward progress; relations with vendors, buying equipment and placing orders.

53. Would have been better prepared for work environment had I been a co-op. VPI&SU's engineering (chemical engineering) is highly respected in industry. However, that image appears to be changing as VPI&SU goes more research oriented in the bachelor level areas. Would like to see more academic/industrial exchange at lower levels with graduates and students. I feel this would benefit both groups. This could be done as a visiting graduate program or something along that line.

54. Highly recommend the co-op program as giving the knowledge necessary to make an intelligent career choice. If not co-op, at least two summer jobs in the area which you believe is preferred. When interviewing, interview for different types of assignments, with different types of companies to maximize alternatives. Broaden one's base as much as possible in college with both technical and non-technical (read humanities) courses while balancing extra-curricular activities of service and responsibility.

55. Engineering curricula should be emphasizing pertinent design courses rather than concentrating on theoretical analyses.

56. Pure engineering schooling gives students little feel for work world. Co-op program compensates for this deficiency. A definite advantage, particularly for those who may not have had work experience elsewhere.

57. Engineering taught me that any problems can be solved, and taught me how to find out how to solve the problem. Mechanical engineering taught me a little about a lot of subjects and a lot about the important subjects. Techniques of problem solving and logical approaches to problem solving have been very valuable. I am able to learn and do anything I am required to, faster and better than most others.

58. I feel that VPI&SU gave me a much broader education in engineering when compared to other schools. The engineering department required me to take more classes in other areas of engineering than my friends who went to other schools. I also spent some of the best years of my life at VPI&SU, because I enjoyed it so much.

59. The co-op program provides a broadening of the student's outlook, this being critical if the young professional elects to pursue anything other than a narrow technical career. Additionally, I have recently established a small design and build firm licensed for mechanical engineering construction.

60. The co-op experience was very helpful in obtaining my degree both financially and by giving me a chance to see what projects graduates in my field were working on. My co-op employer was not able to give me challenging work assignments and therefore I rate it as a poor company to use for co-op student assignments.

61. While the co-op experience was not good for me, I feel it would be excellent for others, especially if more supervision is made by VPI&SU. Help with finding jobs was poor. There are many companies in petrochemicals alone that are among the best, that I had no knowledge of. Chemical engineering should be a five year course.

62. In my new job, I am finally utilizing skills acquired at Tech. Just the mention of Tech in conversation establishes respect.

63. Encourage more real life work in senior courses. For example, projects in industry around Blacksburg and Roanoke.

64. I would highly recommend co-op experience for laying the ground work for a successful career.

65. The college years are the best of one's life. Students should be encouraged not to rush through it. Graduate degrees should be postponed until after you have worked in your field for a year or two, because it does not help in the advancement of your career. (Unless of course, you have a doctorate degree.) You may decide later that a higher degree in another field may be worth pursuing.

66. Classroom instruction left a lot to be desired on the practical aspects of most any type of civil design or construction management. There seems to be quite a "gap" in what is taught at Tech and what industry requires. The co-op program provides a pretty good training ground to provide students with broader perspectives of what engineers do and what training is required. I would highly recommend that more effort be made by Tech Co-op Program to negotiate higher co-op pay because most engineering students are by-passing "co-oping" because they can find ten week summer jobs that pay as much as two quarters of co-op work. This leaves little incentive for co-oping.

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SELECTED DIFFERENCES BETWEEN CO-OP AND NON CO-OP ENGINEERING GRADUATES

by

Marion Sharrer Wooldridge

(ABSTRACT)

Virginia Tech Engineering graduates of 1975 were surveyed to determine if salary differences existed between matched groups of co-op and non co-op graduates and to determine if selected variables were related to salaries. The average salary for co-ops was higher for both first and current positions (six years after graduation). These differences were significant at the .0545 level for first salary and at .0845 after six years. Several variables had significant relationships to salaries. Location for both groups, undergraduate major for non co-ops and type of employer for co-ops were related to first salary. Four variables were related to current salary: type of employer for co-ops and undergraduate major, job function and fathers' Socio-Economic Index for non co-ops. For most of these variables with significant relationships with salary, the significance levels were similar for both groups, and these probably had little effect on salary differences between groups. Co-ops probably had higher first salaries because of their co-op experience. Two variables with possible effects on salary differences were undergraduate major (which was related to current salary for non co-ops) and type of employer (which was related to current salary for co-ops). These two variables may have

undetermined effects on salary differences between the groups. The effect of fathers' socio-economic attributes (educational level and occupational prestige) seems to increase with time, with closer relationships to current salaries than to first ones.