TEXTBOOK PAGES TO SALARY WAGES: AN EXAMINATION OF THE

RELATIONSHIP BETWEEN COOPERATIVE EDUCATION AND EARLY

EMPLOYMENT OUTCOMES

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Ed. D. in Education Leadership and Policy Analysis

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the

dissertation entitled

TEXTBOOK PAGES TO SALARY WAGES:
AN EXAMINATION OF THE RELATIONSHIP BETWEEN
COOPERATIVE EDUCATION AND EARLY CAREER OUTCOMES

presented by Edna M. Grover-Bisker,

a candidate for the degree of doctor of education leadership and policy analysis,

and hereby certify that, in their opinion, it is worthy of acceptance.

Professor Bradley Curs

Professor Joe Donaldson

Professor Jennifer Hart

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DEDICATION

Completing my dissertation is a dream come true. My husband, children, and parents provided more support, encouragement, and understanding than I ever had the right to ask of them. Throughout the years, they each have given much to my goal of achieving doctoral status. It wasn't until I was writing this dedication that I began to comprehend their sacrifices, although I will never know the true extent of them.

My husband, children, and parents deserve to be recognized, thanked, and exalted. My family has sacrificed much. Without their unyielding support and love, this dream would not have come true. They never once doubted I would graduate—they knew my strength when I did not and helped me to find it.

Throughout my life my parents have instilled in me a belief in the importance of education and have tirelessly supported my educational endeavors, both financially and emotionally. My determination, work ethic, and perseverance are my inheritance, and without these traits or the unconditional love and support of my parents, I would not have believed that I could accomplish such a deed. This degree is more their accomplishment than mine.

This dissertation is dedicated to my husband, children, and parents. Without them I would not have completed this degree. They will never know the extent of my gratitude, appreciation, and love.

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When I began the doctoral program I set the aggressive goal of graduating in four years while working full-time and raising a family. Completing my dissertation required the collaboration of a village—a village filled with family, friends, colleagues, and associates, with each playing a significant role in my ability to complete this degree.

These villagers provided words of encouragement, guidance, understanding, and compassion. I want to thank each of them and acknowledge their contributions. I am sincerely appreciative of them. Each villager is named below, and just as they will forever remain on this page, they will forever have my gratitude.

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ABSTRACT

This study examined the relationship between cooperative education (co-op) and the early career outcomes of graduates at Missouri University of Science and Technology, a science and technological research university in the Midwest. The study's primary purpose was to provide university leadership with a quantitative evaluation of the university's co-op program to determine the program's effectiveness regarding post-graduation employment outcomes. The study data on 2008 to 2010 graduates which included level information such as major, GPA, citizenship, gender, and ethnicity/race, as well as job attainment and full-time annual starting salary at graduation. In addition to descriptive statistics, analysis of variance (ANOVA), logistic regression, and multiple regression analysis were used to investigate the relationships between cooperative education and early career outcomes.

Results from the investigation showed significant differences in co-op participation across student-level characteristics. Further, co-op participants were found to have a higher likelihood of having secured employment at graduation and have higher starting salaries. Following the study, the researcher provided university administrators with the results which are being used to provide a measurable methodological approach to program review and base line evaluation.

CHAPTER ONE: OVERVIEW

Introduction

The term *evaluation* is a key word in contemporary education and occupies center stage in current literature, news, and professional discussions. The reasons for this are many and revolve around an immediate need for all concerned parties to justify programs and expenses, especially for governments, universities, employers, students, and their families. Governments are cutting funding due to the economic recession and budget problems. Universities are combating shrinking enrollments and budgets. Employers are facing a surplus of applicants in the midst of economic crisis. Meanwhile, students and their families are rightfully questioning their return on educational investments.

Salary and wage have long been used as a quantifiable measure of educational outcomes because education influences economic growth (Allwell, 1978; Hayes & Travis, 1976; Hamlin, 1978; Krieger, 2010; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976). Thus, a study of whether educational institutions, and more specifically, co-op programs, produce improved employment outcomes is important. University administrators may benefit from the results of this study of differences between the employment outcomes of students who have and have not participated in cooperative education. As co-op programs continue to evolve, the few existing studies may become outdated and less applicable for current trends, such as the recent global economic recession (Arum & Shavit, 1995; Asher, 1994; Bailey et al., 2004; Bourdieu, 1998; Coleman, 1988; Coll & Eames, 2004; de Broucker, 1999; Drysdale et al., 2007; Dube & Korngold, 1987; Fletcher, 1989; Hunt, 1974; Krupar, 1987; Michigan State Department of Education, 1995; National Commission for Cooperative Education, 1994;

Nielsen, 1984; Stern et al., 1997; Taylor, 2006; Weinstein, 1981; Wilson, 1974).

Consequently, it is important to systematically examine the relationship between

participation in a co-op program and the early employment outcomes of recent graduates

in order to keep the programs beneficial to current students.

This chapter is divided into eight subsections. First, cooperative education is

defined. Second, the conceptual framework is explained to provide the reader a lens for

viewing the problem. Third, the problem of finding information regarding the value

added by a co-op experience is stated. Fourth, the purpose of the study is discussed. Fifth,

the research questions are defined. Sixth, the research assumptions and limitations are

examined. Seventh, the terms used in this study are defined. Eighth, the summary is

provided and the subsequent chapters are outlined.

Cooperative Education Background

Cooperative Education has a long history in the United States. Herman Schneider

originated the cooperative (co-op) education program in Cincinnati more than 100 years

ago using John Dewey's construct of experiential learning (Hoberman, 1994). The

program aimed to provide students with hands-on learning or experiential education by

incorporating related work experience into the curriculum to complement traditional

classroom learning. When the first co-op program was introduced in the United States in

1906, little awareness existed regarding the importance of experiential learning to the

future of education and industry (Hamlin, 1978). The program was extremely successful

and popular with employers, and its students were in high demand (Hoberman, 1994).

Soon others began to follow in the footsteps of Cincinnati. In 1909, Northeastern

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University in Boston began a co-op program, and in 1911 the University of Detroit followed suit (Stanton, 1988).

According to Hutcheson (1995), co-op education flourished during the 1960s. In 1965, the federal Higher Education Act provided support specifically for cooperative education. The federal government continued funding through 1992 when Congress ended its support of co-ops. In all, the federal government appropriated more than $220 million toward cooperative education (Carlson, 1999). Co-op programs were promoted to give students a "jumpstart on a full-time job after graduation" (Hoberman, 1994, p. 29) and a "link between education and work" (Van Der Vorm, 1995, p. 28). Students found they could "gain professional experience without giving up the college experience" (National Commission for Cooperative Education, 1995, p. 2). In addition, students who participated in co-op programs increased their self-confidence, developed a greater sense of relevancy to and meaning in their studies, and enhanced their career awareness (Fletcher, 1989; Michigan State Department of Education, 1995; National Commission for Cooperative Education, 1994).

Components of co-op education programs vary from one institution to another. Ricks (1990) noted that co-op education programs focus on the students' needs. Sovilla (1988) concurred with Ricks (1990), stating co-op programs are adapted to local conditions and the characteristics of each student body resulting in nationwide and worldwide variability. A need exists to clarify the variability in co-op education programs, explain the characteristics of these components, and define the dependent variables in the outcome studies (Fletcher, 1989).

Different models of co-op programs exist nationally and internationally and in high schools, 2-year and 4-year colleges, and universities (Fletcher, 1989). Co-op practitioners, educators, and administrators proclaim the beneficial outcomes of co-op programs, but to evaluate the outcomes and demonstrate accountability, educators must not ignore that the programs vary and acknowledge the manner in which they do (Fletcher, 1989).

Researchers acknowledge the lack of a consensus regarding the standards for co-op education program design and operation. Pearson (1982) outlined the diversity of operating arrangements or calendars practiced by co-op education students. Sovilla (1988) commented, "Our field already has an identification crisis due to the proliferation of models" (p. 144). Heinemann (1988) stated, except for the Cooperative Education Division of the American Society for Engineering Education and the Canadian Association for Cooperative Education, no established certification standards exist.

The integration of classroom theory with practical experience in a formal program is best defined on the basis of the following criteria: the educational institution develops and approves the work situation as a suitable learning situation; the learning situation involves productive work and not mere observation; the employer pays the student for the work performed; and the educational institution monitors the co-op student's progress on the job and the employer evaluates the student's performance (Ricks, 1990). Much of the reported research on cooperative education has lacked scientific rigor and does not contribute to theory building or practice, which are necessary if the co-op is to become a viable educational option (Ricks, 1993).

The co-op is a structured educational strategy that integrates classroom studies with work-based learning related to a student's academic or career goals. The co-op is an established form of experiential learning as it provides field-based experiences that integrate theory and practice. The co-op is a partnership among students, educational institutions, and work sites including business, government, and non-profit community organizations. Students may earn credit and a grade for their co-op experience while working in a paid or unpaid capacity. College and university professional and career-technical programs such as engineering, media arts, and business often require cooperative education courses for their degrees (Ricks, 1990).

Conceptual Framework

Conceptual frameworks "represent ways of thinking about a study, or ways of representing how complex things work the way they do" (Bordage, 2009, p. 313). A key feature of conceptual frameworks is that they provide a lens for viewing reality, thus allowing the viewer to focus on or exclude certain entities, processes, and relationships. This study uses experiential learning theory and the human capital theory of economics with a particular emphasis on Siedenberg's (1989) economic wage model as the theoretical framework. The human capital theory provides a framework for the study by suggesting that education raises the productivity of workers by imparting useful knowledge and skills, thus raising workers' future income by increasing their lifetime earnings (Becker, 1964). The Siedenberg model is important because it uses economic theory and statistical analysis to investigate the relationship between co-ops and early career outcomes.

A review of the experiential learning research literature, which is explained in detail in Chapter 2, indicates that in many cases, participation in a co-op produces higher starting salaries for participants (Arum & Shavit, 1995; Asher, 1994; Bailey et al., 2004; Bourdieu, 1998; Coleman, 1988; Coll & Eames, 2004; de Broucker, 1999; Drysdale et al., 2007; Dube & Korngold, 1987; Fletcher, 1989; Hunt, 1974; Krupar, 1987; Michigan State Department of Education, 1995; National Commission for Cooperative Education, 1994; Nielsen, 1984; Stern et al., 1997; Taylor, 2006; Weinstein, 1981; Wilson, 1974). The reasons vary among studies for why co-op graduates usually receive higher starting salaries than their non-participating peers, but all can be attributed to co-op participation raising the stock of human capital.

Human capital theory is a branch of economics that analyzes the process of investment in individuals (Siedenberg, 1989). The human capital view emphasizes differences among people rather than differences among jobs. The basic operational concept of this work is the human capital earnings function. Significant explanatory variables of earnings have proven to be measures of the stock of human capital (e.g., quantity and quality of schooling, on-the-job training, and experience), as well as a vector of personality, attitudinal, and psychological characteristics (e.g., age, sex, ability, and socioeconomic status of parents) (Siedenberg, 1989). Traditional labor market variables are sometimes included as well (Siedenberg, 1989).

This research used the Siedenberg (1989) wage model to quantitatively operationalize the human capital earnings function. The Siedenberg (1989) economic wage model can be expressed as follows: W=f(H,P,L), where W refers to the wage rate the graduate receives and is a function of H (human capital), P (personal characteristics),

and L (labor market conditions). H, P, and L can comprise several variables. Siedenberg's (1989) economic wage model uses regression analysis to control for the effects of multiple independent variables, thus isolating the relationship between participation in a co-op and the early employment outcomes of job attainment and earnings. The Siedenberg (1989) model employs economic theory and statistical analysis to investigate the relationship between co-op participation and early career outcomes while minimizing confounding effects and giving a greater degree of assurance to the results. The theoretical framework for this study is a nexus between experiential learning theory and human capital economics.

Statement of the Problem

It is generally accepted that an investment in higher education is one of the best investments a person could make based on an evaluation of the income differential between the average high school and college graduates (The United States Department of Education, 2006). The monumental Spellings report questioned that long-held assumption based on the U.S. slipping to 12th in higher education attainment among major industrialized countries, and the report asked institutions of higher education to address issues of accountability and efficiency. Institutions of higher education, and especially public institutions, are accountable to the governments that support them, the citizens whose tax dollars are the source of funding, and the students who attend (The United States Department of Education, 2006). According to the National Center for Public Policy and Higher Education (2007), a large percentage of the public, including parents, believe that colleges and universities could use their resources more wisely. The

2007 National Center for Higher Education and Public Policy Study found the following results:

- 87% believe higher education improves job prospects

- 67% believe higher education is worth the investment

- 78% believe students have to borrow too much to attend

- 52% agree "colleges are like a business" and care more about the bottom line than educational values

- 44% say waste and mismanagement are "very important" factors in driving up costs (an additional 37% say they are "somewhat important" factors in cost)

- 48% believe their state's public college and university systems need to be fundamentally overhauled

- 56% say colleges could spend a lot less and still maintain excellence

Many college students and their parents, not to mention administrators and legislatures, are basing their educational expenditures on an employment criterion (The United States Department of Education, 2006). Education consumers are spending money and want positive outcomes to show for it (The United States Department of Education, 2006). The value-added to students' employability may drive educational expectations. Harvey and Green (1993) noted:

> There have been attempts to assess the value-added to students of their education. Value-added refers to the enhancement of the knowledge, skills, and abilities of students and the empowering of them as critical, reflective, life-long learners. It is difficult to assess the value added by education and most attempts have relied on measurement of entry and exit

grades or abilities using somewhat crude indicators. Quantitative analysis

of value-added is difficult for a variety of reasons including, the

establishment of base benchmarks, measurement problems and the

attribution of added value to the program rather than some other factor.

Arguably, though, the assessment of value-added is at the core of any

improvement-oriented, value-for-money and transformative approach to

quality assessment at the program level. (p. 14)

Co-op experiences provide an increase in practical knowledge and money, which

should increase the value added to a college degree (National Commission for

Cooperative Education, 1995). Bennett (2001) defines value-added as what is improved

about students' capabilities or knowledge as a result of their education at a particular

college or university. Measuring value requires having assessments of students after they

have had the full benefit of their education at the college. Value-added is the difference a

college makes in a student's total education.

During this period when many institutions of higher education are evaluating their

educational goals and curriculum offerings (The United States Department of Education,

2006), the need arises to understand and articulate the outcomes of educational programs

such as co-ops (National Commission for Cooperative Education, 1995). The

commitment to a co-op requires an investment; the return comes in the form of a job of

good potential upon graduation. At this time, not enough information is available to

confirm whether co-op students transition into quality jobs related to their education. This

study examines the relationship between co-op participation and the early career

outcomes of job attainment and starting salary in an effort to quantify the value added by

a co-op experience. The results can be used to assess co-op programs and to inform program administrators and university leadership of areas that need improvement. In addition, the study provides a measurable methodological approach for program review and base line evaluation—something that has been lacking in other studies on co-op participation.

Purpose of the Study

The purpose of this study is to examine the relationship between cooperative education and the early employment outcomes of job attainment and starting salary of post-secondary graduates at Missouri S&T, a science and technological research university in the Midwest. The study's primary purpose is to provide quantitative evaluation of the co-op program to inform program administrators and university leadership. The results of this study provide description, assessment, and accountability of the co-op program in question during a time of increased calls for accountability. This study is needed to provide quantitative information and analysis for overall knowledge about co-operative education, and it is also important to the institution studied. Administrators need data to be able to make informed program decisions, especially when budgets are being cut and education funding is dwindling. This research defines the co-op program and study objectives at Missouri S&T, the methods for assessment used in the study, and the cost accounting procedures necessary for program administrators and university leaders to evaluate co-op programs.

Knowing whether participation in a co-op correlates with obtaining a job at graduation or a higher starting salary is important information to inform co-op professional practice, student and parental choices, and stakeholder decisions. Career

advisors and co-op program administrators need to know how to advise students regarding career development decisions. Students and parents need to know the facts to illuminate choices such as which school to attend and whether to participate in a co-op, delay graduation, and increase education costs. Stakeholders such as university administrators, legislators, and taxpayers need to know whether co-op benefits are worth the costs especially during times of budget crises.

The University Studied

Founded in 1870 in Rolla, Missouri, as the University of Missouri School of Mines and Metallurgy (commonly known as the Missouri School of Mines (MSM)), the university was a product of the land-grant movement of the late nineteenth century. Land-grant institutions are institutions of higher education in the United States designated by each state to receive the benefits of the Morrill Acts of 1862 and 1890 (Missouri University of Science and Technology, 2008). The Morrill Acts funded educational institutions by granting federally controlled land to the states for the states to develop or sell to raise funds to establish and endow "land grant" colleges. The mission of these institutions as set forth in the 1862 Act is to focus on the teaching of agriculture, science, and engineering as a response to the industrial revolution and changing social class rather than higher education's historic core of classical studies (The National Association of State Universities and Land-Grant Colleges, 2008).

In the initial years, MSM primarily educated mining engineers and surveyors. The university expanded slowly in the first 50 years. As the need for engineering and scientific education grew at the close of World War II, so did enrollment on the campus. Advanced graduate education and research began to assume a greater emphasis during

the 1950s as the Missouri School of Mines evolved into a world-class technological research university whose impact reached well beyond the state of Missouri and the nation.

In 1964, the institution changed its name to the University of Missouri at Rolla, and later the University of Missouri–Rolla to recognize its expanding nature. UMR, as it quickly came to be called, was the science and engineering flagship of a reorganized four-campus University of Missouri System. The institution has continued to evolve and grow while maintaining a science and technology-based mission. On Jan. 1, 2008, its name was changed to Missouri University of Science and Technology (Missouri S&T). This new name better defines the university as a leading technological research institution and better defines its identity in the University of Missouri System. For more than a century, Missouri S&T has been a national leader in equipping students to lead a global transition from an industrial to an information technology-driven economy. Drawing students from 47 states and more than 50 countries, Missouri S&T continues to focus on preparing students to use their innovative skills and strong work ethics to improve the lives of people in the United States and around the globe (Missouri University of Science and Technology, 2008).

As a technological research university, Missouri S&T is a member of a distinct group of American institutions of higher education. Technological research universities distinguish themselves by having a mission-based commitment to improving the world through the study and application of advanced science and technology (Missouri University of Science and Technology, 2008). Today's prestigious technological research universities have a reputation for providing superior education and robust research

programs in the fields of science, technology, engineering, and mathematics. More than 50% of students at these institutions complete degrees in the STEM fields (Missouri University of Science and Technology, 2008).

Missouri S&T has one of the most productive research programs among universities specializing in STEM fields, according to Academic Analytics (2008). Missouri S&T was ranked fourteenth among the nation's specialized STEM universities in Academic Analytics' 2006–2007 Faculty Scholarly Productivity Index. By this definition, 17 technological research universities exist in the United States. While these universities attract the country's most talented students, most technological research universities are also renowned for strong offerings in the humanities, liberal arts, and social sciences, which complement and provide context to the technological strengths of such institutions (Missouri University of Science and Technology, 2008). The Missouri S&T mission and values follow.

The Missouri S&T mission statement is: Missouri University of Science and Technology integrates education and research to create and convey knowledge to solve problems for our State and the technological world. The Missouri S&T vision is: Missouri University of Science and Technology will be recognized as one of the top five technological research universities in the nation. The Missouri S&T values are: Tradition: We are a diverse scholarly community of hard-working problem-solvers who draw inspiration, strength, and pride from our history, our students' success, and our entrepreneurial spirit.

Interdisciplinary Collaboration: We value the entire realm of human

knowledge and seek to transcend conventional boundaries in the pursuit of

our goals.

Inclusiveness: We encourage and depend upon mutual recognition and

respect and the voluntary cooperative efforts of our diverse constituents to

sustain a strong and cohesive scholarly community.

Excellence: We embrace academic integrity, exceptional results, and

constant improvement in teaching, research, service, and economic

development activities. (Missouri S&T Office of the Chancellor, 2010)

At Missouri S&T, the fall 2009 student enrollment stood at 6,815 students. For

undergraduate students, the average parental annual income was $78,250. The percentage

of undergraduate students with a family income below $50,000 was 35 percent, 34%

were first generation college students and 22% were Pell Grant eligible. The approximate

indebtedness for an individual graduate student graduating from Missouri S&T in fall

2009 was $23,000. The average 2009 starting salary for a graduate student was $57,000.

The financial profile for Missouri S&T students in fall 2009 follows:

- 34% were first-generation college students

- +80% received scholarships and financial aid

- 22% qualified for low income Pell Grants

- 82% planned to work while enrolled at Missouri S&T

The total financial assistance awarded by Missouri S&T for 2008-2009 was

$67,273,977 (Missouri University of Science and Technology, Institutional Research and

Assessment, 2010).

The Co-op Program Studied

During the administration of Dr. C. H. Fulton in 1921, some thought was given to aiding graduates from Missouri S&T, then called Missouri School of Mines, in finding employment. Dr. Fulton was anxious to build the student enrollment, and in doing so he felt the school should assist students upon graduation to find gainful employment. In 1923, Mr. Noel Hubbard (who retired in 1963 as an Assistant Dean) was appointed Assistant Registrar and was directed to develop a placement program.

Dr. Curtis L. Wilson became the head of Missouri S&T in 1941 (then the School of Mines and Metallurgy). In 1944 he appointed Rex Z. Williams to the position of Assistant Dean and Director of Placement. Under the supervision of Dean Williams, post-graduation placement officially began.

It was not until the end of World War II that the nationwide system of placement associations began to form in rapid succession. This was because of the great number of college graduates during the post-war period, 1947-1960. It was during this period, on June 7, 1949, that the Midwest College Placement Association came into being and Missouri S&T became a member of the association. The Career Placement and Cooperative Training office moved to its current location in Norwood Hall in late August 1991, and the office is currently under the direction of Dr. Lea-Ann Morton. (J. Boeding, personal communication, Jan. 11, 2010; Missouri S&T Archives).

The co-op program was designed to provide students with an employment opportunity to gain practical degree-related work experience prior to graduation. The program is set up so students can work full-time for one semester or for a combination of semesters such as spring/summer or summer/fall, allowing up to nine months of work

experience vs. the three summer months allowed for internship positions. At the institution studied, a co-op is defined as a position consisting of work during the summer plus one semester, while an internship is summer-only employment. Students may also obtain a parallel co-op job with local employers where they work and study simultaneously on a part-time basis. Approximately 100-150 employers hire for approximately 500 co-op positions annually, and students apply for those positions through the traditional resume/interview job search process, which is facilitated by Missouri S&T Career Opportunities and Employer Relations. Missouri S&T Career Opportunities and Employer Relations also works individually with students who wish to participate in a co-op with an employer who does not currently participate in the co-op program (Missouri S&T, 2010).

To be eligible to participate in the co-op program, a student must be enrolled full-time, which is defined as satisfactorily carrying and passing a minimum of 12 credit hours (9 credit hours for a graduate student) in a fall or spring semester. A student must have at least a cumulative GPA of 2.0 out of 4.0 to apply to and participate in the program. The student must not be on any type of probation. The sponsoring company may establish other eligibility requirements with the approval of the university. Freshmen are eligible after two semesters, while transfer students are immediately eligible. A transfer student who is participating in a co-op program through another institution may transfer and continue the co-op affiliation subject to institutional guidelines. A graduate student is eligible after completing one semester, unless the undergraduate degree is from the institution, upon which the student is immediately eligible. An international student is eligible after completing nine months of studies and with academic department approval.

International students are eligible to apply for up to 12 months of Curricular Practical Training (CPT), which allows them to accept internship or co-op positions prior to graduation. CPT is approved and issued by the International Affairs Office, and applications can be processed within one week. Employers do not need to sponsor international students for co-op or internship employment (Missouri S&T, 2010).

Employers hire co-op students throughout the academic year. Most commonly, though, employers prefer to recruit a student for combined semesters (summer/fall or spring/summer), and will then decide to make additional offers based on student performance and employer needs. Another co-op option includes alternating multiple semesters of study with employment. This is a decision between the employer and student, however, and the schedule can be arranged as agreed upon by both parties. It is university policy that students are not away from their studies for a full academic year unless prior authorization is given by the academic department (Missouri S&T, 2010).

Once a student receives a written offer letter for a co-op position, each co-op term (summer, fall, and spring) must be registered with the university. To register, students bring a copy of their offer letter to Missouri S&T Career Opportunities and Employer Relations and complete a set of forms. This ensures that the student maintains student status with the Registrar's Office while working away from campus. Missouri S&T Career Opportunities and Employer Relations communicates pre-registration information to working co-ops to ensure that a student's return to campus is smooth and convenient. For students wanting to earn academic credit, all co-op terms must be registered. Earning degree credit for co-op participation is optional and at the discretion of the academic department. Credit options are discussed between the student and academic advisor prior

to co-op registration with Missouri S&T Career Opportunities and Employer Relations. Retroactive credit cannot be granted after the co-op experience term (Missouri S&T, 2010).

When registering a co-op, a co-op fee is applied per term of fall, spring, or summer. The fee is equivalent to the educational fee of one, in-state credit hour (regardless of residency). The fee of one, in-state credit hour for 2009/2010 was $245.60 (Missouri University of Science and Technology, Financial Aid Office, 2010). This fee does not apply academic credit to a student transcript, but if academic credit is granted, then regular tuition rates apply based upon in-state/out-of state tuition and the number of credit hours received during the co-op.

Salaries and wages vary from one employer to another, as do the travel and housing benefits extended to co-op students. Wages may be determined based on a student's progress toward a degree (class level), current GPA, and accrued work experience. The university does not set pay rates for any participating company or agency, but it does publish average monthly co-op salaries and average annual starting salaries based on student reports. These reports categorize the salaries based on academic major for easy reference and comparison.

In 2010 at the time of this research, Missouri S&T had an enrollment of approximately 6,815 total full-time students (Missouri University of Science and Technology, Institutional Research and Assessment, 2010). The university co-op program had been operating since 1956. The co-op program started with 133 male students and 18 firms. As the years progressed, the institution increased the number of participating businesses and provided a larger number of opportunities for its students. By 2009, (see

Figure 1) the co-op program had grown to 483 registered co-ops with 145 different employers located in 36 states (Missouri University of Science and Technology, Office of Career Opportunities and Employer Relations, 2010).

Figure 1 Co-op Program Participation
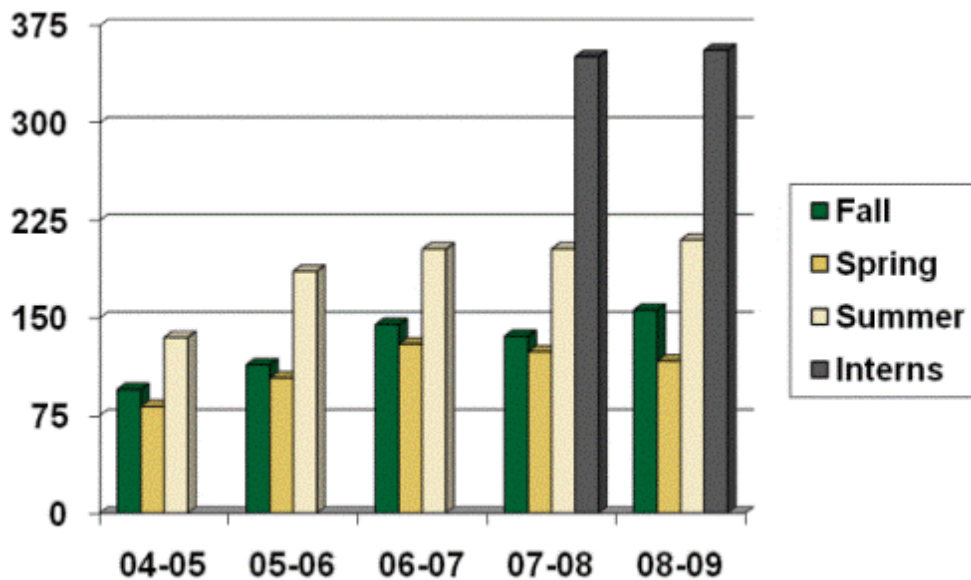
Table 1 provides the average co-op salary as divided by major and by undergraduate or graduate status for 2009-2010. At least three published reports were required to list an average salary for one category, so the non-reports reflect majors for which fewer than three reports were received. The overall average is provided to show the average for the year.

The differences across majors suggest that the highest co-op salaries go to the majors requiring significant quantitative skills and in labor market shortages. For example, Chemical, Mechanical, and Mining engineering majors in 2009-2010 received co-op salary offers of more than $2,900. Aerospace Engineering and Business and Management Systems received co-op salaries of less than $2,500. Despite the variance

between majors, the co-op salaries are impressive in all majors considering the students

have not yet completed their respective degrees.

Table 1 2009-2010 Co-op Average Monthly Salary

2009-2010 Missouri S&T Co-op Average Monthly Salary

Major	Average Undergraduate	Average Graduate
Aerospace Engineering	$2,265	
Architectural Engineering	$2,594	
Business Administration (MBA)		$2,754
Bus and Mgt Systems	$2,388	
Chemical Engineering	$3,818	
Civil Engineering	$2,676	
Computer Engineering	$2,790	$4,350
Computer Science	$2,595	$3,694
Electrical Engineering	$2,771	$4,216
Engineering Management	$2,710	$3,390
IST	$2,663	$3,352
Mechanical Engineering	$2,921	$2,654
Metallurgical Engineering	$2,731	
Mining Engineering	$3,153	
Overall Average	$2,947	$3,536

Research Questions

The primary focus of this study is on the differences in job attainment and starting

salary in students' first full-time job at graduation as related to the students' majors.

Based on the findings from previous studies, this study expected to find an earnings

advantage for co-op participants over those who chose not to participate in a co-op

(Allwell, 1978; Hamlin, 1978; Hayes & Travis, 1976; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976). This study investigated the relationship between co-op participation and early employment outcomes of 2008 to 2010 graduates from Missouri S&T. The following research questions were posed:

1.What are the differences in demographics and personal attributes between students who participate in a co-op and students who do not?

Descriptive statistical information is needed to set a base line of characteristics to inform the study. The descriptive statistics had to be the first step in the research process to summarize data in a clear and understandable way. Given the findings of past research conducted on co-op participation, this study expected co-op students to be motivated, hardworking, and have higher GPAs than students who did not participate in a co-op (Wilson, 1987; Brown, 1984). The students who participated in a co-op likely did so with the expectation of obtaining an employment advantage and they proactively worked to maximize their future career options.

2.Does participation in a co-op correlate with having full-time employment in one's field of study at graduation?

This study expected to find that participation in a co-op led to having a job at graduation because participation in a co-op should raise one's human capital. A review of the literature indicated that co-op participation does, in many cases and populations, produce higher instances of having a job at graduation. Several studies have shown that co-op graduates have a higher rate of job attainment at

graduation (Hanks & Schiller, 1984; Hamlin, 1978; Harris & Hodgson, 1974; Patterson & Mahoney, 1985).

Although co-op programs have become a typical platform for promoting job attainment and higher starting salaries, limited research exists regarding their effectiveness in reaching those goals. Furthermore, many of the published studies have failed to account for additional characteristics known to affect hiring and salary.

3.Does participation in a co-op correlate with a higher starting salary?

This study expected to find that participation in a co-op leads to a higher starting salary because such participation should raise one's human capital. A review of the literature indicated that co-op participation does, in many cases and populations, produce higher starting salaries for participants. Several studies have shown that co-op graduates receive higher starting salaries than their non-participating peers (Allwell, 1978; Hamlin, 1978; Hayes & Travis, 1976; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976).

Assumptions and Limitations

This study used existing data provided by the institution to examine the relationship between participation in a co-op and the early employment outcomes of job placement and starting salary at graduation. The primary data sets were the annual post-graduation surveys and the co-op program records. The post-graduation survey data were primarily self-reported via an online survey housed on Missouri S&T Career Opportunities and Employer Relations' website. It was assumed that the student-reported data were accurate.

Kerlinger (1986) lists three major limitations to ex-post facto research: (a) The independent variables cannot be manipulated, (b) the treatments cannot be randomized, and (c) risks of improper interpretation exist. Participation in a co-op and the starting salary were not assigned conditions, so they had to be studied in their natural environment while taking other mediating factors into account in an effort to assess potential relationships. Participation in a co-op could not be isolated from a variety of historical and demographic issues. The potential threats, mediating factors, and conditions include but are not limited to a student's age, socio-economic background, work ethic, and other extraneous variables. The potential threats could not be eliminated and therefore some risk of improper interpretation exists. Furthermore, causation cannot be implied.

Threats to Internal Validity

Internal validity means the changes observed in the dependent variable are due to the effect of the independent variable or variables and not to other unintended variables (known as extraneous variables, alternative explanations, or rival hypotheses). If extraneous variables are controlled, then the results can be said to be due to the independent variable or variables, and for that reason the study is internally valid (Mertens, 2009). The threats to internal validity follow.

Extraneous variables. Some factors that affect wage rates are difficult to consider using Siedenberg's (1989) model. Subjective qualities of individuals may have been crucial not only in determining wage rates, but also in initially securing employment. These characteristics may include motivation, self-concept, self-esteem, beliefs, values, attitudes, and other personality traits. These qualities were problematic to measure, and

their significance was not completely captured by the independent variables available for use in the model. Some of the included variables, however, may have served as proxies for these effective traits or may have been correlated with them. It is assumed that these effective traits had a minimum effect on the study's outcomes and that they affected both the co-op and non-co-op students equally.

In this study, data were selected based on availability. The data may have been affected by significant variables not measured. In the context of this study, the independent variables were not controlled. No opportunity was given to arrange the conditions of the data or to manipulate the variables influencing the facts. Multiple regression was selected to examine more than one predictor of early career outcomes. This was done in effort to determine whether the inclusion of additional predictor variables led to an increased prediction of the outcome variable (Field, 2005) and to test the relationship between co-op participation and early employment outcomes.

Instrumentation. Instrumentation was a threat to internal validity because data from different databases and sources were compiled for use. The data were triangulated to compile the most accurate data set. The initial data were obtained from the post-graduation surveys of graduates from 2008 to 2010. The post-graduation surveys were self-reported via the institutional website. Additional records were obtained from the co-op program. The co-op program data set was checked and added to the initial post-graduation survey data. Finally, the data set was compared with the institution's PeopleSoft student records for accuracy and to fill in any missing data. After group assignment was made, a data set was produced with the student name and number removed and replaced with a participant number. This was done to ensure participant

confidentiality. Reporting salary information was voluntary, which may have reduced participation and affected the results.

Differential selection. The ex-post facto study in a natural situation did not allow for controlled selection of subjects. According to Isaac & Michael (1971), "Locating existing groups of subjects who are similar in all respects except for their exposure to one variable is extremely difficult" (p. 23). Selection was a major limitation of this study. The use of a purposive sample means the accessible population was the sample (Fowler, 1988). Data were gathered based on voluntary self-reports, which further biased the population. The participants were 2008 to 2010 graduates from Missouri S&T, a science and technological research university in the Midwest. The participants had different characteristics between the comparison groups. It could be interpreted that the findings were due to group differences, not necessarily to the independent variable of co-op participation. The study controlled for deferential selection effects by including all available characteristics as additional independent variables and by conducting descriptive statistical analysis.

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Threats to External Validity

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External validity is the extent to which findings in one study can be applied to another situation. If the findings from one study are observed in another, then the results are said to be generalizable or externally valid (Mertens, 2009). The threats to external validity follow.

Explicit description of the experimental treatment (Mertens, 2009). For research to be externally valid, the independent variable must be sufficiently described so it can be reproduced. The primary independent variable in this research was participation in a co-

op. It would be difficult to adequately describe a co-op program let alone each independent co-op experience in a way that this study could be reproduced. Co-op participation at Missouri S&T was implemented in a variety of ways, which significantly reduces the external validity.

Interaction of history and treatment effects (Mertens, 2009). This research was conducted in a particular time replete with contextual factors that cannot be exactly duplicated in another setting. Specific historical influences were present in the situation (e.g., unusually low starting salaries and hiring rates due to a global recession), which hinder the generalization of these results to another situation.

Other threats to validity. In addition, this study was limited by geographical area and design assumptions. The study was limited geographically to the 2008 to 2010 graduates of a mid-western science and technological research institution, which limited extrapolation of the results. The results may not be generalizable to other institutions. Another concern was researcher positionality because the researcher was employed at the site of the research during the study.

<div align="center">Definition of Key Terms</div>

The following terms are used in the discussion of the research problem and data handling:

Co-op. Co-op is an abbreviation for Cooperative Education. At the university studied, the program is set up so students may work full-time for one or for a combination of semesters such as spring/summer or summer/fall, allowing eight to nine months of work experience compared with the three summer months of work in an internship position.

Co-op education. The integration of classroom theory with practical experience in a formal program is best defined on the basis of the following criteria: the educational institution develops and approves the work situation as a suitable learning situation; the learning situation involves productive work and not mere observation; the employer pays the student for the work performed; and the educational institution monitors the co-op student's progress on the job and the employer evaluates the student's performance (Ricks, 1990).

Co-op student. A student who has ever registered at least one co-op experience with the university is classified as a co-op student.

Ex-post facto. Ex-post facto is Latin for *from a thing done afterward*, meaning the research took place retroactively on data already submitted and collected (ex-post facto, 2009).

Experiential learning. Experiential learning is a cyclical process that capitalizes on the participants' experiences for acquisition of knowledge (Miettinen, 2000).

Internal validity. Internal validity means the changes observed in the dependent variable are due to the effect of the independent variable or variables and not to other unintended variables (known as extraneous variables, alternative explanations, or rival hypotheses). If extraneous variables are controlled, then the results can be said to be due to the independent variable or variables, and for that reason the study is internally valid (Mertens, 2009).

Non-co-op student. A student who, by the time of graduation, has never registered a co-op experience with the university is classified as a non-co-op student.

Summary

This study is organized into five chapters. Chapter One presents an introduction to the study. Chapter Two includes a review of the relevant literature for higher education accountability, a description of experiential learning and cooperative education, and an explanation of general co-op benefits. Chapter Three provides a description of the research design and methods used in the study. Chapter Four reports the findings of the study and includes the data analysis. Chapter Five summarizes the findings and identifies the implications for further research.

CHAPTER TWO: LITERATURE REVIEW

Real education comes after we leave school and there is no reason why it should stop

before death. –John Dewey (1859-1952)

Introduction

The literature pertinent to this study is included in this literature review. The literature calling for quantitative assessment of educational outcomes is outlined as well as pertinent literature on cooperative education. The literature presents the use of employment outcomes as a valid method for assessing educational outcomes, and this forms the foundation of this study. A main source of literature has been *The Journal of Cooperative Education* (Porter & Neilsen, 1986) established in 1963 and first published in 1964 by the Cooperative Education Association. The U.S. Congress and various other governmental agencies have also reviewed and conducted relevant studies on this topic. The literature presented here supports the idea that exposure to the characteristics and activities of co-op programs, either directly through student participation or indirectly through institution participation, motivates graduates to realize a connection between school and work, to pursue additional education, and subsequently to achieve salary gains.

This chapter is divided into five subsections. First, a conceptual framework from both experiential learning theory and human capital economics is developed based upon Siedenburg's (1989) wage model. Second, experiential learning theory is explained as the core belief behind cooperative education. Third, the student benefits, outcomes, and results of cooperative education are presented. Fourth, higher education accountability is

discussed with specific attention paid to the evaluation of cooperative education

programs. Fifth, the summary is provided and the subsequent chapters are outlined.

Theoretical and Conceptual Framework

Conceptual frameworks "represent ways of thinking about a study, or ways of

representing how complex things work the way they do" (Bordage, 2009). A conceptual

framework typically specifies a set of relevant entities of study or action (such as actors,

organizations, and outcomes), processes acting on these entities, and the presumed,

observed, or predicted relationships between entities and processes (Rocco & Plakhotnik,

2009). A key feature of conceptual frameworks is that they provide a lens for viewing

reality that allows the viewer to focus on (or exclude) certain entities, processes, and

relationships. Bordage (2009) describes these functions as illumination (shedding light on

particular aspects of reality to the exclusion of others) and magnification (permitting

more fine-grained observation of the illuminated aspects). The conceptual framework for

this study was a nexus between human capital economics theory and experiential learning

theory utilizing Siedenberg's (1989) economic wage model.

Human Capital Theory

The October 1962 volume of *The Journal of Political Economy*

supplement on "Investment in Human Beings" included the preliminary chapters

of Gary Becker's 1964 monograph *Human Capital*, which is considered by some

to be the birth of human capital theory (Blaug, 1976). Schultz penned the first

textbook exclusively devoted to the subject in 1963 (Blaug, 1976). Essentially,

human capital theory suggests that education or training raises the productivity of

workers by imparting useful knowledge and skills, thus raising workers' future income by increasing their lifetime earnings (Becker, 1964).

Becker (1964) and Mincer (1974) use human capital theory to link investments in educational training with the outcome of workers' wages. Numerous studies conducted since 1964 have estimated the rate of return on one's education with most showing that formal schooling is an important element in explaining variations in salary and wages (Cohn & Addison, 1998; Psacharopoulos, 1985, 1994). The majority of these studies have reported calculated rates of return within the range of 5-15% (Blaug, 1976). Mincer's book *Schooling, Experience and Earnings* (1974) contends that if attention is concentrated on a cohort of men with seven to nine years of work experience, then it is possible to explain about one-third of the inequality in earnings solely by differences in formal schooling.

Becker's *Human Capital* (1975) notes that observed changes in American school and college attendance rates can be satisfactorily explained by the persistently high yield of educational investment to individuals, suggesting that education raises the productivity of workers by imparting useful knowledge and skills. Many different reasons exist for how education relates to worker productivity. Spence (1973) maintains that education is used as a market signal to reflect workers' superior ability acquired during the process of education, rather than through skills and knowledge. Thurow (1975) claims that productivity is a job characteristic and not a worker characteristic. Thurow's work suggests that employers use education credentials to select workers because educated workers

have a proven training record and can be trained for specific jobs at a lower cost and more quickly than less-educated workers. Schultz (1975) proposes that education provides an individual experience and ability to deal with disequilibria in changing economic conditions. Such ability includes that of noticing a given disequilibrium, analyzing information, and reallocating resources to act.

Levin and Kelley (1994) advise that education can improve productivity (and have an effect on income) only if complementary inputs exist, which include training, contract terms, and management practices. They argue that economists and social scientists have overestimated the payoffs resulting from increased formal education. Hall and Jones (1999) uphold that differences in capital accumulation and productivity are basically related to differences in social infrastructure, that is, the institutions and government policies that create the economic environment within which individuals acquire skills and organizations acquire capital. Lack of these conditions would cause loss in production.

In general, research on human capital has been interpreted as reflecting a certain underlying rationality in decisions about schooling. Regardless, research cannot ignore the effects of nature and lean so heavily on the effects of nurture (education). Edward Denison made the so-called "two-thirds assumption" to attribute two-thirds of the earnings differentials associated with different amounts of education to the pure effect of schooling, ascribing the rest to some combination of genetic endowment and social origins (Blaug, 1976). The classic stance of the research on human capital theory in no way denies the interaction of preschool (nature) factors on earnings, but has resolved that whatever interaction

there is still leaves considerable room for the purely additive (nurture) effects of education and various explanatory variables (Blau & Duncan, 1972; Conlisk, 1971; Griliches & Mason, 1972).

Essentially, human capital theory is a branch of economics that analyzes the process of investment in individuals (Siedenberg, 1989). The human capital view emphasizes differences among people rather than differences among jobs. The basic operational concept of this work is the human capital earnings function. Significant explanatory variables of earnings have proven to be measures of the stock of human capital (e.g., quantity and quality of schooling, on-the-job training, and experience), as well as a vector of personality, attitudinal, and psychological characteristics (e.g., age, sex, ability, and socioeconomic status of one's parents) (Siedenberg, 1989). Traditional labor market variables are also sometimes included (Siedenberg, 1989).

Siedenberg's Economic Wage Model

This study used Siedenberg's (1989) economic wage model with regression analysis to control for the effects of multiple independent variables, thus isolating the relationship between co-op participation and the early employment outcomes of job attainment and earnings. The model and statistical techniques used provide a strong approach to the investigation of the relationship between co-op participation and early employment outcomes. In particular, the minimizing or elimination of the confounding effects gives a greater degree of assurance to the results. The Siedenberg model employs economic theory and statistical analysis to investigate the relationship between co-op

participation and early career outcomes. This theory also includes correlates measuring the acquired human capital, personal characteristics, and, to a lesser degree, conditions.

The Siedenberg (1989) model can be expressed as follows: W=f(H,P,L), where W refers to the wage rate the graduate receives (in this case, the starting salary) and is a function of H (human capital), P (personal characteristics), and L (labor market conditions). H, P, and L can comprise several variables. In looking at the inclusion of variables in "H," this model differs slightly from most other economic studies of earnings functions. All seek to measure earnings benefits associated with investment in schooling. In this study, however, examination was of a type of schooling variable—co-op participation vs. non-co-op participation—rather than on a quantitative measure of the years of schooling completed. Co-op participation was included as a dichotomous variable, indicating participation or nonparticipation. Additional variables representing forms of human capital, such as educational program (academic major) and grade point average, were included in estimating the equations (Siedenberg, 1989).

Components of "P" are traits that "define" the graduate and might be considered in a hiring or wage decision (Siedenberg, 1989). According to Siedenberg (1989), these might include personal characteristics. In this study, the demographics and personal characteristics studied included gender, citizenship, and ethnicity/race. In addition, variables indicative of grade point average and academic major grouping were used as proxies for ability.

Components of "L" are the objective labor market measures that might include factors important to labor market situations such as location, region, and market condition (Siedenberg, 1989). Wages are related to the labor market conditions in society at the

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time. Factors such as the unemployment rate and economic growth are important in determining whether students obtain jobs. For the purpose of this study, the component "L" was included as a dummy variable for each year indicating the differences students faced by year of graduation.

Siedenberg used his model with a population of non-traditional students (1990), finding that cooperative experiences allowed students with little formal work experience to catch up in salary with students who had previous work experience. The model effectively demonstrated the role of cooperative education in establishing competitive salaries among this population. Repeated efforts have established that co-op participants usually enjoy a salary advantage over their peers (Gardner, Nixon, & Motschenbacher, 1992; Siedenburg, 1990).

Gardner (1992) applied the Siedenberg model to a group of traditional engineering students—that is, engineering students who had graduated from college between the ages of 22 and 25 with minimal previous work experience other than that obtained while attending college. Gardner (1992) found that the co-op students had significantly higher starting salaries than their non-co-op counterparts. Gardner (1997) later evaluated the starting salaries of a similar group of students, thus adding a comparison of expectations and job level to his investigation of salary. Blair, Millea, and Hammer (2004) looked at academic performance and compensation of engineering majors by examining three dimensions of the co-op experience: GPA, starting salary, and time until graduation. Their study found that co-op students had higher GPAs and starting salaries but took two semesters longer to graduate. Beyond that, little evidence is

available on the model used to measure outcomes for four-year college students, although

Wessels and Pumphrey (1995) explored these issues among 2-year college graduates.

Experiential Learning

"Tell me, and I will forget. Show me, and I may remember. Involve me, and I will

understand" (Confucius circa 450 BC).

In current theory and practice, cooperative education is viewed as an established

form of experiential learning. Experiential learning seems predominantly understood as

reflective construction of meaning, with particular emphasis on "critical reflection" and

dialogue. This section includes a brief explanation of the theories of experiential learning,

reflective adult learning, constructivism, and experiential learning theory as they all

support cooperative education as a learning process.

Experiential learning is a cyclical process that capitalizes on the participants'

experiences for acquisition of knowledge (Miettinen, 2000). This process involves setting

goals, thinking, planning, experimentation, reflection, observation, and review. By

engaging in these activities, learners construct meaning in a way unique to themselves

while incorporating the cognitive, emotional, and physical aspects of learning.

Experiential education provides an opportunity for students to actively participate in the

learning process, which is one of the primary premises of cooperative education.

Reflective adult learning theory casts the individual as the central actor in a drama

of personal meaning-making (Mezirow, 1990). The learner reflects on lived experience

then interprets and generalizes this experience to form mental structures. These structures

make up knowledge, which is stored in memory as concepts that can be represented,

expressed, and transferred to new situations. Explanations in this perspective inquire into

ways people attend to and perceive experience, interpret and categorize it as concepts, and then continue adapting or transforming their conceptual structures or "meaning perspectives" (Mezirow, 1990). Cooperative education provides a valuable reflection on the learning experience for students.

Constructivism has a long and distinguished history (Piaget, 1966; Vygotsky, 1978; Wells, 1995), portraying learners as independent constructors of their own knowledge with varying capacity or confidence to rely on their own constructions. All views of constructivism do share one central premise, however: Learners are believed to construct, through reflection, a personal understanding of relevant structures of meaning derived from their action in the world. Piaget (1966) described this construction process as oscillating between assimilation of new objects of knowledge into one's network of internal constructs, and accommodation of these constructs in response to new experiences that may contradict them. Cooperative education experiences provide a laboratory of sorts for constructivist learning to occur.

In literature on adult learning, this reflective view is embedded in the writings of Boud and Miller (1996), Kolb (1984), MacKeracher (1996), Mezirow (1990), Schon (1983), and many others. Schon (1983) in particular has been a significant promoter of constructivism to understand workplace learning, arguing that practitioners learn by noticing and framing problems of interest to them in particular ways, then inquiring and experimenting with solutions. Their knowledge is "constructed" through reflection during and after this experimental action on the "ill-defined" and "messy" problems of practice. Both Brookfield (1987) and Mezirow (1990) have made considerable contributions to constructivist views of adult learning by theorizing how "critical reflection" interrupts

and reconstructs human beliefs. Brookfield shows how both skeptical questioning and imaginative speculation can reflect on experience to refine, deepen, or correct adults' knowledge constructions. Mezirow (1996) has continued to argue that reflection on fundamental premises opens meaning perspectives that are more "inclusive, differentiating, permeable, critically reflective, and integrative of experience" (p. 163).

Kolb (1984) and Schon (1983) popularized the Experiential Learning Theory (ELT) conceptualization. ELT "provides a holistic model of the learning process and a multilinear model of adult development" (Baker, Jensen, & Kolb, 2002, p. 51). The focus of ELT is on experience, which serves as the main driving force in learning because knowledge is constructed through the transformative reflection on one's experience (Baker et al., 2002). Cooperative education fits well into the ELT model. The learning model outlined by ELT contains two distinct modes of gaining experience related to each other: concrete experience (apprehension) and abstract conceptualization (comprehension). In addition, two distinct modes of transforming the experience occur so that learning is achieved: reflective observation (intension) and active experimentation (extension) (Baker et al., 2002). When these four modes are viewed together, they constitute a 4-stage learning cycle of the experiential learning process. The learners begin with a concrete experience, which then leads them to observe and reflect on their experience. After this period of reflective observation, the learners piece their thoughts together to create abstract concepts about what occurred, which will serve as guides for future actions. With these guides in place, the learners actively test what they have constructed, thus leading to new experiences and the renewing of the learning cycle

(Baker et al., 2002). Cooperative education integrates the four distinct modes into the experiential learning opportunity.

The Experiential Learning Cycle (Oxendine, Robinson, & Willson, 2004) includes the components of experience, critical reflection, abstract conceptualization, active experimentation, and more critical reflection. Real experiences help the individual learn advanced abstract concepts. The experiences might allow the individual to actively collect information to learn and become a member of the community of practice. Perhaps critical thinking and reflection may refine ideas or lead the individual to consider alternate possibilities. Each phase potentially leads to another and builds upon the former (Oxendine et al., 2004).

The ELT model for learning can be viewed as a cycle consisting of two distinct continuums: apprehension-comprehension and intension-extension. These dialectical entities, however, must be integrated in order for learning to occur. Apprehension-comprehension involves the perception of experience, while intension-extension involves the transformation of the experience. One without the other is an ineffective means for acquiring knowledge (Baker et al., 2002). Another way to view this idea is summarized as follows: "Perception alone is not sufficient for learning; something must be done with it," and "Transformation alone cannot represent learning, for there must be something to be transformed" (Baker et al., 2002, p. 56-67).

The ELT model attempts to explain why learners approach learning experiences in such different manners but are still able to flourish. Indeed, some individuals develop greater proficiencies in some areas of learning when compared with others (Laschinger, 1990). The ELT model shows that during the learning process, learners must continually

choose which abilities to use in a given learning situation and resolve learning abilities on opposite ends of a continuum (Baker et al., 2002). Indeed, learners approach the tasks of grasping experience and transforming experience from different points within a continuum of approaches. It is important that learners also resolve their discomfort with the opposite approach on the continuum in order for effective learning to occur. Thus, if a learner is more comfortable perceiving new information in a concrete manner and actively experimenting during the processing of the experience, then the learner must also undergo some abstract conceptualization and reflective observation to complete the cycle and lead to effective learning. A learner who experiments with models and manipulates them in the process of learning must also be able to conceptualize and form observations based upon experiences. This must occur even if the learners do not consider themselves strong in these areas (Baker et al., 2002).

Since Kolb created the ELT and the accompanying learning model in 1984, his work has been met with various criticisms about its worth and effectiveness (Oxendine et al., 2004). One of the criticisms of this model is that the concrete experience part of the learning cycle is not appropriately explained in the theory and remains largely unexplored. Herron (as cited in Yorks & Kasl, 2002), believes "the notion of feeling is nowhere defined or elaborated, thus concrete experience is not properly explored… the model is really about reflective observation, abstract conceptualization, and active experimentation" (p. 180-81). Another common criticism of the theory is the idea that immediate and concrete experience is problematic and unrealistic (Miettinen, 2000).

Other criticisms of the ELT are that the concepts outlined by Kolb (1984) are too ill-defined and open to various interpretations and the ideas he presents are an eclectic

blend of ideas from various theorists that do not fit logically together (Miettinen, 2000). Another, perhaps more biting criticism of Kolb's work is that his ELT model is only an attempt to explain the societal benefit of his Learning Styles Inventory and thus may actually be a well derived marketing ploy (Miettinen, 2000). Also, it is believed that the phases in the ELT learning model remain separate and do not connect to each other in any manner (Miettinen, 2000).

Another weakness of the ELT learning model is in the differences between it and the ideas established by John Dewey, whose beliefs are largely attributed to the establishment of the ELT learning model and cooperative education (Miettinen, 2000). Dewey believed non-reflective experience borne out of habit was the dominant form of experience, and that reflective experience only occurred when there were contradictions of the habitual experience. Kolb's ELT does not discuss the role of non-reflective experience in the process of learning (Miettinen, 2000).

In addition, Dewey believed observations of reality and nature were the starting point of knowledge acquisition. Kolb states that experience is the starting point of knowledge acquisition and disregards the observations concerning the subjective reality of the learner (Miettinen, 2000). The ELT learning model lacks discussion concerning the social aspects of experience. The ELT learning model focuses on the learning process for a single learner and fails to mention how the individual fits into a social group during the process and what role the group may play. Also, no discussion is included on how a social group may gain knowledge through a common experience (Miettinen, 2000).

Despite criticisms, the ELT learning model has merits in the field of education (Oxendine et al., 2004). Individuals have their own unique sets of experiences and

abilities they feel comfortable using. Kolb's theory accounts for this fact and shows how learners can utilize experiences and learning strengths in the process of constructing knowledge. Kolb also integrated two dialectical entities into the model to create a complete learning cycle in which the entire learning process can be traced. In addition, Kolb shows how the learner can be effective using learning strengths, while at the same time using underdeveloped skills to complete the learning cycle (Oxendine et al., 2004). Currently many applications of ELT exist within educational systems, especially in higher education. Examples include field courses, study abroad, mentoring, internships, service learning, and cooperative education (Millenbah, Campa, & Winterstein, 2004).

<div align="center">Co-op Student Benefits, Outcomes, and Results</div>

The growth of co-op programs is likely attributable to the perceived benefits they provide by bringing students and higher education institutions together with governments, the private sector, and non-profit sectors (Coll & Eames, 2004). For example, businesses are able to benefit from co-op programs through the establishment of direct partnerships with higher education institutions. They are also able to obtain direct access to training resources for specific skills involving advanced forms of knowledge and technology. While it remains unclear why co-op graduates enjoy greater benefits in the job market, the most common explanations have been that co-op graduates possess more human capital or skills needed in the labor market (Arum & Shavit, 1995). Additionally, co-op programs may serve to increase social networks, connections, and relationships (Bourdieu, 1998; Coleman, 1988), while also fostering connections between classroom learning and real-life experience (Drysdale et al., 2007).

Pace University, a private, comprehensive multi-campus university in the New York metropolitan area, has documented co-op benefits through surveys of faculty, students, and employers. At least half of incoming students were influenced to attend Pace by the existence of the co-op program, representing a one-year tuition income of nearly $240,000. The co-op program's retention rate was 96 percent, compared with the university-wide rate of 52% (Dube & Korngold, 1987).

A 1987 Detroit study found that 94% of the co-op graduates who were studied received at least one merit increase in salary as opposed to 67% of the non-co-op graduates (Krupar, 1987). Another study conducted at Boston College found similar results for its co-op and non-co-op graduates (Nielsen, 1984).

One national educational report that has addressed cooperative education directly is the National Commission on Secondary Vocational Education's (1984) publication, *The Unfinished Agenda*. The Commission concluded:

Cooperative vocational education, a form of field-based learning, has been one of the most successful aspects of vocational education… (p. 19).

…Cooperative vocational education programs have high job placement records, and both students and employers express more satisfaction with this approach to field-based learning than any other (p. 20).

In addition, students who participated in co-op education programs increased their self-confidence, developed a greater sense of relevancy to and meaning in their studies, and enhanced their career awareness (Fletcher, 1989; Michigan State Department of Education, 1995; National Commission for Cooperative Education, 1994).

The general consensus of research conducted indicates that participation in a co-op experience is very beneficial for all parties involved. Increased maturity, clearer career goals, positive personal change, and improved social attitudes are the rewards for many cooperative education students (Wilson, 1974). Weinstein (1981) found a significant difference in students' certainty toward career goals between co-op students and non-co-op students. Weinstein (1981) found 77% of co-op students, as compared with 68% of non-co-op students, were very clear and satisfied with their choice for a career. This implies that more non-co-op students are unsure about their career choice than are co-op students.

Cooperative education students learn to work with others (Hunt, 1974). Notable companies such as General Electric, Ford, 3M, and Union Carbide have extremely positive comments regarding students they have employed through cooperative education (Hunt, 1974). Higher employee retention, greater productivity, and faster advancement are all characteristics observed in their co-op career recruits (Hunt, 1974). Although some of these claims are based on positive personal experiences rather than on purely objective evaluation, they are valid in terms of the value of cooperative education.

Some researchers argue that co-op graduates also provide a mode of differentiation for employers, signaling high academic ability, moral reasoning, social and personal responsibility, empathy and complexity, connectedness, specific experience, and a professional persona (Ascher, 1994; Stern et al., 1997). Studies have highlighted the relevance of work experience and demonstrated the positive impact it has on students (Asher, 1994; Bailey et al., 2004; Coll & Eames, 2004; de Broucker, 1999; Stern et al., 1997; Taylor, 2006). Some studies have even shown school performance to be enhanced

by co-op participation because students may believe that work and school prepare them for the future in similar ways, or they may be more satisfied pursuing both ventures simultaneously (Stern & Briggs, 2001).

Increased Academic Achievement

Studies published by McNutt (1974) and Spect (1985) compared the academic achievement of co-op and non-co-op students. Both studies provided substantial evidence that student comprehension, retention, and grade point averages were higher in the co-op groups. McNutt's (1974) study compared the mean GPA of co-op students with non-co-op students and found a significantly higher GPA in the co-op group. Spect's (1985) study compared lecture-based instruction to cooperative education to determine whether improved retention occurred in the co-op students due to the level of participation. Her study provided significant evidence that co-op student retention did improve more than the other students. A series of studies have found that co-op students scored higher on Graduate Record Examination (GRE) achievement tests (Stanton, 1988). In fact, one study found a small but statistically significant difference in the grades between co-op and non-co-op students, with the co-op students receiving higher grades (Stanton, 1988).

Job Attainment

Obtaining a job at graduation is another one of the major benefits to students who participate in cooperative education programs (Hamlin, 1978; Hanks & Schiller, 1984; Harris & Hodgson, 1974; Patterson & Mahoney, 1985). Patterson and Mahoney (1985) cite findings from employers showing that recruitment efforts were 13 times more successful with co-op graduates, recruitment costs were lower per employee ($50

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compared with $800), and nearly 80% of co-op students who were offered permanent jobs accepted them.

In the study by Harris and Hodgson (1974), both student and employer participants voiced an acceptance and approval level of more than 90% in the observed co-op program. As indicated by the 1,032 students surveyed, the most beneficial aspect of participating in a co-op was the experience gained that helped rapidly secure career positions (Harris & Hodgson, 1974).

Hamlin's (1978) study focused on the rate at which co-op graduates and non-co-op graduates secured career jobs. His research showed 63% of the co-op graduates secured a full-time job in less than one month after graduation, while only 37% of non-co-op graduates did the same. He also discovered 54.1% of co-op graduates received pay increases in the $2,501-$5,000 range while only 45.9% of non-co-op graduates earned the same amount. In addition, the co-op graduates received promotions faster (Hamlin, 1978). Another significant finding was that 61% of the co-op graduates held jobs in their major as compared with 39% of non-co-op graduates (Hamlin, 1978).

Miami University provides graduate students in communications with a cable management seminar with the purpose of improving the participating students' prospects in the job market post-graduation (Hanks & Schiller, 1984). The seminar was the result of a survey indicating employers' desire for more experienced students as career candidates (Hanks & Schiller, 1984). Cooperative education allows students to put into practice the knowledge and skills they have learned in school (Hamlin, 1978). It provides an opportunity for students to get a head start in gaining professional experience in the area of their career choice (Hamlin, 1978). Successful work experience helps students to

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develop confidence and self-worth. In our current culture, the means for proving one's worth is through successful achievement in work (McNutt, 1974).

However, most of the studies regarding co-op participation and position attainment are dated. A more recent paper that draws on data from the 1992 Canadian Survey of National Graduates found university co-op graduates of technical fields were 12% more likely to have full-time jobs at graduation than their non-co-op counterparts (Darch, 1995). Among those who were employed at the time of the survey, math and physical science graduates earned $5,490 more per year than non-co-op graduates in the same field. More recent research employing data from the 1995 Canadian Survey of National Graduates also found a co-op program led to a significant improvement in annual earnings just two years after graduation among university graduates who obtained their degrees in 1995 (Walters, 2003).

Earnings/Salary

Studies done at Pace University (New York) in the 1981-1982 academic year showed the 243 students who participated in cooperative education earned a total of $667,623, or an average of $2,692 per student (Korngold, 1983). The ultimate benefit of participating in cooperative education seems to be realized most after graduation and upon entry into the workforce. Not only do cooperative education students typically earn more than other working students, which aids in financing a college education, but also they often begin their careers with higher salaries than their peers.

A review of the literature indicates that participation in co-op, in many cases, produces higher starting salaries for participants. Several studies have shown co-op graduates command higher starting salaries than their non-participating peers (Allwell,

1978; Hamlin, 1978; Hayes & Travis, 1976; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976).

McNutt (1974) provided evidence that students who accumulated higher GPAs began careers at a significantly higher salary level than others. Her finding that co-op experiences attributed to higher GPAs can be interpreted to suggest that participation in a co-op produces higher starting salaries.

Slick and Welch (1974) compared cooperative education students' career job earnings to those of students who participated in two other work programs. Samples of 2,165 students were surveyed approximately 18 months after graduation. The findings proved that the majority of co-op students earned more than $200 weekly, while the majority of other graduates earned less than $100 per week. Other findings included that co-op students kept their employment longer, they were more satisfied with their jobs and pay, and their employers were more satisfied with them than their peers who participated in other work programs (Slick & Welch, 1974).

Hamlin (1978) provided evidence that 1974-1976 co-op graduates of Northern Virginia Community College initially earned more than non-co-op graduates from those years. His research showed 33.9% of co-op graduates earned more than $10,000 annually, while only 26.8% of their non-participating counterparts earned the same amount (Hamlin, 1978). Hayes and Travis (1976) reported that starting salaries for cooperative education graduates were 9% higher than for other college graduates.

Walsh and Breglio (1976) conducted research to assess the effectiveness of cooperative education in the nation's 100 largest urban secondary and post-secondary schools. This study was very large and encompassed just under 1,500 students from more

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than 80 different institutions who responded. Their research concluded that after graduation, both secondary and post-secondary cooperative education graduates obtained higher paying jobs than their non-participating counterparts.

An evaluation of the Marymount College Cooperative Experiential Education Program by Allwell (1978) showed the mean salary of co-op students versus non-co-op students to be substantially different. The co-op students had a mean salary of $9,595, while the non-co-op students had a mean salary of $8,434. The difference in mean salaries yielded a $\underline{t}$ score of 4.10, which was significant at the .01 level.

Rogers and Weston (1987) found 73% of the co-op engineering graduates from North Carolina State University reported salaries of at least $24,000 during the co-op, as compared with 43% of the non-co-op group. In studies by Lewis (1976) and Kingston (1970), the researchers found no difference between the initial earnings of co-op graduates vs. other graduates. Conversely, Kingston (1970) did find a positive benefit of participating in cooperative education. She found that co-op graduates received salary increases more rapidly than their counterparts (Kingston, 1970).

Walsh and Breglio (1976) found that a student's participation in cooperative education at the secondary level appeared to have little effect on the average weekly earnings of those interviewed. On the other hand, at the post-secondary level, respondents earned substantially more than their non-participating counterparts (Walsh & Breglio, 1976).

Cooperative Education by Gender

It is possible that cooperative education may have different effects upon men and women. Co-op programs may present one avenue for women to greatly lessen the effects

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of wage gap (Walters & Zarifa, 2008). Traditionally, men have been entering more technical fields of study and as a result often obtain more stable immediate employment and better paying jobs. Although men continue to be overrepresented in the fields of engineering, math, the physical sciences, and business (Zarifa, 2008), men have extended beyond these fields to enter traditionally female fields of study such as education and the social sciences. Several existing studies have found that women consistently receive positive effects on earnings and employment from various vocational education programs, while the effects for men have been more variable (Arum & Shavit, 1995; Lewis et al., 1993). To the researcher's knowledge, few if any existing studies have sought to explore the possibility of unequal returns to co-op participation according to gender. Consequently, this research provides a recent examination of the associated results for men and women.

Wilson (1987) reviewed empirical evidence that supports the assertions of co-op advocates: participation contributes to clarification of career goals, autonomy and self-confidence, awareness of interpersonal relations, and increased motivation. In addition, Wilson (1989) stated that outcome evaluations have improved through the use of more adequate instruments, more systematic methodology, and attempts to base evaluation on theory. Brown's (1984) literature review suggests that co-op participation provides students with realistic information about careers and organizations, improves their job-related skills, and gives students stronger certainty about career choice. However, Brown does cite limitations of the current research: lack of information about how co-op participation affects worker behavior, diverse types of co-op programs lumped together, and lack of theory-based evaluation. Siedenberg (1989) critiqued the quality and quantity

of research on co-op effectiveness. He identified methodological problems in the evaluation of co-op programs, such as small sample size, limitation to one discipline, limited response rate, and failure to control for the effects of grade point average among other variables. This research attempted to control for those variables.

Higher Education Accountability

In 2005, the formation of a Commission on the Future of Higher Education, known as the Spellings Commission, was motivated by the fear that the American higher education system was deteriorating and failing to prepare the American workforce for the rigors and competitiveness of the global marketplace (The United States Department of Education, 2006). The Spellings Commission final report titled *A Test of Leadership: Charting the Future of U.S. Higher Education (2006)* opens by stating, "Higher education in the United States has become one of our greatest success stories." However, it goes on to bluntly state, "Foreign higher education systems are passing us by at a time when education is more important to our collective prosperity than ever" (p. 11). Essentially, the Spellings report called for increased accountability and efficiency in higher education in the United States. An investment in higher education is one of the best investments a young person could make, an evaluation made by considering the income differential between the average high school and college graduate. The income gap between high school graduates and college graduates has increased significantly over time (College Board, 2007). The earnings benefit is large enough for the average college graduate to recoup both earnings forgone during the college years and the cost of full tuition and fees in a relatively short period of time. During a typical 40-year working life, typical college graduates with a bachelor degree earn more than 60% more than typical

high school graduates (College Board, 2007). In 2005, the typical full-time year-round

worker in the United States with a 4-year college degree earned $50,900, which is 62%

more than the $31,500 earned by the typical full-time year-round worker with a high

school diploma. Similarly, during a typical 40-year working life, college graduates with

advanced degrees such as a master's degree or doctorate earn two to three times as much

as high school graduates (College Board, 2007).

The monumental Spellings report questioned the long-held truth that an

investment in higher education is one of the best investments a young person could make,

and it asked institutions of higher education to address issues of accountability and

efficiency (The United States Department of Education, 2006). The Spellings report may

be a bit dated but its cynical view of American higher education represented the view of

legislatures, corporate leaders and other opinion leaders. It was the first signal of what

was to come that heralded declining levels of government financial support of higher

education and increased attempts to regulate higher education.

At this time of significant challenges for higher education, we must continue to

improve assessment and performance, to fight public criticism such as the Spellings

report. I see no respite from this work in the near future. The commission stated that U.S.

higher education must improve in dramatic ways such as implementing accountability

measures and proof of learning via exit testing. The yearlong examination of the

challenges facing higher education brought the conclusion that the past attainments to the

U.S. educational system have led our nation to unwarranted complacency about its future.

According to the United States Department of Education (2006):

Where once the United States led the world in educational attainment,

recent data from the Organization for Economic Cooperation and

Development (OECD) indicate our nation is now ranked 12th among major

industrialized countries in higher education attainment. Another half

dozen countries are close on our heels. And these global pressures come at

a time when data from the U.S. Department of Labor indicate

postsecondary education will be ever more important for workers hoping

to fill the fastest-growing jobs in our new economy. (p. xii)

According to the OECD (2009), in 1995 the U.S. and New Zealand led the way in

the percentage of college degree holders. By 2006 (the last year for which the OECD has

data), 11 countries had a higher percentage of either 2- or 4-year college graduates among

their 25- to 34-year-old populations.

The commission noted concern for the seemingly inexorable increase in college

costs, which have outpaced inflation for the past two decades and have made affordability

an ever-growing worry for students, families, and policymakers. Too many students are

either discouraged from attending college by the rising costs, or they take on worrisome

debt burdens in order to complete a degree. While students bear the immediate brunt of

tuition increases, affordability is also a crucial policy dilemma for those who are asked to

fund higher education, notably federal and state taxpayers. Even as institutional costs go

up, in recent years state subsidies have decreased on a per capita basis and public concern

about affordability may eventually contribute to an erosion of confidence in higher

education. The view of the authors of the Spellings Report is that affordability is directly

affected by a financing system that provides limited incentives for colleges and

universities to take aggressive steps to improve institutional efficiency and productivity (The United States Department of Education, 2006, p. 2).

The Spellings Report speaks a great deal about affordability and about the significant increases in college tuition during the past two decades. The report notes a decline in state funding during this same period, and higher education now finds itself with many mandates, almost all unfunded, placed on it by state or federal authorities. Regardless, institutions of higher education, and especially public institutions, are accountable to the state governments that support them, to the citizens of the state whose tax dollars are the source of funding, and to the students who attend (The United States Department of Education, 2006). It is the obligation of public colleges and universities to use resources wisely (The United States Department of Education, 2006).

The trend in the United States has been to move away from public support of education as a general good, and more toward a system whereby users are expected to pay more directly for the benefits they receive.

> …State funding fell to the lowest level in over two decades…The bottom line is state funding for higher education will not grow enough to support enrollment demand without higher education addressing issues of efficiency, productivity, transparency, and accountability clearly and successfully (The United States Department of Education, 2006, p. 10).

According to Arne Duncan (2009), U.S. Secretary of Education, "Governing boards and institutional leaders must move beyond the iron triangle of seemingly conflicting choices—improving quality, increasing access, and yet constraining costs—toward a culture of accountability."

The need for change is further complicated because the public does not believe

colleges need to choose among maintaining quality, expanding access, and holding down

costs (National Center for Public Policy and Higher Education, 2007, pp. 9). The

Spellings Report states higher education has not been as efficient as it could be.

"Affordability is directly affected by a financing system that provides limited incentives

for colleges and universities to take aggressive steps to improve institutional efficiency

and productivity" (The United States Department of Education, 2006, p. 10). In various

fiscal crises, however, efforts have clearly been made to eliminate or greatly reduce

inefficiencies. For example, very few campuses do not focus on enrollment management

by trying to squeeze out as many courses as possible from scarce discretionary dollars

(The United States Department of Education, 2006). It is debatable, though, whether

these efficiencies are beneficial for higher education.

According to Wartman and Savage (2008):

With little evidence the cost of college is likely to go down, parents look

for value… They compare colleges and universities in terms of housing

options, meal plans, and other quality of life factors, but they are also

keenly aware of time to graduation, career placement, and the perceived

value of a diploma from the institution. (pp. 92-93)

The terms *efficiency* and *accountability* are difficult to define in the context of

higher education, and they do not easily transfer to all contexts of university instruction.

Efficiency and accountability are difficult to assess in a traditional university education

(The United States Department of Education, 2006). The Spellings Report makes an

extremely important point: Higher education needs to perform at high levels and should

be able to prove to stakeholders it does. The Spellings Report implores higher education to be more like a business. It scolds higher education leaders for not conducting cost benefit analysis and urges the development of yardsticks for performance, accountability, and efficiency.

University administrators have long sought evidence of the effect of education on student outcomes, but the Spellings Report created a sense of urgency. Salary and wage have long been used as a quantifiable measure of educational outcomes (Allwell, 1978; Hamlin, 1978; Hayes & Travis, 1976; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976) because education influences economic growth. Denison (1985) estimates typically a quarter of the growth of output per person arises from increases in educational attainment. Along those same lines, obtaining a career boost has long been considered as a major benefit of co-op programs (Coll & Eames, 2004; Dube & Korngold, 1987; Krupar, 1987; Nielsen, 1984). The simultaneous education and work or "learning by doing" experience offered by co-op programs is widely assumed to prepare graduates for the labor market (Arum & Shavit, 1995; Bourdieu, 1998; Coleman, 1988; Coll & Eames, 2004; Dube & Korngold, 1987; Krupar, 1987; Nielsen, 1984). Thus, a study of whether colleges, and more specifically, co-op programs, produce improved employment outcomes is important.

The origins of public program evaluation and accountability can be traced to the 1800s, when the government first asked for external inspectors to evaluate public programs such as education (Stufflebeam, Madaus, & Kellaghan, 2000). In education, evaluation emerged from a tradition of testing to assess student outcomes, and it progressed through an era of specification of objectives and measurement to determine

whether the objectives had been met. Ralph Tyler (Stufflebeam et al., 2000) developed

the objectives-based model for evaluation, and Malcolm Provus (Stufflebeam et al.,

2000) developed the discrepancy evaluation model.

In 1980, Tyler developed and published a system for evaluation procedures with

specific suggestions for appropriate and adequate appraisal of objectives and unplanned

outcomes, as well as methods of analysis and interpretation (Tyler, 1980). Tyler mentions

one of the main problems with education is that educational programs "do not have

clearly defined purposes." These "purposes" as he describes them should be translated

into educational objectives. This objective-based approach to evaluation is at the core of

what Tyler proposes.

Tyler's approach to evaluation follows these steps:

1. Establish broad goals or objectives.

2. Classify the goals or objectives.

3. Define objectives in behavioral terms.

4. Find situations in which achievement of objectives can be shown.

5. Develop or select measurement techniques.

6. Collect performance data.

7. Compare performance data with behaviorally stated objectives.

Any discrepancies in performance should lead to modification, and then the cycle would

begin again (Worthen & Sanders, 1987).

The Tyler (1980) model informs the present study in several ways. This research

looks at the achievement of co-op objectives as position attainment and a higher starting

salary than non-co-op graduates. The study has selected and developed measurement

techniques in the statistical analysis conducted. At the time of the study, the performance data had already been collected by the university in the study. The results of the current study will provide information to allow university administrators to modify the co-op program for the cycle of evaluation to begin again.

Tyler's (1980) philosophy is similar to contemporary views in many ways. He describes education as a dynamic process involving the active efforts of the learner. Tyler describes education as a process of changing the behavior patterns of people. The "Tylerian" view of evaluation then becomes a process of determining the educational effectiveness of learning experiences (Bloom, Madaus, & Hastings, 1981).

Provus's (1971) discrepancy evaluation model involves the comparison of performance (P) with a standard (S). The model was designed for use in the context of program change. Provus defined evaluation as the following four stages: program change, program development, definition, and installation to the final product. Provus then added a fifth stage, cost-benefit analysis.

Cooperative Education Program Evaluation

The review of the co-op literature identified the efforts by researchers to document the non-monetary and monetary benefits of co-op programs. Siedenberg (1989) critiqued the quality and quantity of research on program effectiveness. He identified methodological problems in co-op program evaluation, such as small sample size, limitation to one discipline, limited response rate, and failure to control for the effects of grade point average, local unemployment rates, and prior work experience, among other variables.

In contrast, Wilson (1987) reviewed an accumulation of empirical evidence that lends support to the accuracy of the contentions of co-op advocates; co-op participation contributes to the clarification of career goals, autonomy and self-confidence, awareness of interpersonal relations, and increased motivation. In addition, Wilson (1989) states outcome evaluations have improved, citing the use of more adequate instruments, more systematic methodology, and attempts to base evaluation on theory.

Brown's (1984) literature review suggested that co-op participation gives students realistic information about careers and organizations, improves job-related skills, and gives students a stronger certainty about their career choice. However, she cites the following limitations of current research: lack of information about how a co-op affects worker behavior, diverse types of co-op programs lumped together, and lack of theory-based evaluation. Her study found co-op graduates have more realistic expectations about their first job, they chose jobs relevant to their career plans, and they had a greater sense of power on the job.

Leske and Persico's (1984) review of secondary cooperative vocational education research found few significant differences between co-op participants and other students as well as conflicting evidence on economic, social, personal, and equity outcomes. By identifying methodological problems, they concluded that co-op participation should not be considered a priority for all students Their formal evaluation model can be used to assess secondary co-op programs.

In general, the existing research supports the benefits of cooperative education but shows a need for improvement in program evaluation and review. Laurer and McNabb (1974) described a systematic seven-step process of assessment, which lead to the

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development of an evaluation system for cooperative education programs. McGhee (1980) outlined recommendations for summative evaluation of co-op programs, determined the scope and procedures for program evaluation, the selection of external evaluators and the collection and analysis of data for a study of a program, encouraging evaluations to be conducted for the purpose of considering future operation.

Siedenberg (1989) raised doubts regarding the validity of results based on methodological issues. He proposed an economic wage model with regression analysis to control for the effects of multiple independent variables, thus isolating the relationship between cooperative education and wages. The Siedenberg (1989) model can be expressed as follows: $W=f(H,P,L)$, where W refers to the wage rate the graduate receives (in this case, starting salary) and is a function of H (human capital), P (personal characteristics), and L (labor market conditions). H, P, and L can comprise several variables. Siedenberg (1990) used this model with a population of non-traditional students, and he found that cooperative experiences allowed students with little formal work experiences to catch up in salary with students who had previous work experiences. The model effectively demonstrated the role of cooperative education in establishing salaries among this population. Gardner (1992) later applied Siedenberg's model to a group of traditional students from the Michigan State University College of Engineering. Gardner discovered a significant positive coefficient for co-ops in the regressions, which represented a gain for co-op students in terms of starting salary.

Summary

Chapter Two presented the conceptual framework for the study, defined cooperative education as experiential learning, provided literature pertinent to the

benefits of cooperative education, and outlined the historical perspective of higher education and cooperative education accountability. The literature highlights the need to quantitatively assess educational outcomes, which forms the foundation of this study. The literature presented supports the idea that exposure to the characteristics and activities of co-op programs, either directly through student participation or indirectly through institution participation, motivates graduates to realize a connection between school and work, to pursue additional education, and subsequently to achieve positive employment outcomes. The literature points to the evaluation of employment outcomes as a method for assessing education, which leads to the methodology for the study. The following chapter provides a detailed explanation of the study methodology.

CHAPTER THREE: METHODOLOGY

Chapter Three provides a description of the methodology and procedures used in conducting this study in order to meet the objectives mentioned in Chapter One. This chapter is divided into six subsections. First, the purpose and overview are given. Second, the research questions are described. Third, the data collection and procedures are outlined. Fourth, the population and sample are explained. Fifth, the data analysis is discussed. Sixth, the summary concludes this chapter.

Purpose and Overview

The purpose of this study was to examine the relationship between cooperative education and the early employment outcomes of job attainment and starting salary of post-secondary graduates at Missouri S&T, a science and technological research university in the Midwest. The study's primary purpose was to provide quantitative evaluation of the co-op program to inform program administrators and university leadership with a description, assessment, and accountability of the co-op program in question. This is important because of the increased need for educational institutions to have accountability with the stakeholders. In addition, this research defines the university's co-op program and study objectives, as well as provides methods of assessment and the cost accounting procedures necessary for program administrators and university leaders to assess co-op programs.

The primary focus of this study is to identify whether co-op participation is related to differences in the educational outcomes of students regarding the first full-time job attainment within a student's field of study and the starting salary for the sample observed. This study investigated the relationship between co-op participation and the

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early career outcomes of Missouri S&T graduates from 2008 to 2010. Findings in previous studies regarding co-op programs led the researcher to expect an earnings advantage for co-op participants (Allwell, 1978; Hamlin, 1978; Hayes & Travis, 1976; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976). Through the use of statistical analysis, this research clarified the relationship of co-op participation and other demographic and personal attributes on early employment outcomes.

Research Design

The research design was ex-post facto, descriptive, and correlational research viewed through a postpositivist paradigm. *Ex-post facto* is Latin for *from a thing done afterward*, meaning the research took place retroactively on data already submitted and collected (ex-post facto, 2009). Kerlinger (1986) defined ex-post facto research as:

> research in which the independent variable or variables have already
> occurred and in which the researcher starts with the observation of a
> dependent variable or variables. He then studies the independent variables
> in retrospect for their possible relations to, and effects on, the dependent
> variable or variables (p. 360).

This research sought to establish correlational relationships between events and circumstances with this ex-post facto method of research. This study examined the relationship between the circumstance of participation in a co-op and early career outcomes. The ex-post facto design was appropriate because experimental manipulation was neither ethical nor possible. To study the relationship between co-op participation and starting salary at graduation, the researcher had to retroactively study what had

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happened with data collected in the past. According to Isaac and Michael (1971), an ex-post facto study yields useful information concerning the nature of phenomena.

To seek correlation, the researcher sought to identify whether a relationship existed between co-op participation and early career outcomes. According to Mertens (2009), "Relationship studies usually explore relationships… to gain a better understanding of factors that contribute to a more complex characteristic" (p. 154). Mertens (2009) advises against assuming cause and effect from correlational data because explanations other than causality may exist. Even though a strong relationship may be found between a set of variables and an outcome measure, it is not always possible to then achieve the desired outcomes by manipulating the set of prediction variables.

Mertens (2009) defined a paradigm as:

A worldview that includes certain philosophical assumptions about the nature of ethics, reality, knowledge, and systematic inquiry, i.e., axiology, ontology, epistemology, and methodology… a researcher's paradigmatic stance has implications for choices of method. For example, postpositivism typically employs a preordinate, quantitative design, which means the researcher establishes the research questions prior to data collection (pp. 451-452).

Essentially, the postpositivist paradigm allowed the researcher of this study to assume she was studying an object. Postpositivists believe the theories, hypotheses, and background knowledge held by the investigator could strongly influence what is observed. This researcher assumed she could "discover" meaning in the research through

rigorous and precise measurement, observation, dissection, disassembly, and reassembly (Nguyen, 2007). Objectivity was the standard goal, and she attempted to remain neutral by following prescribed procedures to prevent bias.

Research Questions

This study investigated the relationship between co-op participation and the early employment outcomes of graduates at Missouri S&T during 2008-2010. The following research questions were posed:

1.What are the differences in demographics and personal attributes between students who participate in a co-op and students who do not?

2.Does participation in a co-op correlate with having a job in one's field of study at graduation?

3.Does participation in a co-op correlate with a higher starting salary?

Data Collection and Procedures

The researcher secured permission from the Missouri S&T Career Opportunities and Employer Relations director and assistant director for co-ops and internships to use the ex-post facto data in the investigation. The persons participating in this study voluntarily submitted the data. The data were already collected and available, which made the data set a convenience sample.

The initial data set was obtained from the post-graduation surveys for Missouri S&T graduates in the years 2008 to 2010. The post-graduation survey data were primarily self-reported via an online survey housed on the Missouri S&T Career Opportunities and Employer Relations website. The survey went out via email to all students prior to graduation. Results were received by the director of Missouri S&T Career Opportunities

and Employer Relations and compiled by the administrative assistant. In addition, Career Opportunities and Employer Relations staff also attended graduate events such as the annual Grad Fair event and the actual graduation ceremony in an attempt to capture data by hand. The Missouri S&T Career Opportunities and Employer Relations director also annually sent the preliminary findings to department chairs asking them to supplement the findings with any departmental data submitted by faculty. From the post-grad data, the researcher was able to obtain the following data: a student number, gender, graduation date, class level, degree, major, GPA, full-time job title, full-time hire company, full-time hire location, full-time hire annual starting salary, full-time hire signing bonus, full-time hire starting date, co-op participation with full-time hire company, co-op participation with a different company, and additional offers received.

The co-op program records were compiled and kept by program staff as students registered for co-ops and updated their student records each semester. The co-op records contained a student number, class level, degree, major, GPA, co-op participation with full-time hire company, co-op participation with a different company, and additional offers received. The co-op data were checked and added to the initial post-graduation survey data.

For the current study, the post-grad data and the co-op program data were collected, compiled, checked, corrected, and then turned over to the researcher. The data set was finalized on July 1 of each year between 2008 and 2010. The final data set was checked against the institution's PeopleSoft student records for accuracy and to fill in any missing data. To isolate the students who had participated in a co-op, those students were coded with a 1. The comparison group consisted of graduating students who had not

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participated in a co-op, and these students were coded with a 0. After group assignment was made, a data set was produced with the student name and number removed and replaced with a participant number. This was done to ensure each participant's confidentiality. The final data set used in this study included the following information: participant number, gender, graduation date, class level, degree, major, GPA, full-time position attainment, full-time hire annual starting salary, and co-op participation.

Instrumentation

The primary instrument used in this study was the post-graduation survey given to Missouri S&T graduates during the years 2008 to 2010. The graduates provided self-reported data regarding job obtainment and starting salary on this post-graduation survey. Employers hired students throughout the academic year, and the data set was finalized on July 1 of each year. The dependent variables of the early career outcomes were position attainment at graduation and full-time annual starting salary. The primary independent variable was co-op participation, but additional independent variables used in the study included a student's major, graduation date, GPA, citizenship, gender, and ethnicity/race. A detailed explanation of the variables follows.

Dependent Variables

Job Attainment. The job attainment variable was taken from the student reports of job plans. The annual reporting of job plans included the following options: a) Accepted a job (with additional data then requested; b) Graduate School; c) Military; d) No Job Reported. The company name and work location were reported by the student and confirmed when possible with employer reports. The job attainment reports of a student who accepted a job were coded as a 1, while all other responses were coded as a 0.

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Full-time hire salary. Students were asked to self-report their starting salary, which was then confirmed by employers when possible. Salaries varied from one employer to another. The institution studied did not set pay rates for any participating company or agency, but it did publish the average annual salaries based on student reports for the purposes of reference, advising, marketing, and ranking of co-op programs. The full-time annual starting salary was the reported gross pay dollar amount earned by an individual per calendar year.

Independent Variables

Co-op participation. Students self-reported the co-op participation variable via the co-op registration process required by the university registrar's office and the co-op program. The students were required to register their co-op participation with Missouri S&T Career Opportunities and Employer Relations by the last day to register for classes each semester to retain their student status while they were away on co-op. Because the co-op registration was mandatory for retaining student status, the co-op participation data were accurate and complete. In contrast to the optional and self-reported full-time salary data, the co-op participation data collection was an institutional requirement. The co-op program records were compiled and kept by program staff as students registered for co-op participation and updated their student records each semester. The co-op participation data set was finalized on July 1 of each year. The co-op participation variable was coded as a 1, while non-co-op participation reports were coded as a 0. This study did not note the total number of co-ops represented or the year of co-op participation per individual student.

Major. As suggested by Astin (1997), attributes such as persistence rates vary among academic majors. Given that the majority of students at the institution studied were pursuing an engineering major or career, the academic major of the student was an important demographic variable. Students self-reported the data on a post-graduation survey that was primarily administered via an online survey housed on the institution's website. Responses for major were compared with the data sets from the institution's PeopleSoft student records and the co-op program records for accuracy. The institution studied offered more than 30 undergraduate degree programs. The individual majors represented were used for descriptive statistics to show co-op participation by individual major title. For multiple regression and logistic regression, the major fields were coded as Engineering: 0, Sciences: 1, and Other (Humanities and all other fields): 2.

Graduation date. A student's graduation date was noted in the study. Graduation date information was derived from the institution's PeopleSoft student records. The graduation dates were analyzed for the descriptive statistics to determine differences between years represented in the study. The data set of graduation dates was used in the regression analysis and logistic regression to compare the years and detect patterns. For multiple regression and logistic regression, the graduation date fields were coded as follows:

Summer 07, Fall 07, Spring 08 = Academic Year 2007/2008 = 0,

Summer 08, Fall 08, Spring 09 = Academic Year 2008/2009 = 1,

Summer 09, Fall 09, Spring 10 = Academic Year 2009/2010= 2.

GPA. Grade point average (GPA) is a widely accepted measure of academic success. GPA data were derived from the institution's PeopleSoft student records for

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accuracy. The institution in the study used a 4.0 scale for GPA. The GPA was used for descriptive statistics to show the differences between the GPA of co-op participants and non-co-op groups.

Citizenship. A student's citizenship status was noted in the study. Citizenship data was derived from the institution's PeopleSoft student records for accuracy. Citizenship data was reported as permanent resident, student visa, or U.S. citizen. The citizenship data was used for descriptive statistics to show differences between co-op participants and non-co-op groups. The citizenship data was coded as U.S. citizen: 0 and others: 1 for multiple regression and logistic regression to correlate with employment outcomes.

Gender. The gender of the students in the population was included in this study and treated as a categorical variable. Institutional data from the institution's PeopleSoft student records system was used for this variable. Gender was reported as male or female. The gender data were used for descriptive statistics to show differences between co-op participants and non-co-op groups. The gender data was coded as female: 0 and male: 1 for multiple regression and logistic regression to correlate to employment outcomes.

Ethnicity/Race. The ethnicity/race of the students in the population was included in this study and treated as a categorical variable. Institutional data from the institution's PeopleSoft student records system was used for this variable. Ethnicity/race was reported as American Indian/Alaskan Native, Asian or Pacific Islander, Black/Non-Hispanic, Hispanic, N/A, Non-Resident Alien, or White/Non-Hispanic. The data was used for descriptive statistics to show differences between co-op participants and non-co-op groups. The ethnicity/race data was coded as White/Non-Hispanic: 0 and Other: 1 for

multiple regression and logistic regression to correlate to employment outcomes. This coding was appropriate given the sample size.

<div align="center">Population and Sample</div>

The data for this study was drawn from the post-graduation surveys of Missouri S&T graduates during the years 2008 to 2010. Table 2 presents an overview of the student population and sample from Missouri S&T during the three years studied. This study used data received from 1,880 students collected during a period of three years, 2008 to 2010, of which 135 had participated in a co-op. The table includes a column of the total number of students graduating from the institution by year, thus providing a scale for the study period. The Graduates Reporting data column is comprised of the graduates who voluntarily reported data for the study across all kinds of post-school plans. The Co-op Graduates Reporting column contains the number of graduates for each year of the study who had participated in a co-op at some point during their academic career. The Non-Co-op Graduates Reporting column contains the number of graduates for each year who had not participated in a co-op at any point during their academic career. The bottom two rows of the table show the total number of students in each category, as well as the average number of students in each category. This information allows the reader to make comparisons and draw conclusions about the population and sample of the study.

As shown in the table, the number of graduates from the institution remained steady throughout the time period studied. The number of graduates who reported information declined significantly after 2008. This is likely attributed to the global recession occurring at the time and the situation of fewer jobs available after 2008.

Graduates who were unable to find jobs in 2009 and 2010 were more likely to attend

graduate school, join the military, or not report data (see Figure 6). During the study

period, 4,164 students graduated from the institution, of which 1,880 volunteered data to

be used in the study for a 45% participation rate.

Table 2 Population and Sample

Population and Sample

Year	Total Graduates	Graduates Reporting (Sample)	Co-op Graduates Reporting	Non-co-op Graduates Reporting
2007/08	1,379	711	24	687
2008/09	1,337	558	31	528
2009/10	1,448	611	80	531
Study Total	4,164	1,880	135	1,746
Average	1,338	627	45	582

Data Analysis

Quantitative research applies objective, unbiased processes to develop and test

hypotheses, guide decisions, and inform stakeholders (Patton, 1997). This study utilized

pre-existing data compiled by Missouri S&T Career Opportunities and Employer

Relations. The individuals who had and had not participated in a co-op were separated

into a comparison group. The data sets were combined and analyzed using PSAW 18

(2009) statistical analysis software. This section includes a discussion on the various data

analyses and measures used in the study. The data analyzed included a student's major,

graduation date, co-op participation, GPA, citizenship, gender, ethnicity/race, and full-

time hire annual starting salary. Data analysis for each research question is discussed in

this section. Tables with narrative descriptions of data are included in Chapter Four. The

section summarizing the results of the study includes a discussion on the type of statistical analysis used.

Procedures

The p-value for the study was set at .05 because that value has become the general standard and tradition in educational research and journals. The .05 p-value is generally viewed as the threshold value for declaring statistical significance. The *p-value* was the likelihood that the observed relationship between co-op participation and employment outcomes occurred by chance. The results are statistically significant and the variables are considered correlated if there was, at most, a 5% chance of the two variables occurring together by coincidence. If the chance of the variables occurring randomly was more than 5%, then the chance was too high to dismiss and no correlation was reported. Similarly, if the study had a smaller number of student reports, then chance would have played a larger role. The formula for determining statistical significance depends not only on the actual variables in the two groups, but also on the number of people in each group.

Research Question 1: What are the differences in demographics and personal attributes between students who participate in a co-op and students who do not?

Descriptive statistics were used to answer the research question regarding the differences between students who participate in a co-op and students who do not. Descriptive statistics such as a measure of the mean, standard deviation, and analysis of variance (ANOVA) were conducted to determine differences between the groups. Statistical significance was tested at greater than or equal to .05. The descriptive statistics provided summaries of the sample and the measures, and they formed the basis of the quantitative analysis of the data. The descriptive statistics provided a summary that

enabled comparison across categories (Field, 2005). For example, the average GPA for each group gave a descriptive sense of the mean GPA and variation.

Research Question 2: Does participation in a co-op correlate with a having a job in one's field of major at graduation?

Whether co-op participation correlated with having a job in one's field of major by graduation was answered by a logistic regression analysis. According to Field (2005), "Logistic regression is multiple regression but with an outcome variable that is a categorical dichotomy and predictor variables that are continuous or categorical. This simply means we can predict which of the two categories a person is likely to belong to given certain other information" (p. 218).

Logistic regression analysis allows for control of the regular and/or orderly differences that may exist among the subgroups when comparing co-op participation with non-co-op participation regarding the outcome measure of having a job at graduation. This was done to determine whether the inclusion of additional predictor variables led to increased prediction of the outcome variable (Field, 2005). This research used logistic regression to test the relationship between co-op participation and having a job at graduation. The regression allowed for modeling of the relationship between the predictor variables and the outcome of job attainment.

Logistic regression fits a model to predict a dependent (Y) variable, which in this research question is having a job at graduation, from two or more independent (X) variables (Field, 2005). The analysis tested the strength of the relationship between the predictor variable of co-op participation and having a job at graduation by conducting simple correlation coefficients between the variables. This researcher chose logistic

regression over correlation in order to examine more than one predictor of higher starting salary.

The goodness of fit of the model was tested with Hosmer and Lemeshow's R2 as a "measure of how much the badness of fit improves as a result of the inclusion of the predictor variables. It can vary between 0 (indicating that the predictors are useless at predicting the outcome variable) and 1 (indicating that the model predicts the outcome variable perfectly)," (Field, 2005, p. 269).

Research Question 3: Does participation in a co-op correlate with a higher starting salary?

The question of whether participation in co-op correlated with a higher starting salary was answered by a multiple regression analysis. Multivariate regression analysis allows for control of the regular and/or orderly differences that may exist among the subgroups when comparing co-op participation vs. non-co-op participation groups on the outcome measure of starting salary. This was done to determine whether the inclusion of additional predictor variables led to increased prediction of the outcome variable (Field, 2005). This research used multiple regression to test the relationship between co-op participation and the starting salary outcome. The regression allowed for modeling of the relationship between the predictor variables and the outcome of starting salary. The use of multivariate regression analysis overcame the problem of confounding effects.

Multiple regression fits a model to predict a dependent (Y) variable, which in this research is salary, from two or more independent (X) variables (Field, 2005). The analysis tested the strength of the relationship between the predictor variable of co-op participation and a higher starting salary by conducting simple correlation coefficients

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between the variables. This study used multiple regression rather than correlation in order to examine more than one predictor of higher starting salary.

The goodness of fit of the model was tested with the coefficient of determination R^2 whose main purpose is the prediction of future outcomes on the basis of other related information. R^2 is the proportion of variability in a data set that is accounted for by the statistical model. R^2 provides a measure of how well future outcomes are likely to be predicted by the model.

If the model fits the data well, then the overall R^2 value will be high, and the corresponding P value will be low (the good fit is unlikely to be a coincidence). In addition to the overall P value, multiple regression also reports an individual P value for each independent variable. A low P value means that a particular independent variable significantly improves the fit of the model. The P value is calculated by comparing the goodness-of-fit of the entire model to the goodness-of-fit when that independent variable is omitted. If the fit is much worse when that variable is omitted from the model, then the P value will be low, telling you that the variable has a significant impact on the model (Field, 2005).

<p style="text-align:center">Summary</p>

The purpose of this study was to examine the relationship between cooperative education and the early employment outcomes of job attainment and starting salary of post-secondary graduates at Missouri University of Science and Technology. The study's primary purpose was to provide quantitative evaluation of the co-op program to inform program administrators and university leadership with description, assessment, and accountability of the co-op program in question. This study used pre-existing data from

the university Career Opportunities and Employer Relations for graduates from 2008 to 2010. Data analyzed included major, graduation date, GPA, citizenship, gender, ethnicity/race, co-op participation, job attainment, and full-time annual starting salary. In addition to descriptive statistics, analysis of variance (ANOVA), multiple regression analysis, and logistic regression were used to investigate the relationships between cooperative education and early employment outcomes.

Chapter Three provided an explanation for the purpose of the study, presented the research questions, introduced the data collection procedures, discussed the sample population, and outlined the data analysis. Chapter Four presents an analysis of the data and discusses the results for each of the research questions. Chapter Five summarizes the study and presents a discussion of the findings. Conclusions from the study are presented and implications for future research are highlighted.

CHAPTER FOUR: RESULTS OF THE STUDY

The purpose of this study was to examine the relationship between cooperative education and early employment outcomes of post-secondary graduates at Missouri S&T. The study examined three years of data in order to investigate relationships between cooperative education participation and early employment outcomes of post-secondary graduates. This study used data received from 1,880 students collected during a period of three academic years, 2008 to 2010. The study's primary purpose was to provide quantitative evaluation of the co-op program to inform program administrators and university leadership with description, assessment, and accountability of the co-op program in question. The researcher compiled pre-existing data from databases managed by Missouri S&T Career Opportunities and Employer Relations. The following section includes an analysis of the findings. Results for each research question are displayed in text and/or table format. The chapter concludes with a brief summary of the findings.

Descriptive Statistics

Demographics

Table 3 provides an overview of the demographics of the institution's graduates during the study years, as well as of the study's sample for comparison purposes. The column showing the institution's graduates displays the totals for the listed demographic variables for the 4,164 students graduating from the institution during the study period. The sample column shows the totals for the listed demographic variables of the 1,880 students included in the sample during the study period. The percentage columns show scale.

To ensure that the study sample was representative of the entire population of students, the study sample (1,880) was compared with the source population (4,164) according to the stratification criteria: major, gender, and ethnicity. As seen in Table 3, the sample was closely representative of the total population for the categories of engineering majors and gender. Compared with the source population, the science majors were slightly overrepresented and the other majors were underrepresented. Similarly, the category of ethnicity was marginally dissimilar because the sample somewhat overrepresented white ethnicity and underrepresented other groups. The validity of the sample data was determined by the degree of similarities, despite some relatively minor differences, between the characteristics of the population and the sample. Given the absence of largely divergent profiles, the researcher concluded that the response rate of 45% does not indicate a bias nor invalidate the sample data (Groves, 2006). The response rate does allow for generalization of the results for the population.

Table 3 Demographics of Institution Graduates and the Study Sample

Demographics of Graduates and Sample

Demographic Variables		Institution Graduates 2008 to 2010	%	Sample	%
Major	Engineering	3,861	78%	1,491	79%
	Sciences	501	10%	274	15%
	Other	594	12%	115	6%
Citizenship	US Citizen	N/A	N/A	1,684	90%
	Other	N/A	N/A	197	10%
Gender	Female	1,084	22%	445	24%
	Male	3,872	78%	1,436	76%
Ethnicity	White	3,488	70%	1,465	78%
	Other	1,468	30%	416	22%
Total		4,164		1,880	

Table 4 gives an overview of the demographics of the study sample by

highlighting both co-op and non-co-op students. The Study Total column shows the totals

for the listed demographic variables for all 1,880 student reports included in the study.

The Co-op column shows the totals for the listed demographic variables of the 135

students who did participate in a co-op at some point during their academic career at the

institution. The Non-co-op column shows the totals for the listed demographic variables

of the 1,745 students who did not participate in a co-op. The percentage column shows

scale. The majority of students reporting did not participate in a co-op.

Table 4 Study Demographics

Study Demographics

Demographic Variables		Study Total	Co-op	Co-op %	Non-co-op	Non-co-op %
Major	Engineering	1,491	110	7.4%	1,381	92.6%
	Sciences	274	21	7.7%	253	92.3%
	Other	115	4	3.5%	111	96.5%
Citizenship	US Citizen	1,684	105	6.2%	1,579	95.8%
	Other	197	30	15.2%	167	84.8%
Gender	Female	445	20	4.5%	425	95.5%
	Male	1,436	115	8.0%	1,321	92.0%
Ethnicity	White	1,465	89	6.1%	1,376	94.9%
	Other	416	46	11.1%	370	88.9%
Study Total		1880	135	7.2%	1,746	92.8%

Position Attainment

Figures 2 and 3 provide graphic representation of the students' employment status

at the time of graduation according to student reports from the three years studied. Each

semester the current graduates voluntarily report what they intend to do after graduation.

In Missouri S&T Career Opportunities and Employer Relations, this is commonly

referred to as *firm plans*. The options for reporting plans after graduation are as follows:

accepted a job, graduate school, military, or no job reported. Figure 2 shows a graphic

representation of graduate reports of plans for the entire three-year study period. Of the

students who reported, 64% accepted a job, 18% planned to attend graduate school, 5%

entered the military, and 13% reported no job. Essentially 86.5% of students had firm

plans for after graduation.

Figure 2 2008-2010 Firm Plans Combined

Firm Plans 2008-2010

86.5% of students reporting had firm plans
BA, BA, MS, PHD
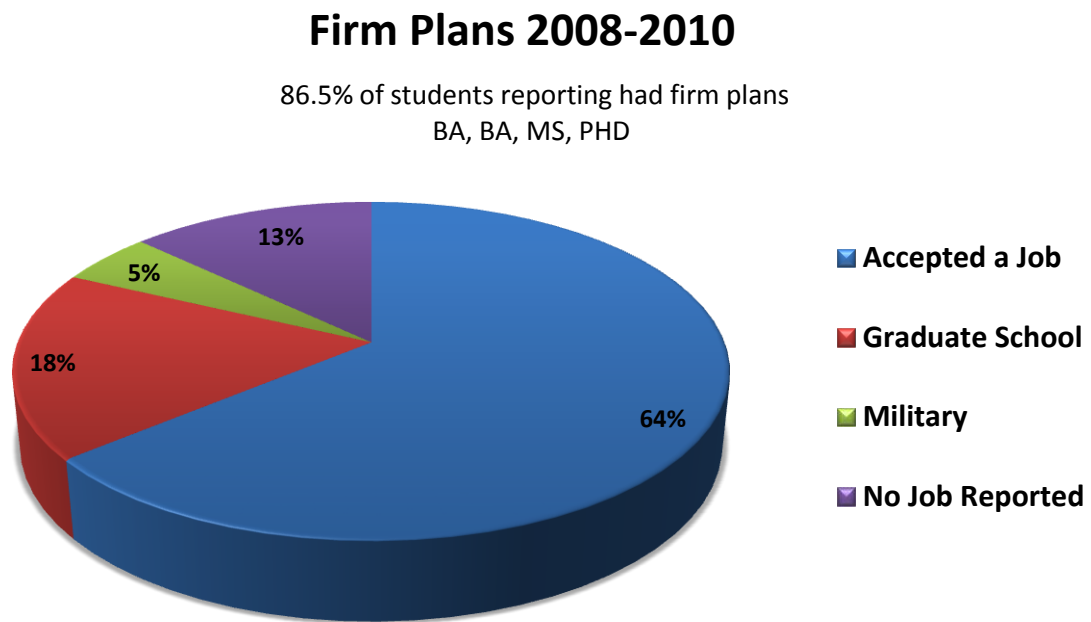
Figure 3 provides a graphic representation and comparison of the plan options as

reported by the graduates from the three years studied. The figure shows a decrease in the

percentage of students who had accepted a job by the time of graduation, according to the

student reports: 74% of graduates during the 2007 to 2008 academic year, 60% of graduates during the 2008 to 2009 academic year (a 14% decrease), and 54% of graduates during the 2009 to 2010 (a 6% decrease). The downward progression of graduates who had accepted a job corresponds with the distinct rise in students attending graduate school and reporting no job. An increase of 8% occurred in students attending graduate school for the 3 years studied and a rise of 16% of no job reported. The patterns of rise and decline mirror what was occurring in the global economic downturn during an international decline in jobs due to the global recession during the study period. The students who reported firm plans to enter the military held fairly steady.

Figure 3 Reported Firm Plans Comparison

Reported Firm Plans Comparison
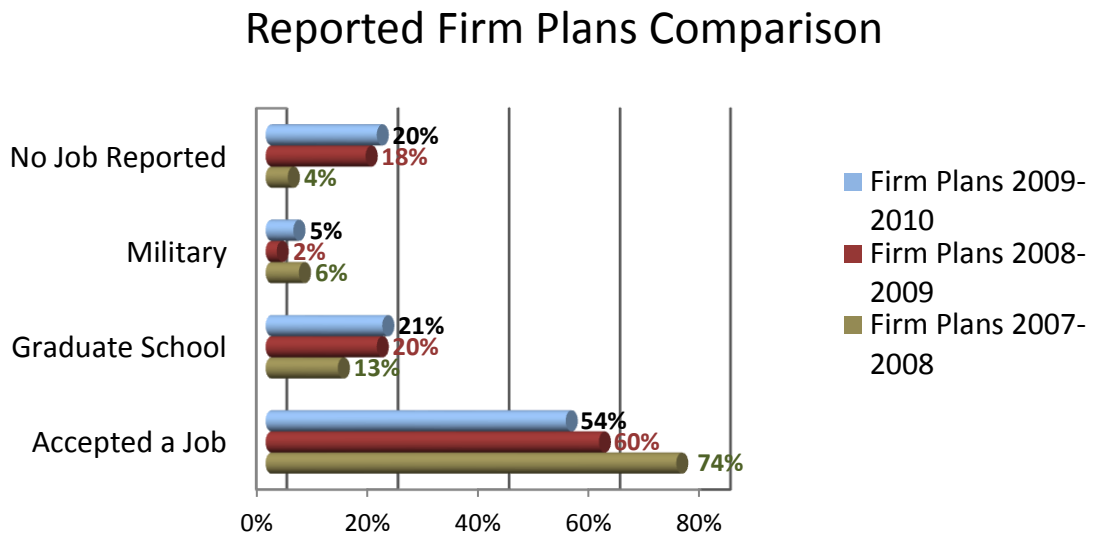
Salary

Table 5 provides an overview of the simple average salaries of undergraduate students across demographic variables during the three years studied without controlling for differences. This study utilized data received from 1,880 students collected during a period of three academic years, 2008 to 2010. In calculating the salary averages, some salary values were missing, which resulted from students submitting incomplete information. The missing values were excluded from the calculations.

The salary differences across undergraduate major groups suggest that the highest starting salaries usually go to majors requiring significant quantitative skills and in labor market shortages as well as to students who have participated in a co-op. As the table exhibits, engineering majors without co-op participation received an average starting salary offer of $56,127, while the engineering student with co-op participation received an average starting salary of $60,843, for a difference of $4,716. Science majors without co-op participation received an average starting salary offer of $52,892, while co-op science students received an average salary of $57,000, for a difference of $4,108. Non-co-op participants of other majors received an average starting salary offer of $43,251, while co-op participants of other majors received an average salary of $58,250, for a difference of $14,999. Across all majors, the undergraduate average starting salaries of co-op participants were $4,108-$14,999 higher than the average starting salaries of non-co-op participants. Regardless of the demographic variables and individual characteristics studied, students without co-op participation experience had a simple average starting salary of $55,300 while co-op participation students reported a simple average starting salary of $60,364, for a $5,064 salary advantage not controlling for differences. The

average salary analysis controlling for differences was tested specifically in Research

Question 3 and is explained in further detail in that section.

Table 5 Undergraduate Salary

Average Undergraduate Salary

Demographic Variables		Total	Co-op	Non-co-op
Major	Engineering	$56,505	$60,843	$56,127
	Sciences	$53,192	$57,000	$52,892
	Other	$44,251	$58,250	$43,251
Average GPA	Less than 3.7	$55,139	$59,115	$54,827
	Greater than 3.7	$57,475	$63,300	$56,842
Citizenship	US Citizen	$55,704	$60,561	$55,306
	Other	$54,900	$56,167	$53,000
Gender	Female	$54,272	$58,325	$54,095
	Male	$56,126	$60,641	$55,680
Ethnicity	White	$55,738	$61,034	$55,305
	Other	$55,435	$56,955	$55,266
Study Total		$55,699	$60,364	$55,300

Table 6 shows an overview of the simple average salaries of graduate students

from Missouri S&T during the three years studied without controlling for differences. As

the table exhibits, engineering majors without co-op participation received an average

starting salary offer of $62,026, while engineering students with co-op participation

received an average salary of $70,752, a difference of $8,726. Science majors without co-

op participation received an average starting salary offer of $56,599, while science

students with co-op participation received an average salary of $59,143, a difference of

$2,544. Non-co-op participants of other majors received an average starting salary offer

of $52,725, while co-op participants of other majors received an average salary of

$60,000, a difference of $7,275. Across all majors, the simple average starting salaries of

graduate students who had participated in a co-op were $2,544-$8,726 higher than the simple average starting salaries of graduate students without co-op participation without controlling for differences. Students without co-op participation experience had a simple average starting salary of $60,543, while co-op participants reported a simple average starting salary of $65,001, which is a $4,458 salary advantage without controlling for differences. The average salary analysis controlling for differences was tested specifically in Research Question 3 and is explained further in that section.

Table 6 Graduate Salary

Average Graduate Salary

Demographic Variables		Total	Co-op	Non-co-op
Major	Engineering	$62,639	$70,752	$62,026
	Sciences	$57,174	$59,143	$56,599
	Other	$53,533	$60,000	$52,725
Average GPA	Less than 3.7	$60,410	$71,504	$59,617
	Greater than 3.7	$61,387	$62,833	$61,176
Citizenship	US Citizen	$59,160	$65,000	$58,995
	Other	$62,671	$65,001	$62,184
Gender	Female	$57,580	$59,200	$57,310
	Male	$62,104	$67,638	$61,530
Ethnicity	White	$58,491	$65,000	$58,274
	Other	$62,702	$65,001	$62,289
Study Total		$61,006	$65,001	$60,543

Table 7 contains an overview of the average full-time annual salary for the entire study period as categorized by major, undergraduate, and graduate. At least three reports were needed to calculate an average in any category. The differences across majors suggest that the highest starting salaries often go to majors perceived to be more

academically rigorous or quantitatively based as well as to fields with less desirable working conditions.

Undergraduate chemical, mining, and petroleum engineering majors received starting salary offers of more than $60,000. Petroleum engineering majors were a significant outlier with average undergraduate starting salaries of $71,262, which was most likely due to the less desirable work locations in harsh environments. A surprising discovery was that undergraduate economics and physics majors also had starting salaries of more than $60,000. The undergraduate majors of english, history, and psychology received average starting salaries of less than $40,000. Graduate electrical, geological, and nuclear engineering majors received starting salaries of more than $65,000. Graduate petroleum engineering majors were a significant outlier with average undergraduate starting salaries of $80,000, which was most likely due to less desirable work locations in harsher environments. A surprising finding was that graduate geology and geophysics majors also had starting salaries of more than $65,000. Despite the variance between undergraduate salaries between majors, the starting undergraduate salaries are most impressive. According to a report by Payscale Inc. (2008), a Seattle-based research firm, Missouri S&T graduates had the highest starting salaries in the Midwest and were among the best-paid in the nation in 2008.

Table 7 2008-2010 Full-time Average Annual Salary

2008-2010 Missouri S&T Full-time Average Annual Salary

Major	Undergrad	Number	Grad	Number	Combined	Number
Aerospace Engineering	$54,879	81	$54,500	4	$54,863	85
Applied Math	$45,919	16	$43,000	2	$45,653	18

Architectural Engineering	$51,031	72	$53,000	4	$51,122	76
Biological Sciences	$47,986	53	N/A	3	$47,986	56
MBA	N/A	N/A	$52,460	6	$52,460	6
Business Administration Systems	N/A	2	$60,000	2	$60,000	4
Bus and Mgt Systems	$45,015	38	$57,000	1	$45,586	39
Ceramic Engineering	$56,219	39	$64,475	6	$57,720	45
Chemical Engineering	$62,426	104	$56,000	8	$62,200	112
Chemistry	$48,500	15	$39,000	7	$45,333	22
Civil Engineering	$49,715	136	$56,460	31	$50,488	167
Computer Engineering	$56,997	63	$61,650	20	$57,843	83
Computer Science	$57,340	54	$63,002	24	$58,755	78
Economics	$60,907	4	N/A	1	$60,907	5
Electrical Engineering	$57,136	164	$68,276	43	$58,777	207
Engineering Management	$56,052	82	$61,795	46	$57,760	128
English	$29,000	4	N/A	N/A	$29,000	4
Environmental Engineering	$53,471	22	N/A	5	$53,471	26
Geological Engineering	$48,125	12	$68,000	29	$52,100	41
Geology and Geophysics	$52,640	16	$67,500	11	$55,117	27
History	$39,125	16	N/A	N/A	$39,125	16
IST	$52,493	40	$58,536	14	$54,126	54
Interdisciplinary Engineering	$58,000	8	N/A	2	$58,000	10
Manufacturing Engineering	N/A	N/A	$59,600	9	$59,600	9
Material Science and Engineering	N/A	N/A	$63,667	10	$63,667	10
Mechanical	$57,662	236	$61,919	30	$58,049	266

Engineering						
Metallurgical Engineering	$59,829	42	$61,667	8	$59,991	50
Mining Engineering	$60,783	55	N/A	5	$60,783	60
Nuclear Engineering	$59,534	47	$65,000	10	$60,081	57
Petroleum Engineering	$71,262	33	$80,000	8	$73,009	41
Physics	$50,141	13	$44,833	4	$47,866	17
Psychology	$29,500	24	N/A	N/A	$29,500	24
Systems Engineering	N/A	1	$65,100	17	$65,100	18
Technical Communication	N/A	5	N/A	4	N/A	9
Overall Average	$55,699	1,498	$61,006	382	$56,525	1,880

Research Question 1: What are the differences in demographics and personal attributes between students who participate in a co-op and students who do not?

Co-op Participation

Table 8 exhibits the total number of undergraduate participants by year. Additionally, data in Table 8 reflect the number of co-op participants and non-co-op participants by year. The number of co-op participants reporting decreased from 21 in 2007/2008 to 17 in 2008/2009, and then increased significantly to 68 in 2009/2010 while the rate of co-op participation remained steady (see Figure 1). The change in reporting most likely occurred because of a change in staff in the co-op program. The new staff member was likely more diligent in seeking graduate survey responses from co-op students, which resulted in the increased reporting.

This research used a Pearson chi-square test for independence to investigate whether a significant relationship existed between the distribution frequencies of co-op students to non-co-op students across the years studied. The chi-square test provided an effective analysis of the relationship between the two variables by comparing the actual count with the expected count. The chi-square tests were performed to determine whether the observed percentages differed significantly from what was expected. A significant statistical difference was found between groups, which indicated that the distributions vary significantly $x^2(1) = 46.30$, $p = 0.000$.

Table 8 Undergraduate Co-op Participation by Year

Co-op Undergraduate Participation by Year			
Year	*Co-op*	*Non-co-op*	*Total*
2007/2008	21	512	533
2008/2009	17	439	456
2009/2010	68	441	509
Total	106	1,392	1,498

Table 9 presents the total number of graduate participants by year. Additionally, data in Table 9 reflects the number of co-op participants and non-co-op participants by year. This research computes the chi-square tests for independence to determine the significance of the distribution frequencies of co-op participation students to non-co-op participation students across the years. A significant statistical difference was found between groups, which indicated that the distributions vary significantly, $x^2(1) = 16.85$, $p = 0.000$. The total number of graduate students participating in a co-op during the study period was 29, ranging from a low of three graduate students in 2007/2008 to a high of 14 in 2008/2009.

Table 9 Graduate Co-op Participation by Year

Co-op Graduate Participation by Year

Year	Co-op	Non-co-op	Total
2007/08	3	175	178
2008/09	14	88	102
2009/10	12	90	102
Total	29	353	382

Table 10 demonstrates undergraduate co-op participation by major group. This research computes the chi-square tests for independence to determine the significance of the distribution frequencies of co-op students to non-co-op students across all major types. The value of Pearson's chi-square, with 2 degrees of freedom, was shown to be 6.27, with the P-value of 0.043 indicating a significant statistical difference between groups at a 0.05 significance level. Thus it can be inferred that a significant statistical difference exists between groups, which indicates that the distributions vary significantly at a 0.05 level of significance.

The undergraduate major group with the highest percentage of co-op participation was Engineering with 8% co-op participation, which was 3% higher than Science with 5% co-op participation. The major group labeled Other, which consisted of majors in the arts and humanities, had the least percentage of co-op participation with 2 percent. This finding revealed the expected results for the composition of the co-op program. These results were expected because co-op programs have been traditionally common in the fields of engineering (Hoberman, 1994). The majority of co-op participants in the study were engineers, and this was expected because of the higher number of engineers on the Missouri S&T campus.

Table 10 Undergraduate Co-op Participation by Major Type

Co-op Undergraduate Participation by Major Type

Major Type	Co-op	%	Non-co-op	%	Total
Engineering	94	8	1,102	92	1,196
Science	10	5	197	95	207
Other	2	2	93	98	95
Total	106	7	1,392	93	1,498

Table 11 demonstrates graduate co-op participation by major group. The graduate major group with the highest percentage of co-op participation was Science with 16 percent, which was 6% higher than the Other group with 10% participation. The major group of Engineering had the least percentage of co-op participation with 5 percent. This finding revealed surprising results for the composition of the graduate co-op program. The results are interesting because co-op programs have been traditionally common in the fields of engineering. The majority of the graduate co-op participants were engineers, and this was expected because of the higher number of engineers on the campus; however, the science majors participated in co-ops at a higher percentage rate. While co-op participation is still common in the engineering majors, the results indicate that the percentage of co-op participation is slightly higher among graduate students in the science fields at the institution studied.

This research computes the chi-square tests for independence to determine the significance of the distribution frequencies of co-op students to non-co-op students across major type. The value of Pearson's chi-square, with two degrees of freedom, was shown to be 6.27, with a P-value of 0.04 indicating a significant statistical difference between groups at a 0.05 significance level. Thus it can be inferred that a significant statistical

difference exists between groups indicating that the distributions vary significantly at a

0.05 level of significance.

Table 11 Graduate Co-op Participation by Major Type

Co-op Graduate Participation by Major Type

Major Type	Co-op	%	Non-co-op	%	Total
Engineering	16	5	279	95	295
Science	11	16	56	84	67
Other	2	10	18	90	20
Total	29	8	353	92	382

GPA

Table 12 shows the undergraduate co-op participation student average GPA was

3.36 and the undergraduate non-co-op participation student average GPA was 3.31. The

difference in undergraduate GPA is 0.05 with co-op participants carrying a higher GPA.

The lower GPA for undergraduate non-co-op participants was expected. The graduate co-

op participant's average GPA was 3.79, and the graduate non-co-op participant's average

GPA was 3.74. The difference in graduate GPA is 0.05 with co-op participation students

carrying a higher GPA. The higher GPA for graduate co-op participants was expected.

The combined co-op participant's average GPA was 3.45, and the non-co-op participant's

average GPA was 3.40. The difference in GPA is 0.05 with co-op participants carrying a

higher GPA. The higher GPA for co-op participants was expected because past studies

have shown co-op participants to have higher GPAs (McNutt, 1974; Spect, 1985;

Stanton, 1988). A discussion of the statistical significance of these results follows.

Table 12 GPA

GPA				
Degree Type	*Co-op Participation*	*Number*	*Mean GPA*	*Std. Dev*
Undergrad	Co-op	106	3.36	.0421
	Non-co-op	1,392	3.31	.4536
	Total	1,499	3.32	.4504
Graduate	Co-op	29	3.79	.2548
	Non-co-op	353	3.74	.2828
	Total	382	3.75	.2806
Combined	Co-op	135	3.45	.4146
	Non-co-op	1,745	3.40	.4587
	Total	1,880	3.40	.4558

Table 13 shows the statistical significance of the GPA results. The means between groups and within groups were analyzed using the analysis of variance (ANOVA) technique (Owen & Clark, 2001). Note that the undergraduate results were not significant at a 0.05 level of significance (P-value is 0.286). The graduate results were not significant at a 0.05 level of significance (P-value is 0.222). Therefore, in both categories (undergraduate and graduate), no statistically significant difference occurred (at a 0.05 level of significance) in GPA between co-op participants and non-co-op participants. The ANOVAs were confounded by the small sample, especially the co-op participation group. The problem stems from the small sample. The lack of statistically significant results does not mean that no useful interpretation of the data exists. By scanning the means between groups, an observation can be made that has practical significance. The combined co-op participant's average GPA was 3.45, and the non-co-op participant's average GPA was 3.40. The difference in GPA is 0.05 with co-op participants carrying a higher GPA. The higher GPA for co-op participants was expected because past studies

have shown co-op participants to have higher GPAs (McNutt, 1974; Spect, 1985; Stanton, 1988). Although not statistically significant, the relationship between GPA and co-op participation would be an interesting direction for future investigation involving much larger samples. Regardless, because the results of the significance test found no significant differences in GPA between the groups, then the correlation between co-op participation and GPA is inconclusive.

The analysis encountered a small sample problem that confuses the meaning of the significance statistics. Data utilized in this study was self-reported by graduates. Graduates who did not submit all of the data requested were not included in the study. Likewise, co-op participants who did not submit all the required data at graduation were excluded from the study.

Table 13 GPA Statistical Significance (ANOVA)

GPA

Degree Type	*Source*	*Sum of Squares*	*df*	*Mean Square*	*f*	*Sig.*
Undergrad	Between Groups	.511	1	.511	1.121	.290
	Within Groups	682.36	1496	.456	1.	
	Total	683.87	1497			
Graduate	Between Groups	1.765	1	1.765	1.494	.222
	Within Groups	448.91	380	1.181		
	Total	450.68	381			

Citizenship

Table 14 shows the differences in co-op participation between the citizenship groups. The citizenship group with the highest percentage of co-op participation was

94

Other with 15% representation, which was 9% higher than U.S. Citizen with 6 percent.

This finding revealed interesting results for the composition of the co-op program. The

Other group was expected to be high because co-op participation provides a fairly easy

avenue for non-U.S. citizens seeking employment in the U.S. Non-U.S. citizens are

eligible for co-op participation after completing nine months of studies, and with

academic department approval. Non-U.S. citizen students are eligible to apply for up to

12 months of Curricular Practical Training (CPT), which allows them to accept internship

or co-op positions prior to graduation. CPT is approved and issued by the Missouri S&T

International Affairs Office, and applications can be processed within one week.

Employers do not need to sponsor international students for co-op or internship

employment. Essentially, co-op participation provides international students with a much

easier avenue to employment than seeking a work permit.

A chi-square test for independence was performed in order to determine the

significance of the distribution frequencies of co-op participants to non-co-op

participants. The value of Pearson's chi-square, with 1 degree of freedom, is 21.38 with a

P-value of 0.000. This indicates a significant statistical difference between groups at a

0.05 level of significance. Thus it can be inferred that a significant relationship exists

between groups, which indicates that the distributions vary significantly.

Table 14 Citizenship

Citizenship

Citizenship	Co-op	%	Non-co-op	%	Combined	%
US Citizen	105	6	1,578	94	1,683	90
Other	30	15	167	85	197	10
Total	135	7	1,745	93	1,880	

Gender

Table 15 delineates which gender had the most co-op participation. Males had the

highest percentage of co-op participation with 8 percent, which was 4% higher than

females who had 4% participation. This finding was expected because of the higher

prevalence of males on the Missouri S&T campus (roughly 80 percent). Pearson's chi-

square tests for independence were performed to determine significance of the

distribution frequencies of co-op participants to non-co-op participants. The value of

Pearson's chi-square, with 1 degree of freedom, was shown to be 6.31, with a P-value of

0.012. This indicates a statistical difference between groups at a 0.05 level of

significance. Results can be stated that a significant relationship exists between groups,

which indicate that the distributions vary significantly.

Table 15 Gender

Gender

Gender	Co-op	%	Non-co-op	%	Combined	%
Male	115	8	1,320	92	1,435	76
Female	20	4	425	96	445	24
Total	135	7	1,745	93	1,880	

Ethnicity/Race

Table 16 shows which ethnicity/race group had the most co-op participation. The

Other group had the highest percentage of co-op participation with 11 percent, which was

5% higher than White, Non-Hispanic with 6 percent. This finding was somewhat

expected yet provided interesting insight into the composition of the co-op program. The

Other group was expected to be somewhat higher for the same reasons that were

indicated in the discussion of citizenship. The co-op program provides a fairly easy

avenue for non-U.S. citizens seeking employment in the U.S. by utilizing Curricular

Practical Training (CPT), which allows them to accept internship or co-op positions prior

to graduation. In addition, many employers will actively seek out Non-White students for

co-op participation to increase the diversity of their co-op programs in hopes of

eventually increasing the diversity of their work force.

This research computed the chi-square tests for independence to determine the

significance of the distribution frequencies of co-op participants to non-co-op

participants. The value of Pearson's chi-square, with 1 degree of freedom, was shown to

be 12.05, with a two-tailed significance level of .001, or p=.001 indicating that a

statistical difference did exist between groups. A significant difference was found

between the groups when using the alpha level of 0.05 as the criterion to identify the

significance. Results can be stated that a significant relationship was found between

groups, indicating that the distributions vary significantly. The chi-square test of

independence of the relationship between ethnicity/race and co-op participation found a

statistically significant relationship between the variables.

Table 16 Ethnicity/Race

Ethnicity/Race

Ethnicity/Race	Co-op	%	Non-co-op	%	Combined	%
White, Non-Hispanic	89	6	1,375	94	1,464	78
Other	46	11	370	89	416	22
Total	135	7	1,745	93	1,880	

Research Question 2: Does participation in a co-op correlate with a having a job in one's

field of major at graduation?

Research question 2 was investigated by a logistic regression to model the

probability of a student being employed full-time in their field of major at graduation as a

function of individual characteristics. The dependent variable is the respondents' full-

time employment status at graduation. Table 17 shows the odds ratio, standard errors, and

overall percentage correct for the regression of full-time employment status. According to

Fields (2009):

Crucial to the interpretation of logistic regression is the value of the odds

ratio (Exp(B)), which is an indicator of the change in odds resulting from a unit

change in the predictor. . . . The odds of an event occurring is defined as the

probability of an event occurring divided by the probability of that event not

occurring.

The estimates in Table 17 represent the odds of being employed full-time relative

to not being employed full-time. The odds ratio is interpreted in terms of the change in

odds. Essentially, an odds ratio of less than 1 indicates an inverse relationship between

the predictor variable and the outcome variable (obtaining a job at graduation). An odds

ratio of greater than 1 indicates a positive relationship between the predictor variable and

the outcome variable of obtaining a job at graduation. An odds ratio of 1 indicates no

relationship between the predictor variable and the outcome variable.

The first model (column 1) predicts job attainment using an indicator of co-op

participation, without any other covariates. Thus, the coefficient for co-op participation

98

represents the mean difference in the odds of being employed between students who participated in a co-op and those who did not. The second model (column 2) includes the control variables representing the educational characteristics of the student, including major type and GPA. The third model (column 3) adds demographic variables to control for ethnicity/race, gender, and citizenship. The fourth model (column 4) adds labor market measures determined by the year of graduation.

In general, the results of model 1 indicate a positive relationship between co-op participation and obtaining a job at graduation. The odds of a co-op participant obtaining a job at graduation are 1.18 times higher than for those who did not participate in a co-op. Adding measures of educational characteristics to the models (moving from model 1 to model 2) reduces the odds of job attainment to 1.16 (model 2), and additional covariates further reduce the odds to 1.15 (model 3). Interestingly, adding labor market covariates increases the odds of job attainment for co-op participants to 1.49 (model 4).

Analysis of model 4 shows that co-op participation had a statistically significant positive relationship with the likelihood of a student being employed at graduation. The interpretation of the odds is that the odds of a co-op participant are 1.49 times higher than those of a non-co-op participant when all the other variables were held constant. This finding was expected given the available literature, which found that getting a job is a major benefit of co-op participation because of more successful recruitment efforts, lower recruitment costs, and a higher percentage of co-op students who accept permanent job offers with their co-op company (Hamlin, 1978; Hanks & Schiller, 1984; Harris & Hodgson, 1974; Patterson & Mahoney, 1985).

Further analysis of model 4 shows that having an engineering major had a statistically significant positive effect on job attainment, but that science and other majors did not have a statistically significant effect on getting a job. Engineering major students had an odds ratio that was 2.70 larger than the other majors except for science when the other factors were held constant. Science majors had an odds ratio that was 1.40 larger than the other majors except for engineering. The finding that having an engineering major had a positive effect on job attainment was expected based on the conceptual framework of human capital theory, a branch of economics that analyzes the process of investment in individuals (Siedenberg, 1989). The human capital view emphasizes differences among people rather than differences among jobs. The basic operational concept of this work is the human capital earnings function. Significant explanatory variables of earnings have proven to be measures of the stock of human capital (e.g., quantity and quality of schooling, on-the-job training, and experience), as well as a vector of personality, attitudinal, and psychological characteristics (e.g., age, sex, ability, and socioeconomic status of parents) (Siedenberg, 1989). Essentially, supply and demand play a role in that engineers are in high demand and thus have higher odds for job attainment at graduation. Additionally, science majors tend to attend graduate school rather than seek full-time employment. However, this is mere supposition, and further research and evidence is needed before any firm explanation is reached.

GPA did not have a statistically significant effect on the odds for job attainment. Essentially, the odds ratio of .98 indicates an inverse relationship

between the GPA and the outcome variable of obtaining a job at graduation. This finding was surprising but consistent with a Norwood and Henneberry (2006) study that GPA was one of the least important items in the attributes affecting salary. Employers surveyed in the Norwood and Henneberry (2006) study stated that a candidate's character, passion and dedication toward career goals, and relevant job experience are the most important factors in job attainment.

Ethnicity/race effects on salary were not statistically significant. The odds ratio of 1.10 indicates virtually no relationship between ethnicity/race and the outcome variable of obtaining a job at graduation. The analysis reveals no overt bias in job attainment regarding ethnicity/race. This researcher believed that the insignificant ethnicity/race effects could indicate equality between the races regarding job attainment. This is mere conjecture, though, and further research and evidence is needed before any firm explanation is reached.

Gender had no statistically significant effect on the odds of job attainment. The odds of a male obtaining a position at graduation are .97 which indicates no overt bias in job attainment regarding gender. This researcher believed that the insignificant gender effect could indicate equality between the genders regarding job attainment. This researcher was expecting for females to have higher odds for job attainment specifically in male-dominated majors by reasoning that the female gender would have an edge because of supply and demand. This researcher believed that employers would actively seek to diversify their workforce by evening out the gender ratio, i.e., by adding more females. However, this was not the case.

Citizenship did not have a statistically significant effect on the odds of job attainment. The odds of a student who is a U.S. citizen or permanent resident obtaining a job at graduation are .90 indicating no relationship.

Labor market (graduation year) effects on the odds of job attainment were statistically significant. The odds ratio of .46 for 2007/2008 and .33 for 2008/2009 indicate a decreasing inverse relationship between the labor market and obtaining a job at graduation. This researcher hypothesized that this was because the study period occurred simultaneously with the beginning and deepening of a global recession (Roubini, 2009). Again, this is mere supposition, and further research and evidence is needed before any firm explanation can be reached. In closing, interpretation of the Correct Classification percent in the last row of Table 17 indicates that the correct classification ranged from 66 to 68 percent, with the highest correct classification for model 4.

Table 17 Summary of Coefficients (Exp(B)) from Logistic Regression of Salary

(Standard Errors in Parentheses)

Variable	Model 1	Model 2: Adds Education	Model 3: Adds Demographics	Model 4: Adds Labor Market
Co-op	1.18	1.16	1.15	1.49*
	(.20)	(.20)	(.20)	(.21)
Education:				
Major				
Engineering		2.61**	2.60**	2.70**
		(.20)	(.20)	(.21)
Science		1.48**	1.47	1.40
		(.23)	(.23)	(.23)
GPA		.97	.96	.98
		(.11)	(.11)	(.12)
Demographics:				
Race			.91	.91
			(.16)	(.16)
Gender			1.0	1.03
			(.12)	(.12)
Citizenship			1.04	1.11
			(.22)	(.23)
Labor Market:				
2007/2008				.46**
				(.13)
2008/2009				.33**
				(.13)
Correct Classification %	66	67	67	68

Note: Sample size is 1,881. *p<.05; **p<.01.

Research Question 3: Does participation in a co-op correlate with a higher starting

salary?

In order to determine the correlation of participation in a co-op with a higher

starting salary while considering the effects of demographics, personal characteristics,

and the labor market, a set of regression models was run where the response variable was

earnings in the form of natural log transformed annual salary. Table 18 contains the

results of regressions estimating the association between co-op participation, demographics, personal characteristics, and initial earnings. The interpretation of coefficients is that a one-unit change in the independent variable results in a percent change in the expected value of the starting salary dependent variable while holding all the predictors constant. The first model (column 1) predicts annual salary using an indicator of co-op participation, without any other covariates. Thus, the coefficient of co-op participation represents the mean difference between students who participated in a co-op and those who did not. The second model (column 2) includes control variables representing the education characteristics of the student, including major type and GPA. The third model (column 3) adds demographic variables to control for ethnicity/race, gender, and citizenship. The fourth model (column 4) adds labor market measures determined by the year of graduation.

In general, model 1 results indicate that students who participate in a co-op earn higher starting salaries than students who do not participate in a co-op. Co-op participation resulted in a positive impact on the natural log transformed salary of 0.09, or a 9% larger salary than non-co-op participation students. Adding measures of educational characteristics to the estimation models (moving from model 1 to model 2) maintains the co-op participation coefficient at 9% (model 2), and additional covariates reduce the coefficient to 7% (model 4). Interestingly, removing labor market covariates slightly increases the estimated co-op participation benefit to salary to 8% (model 3).

The functional relationship between salary and independent variables is complicated. The multiple regression statistically controls for the other variables, but any omitted variables that are unobservable create a problem. Every time a variable was

added to the multiple regression, the effect of co-op participation was reduced and the coefficient of determination (R^2) increased. Many other factors and variables correlate with a higher starting salary than just co-op participation. For example, Norwood and Henneberry (2006) found that employers believe a candidate's character, passion and dedication toward career goals, and relevant job experience are very important attributes and that GPA is one of the least important. Thus, salary may very well depend upon factors such as character, passion and dedication, or innate ability and motivation, which are difficult to measure. The difficult-to-measure factors may have important effects on starting salary that are unaccounted for in this study and may have biased the results. This study assumed that observed variables such as major and GPA would serve as adequate proxies for unobserved or omitted variables. According to Norwood and Henneberry (2006), students can be described as a collection of tangible attributes such as major, grades, and experience, as well as less tangible attributes such as character, communication skills, and work ethic. Students can signal intellectual ability by obtaining a difficult major and/or achieving a high GPA. Others may choose to market themselves by obtaining work experience, which can signal a high work ethic (Norwood & Henneberry, 2006).

Analysis of model 4 shows that co-op participation had a statistically significant positive effect on salary. The interpretation of the co-op participation coefficient is that participation in a co-op results in a 7% change in the expected value of salary when all the other variables were held constant. Essentially, the findings conclude that the effect of co-op participation is positive but that this effect decreases when the abilities and other individual characteristics of students are controlled. Thus, the true effect of co-op

participation may not be as large as initially indicated because successful students tend to participate in co-ops. For example, in the study sample an examination of the co-op participation by major (Table 13) shows the highest percentage of co-op participation was Engineering with 8 percent, followed by Science with 5 percent, and the major group labeled Other, consisting of the arts and humanities, carrying only 2% of co-op participation. Considering GPA, which is a common indicator of student ability, this study found no significant differences in GPA between groups even though the combined co-op participation student average GPA was 3.45 and the non-co-op participation student average GPA was 3.40 (Table 14). A higher GPA for co-op participants was expected because past studies have shown co-op participants to have higher GPAs (McNutt, 1974; Spect, 1985; Stanton, 1988). Regardless, the ultimate finding that co-op participation has a positive effect on salary was to be expected because the review of the literature indicated repeated research efforts have established that co-op participants enjoy a salary advantage over their peers (Allwell, 1978; Hamlin, 1978; Hayes & Travis, 1976; Gardner, Nixon, & Motschenbacher, 1992; Rogers & Weston, 1982; Seidenburg, 1990; Stanton, 1988; Walsh & Breglio, 1976).

Further analysis of model 4 shows that a student's major had a statistically significant positive effect on salary. Engineering major students had 23% higher starting salaries than other majors except for science when the other factors were held constant. Engineering majors saw 8% higher salaries than science majors. Science majors had 15% higher starting salaries than other majors except for engineering. The finding that major had a positive effect on salary was expected based on the conceptual framework of human capital theory, a branch of

economics that analyzes the process of investment in individuals (Siedenberg, 1989). The human capital view emphasizes differences among people rather than differences among jobs. The basic operational concept of this work is the human capital earnings function. Significant explanatory variables of earnings have proven to be measures of the stock of human capital (e.g., quantity and quality of schooling, on-the-job training, and experience), as well as a vector of personality, attitudinal, and psychological characteristics (e.g., age, sex, ability, and socioeconomic status of parents) (Siedenberg, 1989). Further, Norwood and Henneberry (2006) held that students can signal intellectual ability by obtaining a difficult major.

GPA also had a statistically significant positive effect on salary. A one-unit change in GPA, for example going from a 3.0 to 4.0 GPA, resulted in a 7% increase in salary. This finding was consistent with the studies by Barkley (1991); Barkley, Stock, and Sylvius (1999); and Norwood and Henneberry (2006). Norwood and Henneberry (2006) held that students can signal intellectual ability by achieving a high GPA. Incidentally, Norwood and Henneberry (2006) found the value of increasing one's GPA from a 3.0 to 4.0 increased the starting salary by $1,397, but that GPA was one of the least important items in the attributes affecting salary. Employers surveyed in the Norwood and Henneberry (2006) study stated that the most important attributes affecting salary are a candidate's character, passion and dedication toward career goals, and relevant job experience.

Ethnicity/race effects on salary were not statistically significant. Considering the demographic factors, white students had 2% higher starting salaries than other students, but again these results were not statistically significant and did not make a significant contribution to predicting the salary outcome. The analysis reveals no overt bias in salary regarding ethnicity/race. This researcher believed that the insignificant ethnicity/race effects could indicate equality between the races in starting salary. This is mere conjecture; further research and evidence are needed before any firm explanation could be reached.

Gender had a statistically significant positive effect on salary. Males had 3% higher starting salaries than females. This finding was disappointing in that equality would be the preferred result, but the results were consistent with other findings. The findings were in line with the research of others. Gerhart (1988) found that men had 6% higher current salaries and suggested that the bulk of the salary disadvantage of women could be attributed to a one-time salary shortfall incurred at the time of hire. Gerhart (1988) determined that differences in one's college major explained much of the starting salary advantage for men, but an unexplained 5% advantage in starting salaries remained.

Citizenship had a statistically significant positive effect on salary. U.S. citizens had 5.9% higher starting salaries than other citizenship status students. This finding was expected because visa holders (which consist of non-U.S. citizen or non-permanent residents) cost more to hire due to certain cost and fees that may be incurred that the employer must pay. This researcher hypothesized that employers might compensate for the additional expense of hiring visa holders by offering lower starting salaries to recoup

the expected sponsorship expenses. However, this is conjecture, and additional research and evidence are needed before any firm explanation is reached.

Labor Market (graduation year) effects on salary were not statistically significant. The effects of labor markets in terms of graduation year results were minimal. This finding was interesting if not surprising because the study period covered the beginning of a global recession. This researcher would not have been surprised to find negative labor market effects on salary. Regardless, the labor market did not affect starting salaries. This researcher hypothesized that this was because of the stable high demand for engineers and scientists, which made up the majority of the study population. Again, this is a hypothesis, and further research and evidence are needed before any firm explanation is reached. In closing, interpretation of the R^2 coefficient of determination in the last row of Table 18 indicates that model 4 explained 18% of the original variance.

Table 18 Summary of Coefficients from Multiple Regression of Salary (Standard Errors in Parentheses)

Variable	Model 1	Model 2: Adds Education	Model 3: Adds Demographics	Model 4: Adds Labor Market
Co-op	.09**	.09**	.08**	.07**
	(.02)	(.02)	(.02)	(.02)
Education:				
Major				
Engineering		.24**	.23**	.23**
		(.03)	(.03)	(.03)
Science		.16**	.14**	.15**
		(.03)	(.03)	(.03)
GPA		.08**	.07**	.07**
		(.01)	(.01)	(.01)
Demographics:				
Ethnicity/Race			.02	.02
			(.02)	(.02)
Gender			.03*	.03**
			(.01)	(.01)
Citizenship			.06*	.06**
			(.02)	(.02)
Labor Market:				
2008/2009				.01
				(.01)
2009/2010				.02
				(.01)
R^2	.02	.16	.18	.18

Note. Sample size is 993. *$p<.05$; **$p<.01$.

Alternative Treatments of Ethnicity/Race

In order to allow for a finer analysis of ethnicity/race two alternative models (Models 5 and 6) were estimated to allow for alternative constructions of the ethnicity/race variable. In the original dataset, ethnicity/race was reported as American Indian/Alaskan Native, Asian or Pacific Islander, Black/Non-Hispanic, Hispanic, N/A, Non-Resident Alien, or White/Non-Hispanic. In the original construction of the

ethnicity/race variable, all categories besides White/Non-Hispanic were coded as 1, thus the interpretation of the ethnicity/race variable in Model 4 grouped domestic and international students of races other than White/Non-Hispanic together. This potentially confounds the interpretation of the ethnicity/race variable due to international students being grouped with domestic minority students.

In Models 5 and 6, the interpretation of the ethnicity/race variable becomes associated with domestic minority students by recoding non-US citizens to zeros. Due to the inclusion of a separate citizenship variable, they are effectively separated into their own reference group in the estimated regression models. The treatment of ethnicity in Model 6 takes this a step further by identifying domestic Asian or Pacific Islander students with White/Non-Hispanic students. Table 19 delineates the ethnicity/race interpretations of each model.

Table 19 Summary of Ethnicity/Race Interpretations of Models

Model #	0	1
Model 4	White/Non-Hispanic	American Indian/Alaskan Native Asian or Pacific Islander Black/Non-Hispanic Hispanic N/A Non-Resident Alien
Model 5	Non-Resident Alien White/Non-Hispanic	American Indian/Alaskan Native Asian or Pacific Islander Black/Non-Hispanic Hispanic N/A
Model 6	Non-Resident Alien US Citizen Asian or Pacific Islander White/Non-Hispanic	American Indian/Alaskan Native Non-US Citizen Asian or Pacific Islander Black/Non-Hispanic Hispanic N/A

Table 20 presents cross-tabulations showing how changing the ethnicity/race interpretation altered the number of observations in each ethnicity/race and citizenship categories. Model 4 included 403 in the Other category of the ethnicity/race variable. Model 5 included 209 in the Other category after removing the non-US citizens. Model 6 included 181 in the Other category after removing the Asian and Pacific Islanders.

Table 20 Ethnicity/Race and Citizenship Cross Tabulation Results

Model #	Citizen Code	Ethnic Code: White	Ethnic Code: Other	Total
Model 4	USA	1407	210	1617
	Other	1	193	194
	Total	1408	403	1811
Model 5	USA	1408	209	1617
	Other	194	0	194
	Total	1602	209	1811
Model 6	USA	1436	181	1617
	Other	194	0	194
	Total	1630	181	1811

The researcher re-ran the logistic regression analysis for Research Question 2 (results follow in Table 21) and the multiple regression analysis for Research Question 3 (results follow in Table 22). The relationship between co-op participation and the early employment outcomes of job attainment and starting salary did not change in Models 4-6 for either research question. Thus, the conclusions with respect to the primary research questions of this study remain unchanged after alternative treatments of the ethnicity/race variable. The ethnicity/race and citizenship coefficients changed slightly but none of the ethnicity/race results were statistically significant in any of the models in any of the regressions. In conclusion, the changes to the interpretation of ethnicity/race did not change the research results.

Table 21 Summary of Coefficients (Exp(B)) from Logistic Regression of Salary

(Standard Errors in Parentheses) with Alternative Treatments of Ethnicity/Race

Variable	Model 4: Adds Labor Market	Model 5: Ethnicity/Race 2	Model 6: Ethnicity/Race 3
Co-op	1.49*	1.49*	1.49*
	(.21)	(.21)	(.21)
Education:			
Major			
Engineering	2.70**	2.70**	2.70**
	(.21)	(.21)	(.21)
Science	1.40	1.40	1.40
	(.23)	(.23)	(.23)
GPA	.98	.98	.98
	(.12)	(.12)	(.12)
Demographics:			
Ethnicity/Race	1.10	1.10	1.05
	(.16)	(.17)	(.18)
Gender	.97	.97	.97
	(.12)	(.12)	(.12)
Citizenship	.90	.99	.98
	(.23)	(.17)	(.17)
Labor Market:			
2007/2008	3.03**	3.03**	3.03**
	(.13)	(.13)	(.13)
2008/2009	1.40**	1.40**	1.40**
	(.13)	(.13)	(.13)
Correct Classification %	68	68	68

Note: Sample size is 1,881. *p<.05; **p<.01.

Table 22 Summary of Coefficients from Multiple Regression of Salary (Standard Errors in Parentheses) with Alternative Treatments of Ethnicity/Race

Variable	Model 4: Adds Labor Market	Model 5: Ethnicity/Race 2	Model 6: Ethnicity/Race 3
Co-op	.07**	.07**	.07**
	(.02)	(.02)	(.02)
Education:			
Major			
Engineering	.23**	.23**	.23**
	(.03)	(.03)	(.03)
Science	.15**	.15**	.15**
	(.03)	(.03)	(.03)
GPA	.07**	.07**	.07**
	(.01)	(.01)	(.01)
Demographics:			
	.02	.02	.02
Ethnicity/Race	(.02)	(.01)	(.02)
Gender	.03**	.03**	.03**
	(.01)	(.01)	(.01)
Citizenship	.06**	.07**	.07**
	(.02)	(.02)	(.02)
Labor Market:			
2008/2009	.01	.01	.01
	(.01)	(.01)	(.01)
2009/2010	.02	.02	.02
	(.01)	(.01)	(.01)
R^2	.18	.18	.18

Note. Sample size is 993. $*p<.05$; $**p<.01$.

Summary

Analysis of the pre-existing data recorded by Missouri S&T Career Opportunities and Employer Relations provided a comprehensive examination of the relationship between cooperative education and employment outcomes for graduates at a mid-western science and technological research institution. Quantitative statistical analysis tests were used to determine significant differences in the students who participated in a co-op and

students who did not in regard to major, class level, GPA, citizenship, gender, and ethnicity/race. Logistic and multiple regression analysis were used to determine what variables correlated with the early employment outcomes of job attainment and higher starting salary. The final chapter to follow discusses the implications of the results, formulates conclusions, makes inferences, and suggests recommendations for further study.

CHAPTER FIVE: DISCUSSION

This study examined the relationship between cooperative education and early employment outcomes of post-secondary graduates at Missouri S&T, a science and technological research university in the Midwest. Chapter Five provides a summary of the research, presents the findings, and provides discussion of the conclusions and implications for theory and practice as well as recommendations for future research.

Summary of the Study

The purpose of this study was to examine the relationship between cooperative education and early employment outcomes of post-secondary graduates at Missouri S&T beginning in 2008 and continuing through 2010. Data comparisons were made between students who had and had not participated in a co-op by utilizing pre-existing data from databases managed by Missouri S&T Career Opportunities and Employer Relations.

The findings presented in this study are useful in making decisions regarding the co-op program. Continued funding and further evolution of the co-op program and Missouri S&T Career Opportunities and Employer Relations may be informed by the findings of this study. An effective analysis of the data can prove useful for validation of the co-op program. This research has potential use for stakeholders, including university administrators, when attempting to meet the requirements for increased accountability. Additionally, this study has implications for future research on the co-op program and educational outcomes. Future research conducted using statewide, regional, or national data could determine if the results can be generalized to other universities.

Findings

This study used data received from 1,880 students collected during a period of three academic years, 2008 to 2010, of which 135 students had participated in a co-op. Descriptive statistics are provided, along with findings organized under each of the three research questions. In addressing each question, this researcher reports findings from the data obtained from databases managed by Missouri S&T Career Opportunities and Employer Relations. Most of the comparisons are statistically significant; however, the differences are larger for some contrasts than others.

Research Question 1 - What are the differences in demographics and personal attributes between students who participate in a co-op and students who do not?

The answer to the question of what are the differences in demographics and personal attributes between students with and without co-op experience was answered by studying the contrasts on the variables included in this study between co-op participants and non-co-op participants. Contrasts on the variables included in this study between students with and without co-op experience are provided in chapter four. All of the comparisons between groups were statistically significant with the exception of GPA.

The lack of statistically significant GPA results does not mean that no useful interpretation of the data exists. By scanning the means between groups, an observation can be made that has practical significance. The combined co-op participant average GPA was 3.45, while the non-co-op participant average GPA was 3.40 (Table 12). The difference in GPA is 0.05, with co-op participants carrying a higher GPA. The higher GPA for co-op participants was expected because past studies have shown co-op participants to have higher GPAs (McNutt, 1974; Spect, 1985; Stanton, 1988). Although

not statistically significant, the relationship between GPA and co-op participation would be an interesting direction to pursue for future investigation involving much larger samples. Regardless, because the results of the significance test find no significant differences in GPA between groups, then the correlation between co-op participation and GPA is inconclusive.

This study provided a valuable description of the co-op participation demographic. The largest numbers of co-op participants occurred during the 2009/2010 academic year. This was most likely because of a combination of changes in the co-op program staff and in the global economy (Tables 8 and 9). In the examination of co-op participation by major group, the study shows the highest percentage of co-op participation was from Engineering majors (8 percent), which was 3% higher than that of Science majors (5 percent). The major group labeled Other, which consisted of the arts and humanities, represented the least percentage of co-op participation (2 percent). These results were expected because co-op programs have been traditionally common in the fields of engineering, and in addition Missouri S&T has a high number of engineers on the campus. Likewise, the study results show the highest rate of participation in a co-op occurs in the following categories: Non-U.S. Citizen, Male, and Non-White.

These findings connect to the conceptual framework of human capital theory in how they allow for analysis of the process of investment in individuals (Siedenberg, 1989). The basic operational concept of this work is the human capital earnings function. Significant explanatory variables of earnings have proven to be measures of the stock of human capital (e.g., quantity and quality of schooling, on-the-job training, and experience), as well as a vector of personality,

attitudinal, and psychological characteristics (e.g., age, sex, ability, and socioeconomic status of parents) (Siedenberg, 1989). Some researchers argue that co-op participation provides a mode of differentiation for employers, signaling high academic ability, moral reasoning, social and personal responsibility, empathy and complexity, connectedness, specific experience, and a professional persona (Ascher, 1994; Stern et al., 1997).

Research Question 2 – Does participation in a co-op lead to a job in one's field of

study at graduation?

The answer to the question of whether co-op participation leads to a job in one's field of study at graduation was answered by a logistic regression where the response variable was job attainment at graduation. The estimates in Table 17 represent the odds of being employed full-time relative to not being employed full-time. Analysis of Model 4 shows that co-op participation had a statistically significant positive effect on job attainment. The interpretation of the findings is that the odds of a co-op participant having a job at graduation are 1.49 times higher than those of a student who did not participate in a co-op when all the other variables were held constant.

Further analysis of Model 4 shows that engineering majors had a statistically significant positive effect on job attainment, but that science and other majors did not have a statistically significant effect. Engineering major students had an odds ratio of 2.70 larger than the other majors except for science when the other factors were held constant. Science majors had an odds ratio of 1.40 larger than other majors except engineering. GPA, ethnicity/race, and gender did not have statistically significant effects on the odds of job attainment. Labor Market (the graduation year) effects on the odds of

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job attainment were statistically significant. The odds ratio of .46 for 2007/2008 and .33 for 2008/2009 indicate a relationship between the labor market and obtaining a job at graduation.

The findings were similar to previous research, which found that getting a job is one of the major benefits of co-op participation (Hamlin, 1978; Hanks & Schiller, 1984; Harris & Hodgson, 1974; Patterson & Mahoney, 1985). Patterson and Mahoney (1985) cite findings from employers that recruitment efforts were 13 times more successful with co-op graduates, recruitment costs were lower ($50 compared to $800), and nearly 80% of co-op students who were offered permanent jobs accepted them. A more recent paper regarding position attainment, drawing on data from the 1992 Canadian Survey of National Graduates, found that university co-op graduates of technical fields were 12% more likely to have full-time jobs than their non-co-op counterparts (Darch, 1995).

Research Question 3 – Does participation in a co-op lead to a higher starting

salary?

The question of whether participation in a co-op leads to a higher starting salary was answered by a set of regression models where the response variable was earnings. The estimates in Table 18 reveal that the effect of participation in a co-op was statistically significant ($p < .001$). In Table 18, Model 1 results indicate that co-op participants received a 9% larger starting salary than non-co-op participants without controlling for other variables. The most notable observation from this table is Model 4, which presents results from regressions estimating the association between co-op participation and salary at .07 or 7% when the effects of major, GPA, ethnicity/race, gender, citizenship, and graduation year are taken into account and held constant. Co-op

participation, major, GPA, gender, and citizenship all had statistically significant positive effects on salary. Ethnicity/race and the labor market (graduation year) were not statistically significant.

Analysis of Model 4 shows that engineering major students had 23% higher starting salaries than other majors except for science when the other factors were held constant. Engineering majors saw 8% higher salaries than science majors. Science majors had 15% higher starting salaries than other majors except engineering. Additionally, a one-unit change in GPA, for example going from a 3.0 to 4.0 GPA, resulted in a 7% increase in salary. Considering the demographic factors, white students had 2% higher starting salaries than other students, but these results were not statistically significant and did not make a significant contribution to predicting the salary outcome. Males had 3% higher starting salaries than females, and U.S. citizens had 6% higher starting salaries than other citizenship status students. The labor markets in terms of graduation year results were minimal and not statistically significant. Interpretation of the R^2 coefficient of determination in the last row of Table 18 indicates that model 4 explained 18% of the original variance.

Similar to other research, the ultimate benefit of co-op participation seems to be realized most after graduation and upon entry into the workforce in the form of a higher starting salary. Co-op students begin their careers with higher salaries than their peers. The past literature indicated that co-op participation, in many cases, produces higher starting salaries for participants. Several studies have shown that co-op graduates command higher starting salaries than their non-participating peers (Allwell, 1978;

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Hamlin, 1978; Hayes & Travis, 1976; Rogers & Weston, 1982; Stanton, 1988; Walsh & Breglio, 1976).

<div align="center">Limitations</div>

This study had several limitations. The limitations to the overall design of the study are discussed in Chapter 1. The specific limitations of the data and findings follow.

The overall study sample (1,880) was 45% of the overall campus population (4,164), and thus the sample may not be generalizable to the overall Missouri S&T population. For sample representativeness, this researcher compared the study sample to the source population according to the stratification criteria: major, gender, and ethnicity. As seen in Table 3, the sample was closely representative of population for the major of engineering and for gender. Compared with the source population, science majors were slightly overrepresented and the other majors were underrepresented. Similarly, the ethnicity was marginally dissimilar as the sample somewhat overrepresented White, Non-Hispanic ethnicity/race and underrepresented other groups. The validity of the sample data was determined by the degree of similarities, despite some relatively minor differences, between the characteristics of the population and the sample. Given the absence of largely divergent profiles, this researcher concluded that the 45% response rate did not indicate a bias or invalidate the sample data (Groves, 2006). It also allows generalizing the results for the population.

The small sample size of co-op participation created a problem that confused the meaning of the statistical significance of the GPA results in Table 13. The root of the problem was that data used in this study was self-reported by graduates. Graduates who did not submit all of the data requested were not used. Likewise, co-op participants who

did not submit all the required data at graduation were excluded from the study. The means between groups and within groups were analyzed using the analysis of variance (ANOVA) technique (Owen & Clark, 2001). In both categories (undergraduate and graduate), no statistically significant difference occurred (at a 0.05 level of significance) in GPA between co-op participants and non-co-op participants. The ANOVAs were confounded by the small sample, especially the co-op participation group. Regardless, the lack of statistically significant results does not mean that no useful interpretation of the data exists. Practical observations could be made by scanning the means between groups. The combined co-op participation student average GPA was 3.45, and the non-co-op participation student average GPA was 3.40. The difference in GPA is 0.05 with co-op participants carrying a higher GPA. The higher GPA for co-op participants was expected because past studies have shown co-op participants to have higher GPAs (McNutt, 1974; Spect, 1985; Stanton, 1988). Although not statistically significant, the relationship between GPA and co-op participation would be an interesting direction for future investigation involving much larger samples. Regardless, because the results of the significance test found no significant differences in GPA between groups, then the correlation between co-op participation and GPA was found to be inconclusive.

Another limitation is concern about causation. Broudy, Ennis, and Krimerman (1973) summarized their concern for (ex-post facto design) causal relationships:

We cannot avoid concern with causal relationships, both general and particular. Education is concerned with bringing about changes, with providing general guidelines for so doing (guidelines that must take the form of causal generalizations), and with particular causal analysis of

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existing or recent occurrences. These practical concerns of the educator

require educational researchers to use causal terms. We should be as clear

as possible about what we are saying when we make a causal allegation

and should have a good idea about what counts as proof and disproof, and

support for and opposition to a causal allegation (p. 401).

In contrast, Kelinger (1986) presented a strong case for the ex-post facto research

method:

It can even be said that ex-post facto research is more important than

experimental research. This is, of course, not a methodological

observation. It means, rather, that the most important social scientific and

educational research problems do not lend themselves to experimentation,

although many of them do lend themselves to controlled inquiry of the ex-

post facto kind. . . . If a tally of sound and important studies in

psychology, sociology, and education were made, it is likely ex-post facto

studies would outnumber and outrank experimental studies (p. 373).

Even with its limitations, the ex-post facto research design plays an important role

in understanding the relationship between co-op and early employment outcomes. The

quantitative nature of the data worked to lessen any effects of researcher bias.

In addition, the factors affecting wage rates are difficult to consider using

Siedenberg's (1989) model. Subjective qualities of individuals may have been crucial not

only in determining wage rates, but also in initially securing employment. These

characteristics may include motivation, self-concept, self-esteem, beliefs, values,

attitudes, and other personality traits. These qualities are problematic to measure. Their

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significance was not completely captured by the independent variables available for use in the model. Some of the included variables, however, may have served as proxies for these effective traits or have been correlated with them. It is assumed that these effective traits had a minimum effect on the outcomes and affected both the co-op and non-co-op students equally.

This researcher selected data based on availability. The data may have been affected by significant variables not measured. In the context of this study, a lack of control over independent variables existed. The researcher had to take the data as they were with no opportunity to arrange the conditions or manipulate the variables influencing the facts. This researcher chose multiple regression to examine more than one predictor of early career outcomes. This was done in effort to determine whether the inclusion of additional predictor variables led to an increased prediction of the outcome variable (Field, 2005) and to test the relationship between co-op participation and early employment outcomes. This was another limitation.

Conclusions

Although, the co-op program has traditionally had support and been recognized as beneficial to students and employers, few existing studies have sought to empirically measure the impact of this educational choice on the early employment outcomes of university graduates. This study examined the relationship between co-op participation and early employment outcomes at Missouri S&T. This study examined the co-op program and provided quantifiable data for three under-informed areas: (1) the characteristics of students who participate in a co-op at the institution studied; (2) the differences in employment status and salary between graduates who participated in a co-

op and those who did not; and (3) the extent to which these outcomes vary by the secondary variable characteristics (major, GPA, citizenship, gender, and ethnicity/race) of the graduate.

Using the given instruments, it was concluded that significant differences exist between students who participate in a co-op and those who do not. In addition, a significant relationship exists between co-op participation and having a job at graduation and receiving a higher starting salary. Students who participate in a co-op earn a simple average starting salary of $4,761 more per year than their counterparts without co-op experience, not considering the effects of major, GPA, ethnicity/race, gender, citizenship, and graduation year. The odds of a student who participated in a co-op obtaining a job at graduation are 1.49 times higher than those of a student without a co-op experience when all the other variables were held constant. Students who participate in a co-op earn 7% higher starting salaries than their counterparts without a co-op experience when the effects of major, GPA, ethnicity/race, gender, citizenship, and graduation year are taken into account and held constant.

The finding that participation in a co-op correlates with 1.49 higher odds of having a job at graduation and a 7% higher starting salary is important information for informing co-op professional practice, student and parental choices, and stakeholder decisions. Career advisors and co-op program administrators can use this knowledge to advise students regarding career development decisions. Students and parents can use this information to inform choices about whether or not to participate in a co-op, delay graduation, and increase education costs. Stakeholders such as university administrators,

legislators, and taxpayers can use this information to determine whether co-op

participation benefits are worth the program costs, especially during times of

budget crisis. Many college students and their parents, not to mention

administrators and legislatures, are basing their educational expenditures on an

employment criterion (The United States Department of Education, 2006).

Education consumers are spending money and want positive outcomes to show

for it (The United States Department of Education, 2006). This study shows that

co-op participation adds value to students' employability.

<div align="center">Recommendations for Practice</div>

The results of this study have multiple implications for postsecondary institutions.

Minimal current and relevant literature exists on the connection between co-op

participation and workplace/career outcomes. This lack of information on co-op

participation outcomes comes at an awkward time—a time when many college students

and their parents, not to mention administrators and legislatures, are basing their

educational expenditures on an employment criterion (College Board, 2007). The value-

added of a co-op participation experience to a student's future employability may affect

one's educational expectations. The commitment to co-op participation requires an

investment; the return comes in the form of most likely obtaining a job of good potential

upon graduation. Prior to this research, the university studied did not have enough

information available to confirm whether that transition was occurring. This research

closed the gap and provided basic information on the outcomes, transparency, and

accountability per the request of the Spellings Commission (U.S. Department of Higher

Education, 2006).

The results of this study have numerous implications which include the following: enabling administrators to provide quantifiable accountability measures to stakeholders, providing informed planning for reduced funding, providing statistically significant facts for marketing the co-op program and the university, and providing justifications for supporting participation in the co-op program.

The results of this study provide useful insight into the early educational outcomes of graduates. Clearly, co-op experience is an asset during the formative first years in the workplace. Results demonstrate that co-op participation positively correlates with positive early employment outcomes.

The results of this study have significant implications for program administrators and university leadership. First and foremost, this research appeases the growing demand for increased quantifiable accountability. According to Rossi, Lipsey, and Freeman (2004), the need for program evaluation is undiminished in the current era and may even be expected to grow. Indeed, contemporary concern over the allocation of scarce resources makes it more essential than ever to evaluate the effectiveness of social interventions. The research results provide quantifiable measurements and benchmarks to set future objectives and devise specific methods of assessing the co-op programs at Missouri S&T. As Lucas (1975) warned, a lack of "cost accounting" procedures makes it difficult for directors to preserve programs. Several factors are behind this demand, not the least is the economic recession due to increasing international economic competition, high unemployment rates, demographic and technological changes, reduction in federal aid, and revenue shortfalls.

This research will inform university leadership during this time of unstable and decreasing funding. In 2007/2008, the median income in Missouri was $46,906, which is $6,424 less than it was in 2001, when adjusted for inflation. Compared with the nation's median income, this decline of 12% was the third largest decline in the nation in median income; the decrease in state funding for public higher education during this time has been about a 24% decline, not adjusted for inflation. In 2006, Missouri ranked 45th lowest in the nation on per capita state and local investments in higher education; Missouri has recently dropped even lower, to no higher than 47th (Missouri Budget Project, 2009). At the January 2010 House Education Appropriations Committee meeting, Commissioner Robert Stein presented the governor's recommendations for the higher education budget. Stein provided a summary of the role and scope of higher education in Missouri stating the sector still has not recovered from the budget cuts of the past several years. Committee members discussed the possibility of prioritizing items in the higher education budget if it is determined that the state will have insufficient resources to meet all the requests (The University of Missouri System Office of Government Relations, 2010).

Administrators are faced with the unpleasant chore of planning for reduced-funding scenarios. The options include the following choices: (a) increase fees, (b) eliminate programs and services, (c) reorganize or restructure to gain efficiencies, or (d) redesign educational delivery systems to achieve economies of scale. This research informs the departmental strategic planning process by providing an example of the effective collection, analysis, and use of data as a measure of educational outcomes. The results of this study will be used to justify efforts to increase the number of participants in

the co-op program and to increase the capacity for collecting study data and utilizing the data to improve decision making at all levels.

This research has the potential to be a pivotal agent in the marketing of the co-op program and the university. As one of their goals, administrators must educate the public (The United States Department of Education, 2006). This research provides data and perspective to use as tools to effectively communicate accurate information on the university co-op program to a wide variety of stakeholders. The results provide information and interpret reality for policy shapers, students, and employers. Furthermore, the results serve as a baseline for additional research and analysis. Regardless, the results inform and allow for critical examination of the relationships affected by co-op participation. These research data enable administrators to craft and deliver a clear, sophisticated, and informed yet easily understood message of how co-op participation is correlated to early employment outcomes. Co-op participation and its correlation with employment outcomes have the potential to affect student and stakeholder satisfaction as well as university sustainability. Some research suggests that students who are more satisfied with their academic experience are more likely to have a positive regard for their alma mater and more likely to translate this regard in financial ways (Bok, 2003). For an institution such as the one studied, graduating engineers who work at major corporations around the globe and have positive regard for their alma mater can translate into increased giving to the university and favorable partnerships with large businesses.

Additionally, this research will be used to inform the professional practice of co-op program administrators by defining the program, the study objectives, the methods of

assessment, and the cost accounting procedures necessary to evaluate the program. This research will also support student participation in co-ops by quantifying the value-added to a students' future employability. The identified correlation to employment outcomes could spark an interest in more students to consider co-op participation.

Further Research

The results of this study suggest several directions for future research regarding the relationship between co-op participation and educational outcomes. Further study could be done on whether graduates are able to maintain initial salary advantages throughout their careers. The initial salary advantage may actually negatively affect an individual's ability to move to another position within the company or exit to another firm. Lawler (1983), in his study on pay and performance, suggested a change of 10% to 15% in base salary was necessary to energize an individual sufficiently to select a new job, relocate, or change his/her performance. Individuals with lower salaries may be more sensitive to meaningful salary adjustments and willing to accept a smaller percentage in additional salary to change jobs.

It would also be worthy to continue this research over a longer period of time. The descriptive characteristics of students who participate in the cooperative education program could be tracked to reveal changes in the composition of the co-op participants with time. For example, while co-op programs were traditionally common in the field of engineering, this research indicated that co-op popularity is expanding to the fields of science and technology as well. Further research would provide quantifiable information on co-op program characteristics over time. It would also be worthy to continue research

on the employment outcomes over time. A longevity study spanning several years would provide much needed insight for the program administrators and university leadership.

Likewise, co-op participation and its correlation with employment outcomes have the potential to affect student and stakeholder satisfaction as well as university sustainability. Some research suggests that students who are more satisfied with their academic experience are more likely to have a positive regard for their alma mater and more likely to translate this regard in financial ways (Bok, 2003). Future research could include a satisfaction survey to see if the alumni who had participated in a co-op experience were more satisfied with their academic experience.

This researcher would like the university to require students to submit an educational outcome report upon graduation, rather than allowing this report to be optional. She has made several attempts to work with the registrar's office to have the reporting of post-graduation plans collected as part of the graduation registration process, but so far this has proven unsuccessful. This step, however, would vastly improve the collection of data for future study samples and provide larger samples for easier study validation.

Summary

The purpose of this study was to examine the relationship between participation in cooperative education and the early employment outcomes of job attainment and salary of post-secondary graduates at Missouri University of Science and Technology during the academic years of 2008 through 2010. Data comparisons were made between students who had participated in a co-op and those who did not by using pre-existing data from databases managed by Missouri S&T Career Opportunities and Employer Relations.

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Implications from this study are three-fold: to provide (1) description; (2) assessment; and (3) accountability of the Missouri S&T co-op program. The results of this study could be used to justify increasing the number of participants in the university's co-op program, as well as to increase the capacity for collecting study data to improve the decision making of all parties affected by co-op participation.

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VITA

Edna Grover-Bisker is a character from stereotypical rural Missouri where people rise and set with the sun and storytelling is a fine art. Her parents were the first generation to graduate from high school, and she was the first to obtain a graduate degree. Her entire family worked very hard to support her educational efforts. As a result of that support and work ethic, she has been successful professionally and personally.

Edna has vast and varied work experience, as she has been without a break in paid employment since she was 12 years old. She has worked a combination of jobs that have varied from farm hand to radio DJ, Missouri Senate Communications Specialist, MoDOT Community Relations Manager, Professor, and Missouri S&T Director of Career Opportunities and Employer Relations. Edna obtained a bachelor's degree in Communications from Central Missouri University in 1995, and a Master's degree in Public Administration from the University of Missouri-Columbia in 1999. Edna stumbled into university teaching in 2000 by offering to help an administrator who was desperately seeking lecturers. It was supposed to be one class, one semester. Instead, she fell in love with teaching and made a dramatic career change to work at a university. In 2011, Edna received her doctorate degree in educational leadership and policy analysis from the University of Missouri-Columbia.

Edna is an advocate of life-long learning and often quotes Benjamin Franklin, "If a man empties his purse into his head, no man can take it away from him. An investment in knowledge always pays the best interest." She insists, "You have to love Ben. He was maybe off with that turkey-as-the-national-bird thing, but he did not miss much else."