INFORMATION TO USERS

The most advanced technology has been used to photograph and reproduce this manuscript from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book. These are also available as one exposure on a standard 35mm slide or as a 17" x 23" black and white photographic print for an additional charge.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

U·M·I

University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700 800/521-0600

Order Number 8907753

Academic achievement differences between majors in computer science—business option and majors in the college of business

Harpool, Jack Donald, Ph.D.

The University of Akron, 1989

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

ACADEMIC ACHIEVEMENT DIFFERENCES BETWEEN MAJORS IN COMPUTER SCIENCE--BUSINESS OPTION AND MAJORS IN THE COLLEGE OF BUSINESS

A Dissertation

Presented to

The Graduate Faculty of The University of Akron

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

Jack D. Harpool

January, 1989

ACADEMIC ACHIEVEMENT DIFFERENCES BETWEEN
MAJORS IN COMPUTER SCIENCE--BUSINESS OPTION
AND MAJORS IN THE COLLEGE OF BUSINESS

Jack D. Harpool

Dissertation

Approved:	Accepted:
Advisor	Dean of the College
Faculty Reader	Dean of Graduate Studies and Research
Department Head	December 21, 1988 Date

ABSTRACT

This study was completed at an urban, Northeastern Ohio, state university to determine whether differences in business course grades existed between four-year Computer Science--Business Option degree majors (Group 1) in the College of Arts and Sciences and their counterpart majors in the four-year College of Business Administration (Group 2). It consisted of a randomized sample of 403 Business Administration majors and 91 Computer Science--Business Administration majors who graduated between 1983 and 1987.

This study was an investigation using course grades received in seven business knowledge courses to differentiate the groups. Both groups of majors took common courses in Accounting I and II, Principles of Macro and Micro Economics (sophomore level), Business Finance, Management, and Marketing (senior level). The study analyzed the courses in group sets. Set 1 consisted of all seven courses; Set 2 the first four courses; and Set 3 the last three courses. This study identified any achievement differences between these majors by studying the first four business courses (sophomore level), and the last three business courses (senior level) for each group.

To determine whether academic business success had changed between the sophomore and senior years, an analysis was made to determine whether differences existed in the grade points over time for the groups. Other demographic variables were included in the hypotheses being tested.

The statistical finding of the research hypotheses suggests that higher grades were more likely to discriminate Computer Science-Business Option majors than Business Administration majors for: (a) all seven business courses, and (b) the first four business courses. In the last three business courses, academic success for Computer Science--Business Option majors was not significantly different than academic success of their counterpart majors in Business Administration.

Findings of this study are contrary to the public notion that Computer Science students may be deficient in their business skills. Assuming that academic achievement may relate to business skill achievement, this study finds that, academically, Computer Science students do significantly better than their counterpart Business Administration majors in those seven fundamental business courses and the first four.

ACKNOWLEDGMENTS

The author is grateful to many people who, during the course of this study offered their assistance and support. Special attention must be given to the members of the doctoral committee Dr. Charles Dye, Dr. Robert Eley, Dr. Bill Frye, Dr. Richard Gigliotti, and Dr. Isadore Newman. A special "thank you" to Dr. Bill Frye and Dr. Isadore Newman who initially provided professional inspirations and guidance during my early research studies and to Dr. Robert Eley, my major advisor who provided professional clarity and direction toward completing this study.

A special thanks to Barbara Jean Mattson for her continuing interest and professional advice in this project and to Carol Lieb for her constant, reliable, and expert assistance in completing the final manuscript form.

A final sincere appreciation cannot be expressed in mere words for Elaine Harpool and our children, Jackie and David, who have willingly and prayerfully supported this undertaking. Without their cooperation and personal sacrifice, this project could not have been completed.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

CHAPTER 1

THE PROBLEM

Introduction to and Rationale for the Study

America's employers need U.S. workers who are proficient in both business skills and computer technology. At the entry level, there are gaps between what young adults are learning and what society and business need them to know (Gardner & Larsen, 1981; Napier & Wetherbe, 1982).

The Changing Work Place

At the time of this investigation, the present period of U.S. development has been called the post-industrial era. Many have referred to this era as the Information Age. Daggett and Branigan (1987) note that our society will demand technical skills and business abilities from college graduates that will be completely different from skills required of earlier graduates during our industrial era.

According to Raspberry (1988), a recent 61-page joint report by U.S. Cabinet Officers titled "Building a Quality Workforce" offers a serious challenge to a gloomy thesis. The report calls for more cooperation

between private business and education. If business, labor, and education do not narrow these knowledge gaps and meet the challenge of the changing work place, jobs will be lost in the United States, as employers search abroad for workers with the necessary skills.

Simple jobs requiring only rudimentary skills and a willingness to work hard are vanishing from the American scene. According to the U.S. Cabinet Officers Report (1988), computerization has caused as many as five jobs to be melted into one. What used to be a succession of simple tasks calling for specific and splintered knowledge now requires people with good technical skills and the ability to analyze customer business needs, to understand several types of information and the relationships among them, and to deal with non-standard requests (Raspberry, 1988).

In the last few decades, the demand for computer use has created new job opportunities and job classifications. Increasing demand for computers has created new business/technical positions for programmers, software consultants and business analysts. Shelly and Cashman (1986) state that, even though the computer software industry was initially considered a "cottage industry," it is now predicted that the computer software industry will grow at a rate exceeding 25% for the next five years due to business demands.

Purpose of the Study

It is a common perception among businesspersons that Computer Science graduates may be deficient in understanding and applying specific business requirements and practices in their computer work. It is this perceived difference in business skills of Computer Science graduates as observed by employers that warrant the need to explore whether academic achievement differences also exist. It is assumed that students who achieve high grades in their specific business courses will also do well as it relates to that particular business assignment when working with computers.

This study was completed at an urban, Northeastern Ohio, state university to determine whether differences in business course grades actually existed between four-year Computer Science--Business Option degree majors (Group 1) in the College of Arts and Sciences and their counterpart majors in the four-year College of Business Administration (Group 2). Both groups graduated with B.S. or B.A. degrees between 1983 and 1987. The purpose of this dissertation, using a general linear model, was to determine whether academic business success as measured by grade points in seven business courses would, in fact, be different or discriminate between majors in Computer Science--Business

Option (Group 1) and in the Business Administration program (Group 2).

It was assumed that the first four courses were fundamental to business and dealt primarily with technical accounting and economic decision making concerns. The last three courses emphasized financial, marketing and management issues with the latter two dealing more with interpersonal concerns. A course description for each course is provided in the Operational Definitions section of this chapter.

Importance of the Problem

Today, colleges and universities have the responsibility to educate and train students to meet the demands of real business. Likewise, graduating seniors need to be assured that business course offerings have been meaningful and appropriate to their future occupational choice.

Business managers are echoing a growing national concern with the way colleges structure their curricula, especially in the fragmenting of knowledge in business programs. Some argue that colleges limit learning of meaningful business skills which often result in weakened insights into how business and organizations really operate (Watkins, 1986).

Others stress the alarm that today's hi-tech business procedures are ones which require business courses to be integrated with training in specialized computer application software packages. Realistically, only these will prepare students to work in business (Clemmensen, 1985; Schroeder & Furtado, 1986; Fisher, 1987).

Furthermore, serious doubts are also being voiced about whether what is taught is really what students should learn. Critics in the academic community have even gone so far as to say that:

> . . . our colleges and universities have also failed to be successful in preparing their students to be effective in a future occupation. (Elman & Lynton, 1986)

To address these concerns, universities across the United States have responded to the need to prepare students for hi-tech business skills. New courses in Computer Science programs have been added, stressing business and management principles. Common courses are: Principles of Economics, Accounting, Finance, Management, and Marketing. Typically, such instruction provides a business orientation and presumably integrates it with the technology of computer software.

The Need for Hi-Tech Business Skills

It is well known that the creation of a successful computerized system requires technical knowledge. However, it is also equally important to recognize that business problems (not always directly related to computer concerns) frequently arise in planning, designing, and implementing a business system (Pettigrew, 1980; Harpool & Gigliotti, 1987). Therefore, to successfully install such a system, Computer Science students must be able to make intelligent business decisions (White & Leifer, 1986).

Positions that are available to the Computer Science graduate or the Computer Science--Business Option graduate also are offered frequently to students in Business Administration programs who have had courses and/or co-op experience in computer systems and programming technology. It is not uncommon, therefore, that candidates for computer job openings come from both programs of study. Two typical computer employment areas are: (a) systems analysis and design, and (b) computer programming (Shelly & Cashmen, 1986).

Systems analysis and design is a job specialty that requires gathering and analyzing business needs and information necessary to design and program efficient computerized business systems or to recommend appropriate business application software packages. Tasks in this specialty area require a minimum of four years of college, a strong business background and a broad yet advanced technical knowledge of both computer hardware and software.

Computer programming is a job specialty that may be broken down into three functional types of computer programming: (a) business application programmers, (b) system programmers, and (c) scientific programmers.

Business application programmers write programs for business applications such as payroll, accounts receivable, inventory control, etc. A knowledge of accounting and business principles and procedures is essential. Most companies desire a four-year degree for such programmers. Students receiving Computer Science degrees coupled with a strong business background are strong candidates for this job specialty. However, some may accept two-year technical degrees in computer programming technology. System Programmers are responsible for maintaining the operating system utilized by the computer. As such, they are required to have extensive technical background. Individuals who wish to become systems programmers frequently major in Computer Science at the four-year college level. Scientific programming, as the name implies, refers to programming computers for scientific or engineering activities such as writing programs for a nuclear reactor or space vehicle. Individuals seeking scientific programming positions normally have a four-year degree in Math or Computer Science.

Do Computer Science Students Lack Business Skills?

Though there are no data or research concerning the level of business skill proficiency of Computer Science graduates, there is a public notion that many are deficient in business skills.

While applauding student technical preparation in Computer Science, Napier and Wetherbe (1982), and Hartong (1985), state that Computer Science graduates often are deficient in overall business knowledge (i.e., business accounting skills, management planning, and financial economics understanding).

According to Napier and Wetherbe (1982):

> The MIS (Management Information System) Programs (i.e., sometimes recognized as Computer Science) are emerging because of the demand by organizations for MIS professionals that have a business and management orientation combined with computer expertise. (pp. 32-35)

According to Hartong (1985):

> Computer Science graduates are unrealistic and have little sense of corporate needs in the very field they are joining. They do not know what to expect from industry jobs and are generally ignorant of how data processing fits into the larger business structure. In fact, they do not know enough about business, period. (pp. 68-78)

Gabel (1988) states that many schools are not providing the business training that corporations need. In the area of Data Communications, there are few schools that really train their students; most are graduating electrical engineers. These students are often technically qualified but have limited business skills.

Most lack any sufficient business background and, while a degree is valuable, learning and applying data communications in a specific business setting is lacking. Additionally, because of the nature of their hi-tech business assignments, a variety of skills are needed. These range from customer relations, to billing, to accounting, to resolving technical problems. Corporations need people who can look at their job as a business. It requires a shift in orientation that schools need to address.

Martin (1985) states that there is much tension between the computer industry and Computer Science departments. This tension principally requires updating and rethinking what is achieved in the core curriculum. It is industry's view that Computer Science graduates are not being properly trained to work in realistic business settings, though in many schools, their technical mastery in computer fundamentals is noteworthy.

Dertouzos (1985) states another position that, because data processing, business functions, and organizations are changing in the next decade, Computer Science departments can and probably should not worry about the gap between academe and the data processing computer industry. Stressing the phenomena that the computer industry is under tremendous transition, teaching fundamental computer technical knowledge courses should be a goal of Computer Science. The need for instructing in specific and current hi-tech business practices is best

taught on the job. Regardless of how we interpret the issues, it clearly reveals the gap between academé and the computer industry.

Statement of the Problem

This study dealt with academic achievement differences between two groups of graduates at an urban, Northeastern Ohio, state university. Because there was a perceived notion that Computer Science graduates were deficient in business and there were no data or research supporting or refuting it, this study was undertaken. The problem was to determine if there were academic business achievement differences between graduates who had received B.S. or B.A. degrees in the Computer Science--Business Option program and the College of Business Administration program. These students graduated from the university between 1983 and 1987. Group 1 consisted of Computer Science--Business Option degree majors in the College of Arts and Sciences and Group 2 consisted of their counterpart majors in the College of Business Administration. Academic achievement was measured by course grades (CGs) in seven common business knowledge courses that were completed by both groups. These courses included: (a) Principles of Macro and Micro Economics, and (b) Accounting I and II. These courses were taken by the end of the sophomore year. The other courses completed

by or at the end of the senior year were: (c) Business Finance, (d) Management: Principles and Concepts, and (e) Marketing Principles. In all, there were seven sequential business knowledge courses used in this study. A course description for each course is provided in the Operational Definitions section of this chapter.

Using sets of courses was assumed to be helpful in explaining and/or identifying those business skills that differentiate Computer Science majors' academic business skill achievement levels from their counterpart majors in the College of Business.

The problem under investigation in this study was to determine whether academic differences between the two groups existed by using various combinations of course sets: (a) in the set of all seven core business courses; (b) in the set of the first four business courses taken by the sophomore year; (c) in the set of the last three business courses taken by the senior year; (d) over time (between sophomore and senior levels); and (e) when covarying selected academic and demographic variables (i.e., sex, race, co-op status and overall undergraduate grade point average).

It may be anticipated that the business course grades at the sophomore level may not differentiate between Groups 1 and 2. The reason may be that students from these groups will not have taken any or many

additional business courses at this time in their college career. However, at the senior level, it may be expected that there will be differences between the groups. One possible explanation is that Business majors, having taken more business courses than Computer Science--Business Option majors, may have higher CGs in the selected courses under study. These additional business courses may have reinforced their knowledge of business concepts. However, the problem of this study was not to explain the causes of possible differences, but rather to determine whether there were academic differences between the two groups and to determine if the given academic variables were sufficiently influential to categorize these two groups.

This study evaluated group prediction in several ways and identified possible time effects between the two groups. Additionally, the study statistically controlled for variables that were considered to have a relationship to academic achievement and group membership.

Research Questions

The problem suggests the following ten research questions:

1. Do the seven business course grades (CGs) differentiate between graduates who majored in Computer Science--Business Option and graduates majoring in Business Administration from The College of Business Administration?

2. Do the CGs of the first four business courses taken by both groups differentiate between Computer Science--Business Option majors and Business Administration majors?

3. Do the CGs of the last three business courses taken differentiate between Computer Science--Business Option majors and the Business Administration majors?

4. Do the CGs of the first four business courses taken differentiate between Computer Science--Business Option or Business Administration majors over and above the last three business courses?

5. Do the CGs of the last three business courses taken differentiate between Computer Science--Business Option or Business Administration majors over and above the first four business courses?

6. Do the CGs of the seven business courses taken differentiate between graduates who had majored in Computer Science--Business Option and graduates majoring in Business Administration over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average?

7. Do the CGs of the first four business courses taken differentiate between Computer Science--Business Option majors and the CGs of Business Administration majors over and above what can be accounted for by

sex, race, age, co-op status, or overall grade point average?

8. Do the CGs of the last three business courses taken differentiate between Computer Science--Business Option majors and the CGs of Business Administration majors over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average.

9. Do the CGs of the first four business courses taken differentiate between Computer Science--Business Option majors and the CGs of Business Administration majors over and above the last three business courses, sex, race, age, co-op status, or overall grade point average?

10. Do the CGs of the last three business courses taken differentiate between majors in either Computer Science--Business Option or Business Administration programs over and above the first four business courses, sex, race, age, co-op status, or overall grade point average?

Research Questions 1-10 are the basis of ten General Hypotheses. These general hypotheses are stated in Chapter IV, pp. 72-93.

Delimitations

The following limitations were imposed upon this study. First, only students who graduated between 1983-1987 and had selected the Business Option in the Computer Science Program (Group 1) in the College of Arts and Sciences and those who had a business major in the College of Business Administration (Group 2) were selected. The final study group consisted of 91 Computer Science--Business Option graduates and 403 Business Administration graduates. Secondly, only those students who completed the seven business knowledge courses were used in the study. Thirdly, the data were obtained from a number of University files. The accuracy of these data may be challenged since individual departments are responsible for submitting various data elements that make up the total student record. Fourthly, only students who were enrolled from 1983 through 1987 were included. Last, the researcher assumed that the major codes and other information in the student master file were current and correct.

Operational Definitions

The following terms are operationally defined to clarify their usage.

Accounting I is the course name and the term used for the introduction to accounting, the language of business. Emphasis is on basic principles, concepts and terminology of accounting for assets, liabilities and proprietorship. This course is a member of the first set of four courses (sophomore level).

Accounting II is the course name and the term used for the study of accounting informational needs of management. Accounting I is a prerequisite. Emphasis is upon planning and control, including financial statement analysis, funds flow, budgets, cost volume-profit analysis and decision-making costs. This course is a member of the first set of four courses (sophomore level).

ANCOVA is the abbreviation for the analysis of covariance.

ANOVA is the abbreviation for the analysis of variance.

Business Application Software Packages is the term used for prewritten programs designed to accomplish a specific business function. These computerized business procedures may be purchased from vendors. Businesses may use accounting, data base, spreadsheet, word processing

and graphics packages to automate routine business procedures.

Business Finance is the course name and the term used for the study of problems of business firms from a financial manager's viewpoint. Topics include planning, sources and uses of funds, capital budgeting and optimum financial structures. This course is a member of the last set of three courses (senior level).

Business Knowledge Course is the term used for any formal academic course that provides learning opportunities which enhance students' abilities to participate in a particular functional area of business. For purposes of this study, business areas of concentration include accounting, business finance, economics, management, and marketing.

Co-op Status is the status of a student who has participated in a formal education program which combines classroom study with on-the-job experience in a paid, academically-related employment position. Co-op extends academia beyond the college campus and into the world of work.

Counterpart is the term used to refer to students who, having different majors, have taken the same business core courses. These students are majors in either Computer Science--Business Option, in the College of Arts

and Sciences; or Business Administration, in the College of Business.

Course Grade, referred to in this study as (CG), is a measure of scholastic success in college courses taken by a student. (A=4, A-=3.7, B+=3.3, B=3.0, B-=2.7, C+=2.3, C=2.0, C-=1.7, D+=1.3, D=1.0, D-=.7)

Data Communications is the term used to describe the electronic communication and transfer of data from one computer to another.

Demographic Variables are variables that characterize selected attributes and may relate to academic achievement.

Discriminant Analysis is (a) the term used to find a mathematical rule or discriminant function for determining which class an observation belongs to, based on knowledge of the quantitative variables only; (b) a set of linear combinations of the quantitative variables that best reveals the differences among classes; or (c) a subset of the quantitative variables that best reveals the differences among the classes. The SAS procedure for discriminant analysis groups data into classes and uses one or more quantitative variables. (SAS Users Guide, 1985)

Grade is a unit of measure indicating a recognized value for completing a course.

Hi-Tech Business Skills is the term used to describe the synthesis of computer skill abilities and business skill abilities necessary in designing, developing and/or installing business computer applications. Such skills include: applying accounting principles, economics, finance, marketing, and management understandings to a broad range of technical and nontechnical problems associated with utilizing computer equipment.

Management: Principles and Concepts is the course name and the term used for the theory and practice in management of human and other economic resources. Extensive coverage of operations systems is emphasized. This course is a member of the last set of three courses (senior level).

Marketing Principles is the course name and the term used for a broad course that integrates commodity, institutional, functional, and managerial concepts of the marketing process. It stresses the total framework of economic activity. This course is a member of the last set of three courses (senior level).

Principles of Macro Economics is the course name and the term used for the study of the economic factors which affect the price level, national income, employment, economic growth of a nation. This course is a member of the first set of four courses (sophomore level).

Principles of Micro Economics is the course name and the term used for the study of the analysis of decision making on the part of the firm and household, and the market processes affecting price, output and resource allocation. This course is a member of the first set of four courses (sophomore level).

SAS Procedures are a collection of advanced computerized procedures for analyzing statistical data. Types of analysis include: regression, analysis of variance, categorical data, multivariate, discriminant, clustering, survival (SAS Users Guide, 1985).

Summary

Chapter I introduced the study by highlighting the fact that the American society has entered the information age and that business and computer technology skills are rapidly being fused together. It was emphasized that there is a perception, but there are no data support, that many Computer Science graduates are ill-prepared to work in realistic business settings, though their technical skills are current and up to date for many non-business computer-related jobs (Napier & Wetherbe, 1982; Hartong, 1985)

The chapter continued by stating that the purpose of the study was to determine whether academic achievement differences between Computer Science--Business Option

degree majors in the classes of 1983-1987 in the College of Arts and Sciences differed from their counterpart business majors in the College of Business. Possible differences were to be examined over various common business courses and over a period of time.

The courses selected were: Accounting I, Accounting II, Principles of Macro Economics, Principles of Micro Economics, Business Finance, Management: Principles and Concepts, and Marketing Principles. The first four courses were taken at the sophomore level and the remaining three at the senior level. These courses provide a basis of business knowledge and are useful in various broad areas associated with the planning and installation of computerized business systems.

The statement of the problem was presented to determine whether business course grade (CG) differences existed between the two groups in varying combinations of the seven business courses, with and without covarying selected academic and demographic variables. This was followed by a list of research questions derived from the problem statement. To conclude the chapter, the delimitations and operational definitions used in the study were presented.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

From the review of literature, it appears that this study will be breaking new ground. Predicting success in college courses has a long and well-established tradition in educational research, as evidenced by a voluminous amount of research reported. Various studies of Computer Science have been conducted at the college level (Plog, 1980; Wileman & Konvalina, 1981; Sorge & Werk, 1984); however, most studies have dealt specifically with the computer programmer or computer programming courses. Very little of the literature discusses academic performance in Business Administration courses. To the investigator's knowledge, there is no documented literature that compares student business achievement in both Computer Science and College of Business programs. Furthermore, literature could not be found that identified profile characteristics of students that may explain the nature of perceived business knowledge differences in Computer Science--Business Option majors from their Business Administration counterparts.

The research of the literature concentrated on previous studies and their findings in academic achievement for Computer Science, Computer Science Education, Business, Business Education and Business Management, as they relate to grade prediction in academic achievement. A refinement of the initial research also dealt with variables that were related to academic achievement, and variables that may predict or explain why students select or desire a particular college major (i.e., group membership).

A computer search of the Comprehensive Dissertation Index file that includes all publications in Dissertation Abstracts International from 1861 to the present was made. The research did not yield many pertinent studies helpful in this investigation. However, some descriptive studies were evaluated to identify particular variables which are good predictors of academic achievement and/or group membership.

From this research it is important to recognize that recent graduates in Computer Science and those possessing hi-tech business skills from Business Administration programs are in short supply and in demand. They are considered a valuable employer resource, and the information age has created a variety of computer-oriented jobs. Many companies aggressively seek recent graduates with

degrees in Computer Science or Business Administration and have high academic grades. However, from the review of the literature that follows, caution should be exercised in being led to believe that academic grades or demographic variables can be conclusively used to predict on-the-job skill proficiency or work performance success.

The literature on the following four topics will be reviewed in this chapter: Transition to Hi-Tech Business Skills, the Relationship Between Academic Achievement and Work Performance, Descriptive Studies, and Variable Relationship Studies.

Transition to Hi-Tech Business Skills

Estimates are that job opportunities in hi-tech business (i.e., business-computer related fields) will grow rapidly through this decade.

According to Holtzkamper, (1985):

> The data processing work force directly working with computers has grown from 650,000 in 1972 to nearly 1.5 million in 1980. The Bureau of Labor Statistics estimates that by 1990, 2.14 million men and women will work in five major categories of the computer industry: Data Entry Operator, Systems Analyst, Computer and Peripheral Operator, Programmer, and Computer Service Technician. It is anticipated that by the end of the 1990s, the number of data processing installations in the United States will top the one million mark as the computer boom grows. (p. 10)

During the 1970s, office productivity increases were much lower than in factories. Essick (1986) suggests that, as factory productivity increased by 85% using automation, similar gains will be made using computers in the business office. Office automation will reduce labor intensive information processing, replacing it with computer storage and hi-speed transmission capabilities. Oliver, Wegner, Thill-Ritter, and Hynek (1986) suggest that, as personal computers become more common, they will be routinely used for accomplishing business tasks that were once performed manually. Already, computers are frequently used in conjunction with specialized software packages by personnel at all business levels. According to Shelly and Cashman (1986), these packages have gained universal acceptance and include: (a) word processing, (b) electronic spreadsheet software, (c) computer graphics software, (d) data base and file management software, and (e) electronic mail software. To overcome business computer knowledge gaps, an increasing number of large organizations are establishing personal computer resource centers staffed by specialists. These personnel possess business and computer technical skills and abilities. They provide advice, expertise in system selection, programming services, training and installation assistance to increasing numbers of employees who acquire computers to support their functions.

Many of the business skills used in these resource centers require a blend of computer and business oriented problem solving. For example, employers who understand how an electronic spreadsheet can be used for cash-flow analysis must also understand the principle and concepts of sales revenue, accounts receivable, fixed and variable expenses, and accounts payable. Students, who hope to be successful in similar work settings, must also understand that business organizations exist within an environment of the international economy. Such organizations are created to meet the needs of a variety of customers in a broad and diversified market for products and services. It is in this type of environment that students are often required to use a blend of hi-tech business skills. In this study, to determine the knowledge level and academic achievement of Computer Science--Business Option graduates as it relates to Business Administration graduates, the following courses were selected: Principles of Macro Economics, Principles of Micro Economics, Accounting I, Accounting II, Business Finance, Management, and Marketing. These courses were assumed to be representative of the fundamental knowledge required for students who would later work in computer oriented assignments that required business problem solving abilities.

The Relationship Between Academic Achievement and Work Performance

Early researchers have questioned whether GPA was related to vocational achievement. In fact, even after four years of college, GPA has been shown to have limited usefulness in predicting later life achievement. Hoyt (1966), in a review of several studies, concluded that academic success in college was only moderately correlated with later life adult achievement. Others (Wallach & Wing, 1969) have shown that grades and academic ability represent only one type of personal competence and may have little relationship to other types of skills and capabilities required in life.

Resnick (1987) states that school learning that is required for success on examinations and the real-world learning needed for career success are two separate issues. Her analysis follows that academic learning stresses individual cognition, whereas in real situations, solutions are commonly derived in a cooperative manner with others. She stresses that there are differences in academic settings and outside work settings. Such differences are (a) academic learning requires "pure thought," and the outside work setting makes use of tool-aided learning, (b) academic learning emphasizes manipulation of abstract symbols, while the outside work setting emphasizes delivery dates with objects, events and people.

After twenty years of issues focusing on equal opportunity and student access to colleges and universities, the emphasis today is on educational quality and the intellectual skills of students. According to Hartle (1986), there is no shortage of evidence that academic quality needs attention. He emphasizes the following:

1. A large number of college students need remediation.
2. State policy makers have begun to raise questions about the nature and quality of instruction at public colleges and universities.
3. Faculty members overwhelmingly believe that today's students have less interest in learning than those students taught at the outset of their careers. (p. 1)

According to Gardner and Larsen (1981), our nation is at risk. This document states that selective attention must be given to higher education and to vocational and technical programs; otherwise, the mediocre education performance in America will continue. The following statements are indicators of the risk.

1. International comparisons of student achievement, completed a year ago, reveal that on 19 academic tests, American students were never first or second. In comparison with other industrialized nations, American students were last seven times.

2. One-half of the population of gifted students do not match their tested ability with comparable achievement in school.

3. College Board achievement tests also reveal consistent declines in recent years in subjects such as Physics and English.

4. Many 17 year olds (some are college bound) do not possess the "high order" intellectual skills expected of them. Nearly 40% cannot draw inferences from written material; only one-fifth can write a persuasive essay; and only one-third can solve a mathematics problem requiring several steps.

5. Business and military leaders complain that they are required to spend millions of dollars on costly remedial education and training programs in such basic skills as reading, writing, and computation.

Added to this, there is a new generation of Americans who are scientifically and technologically illiterate. There is a growing chasm between a small scientific and technological elite and a citizenry ill-informed and indeed uninformed on issues with a science component.

Elman and Lynton (1986) suggest that serious doubts are being voiced about whether what is being taught is really what students should learn. Concern is being raised that our colleges and universities have also failed to be successful in preparing their students to be effective in future occupations. The themes that dominate are:

(a) the curriculum is too narrowly confined to technical skills, (b) there is too much of a gap between theory and practice, and (c) school work consists of purely cognitive, abstract, and analytical material, and too little hands-on experience. These comments echo what Jenck and Niesman (1968) wrote twenty years ago when they pointed out the low correlation between course grades and occupational success. They described and emphasized at length how professional schools within universities tended to de-emphasize occupational commitment and encourage a more academic and less practical view of what students needed to know.

Changing the name of several engineering and business schools to colleges of "engineering science" and "management science" was a striking symptom of this strong trend toward a more academic and abstract cast of career-oriented curricula.

Elman and Lynton (1986) suggest that engineering is one good example being challenged by the complexities of society and technical advances. They state that competent engineers, as well as business managers, must have more than scientific and technical skills. Increasingly, both professionals should be familiar with the way science affects people in business and in the broader realm of society. Skill competence should

demonstrate: (a) an awareness that business procedures in a changing environment are significantly affected by changes in the technology, (b) sensitivity as to how company decisions will affect employment levels, work relationships and, for some, threaten their job security, and (c) an ability to systematically monitor and analyze the business changes and integrate the data developed into overall company goals and planning processes.

Descriptive Studies

In a study conducted by Prather, Williams and Wadley (1976), an investigation using the general linear model was undertaken to determine the relationship between student course grades and program of study. Controlling for student aptitude and longitudinal trends, they investigated the relationship between student course grades and program of study. Regression equations for 62 major fields of study and a group of students without a declared major were presented. The population consisted of 8,735 Fall, 1975, undergraduate students who had taken 40 credit hours of academic courses. A total of 189,013 individual grades were used. Their findings confirm that the major field of study is a predictor of grades received in courses throughout the universities' curriculum offerings. That is as we might expect, a student majoring in psychology

tended to receive a higher grade in psychology and educational foundation courses while grades in other unrelated courses were generally lower for the group. Furthermore, history majors typically did better in their history courses than non-majors. Another interesting point is that predicting course grades by major appears to be acceptable since in this study the goodness of fit as measured by the R^2 adjusted for degrees of freedom ranged from 25% to over 50% in explaining individual course grade variance.

Deckro and Woundenberg (1977) conducted a study of Kent State University students from the Fall Quarter, 1973 through the Winter Quarter, 1975. The purpose of the study was to evaluate both existing and proposed admission criteria as predictors of academic performance among students in its Master of Business Administration Program. The sample contained 157 students, 11.5% were females and 8.9% Afro-American or Spanish-surnamed. Variables included in the study were graduate grade point average, the total admission exam score, undergraduate grade point average, junior/senior grade point average, hours required in program, age of student upon entering program, sex, minority, part time, and full time.

The Deckro and Woundenberg (1977) study analyzed sex influence, minority status, and graduate grade point average as it relates to academic success. The study

found that the sex of an applicant does appear to be an important factor. Women candidates, on the average, do better academically than their male peers. Also, grade point averages were reconfirmed as acceptable predictors of academic success; in the final investigation, there appeared to be no significant relationship between minority status and graduate grade point average. On the other hand, Barnes (1972) finds that many minority group members often have their self-concepts battered by racial prejudice. Carmichael and Hamilton (1967) further state that, when racial minorities allow the dominant group to define their image, they sometimes believe the stereotypes fostered by others and may perform accordingly. If this is true, such attitudes about minority status could affect academic achievement, especially in the area of business achievement in Computer Science.

Schoenfedlt and Brush (1975) studied GPA as a good criterion for measuring academic achievement. Twelve major curricula areas were created by manipulating over 1,900 college student records. The 12 college GPA variables were comparable to early findings when analyzing GPAs over successive semesters. It was found that GPA is a multifaceted composite and that it may be considered a single measure of academic achievement. If academic ability differs between Computer Science students and Business Administration students, then GPA should reflect that.

Variable Relationship Studies

This section of the review of the literature will examine selected covariates, their validity and their inclusion in this study. Covariates used in this study were: sex, race, age, co-op status and overall grade point average. This study used the covariates for the following reasons.

1. Sex differences have been identified in a number of fields of study, especially in math and business, and its influence should be controlled.

2. Covarying race may help to control for some of the SES (Social Economic Status) biases related to academic achievement.

3. Age was selected to control for the maturity of the student. There is ample evidence that the ability to narrow ones focus of attention diminishes somewhat with increasing age, as does ability to handle simultaneous multiple inputs (Hoyer & Plude, 1980). In an academic setting, success in the rigors and demands of taking full-time classes, studying, completing multiple assignments, and possibly maintaining a work load may be related to a student's maturity (i.e., age).

Recently, the area of "sex differences" in research has received considerable attention (Pearson & Ialongo, 1983; Sherman, 1978; Bryden, 1979). The

hypothesis for sex differences stems from the nature/ nurture or biological versus sociocultural explanations (Petersen, 1983). The biological premise is based specifically upon genes, hormone, brain structure, function, and pubertal changes. Such factors have been used to support sex differences in spatial ability and academic achievement. Petersen stresses that only hormonal levels in the body have been correlated with sex differences in cognitive performance. In the past decade most studies have focused on two constructs: spatial ability and mathematics achievement. In socialization research, parental expectations, school structure arrangements and sex role socialization affect academic achievement.

Petersen (1983) states that:

> Research on sex differences and their development has been plagued by bias . . . . Much of the sex difference research in cognition and achievement, particularly in the past decade, has focused on two constructs: Spatial ability and mathematics achievement. Whereas (much) sex difference research . . . focused on a somewhat broader range of issues, research in the last decade seems to have been primarily reactionary, focusing solely on the two constructs in which males were thought to have an advantage. Although there are some interesting questions yet to be pursued with these constructs, it is essential that we keep the scientific questions, rather than the political issues, foremost. For example, with spatial ability it now appears that attention is largely focused on two narrow domains, only one requiring spatial processing: (1) judgment of

> verticality/horizontally, which appears to require more kinesthetic than spatial judgment and (2) mental rotations, a clearly spatial construct although one involving analog processing. Whether this latter construct has predictive validity in relation to occupational achievement or even educational achievement in specific fields remains to be seen . . . . Until we have a clearer understanding of which constructs show sex differences, efforts to explain their development are less likely to be productive. Although it is very important to understand brain processing and hormonal influences, for example, we must be aware that these specific processes . . . may have no generality in terms of a whole array of outcomes to which they are commonly applied, such as pursuit of a career in engineering. (pp. 13-15)

Breaugh and Mann (1981) carried out a study of 1969 and 1979 Master of Business Administration (MBA) graduates. This study was concerned with the accuracy with which successful completion of the MBA degree could be predicted from readily available admissions data: sex of the student, student age, undergraduate grade point average, Graduate Management Admission Test (GMAT) verbal score, and GMAT quantitative score. A discriminant analysis was used. The sample consisted of 507 students. They were randomly split into two parts, one part for deriving the discriminant function and one part for cross-validating the derived determinant function.

The results of the discriminant analysis clearly showed that the two criterion groups (graduates and non-graduates) could be differentiated. Of the students

sampled, 69% of those predicted to graduate actually did. Of the total sample (N=507), 429 students were randomly chosen for the development sample and 78 students were randomly selected for the cross-validation sample.

The discriminant analysis on the development sample clearly showed that the two criterion groups could be differentiated. ($X^2 = 24.30$, $P < .01$). From the correllations between each of the predictor variables and the discriminant function (the linear combination of the predictor variables which most accurately classified students into graduate and non-graduate categories), student age and GMAT quantitative score were the major variables. That is, they were the most heavily weighted variables in the linear combination of predictor variables and, subsequently, differentiated the two groups.

McClure, Wells and Bowerman (1986) conducted a study of students (who completed a MBA program) with the objective of constructing a model which would explain a reasonable proportion of variance in student graduate grade point average (GGPA). The N size was 118. All international students were eliminated from the sample. This was accomplished to account for the possibility that learning a new language and adjusting to a new culture may impact academic performance. Part-time students, were also eliminated because it was felt they operate in an

entirely different environment than do full-time students. That is, their first priority is often a job rather than school.

The model included the following independent variables: GMAT score, age, student from three most competitive schools, student from two least competitive schools, undergraduate quantitative major, status of undergraduate major (Education, Social Science, Liberal Arts or Fine Arts major). The model studied resulted in an $R^2 = 50$ and an adjusted $R^2 = .43$. Implications of the study suggest that the GMAT score, undergraduate grade point average, age, and undergraduate institution are important predictor variables for GGPA. In addition, the study indicates that undergraduate major is a useful predictor variable. It is important to note that Shapiro and Gould (1980) found undergraduate major not to be a useful variable.

Summary

A review of the literature emphasized: Transition to Hi-Tech Business Skills, The Relationship Between Academic Achievement and Work Performance, Descriptive Studies and Variable Relationship Studies concerning academic achievement. Research is available concerning academic performance in Computer Science programming courses. However, little research discusses academic

performance in Business Administration courses and the literature concerning student business achievement in both Computer Science and College of Business is, to the investigator's knowledge, virtually nonexistent.

The following list summarizes the principle conclusions of the studies reviewed in this chapter.

1. Job opportunities in hi-tech business will grow rapidly this decade.

2. Grades and academic ability represent only one type of personal competence and may have little relationship to other types of skills and capabilities in life.

3. Academic quality needs attention as challenged by the complexities of society and technical advances.

4. Major field of study is a predictor of grades received in courses throughout a university's course offerings.

5. Student grades are strongly related to the student's major field of study. Therefore, a student's college grades can be used to differentiate between majors.

6. GPA can be considered a single measure of academic achievement.

7. Student age and undergraduate grade point average may be considered predictor variables and can be used to differentiate two groups.

From the review of literature, it is apparent then, that this study represents a significant contribution to the academic profession. It is an important investigation in analyzing possible academic differences between majors in different fields of study, especially Computer Science and Business Administration programs. Because grades are strongly related to one's major field of study, core business course grade variables were used in the ex post facto research. As suggested by the literature review, sex, race, age, co-op status, and the undergraduate grade point average could also be considered important variables in differentiating groups. Consequently, these variables were selected for use since they may be related to the selection of academic major and may also account for differences in business academic achievement.

CHAPTER III

METHODOLOGY

Introduction

Chapter III includes the statement of the problem and its relationship to the findings of the literature review, the research design to investigate the problem, stages of analysis, population-sample, selection and collection of data, statistical analysis, limitations of the study and summary.

The Problem

This study dealt with academic achievement differences between two groups of graduates at an urban, Northeastern Ohio, state university. Because there was a perceived notion that Computer Science graduates were deficient in business and there were no data or research supporting or refuting it, this study was undertaken. The problem was to determine if there were academic business achievement differences between graduates who had received B.S. or B.A. degrees in the Computer Science--Business Option program and the College of Business Administration program. These students graduated from the university between 1983 and 1987. Group 1 consisted of Computer Science--Business Option degree majors in the College of Arts and Sciences and Group 2 consisted of

their counterpart majors in the College of Business Administration. Academic achievement was measured by course grades (CGs) in seven common business knowledge courses that were completed by both groups. These courses included: (a) Principles of Macro and Micro Economics, and (b) Accounting I and II. These courses were taken by the end of the sophomore year. The other courses completed by or at the end of the senior year were: (c) Business Finance, (d) Management: Principles and Concepts, and (e) Marketing Principles. In all, there were seven sequential business knowledge courses used in this study. A course description for each course is provided in the Operational Definitions section of Chapter I.

Using sets of courses was assumed to be helpful in explaining and/or identifying those business skills that differentiate Computer Science majors' academic business skill achievement levels from their counterpart majors in the College of Business.

The problem under investigation in this study was to determine whether academic differences between the two groups existed by using various combinations of course sets: (a) in the set of all seven core business courses; (b) in the set of the first four business courses taken by the sophomore year; (c) in the set of the last three business courses taken by the senior year; (d) over time (between sophomore and senior levels); and (e) when covarying selected academic and demographic variables (i.e., sex, race, co-op status and overall undergraduate grade point average).

The categorical grouping variable in this study was major program of study. Membership consisted of students being classified as either Computer Science--Business Option majors (Group 1) or Business Administration majors (Group 2). The coding scheme used to distinguish the groups in this study was Group 1, coded 1 and Group 2, coded 0. Conceptually, the study discriminated between the two groups using the seven business core courses. These courses represent business knowledge skills acquired in Accounting, Economics, Finance, Management, and Marketing Principles.

The terms: sex, race, age, co-op status, and overall grade point average, represent a group of independent variables that may have exhibited some relationship to the dependent variable or the individual course grades.

Although none of the studies reviewed indicate specific variables that relate directly to and account for academic success, many do have a direct bearing on CGs. Therefore, the investigator decided that CGs, being the best single descriptor of the material in the course and of academic achievement, be used as a predictor variable. Furthermore, Prather, Williams, and Wadley (1976) state that the major field of study is strongly related to grades received in courses throughout the university's curriculum. Student major then served as the criterion. Other variables covaried were: sex, (Deckro & Woundenberg, 1977), race (Willingham & Morris, 1986), age, (Deckro & Woundenberg, 1977), co-op status, and course grade. It was assumed from

the research that their inclusion in the study would account for any unique variance in explaining differences in academic achievement between the groups.

Research Design

The research design used in this study was ex post facto. According to Kerlinger (1973):

> . . . ex post facto research is systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made, without direct intervention, from noncommittant variation of independent and dependent variables. (p. 379)

There are three major types of ex post facto research. They are: (a) research without hypotheses, (b) research with stated hypotheses, and (c) research with tests, stated hypotheses and alternative hypotheses (Newman & Newman, 1977). This ex post facto research tested stated hypotheses and alternative hypotheses.

According to Newman and Newman (1977), the main advantage of using ex post facto research is the high degree of potential external validity or the ability to generalize results from an experimental situation to the general population. At the same time it is recognized that there are inherent weaknesses in ex post facto research. They are: (a) the inability to randomly assign and manipulate the independent variables (Kerlinger, 1973); and (b) it contains attributes which can only demonstrate relationships--not causation (Newman & Newman, 1977).

The Statistical Analysis System (SAS) was used to analyze the data. Specific procedures within the SAS system were used to obtain descriptive statistics, correlations and tests of significance (SAS, 1985).

Stages of Analysis

To explore the possibility of academic achievement differences, this study consisted of two phases. Using selected business course grades in seven core business courses, Phase 1 attempted to detect academic differences at different times between graduates (1983-1987) who were enrolled as students in either Computer Science or Business Administration. The second phase retested the Phase I hypothesis while controlling variables that are statistically related to academic achievement.

Population: Sample, Selection and Collection of Data

The sample population for this study consisted of Computer Science--Business Option and Business Administration graduates from 1983 through 1987 (see Table 1, p. 46). The final research sample study consisted of the records of 91 students who had received undergraduate degrees in Computer Science and 494 who had graduated in Business Administration. These undergraduate degrees were awarded from an urban, Ohio, state university with nine colleges. At the time of this study, there were

TABLE 1

Population Sample Size By Group

TITLE	MAJOR	MAJOR CODE	GROUP	SAMPLE SIZE
College of Arts and Sciences:				
	Computer Science--Business Option	34600	1	91
TOTAL COMPUTER SCIENCE--BUSINESS OPTION MAJORS:				91
College of Business Administration:				
	Accounting	62000	2	131
	Taxation	62001	2	6
	Finance	64000	2	45
	Management	65000	2	94
	Ind. Acctng.	65001	2	8
	Marketing	66000	2	119
TOTAL BUSINESS ADMINISTRATION MAJORS:				403
TOTAL COMPUTER SCIENCE-BUSINESS OPTION MAJORS AND BUSINESS ADMINISTRATION MAJORS:				494

approximately 27,000 students from 34 states and 83 foreign countries attending this university. With its enrollment, it ranks as the third largest university in Ohio and the 52nd largest in the nation. The university is located in the Northeast Ohio metropolitan area which has an approximate 1.5 million population.

To begin the study, Computer Science--Business Option majors graduating from the College of Arts and Sciences between 1983 through 1987 were identified. In order to create the data file necessary for the study, variables from both the university Student Master File and the Student Grade File were used. This composite file, taken from the then current records, consisted of the following data elements: a) student major code (i.e., Computer Science or Business Administration), (b) degree code, (c) term, (d) graduation year, (e) sex, (f) race, (g) age (i.e., birthdate), (h) co-op status, (i) overall grade point average, and (j) the course grades for Course 1 through Course 7. Data elements (a) through (h) were taken from the Student Master File. Data elements (i) and (j) were taken from the Student Grade File.

The business courses making up the predictor CGs were:

Variable Number	Name
C_1	Principles of Macro Economics
C_2	Principles of Micro Economics
C_3	Accounting I
C_4	Accounting II
C_5	Business Finance
C_6	Management
C_7	Marketing

Statistical Analysis

The data collected were analyzed using multiple linear regression. Being more flexible than traditional analysis of variance, multiple linear regression (McNeil, Kelly, & McNeil, 1975) permits tests for relationships between categorical variables, between categorical and continuous variables, or between continuous variables (Kerlinger & Pedhazer, 1973). Its value is that models may be written which reflect the specific research hypothesis (McNeil, Kelly, & McNeil, 1975). Using this technique permits the researcher to predict the relationship of one variable to another and, in covaring selected variables, to test alternative hypotheses.

This study used the F Test to test the statistical significance of the determined relationships in the hypotheses. It is a robust test in that the selection of subjects and normal distribution of variables can be violated with very little effect on the accuracy of the test (Edwards, 1972).

Reviewing the literature revealed no conclusive evidence of the directional relationship of all the variables in this study. Consequently a non-directional or two tailed test of significance was chosen. Such a test will avoid making a false assumption regarding the direction of the relationship.

The researcher set the alpha level of each hypothesis at .05. This means that the probability of rejecting a true significant relationship between variables is only 5 out of 100 times. The alpha level of .05 was selected since it was felt that the consequences of making a Type 1 error (rejecting a true null hypothesis) were not serious enough as to require a more stringent level. The .05 alpha level will decrease the probability of making a Type II error (Ward & Jennings, 1973).

Adjusted Alpha Level

When making a number of comparisons, the alpha level may rise. To control this, Newman and Fry (1983) suggest that the alpha level established be divided by the number of hypotheses to be tested minus 1.

$$\frac{.05}{\text{\# of hyp } -1} = \text{Adjusted alpha}$$

In this study, .0056 (.05/9) had to be achieved in order for the hypothesis tested to be supported at the given level of significance (.05).

Power Analysis

Power analysis, a technique used in this study, is the ability to detect a difference when a difference exists (Newman & Benz, 1983). It is used conceptually to see how much two groups differ in standard deviation

units. Four parameters are used in power analysis: (a) the alpha level; (b) the N size (number of subjects); (c) the effect size (the strength of the relationship between the independent variables); and (d) the power value selected.

According to Cohen (1977), three main effect (f^2) sizes were: Small (f^2=.02), Medium (f^2=.15), and Large (f^2=.35). In this study, the researcher set a .02 effect size for statistical analysis.

Limitations of the Study

1. The study included student data pertinent to only the four year Computer Science--Business Option and the Business Administration programs from an urban Northeastern Ohio university.

2. The study was confined to a total of 494 students who graduated between 1983 and 1987. Group 1 consisted of 91 Computer Science--Business Option majors from the College of Arts and Sciences and Group 2 consisted of 403 counterpart majors from the College of Business Administration.

3. The study did not distinguish between day or evening students.

4. An ex post facto research design with hypothesis and alternative hypothesis was used. When using ex

post facto research, causation cannot be inferred and internal validity is considered low.

Summary

Chapter III began with a restatement of the problem as to whether: (a) differences in academic achievement discriminate between students majoring in a four-year Computer Science--Business Option program and students majoring in a four year College of Business Administration program at a Northeastern Ohio, urban university; (b) academic achievement differences existed over time between the majors; and (c) other demographic variables explained the relationship of academic achievement to selection of major. The study used an ex post facto design with non-manipulable independent variables.

The study consisted of two (2) phases. Phase I attempted to detect academic differences at different times (sophomore and senior levels) between graduates (1983-1987) using sets of the seven business course grades making up the predictor CGs. Phase II retested the Phase I hypotheses while controlling for sex, race, age, co-op status and grade point average.

Using multiple linear regression, the study used the F Test to test the statistical significance of the determined relationships in the hypotheses. The

researcher set a .02 effect size and a .0056 as the adjusted alpha.

The chapter concluded by listing the limitations of the study.

CHAPTER IV

RESULTS OF THE STUDY

This chapter contains the research findings and results obtained from the statistical analysis of the collected data. These results are presented in 4 sections. Section 1 is a report of the descriptive statistics. Section 2 outlines the method and format to be used in reporting the statistical results. Sections 3 represent the actual statistical results of testing the ten research hypotheses. The last section, section 4 concludes the chapter with a brief summary.

Descriptive Data

The data that represented the variables investigated in this study were course grades for Principles of Macro Economics, Principles of Micro Economics, Accounting I and Accounting II, Business Finance, Management and Marketing. Other descriptive data elements included sex, race, co-op status and overall grade point average.

The mean ($\bar{X}$) and standard deviation (SD) for continuous variables and the percent and frequency for categorical variables will be presented with accompanying tables. Also, selected correlations will be provided.

Table 2 shows the mean ($\bar{X}$) and standard deviation (SD) of the continuous variables. These include over-all undergraduate grade point average, the means and standard deviations of the seven course grades, and the age for the total group of Computer Science and Business Administration majors and for each major separately.

Table 3 shows the size (N) and percent (%) of students among the different categories and groupings. The categorical variables are: major field of study and degree awarded.

Table 4 shows the term that the course work was completed, graduation year, student sex, and race among the groupings. The non-white population consisted of the following ethnic groupings:

American Indian

Black American

Oriental

Spanish Surnamed American

Other

The total N for each group and percentages are listed.

TABLE 2

Descriptive Statistics for Continuous Variables:

Total Group, Computer Science and

Business Administration Majors

Variable	Total Group	Computer Science	Business Administration
	N=494	N=91	N=403
Overall Undergraduate Grade Point Average			
$\bar{X}$	2.8361	2.9189	2.8173
Standard Deviation	.4384	.4095	.4430
Course 1			
X	2.7261	2.9791	2.6690
S.D.	.7789	.7503	.7747
Course 2			
X	2.6630	2.9175	2.6055
S.D.	.8322	.7114	.8473
Course 3			
X	2.7597	2.9824	2.7094
S.D.	.8282	.7475	.8381
Course 4			
X	2.6998	2.8868	2.6576
S.D.	.8539	.7769	.8657
Course 5			
X	2.5607	2.5758	2.5573
S.D.	.8417	.7467	.8626
Course 6			
X	3.0056	3.0087	3.0050
S.D.	.7154	.6997	.7197
Course 7			
X	2.7056	2.8956	2.6628
S.D.	.7330	.6963	.7351
Age			
$\bar{X}$	24.1457	23.8242	24.2184
S.D.	3.7033	2.6691	3.8982

TABLE 3

Descriptive Statistics for Categorical Variables:

Major Field of Study and Degree Awarded

Variable Name	Code	Business Administration		Computer Science	
		N	%	N	%
MAJOR					
Computer Science-	34600			91	18.4
Business Admin.		403	81.6		
Accounting-	62000	131	26.5		
Tax. Acctg.	62001	6	1.2		
Finance-	64000	45	9.1		
Management-	65000	94	19.0		
Indst. Acctg.-	65001	8	1.6		
Marketing-	66000	119	24.1		
DEGREE					
B.S. Arts/Science--					
Computer Science				91	18.4
Business Admin.					
Accounting-	40601	135	33.5		
Bus. Admn.-	40602	1	.2		
Indst Mgt.-	40603	105	26.1		
Finance-	40604	43	10.7		
Marketing	40606	119	29.5		

TABLE 4

Descriptive Statistics for Categorical Variables:

Term, Graduation Year, Sex, and Race

Variable Name	Total	Group	Business Administration		Computer Science	
	N	%	N	%	N	%
TERM						
Fall	202	40.9	165	40.9	37	40.7
Spring	292	59.1	238	59.1	54	59.3
YEAR						
1983	77	15.6	68	16.9	9	9.9
1984	99	20.0	72	17.9	27	29.7
1985	118	23.9	90	22.3	28	30.8
1986	100	20.2	84	20.8	16	17.6
1987	100	20.2	89	22.1	11	12.1
SEX						
M=0	199	40.3	166	41.2	33	36.3
F=1	295	59.7	237	58.8	58	63.7
RACE						
White	463	94.9	378	95.2	85	93.4
Non-white	31	5.1	25	4.8	6	6.6

Table 5 shows the age and co-op status among the groupings. The total N for each group and percentages are listed.

TABLE 5

Descriptive Statistics for

Categorical Variables: Age and Co-op Status

Variable Name	Total Group		Business Administration		Computer Science	
	N	%	N	%	N	%
AGE						
20-25	416	84.4	336	83.40	80	88.3
26-30	53	10.6	46	11.41	7	7.7
31-35	13	2.6	10	2.50	3	3.25
36-40	7	1.4	6	1.40	1	1.11
41-44	-	-	-	-	-	-
45-50	5	1.0	5	1.00	-	-
CO-OP						
0=Non-Co-op	475	96.2	396	98.3	79	86.8
1=Co-op	19	3.8	7	1.7	12	13.2

Grade distribution Tables 6-12 provide the numeric and letter grades, frequency, percent, cumulative frequency, and cumulative percent for each group (Total Group, Business Administration majors, and Computer

Science--Business Option majors). Additionally, on the right side of the Table is listed the course mean ($\bar{X}$) and standard deviation (SD).

Table 6 shows the grade distribution for Macro Economics. The total group grade shows grade ranges from D- to A. The mean is 2.7261 with a standard deviation of .7789. For Business Administration majors, the grade range is D- to A, while the mean is 2.6690 with a standard deviation of .7747. For Computer Science--Business Option majors, the grade range is D to A, while the mean was 2.9791 with a standard deviation of .7503.

Table 7 shows the grade distribution for Micro Economics. The total group grade shows grade ranges from D- to A. The mean is 2.6630 with a standard deviation of .8822. For Business Administration majors, the grade range is D- to A, while the mean is 2.6059 with a standard deviation of .8473. For Computer Science--Business Option majors, the grade range is D+ to A, while the mean is 2.9176 with a standard deviation of .7114.

Table 8 presents the grade distribution for Accounting I. The total group grade shows grade ranges from D- to A. The mean is 2.7597 with a standard deviation of .8282. For Business Administration majors, the grade range is D- to A, while the mean is 2.7094 with a standard deviation of .8380. For Computer Science--

TABLE 6

Grade Distribution for Macro Economics (C_1)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM. %	MEAN	STAND. DEV.
For Total Group							
0.7	D-	1	0.2	1	0.2		
1	D	16	3.2	17	3.4		
1.3	D+	7	1.4	24	4.9		
1.7	C-	23	4.7	47	9.5		
2	C	103	20.9	150	30.4		
2.3	C+	50	10.1	200	40.5	2.7261	.7789
2.7	B-	50	10.1	250	50.6		
3	B	106	21.5	356	72.1		
3.3	B+	46	9.3	402	81.4		
3.7	A-	40	8.1	442	89.5		
4	A	52	10.5	494	100.0		
For Business Administration Majors							
0.7	D-	1	0.2	1	0.2		
1	D	14	3.5	15	3.7		
1.3	D+	7	1.7	22	5.5		
1.7	C-	20	5.0	42	10.4		
2	C	90	22.3	132	32.8		
2.3	C+	44	10.9	176	43.7		
2.7	B-	42	10.4	218	54.1	2.6690	.7747
3	B	84	20.8	302	74.9		
3.3	B+	34	8.4	336	83.4		
3.7	A-	30	7.4	366	90.8		
4	A	37	9.2	403	100.0		
For Computer Science--Business Option Majors							
1	D	2	2.2	2	2.2		
1.7	C-	3	3.3	5	5.5		
2	C	13	14.3	18	19.8		
2.3	C+	6	6.6	24	26.4		
2.7	B-	8	8.8	32	35.2		
3	B	22	24.2	54	59.3	2.9791	.7503
3.3	B+	12	13.2	66	72.5		
3.7	A-	10	11.0	76	83.5		
4	A	15	16.5	91	100.0		

TABLE 7

Grade Distribution for Micro Economics (C_2)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM. %	MEAN	STAND. DEV.
For Total Group							
0.7	D-	7	1.4	7	1.4		
1	D	15	3.0	22	4.5		
1.3	D+	8	1.6	30	6.1		
1.7	C-	37	7.5	67	13.6		
2	C	98	19.8	165	33.4		
2.3	C+	65	13.2	230	46.6	2.6630	.8322
2.7	B-	43	8.7	273	55.3		
3	B	82	16.6	355	71.9		
3.3	B+	44	8.9	399	80.8		
3.7	A-	35	7.1	434	87.9		
4	A	60	12.1	494	100.0		
For Business Administration Majors							
0.7	D-	7	1.7	7	1.7		
1	D	15	3.7	22	5.5		
1.3	D+	7	1.7	29	7.2		
1.7	C-	32	7.9	61	15.1		
2	C	86	21.3	147	36.5		
2.3	C+	55	13.6	202	50.1	2.6055	.8473
2.7	B-	33	8.2	235	58.3		
3	B	67	16.6	302	74.9		
3.3	B+	26	6.5	328	82.4		
3.7	A-	26	6.5	354	87.8		
4	A	49	12.2	403	100.0		
For Computer Science--Business Option Majors							
1.3	D+	1	1.1	1	1.1		
1.7	C-	5	5.5	6	6.6		
2	C	12	13.2	18	19.8		
2.3	C+	10	11.0	28	30.8		
2.7	B-	10	11.0	38	41.8		
3	B	15	16.5	53	58.2	2.9176	.7114
3.3	B+	18	19.8	71	78.0		
3.7	A-	9	9.9	80	87.9		
4	A	11	12.1	91	100.0		

TABLE 8

Grade Distribution for Accounting I (C_3)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM. %	MEAN	STAND. DEV.
For Total Group							
0.7	D-	1	0.2	1	0.2		
1	D	20	4.0	21	4.3		
1.3	D+	7	1.4	28	5.7		
1.7	C-	27	5.5	55	11.1		
2	C	98	19.8	153	31.0		
2.3	C+	42	8.5	195	39.5		
2.7	B-	41	8.3	236	47.8	2.7597	.8282
3	B	109	22.1	345	69.8		
3.3	B+	36	7.3	381	77.1		
3.7	A-	45	9.1	426	86.2		
4	A	68	13.8	494	100.0		
For Business Administration Majors							
0.7	D-	1	0.2	1	0.2		
1	D	17	4.2	18	4.5		
1.3	D+	7	1.7	25	6.2		
1.7	C-	26	6.5	51	12.7		
2	C	86	21.3	137	34.0		
2.3	C+	36	8.9	173	42.9	2.7094	.8380
2.7	B-	34	8.4	207	51.4		
3	B	78	19.4	285	70.7		
3.3	B+	29	7.2	314	77.9		
3.7	A-	38	9.4	352	87.3		
4	A	51	12.7	403	100.0		
For Computer Science--Business Option Majors							
1	D	3	3.3	3	3.3		
1.7	C-	1	1.1	4	4.4		
2	C	12	13.2	16	17.6		
2.3	C+	6	6.6	22	24.2		
2.7	B-	7	7.7	29	31.9		
3	B	31	34.1	60	65.9	2.9824	.7475
3.3	B+	7	7.7	67	73.6		
3.7	A-	7	7.7	74	81.3		
4	A	17	18.7	91	100.0		

Business Option majors, the grade range is D to A, while the mean is 2.9824 with a standard deviation of .7475.

Table 9 shows the grade distribution for Accounting II. The total group grade shows grade ranges from D- to A. The mean is 2.6998 with a standard deviation of .8539. For Business Administration majors, the grade range is D- to A, while the mean is 2.6575 with a standard deviation of .8657. For Computer Science--Business Option majors, the grade range is D to A, while the mean is 2.8868 with a standard deviation of .7769.

Table 10 presents the grade distribution for Business Finance. The total group grade shows grade ranges from D- to A. The mean is 2.5607 with a standard deviation of .8417. For Business Administration majors, the grade range is D- to A, while the mean is 2.5773 with a standard deviation of .86261. For Computer Science--Business Option majors, the grade range is D to A, while the mean is 2.5758 with a standard deviation of .7467.

Table 11 presents the grade distribution for management. The total group grade shows grade ranges from D to A. The mean is 3.0656 with a standard deviation of .7154. For Business Administration majors, the grade range is D to A, while the mean is 3.0050 with a standard deviation of .7197. For Computer Science--Business Option majors, the grade range is D to A, while the mean is 3.0088 with a standard deviation of .6998.

TABLE 9

Grade Distribution for Accounting II (C_4)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM. %	MEAN	STAND. DEV.
For Total Group							
0.7	D-	4	0.8	4	0.8		
1	D	18	3.6	22	4.5		
1.3	D+	10	2.0	32	6.5		
1.7	C-	27	5.5	59	11.9		
2	C	115	23.3	174	35.2		
2.3	C+	47	9.5	221	44.7		
2.7	B-	37	7.5	258	52.2	2.6998	.8539
3	B	95	19.2	353	71.5		
3.3	B+	36	7.3	389	78.7		
3.7	A-	26	5.3	415	84.0		
4	A	79	16.0	494	100.0		
For Business Administration Majors							
0.7	D-	4	1.0	4	1.0		
1	D	17	4.2	21	5.2		
1.3	D+	8	2.0	29	7.2		
1.7	C-	25	6.2	54	13.4		
2	C	99	24.6	153	38.0		
2.3	C+	35	8.7	188	46.7	2.6575	.8657
2.7	B-	31	7.7	219	54.3		
3	B	77	19.1	296	73.4		
3.3	B+	25	6.2	321	79.7		
3.7	A-	18	4.5	339	84.1		
4	A	64	15.9	403	100.0		
For Computer Science--Business Option Majors							
1	D	1	1.1	1	1.1		
1.3	D+	1	1.1	2	2.2		
1.7	C-	1	1.1	3	3.3		
2	C	14	15.4	17	18.7		
2.3	C+	1	1.1	18	19.8		
2.7	B-	4	4.4	22	24.2	2.8868	.7769
3	B	45	49.5	67	73.6		
3.3	B+	2	2.2	69	75.8		
3.7	A-	3	3.3	72	79.1		
4	A	19	20.9	91	100.0		

TABLE 10

Grade Distribution for Business Finance (C_5)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM. %	MEAN	STAND. DEV.
For Total Group							
0.7	D-	7	1.4	7	1.4		
1	D	24	4.9	31	6.3		
1.3	D+	10	2.0	41	8.3		
1.7	C-	45	9.1	86	17.4		
2	C	110	22.3	196	39.7		
2.3	C+	46	9.3	242	49.0	2.5607	.8417
2.7	B-	54	10.9	296	59.9		
3	B	89	18.0	385	77.9		
3.3	B+	28	5.7	413	83.6		
3.7	A-	28	5.7	441	89.3		
4	A	53	10.7	494	100.0		
For Business Administration Majors							
0.7	D-	5	1.2	5	1.2		
1	D	23	5.7	28	6.9		
1.3	D+	8	2.0	36	8.9		
1.7	C-	36	8.9	72	17.9		
2	C	91	22.6	163	40.4		
2.3	C+	42	10.4	205	50.9	2.5773	.86261
2.7	B-	36	8.9	241	59.8		
3	B	68	16.9	309	76.7		
3.3	B+	23	5.7	332	82.4		
3.7	A-	24	6.0	356	88.3		
4	A	47	11.7	403	100.0		
For Computer Science--Business Option Majors							
0.7	D-	2	2.2	2	2.2		
1	D	1	1.1	3	3.3		
1.3	D+	2	2.2	5	5.5		
1.7	C-	9	9.9	14	15.4		
2	C	19	20.9	33	36.3		
2.3	C+	4	4.4	37	40.7		
2.7	B-	18	19.8	55	60.4		
3	B	21	23.1	76	83.5	2.5758	.7467
3.3	B+	5	5.5	81	89.0		
3.7	A-	4	4.4	85	93.4		
4	A	6	6.6	91	100.0		

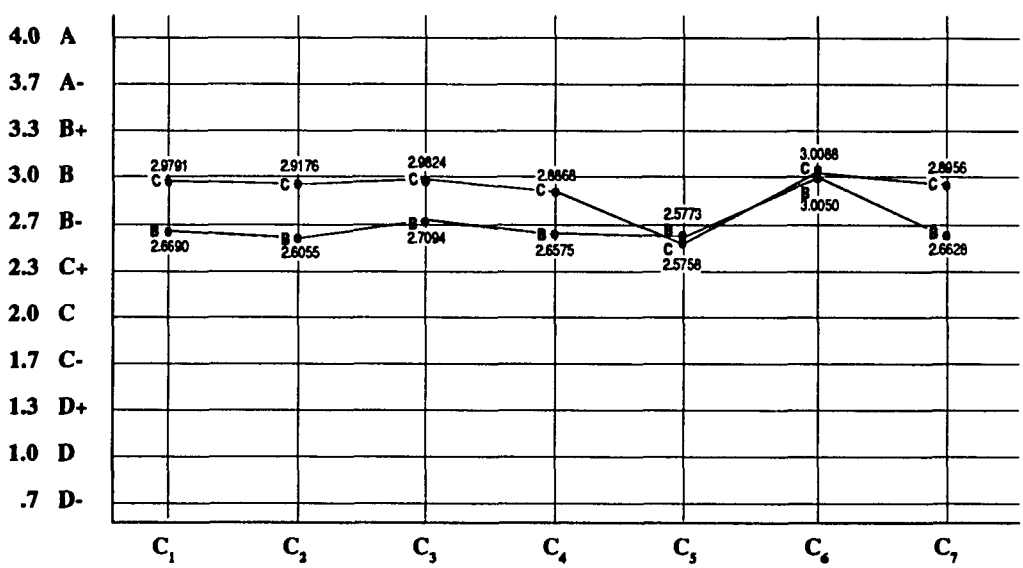
TABLE 11

Grade Distribution for Management (C_6)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM. %	MEAN	STAND. DEV.
For Total Group							
1	D	6	1.2	6	1.2		
1.3	D+	1	0.2	7	1.4		
1.7	C-	4	0.8	11	2.2		
2	C	87	17.6	98	19.8		
2.3	C+	17	3.4	115	23.3		
2.7	B-	27	5.5	142	28.7		
3	B	205	41.5	347	70.2	3.0656	.7154
3.3	B+	18	3.6	365	73.9		
3.7	A-	19	3.8	384	77.7		
4	A	110	22.3	494	100.0		
For Business Administration Majors							
1	D	5	1.2	5	1.2		
1.7	C-	3	0.7	8	2.0		
2	C	73	18.1	81	20.1		
2.3	C+	16	4.0	97	24.1		
2.7	B-	23	5.7	120	29.8		
3	B	160	39.7	280	69.5	3.0050	.7197
3.3	B+	16	4.0	296	73.4		
3.7	A-	16	4.0	312	77.4		
4	A	91	22.6	403	100.00		
For Computer Science--Business Option Majors							
1	D	1	1.1	1	1.1		
1.3	D+	1	1.1	2	2.2		
1.7	C-	1	1.1	3	3.3		
2	C	14	15.4	17	18.7		
2.3	C+	1	1.1	18	19.8		
2.7	B-	4	4.4	22	24.2		
3	B	45	49.5	67	73.6	3.0088	.6998
3.3	B+	2	2.2	69	75.8		
3.7	A-	3	3.3	72	79.1		
4	A	19	20.9	91	100.0		

Table 12 presents the grade distribution for Marketing. The total group grade shows grade ranges from D- to A. The mean is 2.7056 with a standard deviation of .7330. For Business Administration majors, the grade range is D- to A, while the mean is 2.6628 with a standard deviation of .7351. For Computer Science--Business Option majors, the grade range is D- to A, while the mean is 2.8956 with a standard deviation of .6963.

FIGURE 1: Course Means by Major for the Seven Courses (C_1-C_7)



Note: **C = Computer Science Business--Option Majors**
B = Business Administration Majors
(See tables 6-12, Chapter IV for means of each group)

Figure 1 illustrates the mean course grades for each of the seven courses by major. The mean for C_1 is 2.9791 for Computer Science--Business Option majors, and

TABLE 12

Grade Distribution for Marketing (C_7)

PTS.	LET. GR.	FREQ.	%	CUM. FREQ.	CUM.%	MEAN	STAND. DEV.
For Total Group							
0.7	D-	1	0.2	1	0.2		
1	D	4	0.8	5	1.0		
1.3	D+	8	1.6	13	2.6		
1.7	C-	24	4.9	37	7.5		
2	C	122	24.7	159	32.2		
2.3	C+	56	11.3	215	43.5		
2.7	B-	54	10.9	269	54.5	2.7056	.7330
3	B	90	18.2	359	72.7		
3.3	B+	53	10.7	412	83.4		
3.7	A-	36	7.3	448	90.7		
4	A	46	9.3	494	100.0		
For Business Administration Majors							
0.7	D-	1	0.2	1	0.2		
1	D	3	0.7	4	1.0		
1.3	D+	8	2.0	12	3.0		
1.7	C-	21	5.2	33	8.2		
2	C	106	26.3	139	34.5		
2.3	C+	49	12.2	188	46.7	2.6628	.7351
2.7	B-	43	10.7	231	57.3		
3	B	71	17.6	302	74.9		
3.3	B+	39	9.7	341	84.6		
3.7	A-	24	6.0	365	90.6		
4	A	38	9.4	403	100.0		
For Computer Science--Business Option Majors							
1	D	1	1.1	1	1.1		
1.7	C-	3	3.3	4	4.4		
2	C	16	17.6	20	22.0		
2.3	C+	7	7.7	27	29.7		
2.7	B-	11	12.1	38	41.8		
3	B	19	20.9	57	62.6	2.8956	.6963
3.3	B+	14	15.4	71	78.0		
3.7	A-	12	13.2	83	91.2		
4	A	8	8.8	91	100.0		

2.6690 for Business Administration majors. The mean for C_2 is 2.9176 for Computer Science--Business Option majors, and 2.6055 for Business Administration majors. The mean for C_3 is 2.9824 for Computer Science--Business Option majors, and 2.7094 for Business Administration majors. The mean for C_4 is 2.8868 for Computer Science--Business Option majors, and 2.6575 for Business Administration majors. The mean for C_5 is 2.5758 for Computer Science--Business Option majors, and 2.5773 for Business Administration majors. The mean for C_6 is 3.0088 for Computer Science--Business Option majors, and 3.0050 for Business Administration majors. The mean for C_7 is 2.8956 for Computer Science--Business Option majors, and 2.6628 for Business Administration majors.

Table 13 lists correlations between each of the seven course grades as well as the overall grade point average. Each block (i.e., intersection by row and column) contains three entries. The first (top) entry is the correlation for the total group, the second (middle) entry is the correlation for the Computer Science group, and the third (bottom) entry represents the correlation for the Business Administration group.

TABLE 13

Course Correlations for the Total Group and Each Major

	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7
C	.49396D						
2	.32790C						
	.51122D						
C	.49247D	.45806D					
3	.48665D	.35410D					
	.48186D	.46369D					
C	.45700D	.49329D	.54495D				
4	.37882C	.50801D	.52629D				
	.46252D	.48235D	.54123D				
C	.40127D	.41391D	.43494D	.47791D			
5	.26263B	.39150D	.33443C	.41810D			
	.43193D	.42123D	.45530D	.49040D			
C	.34483D	.36223D	.28572D	.34334D	.35361D		
6	.19482	.18917	.20803A	.21828A	.17689		
	.38114D	.39872D	.30348D	.36994D	.38729D		
C	.43383D	.43005D	.42744D	.43534D	.38149D	.38210D	
7	.41579D	.42945D	.42549D	.33713C	.35964D	.44131D	
	.42457D	.41849D	.41703D	.44548D	.38797D	.37315D	
G	.6160 D	.58159D	.56845D	.64572D	.56775D	.54345D	.68198D
P	.49534D	.54219D	.50545D	.67851D	.51578D	.36458D	.69323D
A	.63538D	.58341D	.57469D	.63579D	.57909D	.58199D	.67601D

NOTE:

R12 = Total (top entry)
R12 = C.S. (middle entry)
R12 = Bus. (bottom entry)

Obtained Probability

A≤.05
B≤.01
C≤.001
D≤.0001

Total N for Total Group is 494
Total N for Business Administration Group is 403
Total N for Computer Science--Business Option Group is 91

NOTE: There are many significant correlations of the items. However, this may be due to the large number of subjects.

Statistical Reporting of Results

Newman, Klein, Weis, and Benz (1980) suggest the format that this study will follow. The reported findings will be presented in ten tables. Each hypothesis will emphasize the following data:

1. a research statement of the hypothesis;
2. full and restricted models used to test each hypothesis. Statistical values for each variable will be included;
3. the R^2 (squared multiple correlation coefficient) for each model;
4. the F Ratio (F);
5. The Probability (P);
6. the degrees of freedom in the numerator and denominator;
7. the alpha level and the alpha prime level; and
8. the indication of significance (S) or non-significance (NS).

Each independent variable in the hypothesis model is coded as follows:

Variable Number	Name
C_1	Principles of Macro Economics
C_2	Principles of Micro Economics
C_3	Accounting I
C_4	Accounting II
C_5	Business Finance
C_6	Management
C_7	Marketing
X_8	Sex
X_9	Race
X_{10}	Age
X_{11}	Co-op, coded 1
X_{12}	Overall undergraduate grade point average

Results of the Analysis of the Hypotheses

Discussion and analysis of each hypothesis is based on the tables numbered Table 14 through Table 23.

General Hypothesis 1

H_1: Course grades in all seven core business courses (Economics I and II, Accounting I and II, Business Finance, Management, and Marketing) will discriminate between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the first research hypothesis are depicted in the reported findings in Table 14. Table 14 shows the parameter estimates and the ANOVA for this hypothesis.

TABLE 14

Results for Hypothesis 1

Hypothesis and Models
Hypothesis 1. Course grades in all seven core business courses (Economics I and II, Accounting I and II, Business Finance, Management, and Marketing) will discriminate between majors in either Computer Science--Business Option or Business Administration.
Full Model: Group = (-.0257)U + (.0538)C1 + (.0460)C2 + (.0265)C3 + (.0114)C4 + (-.0508)C5 + (-.0459)C6 + (.0387)C7 + E
Restricted Model: Group = A_oU + E

R2	df	Alpha'	F	P	S/NS
Full = .0488	7/486	.0056	3.5649	.0010	S
Rest. = .0000					

Note: See list of variables on p. 72

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

The results of Hypothesis 1 show that the course grades in all seven core business courses did account for a significant amount of variance in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The Computer Science--Business Option majors scored significantly higher than their counterpart majors on the set of all seven courses. Table 14 reports a probability of .0010 with an F value of 3.5649. The effect size was calculated to be .0513. According to Cohen (1977), this is a small effect size.

This research hypothesis was accepted by the investigator.

General Hypothesis 2

H_2: Course grades in the core business courses for those sophomore students who have completed Economics and Accounting (first four courses) will discriminate between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the second research hypothesis are depicted in the reported findings in Table 15. Table 15 shows the parameter estimates and the ANOVA for this hypothesis.

TABLE 15

Results for Hypothesis 2

Hypothesis and Models
Hypothesis 2. Course grades on the core business courses for those sophomore students who have completed Economics and Accounting (first four courses) will discriminate between majors in either Computer Science--Business Option or Business Administration.
Full Model: Group = (-.0983)U + (.0466)C1 + (.0370)C2 + (.0222)C3 + (-.0016)C4 + E
Restricted Model: Group = A_0U + E

R2	df	Alpha′	F	P	S/NS
Full = .0317	4/489	.0056	4.0028	.0033	S
Rest. = .0000					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha′ = .0056 (alpha adjusted for multiple comparisons)

The results of Hypothesis 2 show that the course grades in the first four business courses did account for a significant amount of variance in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The Computer Science--Business Option majors scored significantly higher than their counterpart majors on the variable set of four sophomore courses. Table 15 reports a probability of .0033 with an F value of 4.0028. The effect size was calculated to be .0327. According to Cohen (1977), this is a small effect size.

This research hypothesis was accepted by the investigator.

General Hypothesis 3

H_3: Course grades on the last three (core business courses (Business Finance, Management, and Marketing) will discriminate between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the third research hypothesis are depicted in the reported findings in Table 16. Table 16 shows the parameter estimates and the ANOVA for this hypothesis.

The results of Hypothesis 3 shows that the course grades in the last three core business courses did not

TABLE 16

Results for Hypothesis 3

Hypothesis and Models
Hypothesis 3. Course grades on the last three (3) core business courses (Business Finance, Management and Marketing) will discriminate between majors in either Computer Science-- Business Option or Business Administration.
Full Model: Group = (.0774)U + (-.0157)C5 + (-.0240)C6 + (.0811)C7 + E
Restricted Model: Group = A_0U + E .

R2	df	Alpha'	F	P	S/NS
Full = .0185	3/490	.0056	3.0801	.0269	NS
Rest. = .0000					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

account for a significant amount of variance in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. There was no significant difference on the set of three sophomore course grades between the two groups. Table 16 reports a probability of .0269 with an F value of 3.0801. The effect size was calculated to be .0188. According to Cohen (1977), this is a small effect size.

This research hypothesis was rejected by the investigator.

General Hypothesis 4

H_4: Course grades on the first four core business courses (Economics I and II and, Accounting I and II) account for a significant amount of variance over and above the last three business courses (Business Finance, Management and Marketing) in discriminating between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the fourth research hypothesis are depicted in the reported findings in Table 17. Table 17 shows the parameter estimates and the ANOVA for this hypothesis.

The results of Hypothesis 4 show that the course grades in the first four core business courses did account

TABLE 17

Results for Hypothesis 4

Hypothesis and Models

Hypothesis 4. Course grades on the first four core business courses (Economics I and II and Accounting I and II) accounts for a significant amount of variance over and above the last three business courses (Business Finance, Management and Marketing) in discriminating between majors in either Computer Science--Business Option or Business Administration.

Full Model: Group = (-.0257)U + (.0538)C1 + (.0460)C2 + (.0265)C3 + (.0114)C4 + (-.0508)C5 + (-.0459)C6 + (.0387)C7 + E

Restricted Model: Group = (.0774)U + (-.0157)C5 + (-.0240)C6 + (.0811)C7 + E

	R2	df	Alpha'	F	P	S/NS
Full =	.0488	4/486	.0056	3.8743	.0041	S
Rest. =	.0185					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

for a significant amount of variance over and above the last three business courses in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The Computer Science--Business Option majors scored significantly higher then their counterpart majors on the sophomore course set over and above the senior course set. The Table reports a probability of .0041 with an F value of 3.8743. The effect size was calculated to be .0318. According to Cohen (1977), this is a small effect size.

This research hypothesis was accepted by the investigator.

General Hypothesis 5

H_5: Course grades on the last three business courses (Business Finance, Management, and Marketing) account for a significant amount of variance over and above the first four business courses (Accounting I and II and Economics I and II in discriminating between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the fifth research hypothesis are depicted in the reported findings in Table 18. Table 18 shows the parameter estimates and the ANOVA for this hypothesis.

TABLE 18

Results for Hypothesis 5

Hypothesis and Models

Hypothesis 5. Course grades on the last three business courses (Business Finance, Management and Marketing) accounts for a significant amount of variance over and above the first four business courses (Accounting I and II and Economics I and II) in discriminating between majors in either Computer Science--Business Option or Business Administration.

Full Model: Group = (-.0257)U + (.0538)C1 + (.0460)C2 + (.0265)C3 + (.0114)C4 + (-.0508)C5 + (-.0459)C6+ (.0387)C7 + E

Restricted Model: Group = (-.0983)U + (.0466)C1 + (.03701)C2 + (.0222)C3 + (-.0016)C4 + E

R2	df	Alpha'	F	P	S/NS
Full = .0488	3/486	.0056	2.9182	.0333	NS
Rest. = .0317					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

The results of Hypothesis 5 show that the course grades in the last three business courses did not account for a significant amount of variance over and above the first four business courses in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. There was no significant difference on the senior course set over and above the sophomore course set between the two groups. Table 18 reports a probability of .0333 with an F value of 2.9182. The effect size was calculated to be .0180. According to Cohen (1977), this is a small effect size.

This research hypothesis was rejected by the investigator.

General Hypothesis 6

H_6: Course grades on all seven core business courses will discriminate between majors over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average.

Data related to the testing of the sixth research hypothesis are depicted in the reported findings in Table 19. Table 19 shows the parameter estimates and the ANOVA for this hypothesis.

The results of Hypothesis 6 show that the course grades in all seven core business courses did account for

TABLE 19

Results for Hypothesis 6

Hypothesis and Models
Hypothesis 6. Course grades on all seven core business courses will discriminate between majors over and above what can be accounted for by sex, race, age, non co-op status, co-op status or overall grade point average.
Full Model: Group = (.2555)U + (.0665)C1 + (.0416)C2 + (.0339)C3 + (.0139)C4 + (-.0429)C5 + (-.0411)C6+ (.0509)C7 + (.0299)X8 + (-.0733)X9 + (-.0051)X10 + (.4423)X11 + (-.0846)X12 + E
Restricted Model: Group = (.0926)U + (.0568)X8 + (-.0350)X9 + (-.0046)X10 + (.4513)X11 + (.0651)X12 + E

R2	df	Alpha'	F	P	S/NS
Full = .1028	7/481	.0056	3.0471	.0039	S
Rest. = .0630					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

a significant amount of variance over and above what can be accounted for by age, sex, race, co-op status, or overall grade point average in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The course grades for the set of all seven courses were significantly higher for the Computer Science--Business Option majors scoring higher than their counterparts over and above any differences due to the covariates. Table 19 reports a probability of .0039 with an F value of 3.0471. The effect size was calculated to be .0443. According to Cohen (1977), this is a small effect size.

This research hypothesis was accepted by the investigator.

General Hypothesis 7

H_7: Course grades on the core business courses for those sophomore students who have completed the Economics and Accounting courses (first four courses) will discriminate between majors over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average.

Data related to the testing of the seventh research hypothesis are depicted in the reported findings in Table 20. Table 20 shows the parameter estimates and the ANOVA for this hypothesis.

TABLE 20

Results for Hypothesis 7

Hypothesis and Models
Hypothesis 7. Course grades on the core business course for those sophomore students who have completed the Economics and Accounting courses (first four courses) will discriminate between majors over and above what can be accounted for by sex, race, age, non co-op status, co-op status or overall grade point average.
Full Model: Group = (.2114)U + (.0645)C1 + (.0377)C2 + (.0332)C3 + (.0066)C4 + (.0295)X8 + (-.0488)X9 + (-.0053)X10 + (.4496)X11 + (-.0964)X12 + E
Restricted Model: Group = (.0926)U + (.0568)X8 + (-.0350)X9 + (-.0046)X10 + (.4513)X11 + (.0651)X12 + E

R2	df	Alpha'	F	P	S/NS
Full = .0878	4/484	.0056	3.2897	.0112	NS
Rest. = .0630					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

The results of Hypothesis 7 show that the course grades for the first four business courses did not account for a significant amount of variance over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The course grades for the set of sophomore courses were not significantly different between the two groups over and above any differences due to the covariates. Table 20 reports a probability of .0112 with an F value of 3.2897. The effect size was calculated to be .0271. According to Cohen (1977), this is a small effect size.

This research hypothesis was rejected by the investigator.

General Hypothesis 8

H_8: Course grades on the last three core business courses for those senior students (who have completed Business Finance, Management, and Marketing) will discriminate between majors over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average.

Data related to the testing of the eighth research hypothesis are depicted in the reported findings in Table 21. Table 21 shows the parameter estimates and the ANOVA for this hypothesis.

The results of Hypothesis 8 show that the course grades on the last three core business courses did not account for a significant amount of variance over and above what can be accounted for by sex, race, age, co-op status, or overall grade point average in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The course grades for the set of the senior courses were not significantly different between the two groups over and above any differences due to the covariates. Table 21 reports a probability of .0957 with an F value of 2.1160. The effect size was calculated to be .0131. According to Cohen (1977), this is a small effect size.

This research hypothesis was rejected by the investigator.

General Hypothesis 9

H_9: Course grades on the first four business courses (Economics I and II, Accounting I and II) account for a significant amount of variance over and above the last three business courses (Business Finance, Management, and

TABLE 21

Results for Hypothesis 8

Hypothesis and Models
Hypothesis 8. Course grades on the last three core business courses for those senior students (who have completed Business Finance, Management and Marketing) will discriminate between majors over and above what can be accounted for by sex, race, age, non co-op status, co-op status, or overall grade point average.
Full Model: Group = (.1451)U + (-.0279)C5 + (-.0377)C6+ (.0565)C7 + (.0566)X8 + (-.0561)X9 + (-.0048)X10 + (.4446)X11 + (.0670)X12 + E
Restricted Model: Group = (.0926)U + (.0568)X8 + (-.0350)X9 + (-.0046)X10 + (.4512)X11 + (.0651)X12 + E

R2	df	Alpha'	F	P	S/NS
Full = .0752	3/485	.0056	2.1160	.0957	NS
Rest. = .0630					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

Marketing), sex, race, age, co-op status, or overall grade point average in discriminating between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the ninth research hypothesis are depicted in the reported findings in Table 22. Table 22 shows the parameter estimates and the ANOVA for this hypothesis.

The results of Hypothesis 9 show that the course grades on the first four core business courses did account for a significant amount of variance over and above the last three business courses, sex, race, age, co-op status, or overall grade point average in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The Computer Science--Business Option majors scored higher than their counterparts over and above any differences due to the covariates on the set of sophomore courses. Table 22 reports a probability of .0055 with an F value of 3.7099. The effect size was calculated to be .0307. According to Cohen (1977), this is a small effect size.

This research hypothesis was accepted by the investigator.

TABLE 22

Results for Hypothesis 9

Hypothesis and Models
Hypothesis 9. Course grades on the first four core business courses (Economics I and II and Accounting I and II) accounts for a significant amount of variance over and above the last three business courses (Business Finance, Management and Marketing), sex, race, age, non co-op status, co-op status, or overall grade point average in discriminating between majors in either Computer Science-Business Option or Business Administration.
Full Model: Group = (.2554)U + (.0665)C1 + (.0416)C2 + (.0339)C3 + (.0139)C4 + (-.0429)C5 + (-.0411)C6+ (.0509)C7 + (.0298)X8 + (-.0733)X9 + (-.0051)X10 + (.4422)X11 + (-.0846)X12 + E
Restricted Model: Group = (.1450)U + (-.0279)C5 + (-.0377)C6 + (.0565)C7 + (.0566)X8 + (-.0561)X9 + (-.0048)X10 + (.4446)X11 + (.0670)X12 + E

R2	df	Alpha'	F	P	S/NS
Full = .1028	4/481	.0056	3.7099	.0055	S
Rest. = .0752					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

General Hypothesis 10

H_{10}: Course grades on the last three core business courses (Business Finance, Management, and Marketing) account for a significant amount of variance over and above the first four business courses Accounting I and II and Economics I and II), sex, race, age, co-op status, or overall grade point average in discriminating between majors in either Computer Science--Business Option or Business Administration.

Data related to the testing of the tenth research hypothesis are depicted in the reported findings in Table 23. Table 23 shows the parameter estimates and the ANOVA for this hypothesis.

The results of Hypothesis 10 shows that the course grades on the last three core business courses did not account for a significant amount of variance over and above the first four business courses, sex, race, age, co-op status, or overall grade point average in discriminating between Computer Science--Business Option majors and Business Administration majors at the .0056 level. The course grades for the set of the last three senior courses were not significantly different between the two groups, over and above any differences due to the covariates. Table 23 reports a probability of .0457 with an

TABLE 23

Results for Hypothesis 10

Hypothesis and Models
Hypothesis 10. Course grades on the last three core business courses (Business Finance, Management, and Marketing) courses account for a significant amount of variance over and above the first four business courses (Accounting I and II and Economics I and II), sex, race, age, non co-op status, co- op status, or overall grade point average in discriminating between majors in either Computer Science--Business Option or Business Administration.
Full Model: Group = (.2554)U + (.0665)C1 + (.0416)C2 + (.0339)C3 + (.0139)C4 + (-.0429)C5 + (-.0411)C6+ (.0509)C7 + (.0298)X8 + (-.0733)X9 + (-.0051)X10 + (.4422)X11 + (-.0846)X12 + E
Restricted Model: Group = (.2114)U + (.0645)C1 + (.0377)C2 + (.0332)C3 + (.0066)C4 + (.0295)X8 + (-.0488)X9 + (-.0053)X10 + (.4496)X11 + (-.0964)X12 + E

R2	df	Alpha'	F	P	S/NS
Full = .1028	3/481	.0056	2.6779	.0457	NS
Rest. = .0878					

Note: See list of variables on p. 72.

S/NS = significance/nonsignificance

Alpha' = .0056 (alpha adjusted for multiple comparisons)

F value of 2.6779. The effect size was calculated to be .0167. According to Cohen (1977), this is a small effect size.

This research hypothesis was rejected by the investigator.

Summary

Chapter IV presented the research findings of the current study. Section 1 provided a report of the descriptive statistics. Section 2 outlined the method and format of reporting results. Sections 3-13 indicated the actual statistical results of the testing of the ten research hypotheses.

Of the ten hypotheses that were tested, five of the tests indicated a significant relationship between the grades (GP) of all seven core business courses taken by Computer Science--Business Option majors and Business Administration majors. See Table 24, Summary of Results of Hypotheses.

The full set discriminated the two groups both with and without the use of the covariates (Hypothesis 1 and Hypothesis 6).

The first four courses (sophomore set) differentiated between the two groups when used as a sole predictor set, when controlling for later differences (senior course set), and when later differences plus the covariates were controlled (Hypotheses 2, 4, and 9).

TABLE 24

Summary of Results of Hypotheses

Hyp.	R2/f	R2/r	df	Alpha'	F	P	S/NS	F2
1	.0488	.0000	7/486	.0056	3.5649	.0010	S	.0513
2	.0317	.0000	4/489	.0056	4.0028	.0033	S	.0327
3	.0185	.0000	3/490	.0056	3.0801	.0269	NS	.0188
4	.0488	.0185	4/486	.0056	3.8743	.0041	S	.0318
5	.0488	.0317	3/486	.0056	2.9182	.0333	NS	.0180
6	.1028	.0630	7/481	.0056	3.0471	.0039	S	.0443
7	.0878	.0630	4/484	.0056	3.2897	.0112	NS	.0271
8	.0752	.0630	3/485	.0056	2.1160	.0957	NS	.0131
9	.1028	.0752	4/481	.0056	3.7099	.0055	S	.0307
10	.1028	.0878	3/481	.0056	2.6779	.0457	NS	.0167

NOTE: Of the ten Hypotheses, Hypotheses 3, 5, 7, 8, and 10 were found to be nonsignificant (S/NS = significance/nonsignificance).

The first four courses did not differentiate group membership when covarying demographic variables (Hypothesis 7).

The last three courses (senior set) did not discriminate between the two groups when used alone, when controlling for the sophomore course set, when controlling for demographic variables and when controlling for the sophomore course set plus the demographic variables (Hypotheses 3, 5, 8, and 10, repectively).

CHAPTER V

SUMMARY

Summary of the Study

This chapter is organized into four main sections. This first section is a summary of the study that includes a concise problem restatement, the procedures used in conducting the study and the research design. The second section describes the research hypotheses and discusses the conclusions derived from the hypotheses which were tested. The third section, the implication section, interprets the findings of this research and provides suggestions for further study and examination. Concluding the chapter is a brief summary.

Statement of the Problem

This study dealt with academic achievement differences between two groups of graduates at an urban, northeastern Ohio, state university. Because there was a perceived notion that Computer Science graduates were deficient in business and there were no data or research supporting or refuting it, this study was undertaken. The problem was to determine if there were academic business achievement differences between graduates who had

received B.S. or B.A. degrees in the Computer Science--Business Option program and the College of Business Administration program. These students graduated from the university between 1983 and 1987. Group 1 consisted of Computer Science--Business Option degree majors in the College of Arts and Sciences and Group 2 consisted of their counterpart majors in the College of Business Administration. Academic achievement was measured by course grades (CGs) in seven common business knowledge courses that were completed by both groups. These courses included: (a) Principles of Macro and Micro Economics, and (b) Accounting I and II. These courses are taken by the end of the sophomore year. The other courses completed by or at the end of the senior year were: (c) Business Finance, (d) Management: Principles and Concepts, and (e) Marketing Principles. In all, there are seven sequential business knowledge courses used in this study. A course description for each course is provided in the Operational Definitions section of Chapter I.

Using sets of courses was assumed to be helpful in explaining and/or identifying those business skills that differentiate Computer Science majors' academic business skill achievement levels from their counterpart majors in the College of Business.

The problem under investigation in this study was to determine whether academic differences between the two groups existed by using various combinations of course sets: (a) in the set of all seven core business courses; (b) in the set of the first four business courses taken by the sophomore year; (c) in the set of the last three business courses taken by the senior year; (d) over time (between sophomore and senior levels); and (e) when covarying selected academic and demographic variables (i.e., sex, race, co-op status and overall undergraduate grade point average).

Statement of the Procedures

This study, being dependent upon pre-existing conditions, employed an ex post facto research design, with hypotheses and tests for alternative hypotheses. The population was derived from the university's student master and grade files. Originally, this population consisted of 2,504 student records. Of the 2,504 records, Group 1 (Computer Science--Business Option majors) consisted of 96 student records and Group 2 (Business Administration majors) consisted of 2,418 student records. After validating each record for data accuracy and suitability to the study, a randomized sample of the business group was taken. The sample to be studied resulted in 403 Business Administration records; one for each student

subject, and 91 Computer Science--Business Option records; one for each student subject. The total count was 494 records. Each record contained the following: major college code, degree code, term graduated, year graduated, age (birth month, birthday, and birth year), ethic code, gender code, overall undergraduate grade point average, co-op status, and seven business course grades (CGs) received for Courses 1-7.

The original 2,504 subject data records resulting in the 494 subject samples for this study were analyzed and manipulated using the Statistical Analysis System (SAS) software on the IBM 3090. Descriptive statistics to include mean ($\overline{X}$), standard deviations, correlations and frequencies were produced.

Multiple linear regression was used in testing each of the ten hypotheses. The F test was employed in the study to test the statistical significance of the relationships identified in the hypotheses. When making a number of comparisons, the alpha level may rise. To control for this, an adjusted alpha of .0056 had to be achieved in order for the hypotheses to be supported at the given level of significance (.05). This level was acceptable since it was assumed that making a Type I error (rejecting a true null hypothesis) and its consequences would not be serious enough to warrant using a more stringent alpha level. An effect size analysis

was also performed in this study. In this study, the researcher set a .02 effect size. Effect size is recorded to indicate the magnitude of the group differences. That is, it is used when one desires to see how much groups differ in standard deviation units.

Summary of the Research Hypotheses and Variables Used

Ten research hypotheses were tested using multiple linear regression techniques. These hypotheses used sets of course grades and tested the course grades' ability to predict or identify group membership as either Computer Science--Business Option or Business Administration. Phase I and II, to be discussed later, used the course grades (CGs) for the set of all seven, the set of the first four and the set of the last three core business courses, plus repeated these tests with the addition of the covariates that were related to academic achievement. The course grades were analyzed for the following courses: Accounting I, Accounting II, Principles of Macro Economics, Principles of Micro Economics, Finance, Marketing, and Management.

The dependent variable in this study was group membership. This variable indicated that the subjects under study were either Computer Science--Business Option majors (coded 1) or Business Administration majors (coded 0). A student record major code 34600 or 34605 indicated

a Computer Science--Business Option major and a student record major code 60100 to 67000 indicated a Business Administration major.

The independent variables were: age (age at which the student graduated with the degree), ethnic background, gender (male or female), overall grade point average (the average recorded upon graduation), co-op status and the individual course grades for each of the seven common core business courses.

Research Design

Phase I used selected sets of combinations of the CGs in all seven core business courses. The purpose of this analysis was to determine whether academic business success as measured by CG would, in fact, differentiate or discriminate between majors in Computer Science--Business Option (Group 1) or in the Business Administration program (Group 2). The same analysis was then undertaken by studying the first four business courses (sophomore set) and the last three business courses (senior set) for each group. To determine whether academic business success had changed between the sophomore and senior years, an analysis was made to determine whether differences existed in the GPs over time for the groups. This was accomplished by comparing the first four courses with the last three courses and vice versa. Hypotheses 1 through 5 were

developed to test for these differences. See Chapter IV, Tables 14-18, pp. 73-81.

Phase II followed a similar comparative analysis in that other demographic variables were included in the hypotheses as mentioned earlier. Hypotheses 6 through 10 were developed to test for this. See Chapter IV, Tables 19-23, pp. 83-92.

Research Hypotheses and Conclusions

This section of Chapter V emphasizes the conclusions derived from testing the ten hypotheses. The study should be of value to both the College of Arts and Sciences and the College of Business Administration since it identifies some significant achievement differences between the two majors and detects the set of courses in which each group excelled. (See Figure 1, Chapter IV, p. 67.) It is of value to the College of Arts and Sciences, in that the study identifies a need to market the Computer Science--Business Option degree and specifically indicate that these students do, in fact, possess basic business knowledge. This is contrary to the popular notion that Computer Science graduates are deficient in business comprehension. The College of Business Administration may also desire to review their admission requirements to the Business program and provide specialized advice to students taking courses identified in this study.

Phase I Analysis

The investigation proceeded to compare CGs in all seven core business courses for Computer Science--Business Option majors (Group 1) and Business Administration majors (Group 2). The results of Hypothesis 1 support the findings that there are significant differences in the grades between the two groups of majors for the seven courses. Contrary to public notion, Computer Science graduates performed better overall than their Business Administration counterparts. In fact, they scored higher in all seven courses than did the Business Administration majors (see Chapter IV, Figure 1, p. 67). This information will be of use to the personnel office, which must select individuals with knowledge in Accounting, Economics, Finance, Marketing, and Management. For positions requiring varied and specific capabilities in these courses, a Computer Science--Business Option graduate might be preferred over a Business Administration graduate, all other selection criteria being equal.

In Hypotheses 2 and 3, the investigation compared possible grade differences (GPs) between both major groups at the sophomore and senior level. The findings support Hypothesis 2 that grades in the first four courses do differentiate between the two groups. These courses reflect economic and decision making abilities that relate

to job knowledge required. Computer Science graduates, again, generally performed better than their Business Administration counterparts. For job tasks and responsibilities that require a strong Mathematics (Accounting) and Economics understanding, Computer Science--Business Option majors may be preferred over Business Administration graduates. On the other hand, the results of Hypothesis 3 indicate that the last three course GPs taken at the senior level do not significantly differentiate between the two groups. These courses emphasized Finance, Marketing, and Management knowledge. The latter two courses dealt more with inter-personal skills and people interactions and responses. So where Marketing, Management, and Finance are key components of a position, either major may be a suitable choice.

Hypotheses 4 and 5 were tested to determine if differences over time predicted group membership between Computer Science-Business Option majors and their counterpart majors in the College of Business Administration. After testing Hypothesis 4, it was determined from the results that there was a significant prediction of group membership by the first four business courses, over and above the last three business courses. Computer Science graduates scored significantly higher than their counterpart majors. Likewise, Hypothesis 5 was tested to evaluate

group differences over time in the last three business courses, over and above the first four business courses for Groups 1 and 2. From the findings it was determined that there was no significant difference for this test and that business achievement differences over time between the two groups could not be detected. The primary difference between these two groups seems most related to their performance in the mathematically oriented first four courses, while the last three courses do not contribute to identifying group membership.

Phase II Analysis

Unlike Hypotheses 1-5 which were performed without age, sex, race, co-op status or overall grade point average being covaried, the study's final Hypotheses 6-10 covaried these variables in testing group differences.

After testing Hypotheses 6 and 9 (like Hypotheses 1 and 4, respectively, except that covariates were included), the results indicated that in each of these two tests, the GPs for all seven business courses, and for the first four business courses, over and above the last three courses, did in fact discriminate between the two groups. This means that the differences between the two groups cannot be attributed to different scores on the covariates. Since the covariates make the test more powerful,

these two tests reconfirm the performance differences between the two groups.

Hypotheses 7, 8, and 10 (like Hypotheses 2, 3, and 5, except that covariates were not included) were not significant. The results of Hypothesis 7 indicate that the first four courses taken at the sophomore level do not differentiate between the two groups. The addition of the covariates reduce the amount of unique variance contributed by the first four courses, which resulted in nonsignificance for this Hypothesis. Hypothesis 8 indicates that the last three course GPs taken at the senior level do not significantly differentiate between the two groups. Finally, the results of Hypothesis 10 indicate that group differences over time in the last three business courses over and above the first four business courses were not significant. The relationship of the covariates to group membership accounted for enough unique variance that any further data provided by the course grades had a negligible impact in discriminating the groups.

The conclusions of this study are clear and direct. Because age, sex, race, co-op status and overall grade point average may be related to business course grades, they were covaried in the researcher's study of the seven business course grades (Hypotheses 6-10). As

a result of covarying these variables, their effect was controlled in the comparative analysis. It was determined from the result of the investigation that the GPs in the seven business core courses and the first four courses did, in fact, discriminate between Computer Science--Business Option majors and Business Administration majors with and without the covariates. Additionally, it was determined that Computer Science--Business Option majors were likely to do better than Business Administration majors for all seven business courses and in the first four business courses. In the last three business courses, academic success for Computer Science--Business Option majors was not significantly different than academic success of their counterpart majors in Business Administration (i.e., the last three business courses did not predict membership).

Implications

Colleges need to provide a Business and Computer Science curriculum which develops business skills as well as technical expertise.

A review of current literature indicates that the demand for computer use has created new business/technical positions. Reliable authorities (Napier & Wetherbe, 1982; Hartong, 1985; Harpool & Gigliotti, 1987) stress that graduates in Computer Science are deficient in business

skills, many of which include accounting and economic skills, management planning and financial and marketing understanding. There are, however, no data or research concerning the level of business skill proficiency of Computer Science graduates. It was assumed in this study that grades in the seven business courses under examination relate to the level of business knowledge required in many computer related business job tasks.

Therefore, this study implies that at the basic level of business knowledge, the two groups are different, with Computer Science--Business Option majors doing better than their Business Administration counterparts, particularly in mathematic component areas. This is contrary to the public notion that they are insufficiently prepared. Such being the case, it may be assumed that, if basic business skills (Economics and Accounting) are required for a hi-tech business computer position, Computer Science majors may be better prepared over some Business Administration majors for that job. On the other hand, if a higher level of business knowledge (i.e., Finance, Management, and Marketing) is required, then an analysis of the specific job tasks should be made. Afterwards, the candidate with the appropriate background should be selected to perform those specified tasks.

Suggestions for Further Research

A research design to reproduce and refine these results is warranted. Other predictor variables are suggested to aid in the discrimination analysis between Computer Science--Business Option majors and Business Administration majors. Further research in the following areas is also suggested.

1. A similar study may be designed using predictor variables relating to the subjects experience in the business area, as this may have reinforced the business knowledge via its application in real life.

2. A similar study may be designed to measure business interest since it is assumed that higher interest tends to result in higher motivation to learn and remember subject matter concepts and practices.

3. There is a need to determine how academic business achievement specifically relates to or links with on-the-job performance. This will improve employer selection procedures in identifying suitable candidates with specific course work for the position.

4. Further research in comparing specific course contents with "real world," "business computer" tasks is needed to assess and revise the curriculum. This will help in tailoring courses to meet business community needs.

5. An examination of business majors' computer skills is needed to assess their ability to handle jobs requiring a blend of computer expertise with business skills.

6. A longitudinal study is needed to study performance profiles in academic business achievement. This will aid in determining time differences and patterns in the way that students perform in the seven courses.

Summary

It is a common perception among business persons that Computer Science graduates may be deficient in understanding and applying specific business requirements and practices in computer work.

This study dealt with academic achievement differences between two groups of graduates: Computer Science--Business Option majors (Group 1), and Business Administration majors (Group 2). Academic achievement, as it was assumed to be related to work performance, was measured by course grades (CGs) in seven common business courses. Hypotheses were tested to measure academic achievement in combinations of course sets: (a) in the set of all seven core business courses; (b) in the set of the first four business courses taken by the sophomore year; (c) in the set of the last three business courses

taken by the senior year; (d) over time (between sophomore and senior levels); and (e) when covarying selected academic and demographic variables (i.e., sex, race, co-op status, and overall undergraduate grade point average).

Group 1 consisted of 96 student records and Group 2 consisted of 494 records to be analyzed. Multiple Linear Regression was used in testing each of the ten hypotheses. The F test was used and an adjusted alpha of .0056 had to be achieved in order for the hypotheses to be supported at the given level of significance (.05). An effect size was set at .02 to indicate the magnitude of the group differences.

The research design was divided into Phase I and Phase II. Phase I dealt with the combination of course sets cited in (a), (b), (c), and (d) above, while Phase II dealt with the same combinations of course sets when covarying selected academic and demographic variables.

Hypotheses findings also indicate that the first four courses do, in general, discriminate between the two majors, while the last three courses do not. The reader is reminded that the effect sizes were small (i.e., .0180 to .0513), and that, while the differences are statistically significant, the differences are only a few tenths of a grade in any given course.

In conclusion, this study finds that Computer Science--Business Option majors (a) have experienced greater achievement in their seven business courses and particularly in the first four than their Business Administration counterparts, and (b) may not experience a different level of academic achievement at the senior level than their Business Administration counterparts. The findings of this study indicate that: (a) Computer Science students are not deficient in business knowledge, and (b) the common perception that Computer Science students lack sufficient business skills may not be altogether true.

BIBLIOGRAPHY

BIBLIOGRAPHY

Barnes, E. J. (1972). The black community as the source of positive self-concept for black children: A theoretical perspective. In R. L. Jones (Ed.), Black psychology. New York: Harper & Row.

Breaugh, J. A., & Mann, R. B. (1981). The utility of discriminant analysis for predicting graduation from a master of business administration program. Educational and Psychological Measurement, 41.

Bryden, M. P. (1979). Evidence for sex-related differences in cerebral organization. In M. A. Wittig & A. C. Pertersen (Eds.), Sex-related differences in cognitive functioning: Developmental issues (pp. 121-143). New York: Academic Press.

Carmichael, S., & Hamilton, C. V. (1967). Black power: The politics of liberation in America. New York: Random House.

Clemmensen, D. R. (1985). In-service workshops help develop computer literacy among business educators. Business Education Forum, 39(6), 27-30.

Cohen, J. (1977). Statistical power analysis for the behavioral sciences. New York: Academic Press.

Daggett, W. R., & Branigan, H. M. (1987). Projections and implications of social, economic, and demographic changes for business education. In M. P. Gregory & W. Daniel (Eds.). Business education for a changing world, NBEA yearbook, No. 15 (pp. 1-15). Reston, VA: National Business Education Association.

Deckro, R. F., & Woundenberg, H. W. (1977). M.B.A. Admission Criteria and Academic Success. Decision Sciences, 8(4), 765-769.

Dertouzos, M. (1985, March). D. P. and academia: The communication gap. Communications of the ACM, 28(3), 256-262.

Edwards, A. L. (1972). Experimental design in psychological research (4th ed.). New York: Holt, Rinehart & Winston.

Elman, S. E., & Lynton, E. A. (1986). Assessment in career-oriented education. In C. Adelman (Ed.), Assessments in American Higher Education (Report No. OR-86-301) Washington DC: U.S. Department of Education, Office of Educational Research and Improvement, Special Services Division, Publications Branch. (ERIC Document Reproduction Service No. ED 273 197)

Essick, L. E. (1986). Principles of Business Data Processing (5th ed.). Chicago: Science Research Associates, Inc.

Fisher, E. H. (1987). Integrating technological changes into the middle/secondary curriculum. In M. P. Gregory & W. Daniel (Eds.), Business education for a changing world, NBEA yearbook, No. 25 (pp. 50-61). Reston, VA: National Business Education Association.

Gabel, D. (1988, November). Control of large networks no dog-and-pony show. Computer World, 22(45), 83-93.

Gardner, D., & Larsen, Y., The National Commission on Excellence in Education. (1981). A nation at risk: The imperative for educational reform (ED 1.2; N 21/3). Washington DC: U.S. Government Printing Office.

Harpool, J. D., & Gigliotti, R. J. (1987). Systems development project course: A behavioral science evaluation. Interface, 9(3), 55-64.

Hartle, T. (1986). The growing interest in measuring the educational achievement of college student. In C. Adelman (Ed.), Assessments in American Higher Education (Report No. OR-86-301), pp. 1-25. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, Special Services Division, Publications Branch. (ERIC Document Reproduction Service No. ED 273 197)

Hartong, C. (1985, September). Of commerce and academia. Datamation, pp. 68-78.

Holtzkamper, C. (1985). The job market for information processing. Business Education Forum, 39(8), 10-15 & 21.

Hoyer, W. J., & Plude, D. J. (1980). Attentional and perceptional processess in the study of cognitive aging. In L. W. Poon (Ed.), Aging in the 1980s: Psychological: Issues. Washington DC: American Psychological Association.

Hoyt, D. P. (1966) College grades and adult accomplishment. The Educational Record, 45, 70-75.

Jenck, C. & Niesman, D. (1968). The academic revolution. Chicago: University of Chicago Press

Kerlinger, F. N. (1973). Foundations of behavioral research. New York: Holt, Rinehart & Winston, Inc.

Kerlinger, F., & Pedhazur, E. J. (1973). Multiple regression in behavioral research. New York: Holt, Rinehart, & Winston.

Martin, J. (1985, March). D.P. and academia: The communication gap. Communications of the ACM, 28(3), 256-262.

McClure, R. H., Wells, C. E., & Bowerman, B. L. (1986). A model of MBA student performance. Research in Higher Education, 25(2), 182-191).

McNeil, K. A., Kelly, F. J., & McNeil, J. T. (1975). Testing research hypotheses using multiple linear regression (1st ed.). Carbondale and Edwardsville: Southern Illinois University Press.

Napier, A., & Wetherbe, J. C. (1982). MIS executives perspectives on MIS curriculum. Interface, 4(1), 32-35.

Newman, I., & Benz, C. (1983). Power analysis. In I. Newman & C. R. Benz (Eds.), Multiple linear regression: readings, exams, problems, syllabus (209-219). Akron, OH: Multiple Linear Regression Special Interest Group of the American Educational Research Association.

Newman, I., & Fry, J. (1983). A response to "a note on multiple comparisons" and comment on shrinkage. In I. Newman & C. R. Benz (Eds.), Multiple linear regression: readings, exams, problems, syllabus (pp.91-95). Akron, OH: Multiple Linear Regression Special Interest Group of the American Educational Research Association.

Newman, I., Klein, R. J., Weis, D., & Benz, C. (1980). A prescription for writing a behavioral dissertation or thesis. Minneapolis, MN: Burgess.

Newman, I., & Newman, C. (1977). Conceptual statistics for beginners. New York: University Press of America.

Oliver, W. E., Wegner, C. A., Thill-Ritter, C. A., & Hynek, M. (1986). The computer in business education. In H. S. Kepner (Ed.), Computers in the classroom (pp. 73-89). Washington, DC: National Education Association.

Pearson, J., & Ialongo, N. (1983). Gender, athletic, and academic activity as predictors of spatial ability: Sex role as mediator. Paper presented at the meetings of the Society for Research in Child Development, Detroit, MI.

Peterson, A. (1983, August). The development of sex-related differences in achievement. Paper presented at the Annual Convention of the American Psychological Association, Anaheim, CA.

Pettigrew, A. M. (1980, December). Political aspects of organizational change. System Development, pp. 401-406.

Plog, C. E. (1980). The relationship of selected personality and personal characteristic variables to achievement in the first-level business computer programming language courses at the community college level (Doctoral dissertation, Northern Illinois University, 1976). Dissertation Abstracts International, 41, 2903A.

Prather, J. E., Williams, J. E., & Wadley, J. K. (1976). The relationship of major fields with undergraduate course grades: A multivariate analysis controlled for academic and personal characteristics and longitudinal trends (Report No. 77-3). Atlanta: Georgia State University. (ERIC Document Reproduction Service No. ED 132 898)

Raspberry, W. (1988, July 21). Too many lacking in basic skills. The Akron Beacon Journal, p. A9.

Resnick, L. (1987). The 1987 presidential address, learning in school and out. Educational Researcher, pp. 13-20.

SAS Institute, Inc. (1985). SAS introductory guide (rev. ed.). Cary, NC: Author.

Schoenfeldt, L. F., & Brush, D. H. (1975). Patterns of college grades across curricular areas: Some implications for GPA as a criterion. American Educational Research Journal, 12, 313-321.

Schroeder, B. L., & Furtado, L. T. (1986). Curriculum improvement. Business Education Forum, 40(8), 32-40.

Shapiro, H. J., & Gould, S. J. (1980). An empirical study of predictive models of success in graduate admissions. Proceedings of the 12th Annual Meeting of the American Institute of Decision Sciences, 130-131.

Shelly, G. B., & Cashman, T. J. (1986). Computer fundamentals with application software (2nd ed.). Boston: Boyd and Fraser Publishing Co.

Sherman, J. A. (1978). Sex-related cognitive differences: An essay on theory and evidence. Springfield, IL: Charles C. Thomas.

Sorge, D. H., & Werk, L. H. (1984). Factors for success as a computer science major. Journal of the Association for Educational Data Systems, 17, 36-45.

Ward, J. H., & Jennings, E. (1973). Introduction to linear models. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Wallach, M. A., & Wing, C. W., Jr. (1969). The talented student. New York: Holt, Rinehart, & Winston.

Watkins, B. T. (1986, May 26). Critics say colleges do a poor job of developing leadership qualities in their undergraduates. Chronicle of Higher Education, pp. 19-21.

White, K. B., & Leifer, R. (1986, September). Information systems development success: Perspectives from project team participants. MIS Quarterly, 10(3), 215-223.

Wileman, S., Kovalina, J., & Stephens, L. (1981, March/April). Factors influencing success in beginning computer science course. Journal of Educational Research, 74, 223-226.

Willingham, W. W., & Morris, M. (1986). Four years later: A longitudinal study of advanced placement students in college (College Board Report No. 86-2). College Board Publications, pp. 1-45.

U.S. Cabinet Officers Report. (1988). Building a quality workforce (Labor Department Stock No. 029-000-00425-1). Washington DC: U.S. Government Printing Office.