

**Post-college earnings of Iowa community college career and technical education  
students: Analysis of selected career clusters**

by

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**ABSTRACT**

The economic impact of community colleges has become an important factor at both state and national levels. The purpose of this study was to identify and understand specific factors such as gender, age, degree attainment and annual gain in earnings that influence fifth-year post-college earnings of Iowa community college students in career and technical education in selected national career clusters. This study analyzed the predictive power of community college students' background characteristics and their highest award attained to their fifth-year annual earnings.

Existing data sets were matched to capture information on students' education and earnings. These data sets were: Iowa Department of Education's Management Information System (MIS), Iowa Workforce Development's Unemployment Insurance (UI) records, and the National Student Clearinghouse.

The results in the Manufacturing; Science, Technology, Engineering and Math (STEM), and the Transportation/Distribution and Logistics clusters were similar. In these clusters gender, age, economic status, community college degree and annual gain in earnings were significant predictors of a student's fifth-year annual earnings. Females and traditional age students should be aware that, if they do not receive an associate degree, their earning potential is significantly less than that of males.

The Architecture and Construction cluster varied in the results. In this cluster gender, age and annual gain in earnings were significant predictors of a student's fifth-year annual earnings. Females and traditional age students are at a disadvantage in this cluster in relationship to their fifth-year annual earnings.

In the Arts, Audiovisual Technology and Communication cluster gender, community college degree and annual gain in earnings were also significant predictors of fifth-year annual earnings. Females need to understand that if they do not receive an associate degree their earning potential is significantly less than males.

Community colleges are encouraged to consider these results when providing career information and guidance to students. Earning potential based on an award is an important variable to consider; however, it is only one of multiple variables that should be considered. Students who leave community college without an award find themselves earning less than the median annual earnings of those who received an associate degree.

## **CHAPTER 1. INTRODUCTION**

The economic impact of community colleges has become an important factor for state and national legislators when appropriating funding to higher education. Public spending is being scrutinized and legislators continue to increase the accountability requirement when public funds are invested. Legislators also have an increase emphasis on creating a workforce that can compete on a global level and regain the competitive edge the United States has enjoyed in the past. Showing a return on investment is desired. In 2003, Iowa community colleges engaged in an economic benefits study. This study concluded that for every dollar of state or local tax money invested in the Iowa community college system, the state received a cumulative return of \$11.00 over 36 years (Christophersen & Robison, 2003). Economic impact studies provide community college with valuable information that can be shared with legislators. When a return on the state and local investment can be shown, there is the potential to alter the way the public looks at higher education.

Christophersen and Robison (2003) conducted economic impact studies for several other states including, Illinois, Maryland, Mississippi, New Jersey, Oklahoma, Oregon, Washington and Wisconsin. They conducted impact studies for individual colleges; however, the focus in this study was only the statewide studies. The nine statewide studies provided a picture of the economic impact of each statewide community college system, which may be used to shape public policy on community college funding. In Iowa, being able to quantify the economic impact of Iowa community colleges has been beneficial in public policy conversations among state legislators.

One factor that Christophersen and Robinson (2003) examined in their study in Iowa was the future earnings of community college graduates. This study indicated that students gain 23% annual return on their investment of time and money for community college education. For every \$1.00 the student invests in a community college education, he or she will receive a cumulative \$6.47 in higher discounted future earnings over the next 36 years. This illustrates an economic impact of community college education; however, this study was not able to show how program of study and the level of degree attainment affect the potential future earnings of community college students.

Stoik (2004) researched Iowa Unemployment Insurance (UI) wage records for individuals who attended Western Iowa Tech Community College (WITCC) to address the extent to which students benefit by attending WITCC as measured by post-college earnings. She found that there was an economic benefit to an individual who attended WITCC. Furthermore, in the first three years of completing a degree, students who received a degree earned more than students who did not complete a degree. The study provided Iowa with detailed information regarding economic benefit as related to one institution.

A commissioned evaluation study by the Iowa Department of Education with Iowa State University examined national and statewide data files that included Iowa Unemployment insurance records (UI), Department of Education Management information system (MIS) and the National Student Clearinghouse (Laanan et al., 2007). The study provided descriptive statistics of post-college earnings of all Iowa community college students disaggregated by demographic information, four award categories, completers and leavers. It was the statewide data system that allowed this dissertation study to be conducted. The current study did not duplicate the commissioned study. It sought to augment the

commission study by exploring specific career areas: (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; (4) Science, Technology, Engineering and Math (STEM); and (5) Transportation/Distribution and Logistics. Specifically, the current longitudinal study examined the impact of Iowa community college student's background characteristic, their highest award received and their annual post-college earning on their fifth-year annual earnings.

Although there are 16 national career clusters, only five clusters were selected as the focus of the current study (see Table 1.1). These clusters represent the skilled trade occupations. Many of Iowa's community colleges are structured around the skilled trade occupations. Therefore, it was believed that focusing around the five clusters mentioned earlier would provide a comprehensive look at one discipline area. In addition, the current study was initiated at the same time the Compton (2008) study was being conducted. The

Table 1.1. Sixteen National Career Clusters

1. Agriculture, Food & Natural Resources	9. Hospitality & Tourism
*2 Architecture & Construction	10. Human Services
*3. Arts/Audio Video Technology & Communications	11. Information Technology
4. Business Management & Administration	12. Law, Public Safety, Corrections & Security
5. Education & Training	*13. Manufacturing
6. Finance	14. Marketing
7. Government & Public Administration	*15. Science, Technology, Engineering and Math
8. Health Sciences	*16. Transportation, Distribution & Logistics

Source: National Association of State Directors of Career and Technical Education Consortium.

two studies intended to augment each other and advance the research to the greatest extent possible. It was determined that the Compton (2008) study would focus on business related clusters and this study would focus on the skilled trade clusters. Although these two studies did not address some career clusters, the majority of career and technical programs offered by Iowa's community colleges are represented in these two studies.

When focusing on the economic impact of Iowa's community colleges, it is helpful to understand that community colleges have a wide range of curricular functions which provide multiple services to students. The curricular functions in community colleges include academic transfer preparation, vocational-technical education, continuing education, developmental education, and community service, therefore, the reasons student's select a community college varies greatly (Cohen & Brawer, 2008). Students may desire to obtain the minimum training needed for obtaining a job through continued education courses or individual credit courses. Others may choose technical training through certificate or diploma programs or through more comprehensive associate degree programs. The majority of community college students seek a degree at the community college with the intent to transfer to a four-year college or university. Iowa's community colleges also provide General Education Diplomas (GEDs) for adults. Although not all of these functions provide a direct and immediate economic benefit to students or the state, each function is designed to assist students in achieving their educational goals and become productive and responsible citizens.

### **Statement of the Problem**

In general, students who obtain higher levels of education will enjoy a greater economic return (Compton, 2008; Friedlander, 1993a, 1996; Grubb, 1999; Laanan, 1998,

1999; Laanan et al., 2007; Stoik, 2004). However, the majority of the research that supports this statement has, historically, been conducted using data from four-year institutions. The economic return of a community college degree does not enjoy the same level of documentation through research.

This lack of research at the community college level has implications on public perception of a community college degree and the value state and federal legislators place on education at community colleges. Parents want the best for their children and believe that a four-year college degree is the pathway to success. The pathway through a community college is not well understood. As students move through their high school experience many develop the aspiration of obtaining a four-year college degree. However, a growing number of high school students are seeking to enter higher education through a community college (Laanan, Compton, & Friedel, 2006a). These growing numbers of people who are choosing community colleges are doing so with less information regarding the benefit of the community college.

As state and federal legislatures increase accountability and determine the level of funding to invest at the community college level, it is important to show a return on the state and federal investment. The federal Carl D. Perkins Act of 2006 added additional performance indicators that focus programs on high wage, high skill and/or high demand employment and hold community colleges accountable for credential attainment, on-time completion, placement and baccalaureate degree attainment. The federal Perkins legislation augments state legislation in Iowa that requires community colleges to offer career and technical programs that prepare student for high demand areas.

In 2005, the state of Iowa passed legislation that emphasized three targeted industries: (1) Advanced Manufacturing, (2) Biotechnology, and (3) Insurance and Financial services. These three industries were seen as major growth areas that the state should focus on strengthening. These focused efforts were precipitated by a reduction in low-wage, low-skilled manufacturing jobs in the state and the need to replace these jobs with higher-wage jobs that require more verbal, math, and technology skills (Laanan et al., 2006a).

Community colleges were viewed as critical partners in preparing workers for higher wage jobs in these industries; however, because the economic benefits of attending a community college were not understood as well as the benefit of a four-year degree, some may have been skeptical of the value of community colleges. Research on degrees below a baccalaureate degree has increased since 1998. The use of unemployment insurance quarterly wage-earning data has allowed researchers the ability to measure the economic impact of a community college award with a higher degree of accuracy.

Iowa community colleges offer certificate, diploma, associate of applied science (AAS), associate of applied arts (AAA), associate of general studies (AGS), associate of science (AS), and associate of arts (AA) awards to their students but lack the data to understand the impact these awards have on a student's post-college earnings. In addition to students who receive awards, community colleges also struggle to understand the impact of the students who elect to exit the community college before obtaining an award. These students are identified as "Leavers" in this study.

The two-year credit students in Iowa's community colleges seek academic programs that prepare them specifically for a technical career or to transfer to a baccalaureate granting institution. Table 1.2 illustrates the distribution of Iowa community college credit student

Table 1.2. Iowa Community College – Credit Student Award by fiscal year

Fiscal Year	2001*	2002	2003	2004	2005
AA	3,809	3,916	4,120	4,164	4,722
AS	940	936	947	1,021	1,076
AGS	33	53	52	67	63
AAA	82	64	68	83	76
AAS	3,511	3,832	3,949	4,075	4,343
Diploma	2,779	2,891	3,183	3,247	3,307
Certificate	912	982	1,155	1,221	1,348
Other	65	90	102	66	88
Total	12,132	12,764	13,576	13,944	15,023

AA=Associate of Arts; AS=Associate of Science; AGS=Associate of General Studies;

AAA=Associate of Applied Art; AAS=Associate of Applied Science;

Note: Students may receive more than one award.

\*Fiscal Year Unknown 1

Source: Iowa Department of Education, Bureau of Community Colleges and Career and Technical Education.

awards from 2001 through 2005. The majority of student awards fall into one of the following categories: certificate, diploma, associate of applied science (AAS) and associate of science (AS) awards, all of which are technical degrees. This wide distribution of awards illustrates the need to better understand how each award impacts students in the future. As community college students make educational decisions on which career field to pursue and what educational level to obtain, they do so with limited information on how a given award will prepare them for the workforce.

This study examined four categories of educational attainment: (1) Leavers, (2) Certificate, (3) Diploma, and (4) Associate degree. This research focused on a limited number of career fields. Of the 16 national career clusters, five clusters were examined in this study: (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM);

and (4) Transportation/Distribution and Logistics. For the purpose of the current study, Manufacturing and Science, Technology, Engineering and Math were combined into one cluster (Manufacturing; Science, Technology, Engineering and Math [STEM]) because they are related to manufacturing in the Classification of Instructional Program (CIP).

### **Significance of the Study**

The implications of this study include public policy and practice, college decision processes, student decision-making, an understanding of the students served, and additional research agendas. The ability for Iowa community colleges to link their performance to economic indicators has the potential to position them well to receive stronger support from local communities and the state legislature. By demonstrating through research positive influences of community college education in Iowa and post-college earnings, we are better able to explain the economic benefit of obtaining an award at a community college and the implications on both local as state tax revenues. Showing these linkages may also change the public perception of educational funding from a drain on the state budget to an investment in the future.

This research provides community college leaders with an understanding of the relationship between a student's background characteristics, their highest award received, their post-college median annual earning and the students' fifth-year annual earnings. Understanding what programs and awards position students for greater financial success in the workplace or lead to further education may assist students as they make their educational choices while attending a community college. Community college leaders may also gain an understanding of the relationship background characteristics and previous education has on

the post-college median quarterly earnings. This information may be useful in allocating resource in order to ensure the success of all students who attend a community college.

This study adds to the research by exploring factors that predict the post-college earning in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career cluster. A multiple regression analysis was utilized to understand the relationships between students' background characteristics, degree attainment and fifth-year post-college earnings. Utilizing five years of earnings data provided an opportunity to study the impact of a community college award.

### **Purpose of the Study**

The purpose of this quantitative study was to better understand the relationship between community college students and their post-college earnings. This study analyzed the predictive power of a community college student's background characteristics, their highest award attained, four consecutive years of gains in median annual earnings to a student's fifth-year annual earnings in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career cluster.

Community colleges, students and legislators may benefit from the results of this study. Community colleges need to clearly understand the economic impact of the community college experience. This study has augmented the existing research by Laanan (1998), Sanchez (1998), Grubb (1999), Christophersen and Robinson (2003), and others by

focusing specifically on programs and the awards that are received by students. Students need to better understand the value of the community college experience and the economic benefits of the different award options that are provided to them through the community colleges. The Iowa legislature has linked education to economic development through the Iowa Industrial New Job Training Program (260E) and the Iowa Jobs Training Program (260F) (Laanan et al, 2006a). However, they need to clearly understand the impact that community colleges can have on economic growth of a region or the state.

The state of Iowa has identified three major targeted industry sectors and will focus the state's economic development resources in these areas. The targeted industries include; advanced manufacturing, biosciences, and information solutions/financial services. This study focuses on two of the three targeted industries that the state Iowa has identified.

### **Research Questions**

In order to identify and understand specific factors such as gender, age, and degree attainment that influence fifth-year post-college earnings of Iowa community college students in career and technical education in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters the following research questions were proposed:

1. What are the background characteristics of Iowa community college students, in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math

- (STEM); and (4) Transportation/Distribution and Logistics national career clusters, who received an award or left without receiving an award?
2. Among students who worked full-time, what are the median annual earnings and the annual percent gain in earnings of Iowa community college students in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters?
  3. Among students who worked full-time, to what extent do their background characteristics, highest award (certificate, diploma, or associate of applied science degree) received and annual gain in earnings in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters predict students' fifth-year annual earnings?

### **Theoretical Perspective**

The theoretical framework utilized in this study is the human capital theory. This theory posits that society and individuals derive economic and social benefit from investments in improving the lives of individuals within the society (Becker, 1993). Community colleges play an important role in developing human capital (Laanan, Hardy, & Katsinas, 2006) because of their close partnerships with business and industry and their focus on preparing students for the world of work, making this theory an appropriate choice.

The human capital theory (Becker, 1993) is useful in studying the impact on post-college annual earnings. Becker (1964) found that education and training are the most

important investments in human capital. Economists understand that a substantial growth in income in the United States remains after the growth in physical capital and labor are accounted for which has lead some economists to place and emphasis on education and training in promoting economic development.

Although the concept of viewing humans as capital has been controversial in the past, it has gained acceptance not only in economics, but also in other disciplines and among the general public. In his research, Becker (1994) calculated a person's rate of return on investments in human capital. These investments may come in a number of ways such as, on-the-job training, apprenticeship training, formal schooling and other knowledge. Each of these ways of investing in human capital require costs to acquire the capital and each investment will have some impact on future earnings. The rate of return places an economic value of an investment in human capital with can assist in determining if there is a value to invest in human capital.

The better one understands how human capital is impacted by education and training the better one will be able to assist community college students invest in their own human capital. Although the current study did not address the financial investments a student makes in his or her educational training which is needed to calculate the economic impact for a student, it has identified factors that influence post-college earnings of community college students. Chapter 2 presents additional literature regarding the human capital theory and calculating economic impact for the student.

The purpose of this study was to identify and understand specific factors such as gender, age, degree attainment and annual gain in earnings that influence fifth-year post-

college earnings of Iowa community college students in career and technical education in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career cluster.

The human capital theory provides a theoretical rationale to view students' background characteristics and the award they received as investments in human capital. The use of students annual gain in earnings are viewed as intervening variables (Creswell, 2003) that influence the predictive power the other independent variables have on the single dependent variable. Annual gain in earnings was used as the intervening variable instead of median annual earnings to better represent students with all income levels. Using the annual gain in earnings variable allows every case to be represented equitably in the regression model.

The independent variables in this study support the human capital theory by representing investments in a student's human capital. As each variable was entered into the linear regression model their predictive power was determined. It was useful to analyze the predictive power of background characteristics and the award the student received, however, the greatest benefit of the annual gain in earning variables was the influence these variables had on background characteristics and the awards a student received.

The dependent variable in the study was the fifth-year annual earnings of students who either left or completed an award at an Iowa community college and worked full time from 2002-07. Several independent variables were used in the study to determine a relationship to fifth-year post-college earnings.

### **Definition of Terms**

The following terms were defined for use in this study:

*Associate of Applied Arts (AAA) degree:* Primarily intended for career training in providing students with professional skills that will allow them to gain employment in a specific field of work in the arts and humanities areas. An AAA degree has a minimum of 72 semester (108 quarter) credit hours and a maximum of 86 semester (129 quarter) credit hours, including general education requirements, which exceed the requirements in the Associate of Applied Science degree.

*Associate of Applied Science (AAS) degree:* A program of study intended to prepare students for entry-level career/technical occupations. A minimum of 72 semester (108 quarter) credit hours and a maximum of 86 semester (129 quarter) credit hours which include at least 12 semester (18 quarter) credit hours of general education.

*Associate of Arts (AA) degree:* Considered a “transfer” degree that provides a strong general education component to satisfy the lower division general education requirements for a baccalaureate degree. An AA degree contains a minimum of 60 semester (90 quarter) hours and a maximum of 64 semester (96 quarter) credit hours.

*Associate of General Studies (AGS) degree:* Designed primarily for acquiring a broad educational background rather than pursuing a specific college major or professional/technical program. It is intended as a flexible program and may include specific curriculum in lower division transfer, occupational education, and professional-technical education. An AGS degree requires a minimum of 60 semester (90 quarter) hours and a maximum of 64 semester (96 quarter) credit hours.

*Associate of Science (AS) degree:* Primarily intended to encourage exploration of academic options, which require a strong background in math and/or science, and prepare students to initiate upper-division work in baccalaureate programs or prepare for employment. An AS degree contains a minimum of 60 semester (90 quarter) credit hours and a maximum of 64 semester (96 quarter) credit hours.

*Career Clusters:* A grouping of occupations and broad industries based on commonalities. The 16 Career Clusters organize academic and occupational knowledge and skills into a coherent course sequence and identify pathways from secondary schools to two- and four-year colleges, graduate schools, and the workplace. They are: Agriculture and Natural Resources; Construction; Manufacturing; Logistics, Transportation, and Distribution Services; Information Technology Services; Wholesale/Retail Sales and Services; Financial Services; Hospitality and Tourism; Business and Administrative Services; Health Services; Human Services; Arts and Communications Services; Legal and Protective Services; Scientific, Engineering, and Technical Services; Education and Training Services; and Public Administration/Government Services.

*Certificate:* Designed for entry-level employment and has a minimum of 12 semester (18 quarter) credit hours and a maximum of 18 semester (27 quarter) credit hours. A certificate may be used toward subsequent completion of a diploma or associate of applied science degree and may be in rapid response to business and industry.

*Classification of Instructional Programs (CIP):* A national classification system to provide taxonomic scheme that will support the accurate, tracking, assessment and reporting of fields of study and program completions activity.

*Completer:* A student who completed an associate's degree, a certificate, or a diploma, and was not found to be enrolled in any postsecondary institution in the year following completion (2002-2003).

*Diploma:* Represented by a coherent sequence of courses consisting of at a minimum of 15 semester (22 quarter) credit hours and not to exceed 48 semester (72 quarter) credit hours, which include at least 3 semester (4 quarter) credit hours of general education. A diploma may be used toward subsequent completion of an associate of applied science degree.

*Full-time working status:* A student who was reported in the Unemployment Insurance (UI) wages as having worked three out four quarters within the year.

*Gain in Median annual earnings:* Created by calculating the difference between the median annual earnings from student's 1<sup>st</sup> and 2<sup>nd</sup> year, 2<sup>nd</sup> and 3<sup>rd</sup> year, 3<sup>rd</sup> and 4<sup>th</sup> year and 4<sup>th</sup> and 5<sup>th</sup> year.

*Highest award received:* The hierarchy of awards is certificate being the shortest award, a diploma and then an associate degree. A student who receives more than one award would be categorized in the higher award category.

*Iowa Workforce Development:* A state department in Iowa that contributes to Iowa's economic growth by providing quality customer-driven services that support prosperity, productivity, health and safety for Iowans. In conjunction with state and local economic development efforts, IWD also assists businesses to fulfill their workforce needs.

*Leaver:* A student who left the community college after completing at least one credit during the academic year without receiving an award and who was not found to be enrolled in any postsecondary institution in the following year (2002-2003).

*Lost wages (Forgone wages):* Wage potential of a student while attending a community college.

*Management Information system (MIS):* An Iowa community college individual student record management system that is managed by the Iowa Department of Education.

*Median annual earnings:* The sum of all quarterly earnings, delimited to students who earned wages in three out of four quarters.

*National Student Clearinghouse (NSC):* The nation's trusted source for post-secondary student degree and enrollment verification. Through its verification reporting solutions, the NSC helps colleges and universities improve efficiency, reduce costs and workload, and enhance the quality-of-service they provide to their students and alumni, lending institutions, employers, and other organizations. All NSC programs are designed to reduce its member schools' administrative burden of providing educational record verification while maintaining the confidentiality and privacy of records in their care in full compliance with the Family Educational Rights and Privacy Act (FERPA). The NSC has a 10-year track record of working with higher education professionals to transform student enrollment and degree verification.

*Occupational Information Network (O\*NET):* This classification is the Department of Labor's replacement for the venerable Dictionary of Occupational Titles (see aforementioned definition). The latest versions are based on the Standard Occupational Classification. The O\*NET consortium has also developed an on-line viewer for accessing information about O\*NET occupations.

*Occupational Outlook Handbook:* A nationally recognized source of career information, designed to provide valuable assistance to individuals making decisions about their future work lives. This handbook is revised every two years.

*Program completer:* A student who successfully completes the requirements of a community college degree program.

*Standard Occupational Classification (1998/2000, SOC):* The SOC is the federal government's official classification structure for occupations. All federal programs that classify workers use or are based on the SOC.

*Targeted Industries:* Defined in Iowa as: Advanced Manufacturing – Industries dedicated to the rapid introduction of new processes, materials and technologies to manufacturing applications; Biosciences – Industries involved in the application of biological and biochemical sciences to plant, animal, processed foods and humans; and Information Solution/Financial Services – Businesses experiencing huge growth in the insurance and financial services/information technology industry.

*Unemployment insurance:* Wage data used by Iowa Workforce Development to calculate financial benefits to qualified workers who are unemployed. UI contains the individual wage data from all employers for each quarter of employment.

### **Summary**

This quantitative study sought to expand the literature on the nation level and provide new research within the state of Iowa about the economic impact of community colleges. Specifically, this study examined the relationship between Iowa community college students' background characteristics, award completion and gain in median annual earning. The study

focused attention on students' fifth-year annual earnings in selected national career clusters at Iowa community colleges. The National Student Clearinghouse was used to filter out those students who transferred from an Iowa community college to another higher education institution.

Multiple state and national data files were utilized to better understand the relationship between the different Iowa community college degrees and the student's post-college annual earnings. The Iowa Department of Education manages the community college Management Information System (MIS). All 15 Iowa community college are required to report student information within this system. This database contains students' background characteristics, major codes and educational attainment, which are some of the independent variables that were used in this study. The Iowa Workforce Development manages the Unemployment Insurance (UI) database for the state of Iowa. Iowa employers are required to report earnings of their employees on a quarterly basis. This data file was used to construct the remaining independent variables and the dependent variable used in this study. The National Student Clearinghouse (NSCH) database contains information that assisted in determining cases, in the MIS database, that are enrolled in other higher education institutions. Although, it was not possible to account for all cases in this study, the NSCH did account for some of the missing cases in the MIS database.

Chapter 2 provides a review of existing research on economic impact and post-college earning of community college students and shows the evolution of the research. The review of literature also provides information on the career and technical system in Iowa, the national career clusters, and shows how the usage of UI wage information has changed the way research is conducted. Although the amount of research regarding community college

student post-college earnings is sparse, there has been a recent surge in such research. The use of the UI wage information has contributed to this surge because it is now easier to acquire wage data which has greatly increased the reliability of research on economic impact and post-college earnings.

Chapter 3 describes the general methodological approach, data sources and variables used in the study. This chapter provides greater detail on the state and national data collection systems used in the study. The participants in the study are described and descriptive statistics are provided on the sample size and background characteristics. The sensitive nature of these data required security agreements between Iowa workforce development, the Iowa Department of Education, and Iowa State University. The data/statistical analysis procedures are explained for each research question, and the limitations and delimitations of the study are also explained in this chapter.

Chapter 4 presents the findings of the study. This chapter addresses the findings related to each research question. The demographic characteristics, median annual earnings, percent increase in annual earnings and the multiple regression analysis are addressed separately for each of the four national career clusters that are identified in the study.

Chapter 5 provides a discussion of the findings by the selected career clusters and by the independent variables. This is followed by the implications, recommendation and conclusions of the study. Legislative interest in the economic impact of community colleges was a significant reason for this study. The policy implications of this study are addressed in this chapter along with suggestions for conducting future research.

## **CHAPTER 2. LITERATURE REVIEW**

The community colleges, as a system, serves the diverse needs of all students and each of the awards granted by the community colleges serve a valid function within the educational system. Depending on the students' needs and interests they can choose which award option is right for them. Since the majority of students seek their education from a community college to gain employment, it would be important to assess which option will yield them the greatest financial return throughout their careers. This literature review focuses on a review of career and technical education in Iowa, the national career clusters and research studies that address the economic benefits of a community college degree.

### **Iowa Community College System**

Iowa's community college system, as it is known today, began to take shape in 1965 when Iowa passed Senate File 550, the Area Schools Act. This act provided the basic governance structure (local boards with state oversight), funding structure (mix of local property taxes state general aid and tuition), and mission (provision of diverse vocational, liberal arts, adult education, and training programs) for fifteen regional institutions (Varner & Friedel, 2004). Each of these institutions serves a specific geographic area of the state and has evolved into Iowa's comprehensive community college system. In 2004, nearly one in four Iowans between the ages of 18 and 64 enrolled in an Iowa community college offering (Varner & Friedel, 2009).

Iowa's community colleges have always been viewed as providing technical training to prepare students to enter the workforce or upgrade their skills to adapt the changing workforce. However, it has only been since the late 1980s when the community college

really began to be viewed as a transfer college. Iowa's community college saw a soar in arts and science enrollments in the 1980s and in 1987 the fall headcount of credit arts and science enrollment surpassed the vocational technical enrollment for the first time since 1972 (Friedel & Varner, 2004). In 2008, credit enrollment in arts and science programs was 76,895 or 60% of the total credit enrollment in Iowa's community colleges. This compares to 40,500 students who were enrolled in career and technical programs (Utman, 2008).

### **National Career Clusters**

The national career clusters are comprised of 16 individual groupings, or clusters, of occupations/career specialties that can be used to organize curriculum and instruction. Occupations/career specialties are grouped into the career clusters based on a common set of knowledge and skills that are needed for career success. The knowledge and skills represented by career clusters prepare learners for a full range of occupations/career specialties, focusing on the holistic, polished blend of technical, academic and employability knowledge and skills. This approach is perceived to enhance the more traditional approach to career and technical education that tends to focus on specific occupational skill sets needed in industry.

In 1994, Goals 2000: Educate America Act created the National Skills Standards Board (NSSB). This board was charged with identifying broad occupational clusters and creating a system of standards, assessments and certifications for each cluster. During this same time the National School-to-Work Opportunity Act created the National School-to-Work Office (NSTWO). In 1996, the NSSB, NSTWO, and the Office of Vocational and Adult Education (OVAE) teamed together on project called "Building Linkages Project" that

lead to the release of the 16 clusters (see Table 1.1) by OVAE in November 1999 (NASDCTEC, 2008).

In 2002, OVAE did not renew funding for career clusters and the National Association of State Directors of Career and Technical Education began to provide leadership for career clusters under the name “States’ Career Clusters Initiative” (NASDCTEC, 2008). The NASDCTE have continued to manage this initiative to the present date.

In the state of Iowa, the Iowa Department of Education recognizes the 16 career clusters. All career and technical programs in Iowa’s community college system are categorized by career clusters, and educational data are reported by the 16 career clusters. Each career and technical education program is assigned a Classification for Instruction (CIP) code, which is defined by the federal Department of Education and reported in the Integrated Postsecondary Educational Data System (IPEDS). A complete list of CIP codes by national career cluster is provided in Appendix A. The Manufacturing cluster and the Science, Technology, Engineering and Math (STEM) cluster were combined for the purposes of this study. The rationale for this recoding was because all of the program codes that constitute these two career clusters are career and technical programs and related to the manufacturing industries. Although there are several distinctions between these two clusters, this study was delimited to only career and technical programs within community colleges. Therefore, only a subset of Science, Technology, Engineering and Math (STEM) related programs were identified.

The Iowa Department of Education and Iowa Workforce Development partnered together to produce publications that demonstrate the relationship between educational

attainment, ranging from high school to a bachelor's degree, and current employment opportunities. These publications are organized produced for each of the 16 career clusters.

The first study to use the national career clusters as framework to study post-college earnings using Iowa community college students was conducted by Compton (2008). His study utilized the same secondary data set utilized in this dissertation study. The Compton study focused on the business, information technology and marketing career clusters. This research study complements the Compton study by focusing on other career clusters.

### **Economic Impact Studies**

The economic impact of community colleges has become an important factor for state and national legislators when appropriating funding to higher education. This has driven several community college systems to invest in economic impact studies. In 2003, the Iowa community college system joined Illinois, Maryland, Mississippi, New Jersey, Oklahoma, Oregon, Washington and Wisconsin in conducting an economic benefits study. This study concluded that for every dollar of state or local tax money invested in the Iowa community college system, the state received a cumulative return of \$11.00 over 36 years (Christophersen & Robison, 2003). One area that Christophersen and Robinson examined in their study was the future earnings of graduates. This study indicated that students gain 23% annual return on their investment of time and money. For every one dollar the student invests in a college education, he or she will receive a cumulative \$6.47 in higher discounted future earnings over the next 36 years. The future earnings of graduates in this study could not address specific subgroups of students, background characteristics or degree attainment, therefore, limiting the impact and use by community colleges. In addition to their state level

economic benefit studies, Christophersen and Robinson also conducted studies for individual colleges.

Economic benefit studies provide community college with valuable information that can be shared with legislators. The results of this economic benefits study were shared with Iowa legislators in 2005 when the Grow Iowa Value fund was established and created Iowa's three targeted industries. The study was able to demonstrate a return on state and local investments and did impact the final language of the legislation.

### **Theoretical Perspective**

The human capital theory (Becker, 1993) is useful in studying the impact on post-college annual earnings. Becker found that education and training are the most important investments in human capital. Becker developed his human capital theory over his career. Economists understand that a substantial growth in income in the United States remains after the growth in physical capital and labor are accounted for which has lead some economists to place and emphasis on education and training in promoting economic development.

Although the concept of viewing humans as capital has been controversial in the past, it has gained acceptance not only in economics, but also in other disciplines and among the general public. In Becker's research he calculates a person's rate of return on investments in human capital. These investments may come in a number of ways such as, on-the-job training, apprenticeship training, formal schooling and other knowledge. Each of these ways of investing in human capital require costs to acquire the capital and each investment will have some impact on future earnings. The rate of return places an economic value of an investment in human capital which can assist in determining if there is a value to invest

human capital. Some investments may only benefit a specific employer. For example training on a piece of equipment or process that has limited use outside of that company. Other investments will have a more general application, for example, training on widely used software programs or theory training in a specific career field. The employer typically pays for training if it is specific in to the company, however many times the individual pays for the investment if it is more general in nature.

The most important investments in human capital are education and training (Becker 1964). Although this study did not address the investments a student makes for their educational training which is needed to calculate the defined economic impact for a student, it identified factors that influence post-college earnings of community college students.

### **Studies of Post-college Earnings Prior to 1998**

Before the early 1990s the vast majority of the literature on economic benefit had been in relation to the baccalaureate awards. There was little research that addressed the economic benefits of a community college degree and the research that was done addressed community colleges in a very broad manner. Since the early 1990s, there have been a growing number of studies in this area.

*The Economic Benefits of Attending Community College* (Sanchez & Laanan, 1998) provides a comprehensive review of the literature prior to 1998; therefore, this literature review references *The Economic Benefits of Attending Community College* for the literature before 1998, and includes current literature that was developed after 1998.

In *The Economic Benefits of Attending Community College*, Sanchez and Laanan (1998) compiled the work of eight other researchers in a comprehensive review of the

economic benefits of attending community college. The research included statewide studies conducted in California, Florida, North Carolina and Washington, with two additional studies focusing on individual community colleges in Washington and California.

Data by federal agencies have categorized educational attainment levels and grouped students into the following categories: (1) not a high school graduate; (2) high school graduate; (3) some college; and (4) baccalaureate, masters, doctoral or professional degree completers. Included in the “some college” category are all individuals who complete less than a four-year program, including those who attain an associate degree or certificate. Data categorized in this way has limited the ability of researchers to isolate the contribution of community colleges in terms of the economic benefit to individuals’ post-college earnings. (Grubb, 1996; Romano, 1986; Sanchez & Laanan, 1998). Therefore, as research on community colleges increased, the method of collecting data has shifted from survey instruments prior to the 1990s to using wage data information from the state department of labor unemployment insurance (UI) wage records files. Wage information can be tracked by using the Social Security number of the individuals and matching it with the information employers submit to the Department of Labor. This system does have some limitations; it doesn’t contain military employees, the unemployed or self-employed individuals and federal employees. The system also doesn’t identify employees as part-time. The UI wage data are comprised of individual state systems. Therefore, it may be cumbersome to use this system in some situations without state-to-state agreements. For example, a community college that is located in a corner of any given state will draw “local” students from three or four surrounding states. Upon graduation many of these students may choose to return to their home state, making tracking these graduates more difficult.

Sanchez and Laanan (1998) provided detailed information regarding the economic benefits of community college education, particularly the relationship between education and earning. They included background information on legislative trends that are driving accountability within the educational system and address the shift of legislators from viewing education as a societal benefit to an economical benefit to the state as well the individual. They also included an historical perspective on the emergence of the accountability movement in the 1980s and the attributes that contributed to the accountability movement. Fiscal restraints, the influence on accreditation process and state mandates were listed as attributing factors by Sanchez and Laanan. State and federal mandates were imposed on community colleges. The Carl D. Perkins Vocational and Applied Technology Education Act had imposed federal accountability on all career and technical programs in the following minimum core areas: Academic attainment, Skill proficiency, Retention, Completion, Placement, and Nontraditional participation. The book also references the Federal Workforce Investment Act (WIA) and the Job Training and Partnership Act (JTPA).

### **Studies of Post-college Earnings 1998 – Present**

In *Learning and Earning in the Middle*, part I: National Studies of Pre-Baccalaureate Education, Grubb (1999) provided a historical perspective on the issue of learning and earning and a comprehensive assessment of research directly focused on pre-baccalaureate education.

Grubb (1999) concurred with Sanchez and Laanan (1998) that the majority of the early research was focused on baccalaureate degrees and higher in relation to the high school diploma and it wasn't until recently that the economic benefit of community colleges has

been addressed. However, in the review Grubb focused specifically on national studies.

When looking at national studies Grubb identified several common data sets that are used in three national longitudinal data sets:

- The National Longitudinal Survey of the Class of 1972 (NLS72);
- The High School and Beyond Study of the classes of 1980 and 1982,
- The National Longitudinal Survey of Youth (NLS-Y), which followed a group of individuals who would have graduated from high school between 1976 and 1983.

Additional data sets used are:

- The Survey of Income and Program Participation (SIPP); this data set encompasses the entire population and not a select group. The survey has been conducted every year since 1984 and was limited as a longitudinal survey since the respondents are only followed for 28 or 32 months.
- The National Survey of Adult Literacy (NALS); while its major purposes were to ascertain literacy practices and measured levels of literacy, it also collected data on employment.
- The Current Population Survey; this is a limited survey that addressed Certificate and Associate degrees in 1992. Relatively few data sets include information about certificate programs which are 2-year programs focusing on occupational preparation.

The review compiles findings of the following research studies: Averett and D'Allesandro (2002); Groot, Osterbeck, & Stern (1995); Grubb (1995a, 1995b); Hollenbeck (1993); Kane and Rouse (1995b); Leigh and Gill (1997); Rivera-Batiz (1998); and Surette (1997, 1999) to address the effects of baccalaureate and associate degrees, certificates and postsecondary education without credentials, on employment outcomes as well as other questions related to

the economic benefit of community colleges. By comparing the aforementioned studies, Grubb established validity in his assessments. With the limited number of studies performed on this topic, it is difficult to refute studies that show a differing assessment of the same issue. However, as the research grows, a clearer picture will emerge.

Grubb's (1999) findings are not surprising:

- In general, the greater the amount of education, the greater the economic return.
- As expected community college training will yield a smaller economic return than the baccalaureate degree; however, there are some areas in the health occupations, engineering, public service and certain technical areas that will yield a higher economic return than a humanities or education baccalaureate degree.
- Overall, there is a clear and substantial economic return to the associate degree; however, academic associate degrees have little economic returns.
- Economic returns are highest in engineering and computer fields for men and health-related occupations for women.
- Cosmetology and child care yield insignificant or negative economic returns.
- Women yield a higher economic benefit than men from a community college degree.
- Certificate attainment has limited economic return except for occupational certificates that can yield a greater return than associate degrees.

In *Learning and Earning in the Middle*, part II: State and Local Studies of Pre-Baccalaureate Education, Grubb analyzed many of the same studies that were addressed by Sanchez and Laanan (1998). The analysis focused on individual state systems and community college systems. Studies that focus on local and state can and do provide more detailed information that is deemed useful to policy makers and administrators. Although the findings in both

local and state studies corroborate the findings in the national studies, policy makers view them with greater validity because they take into consideration the differences in the state workforce and the educational system.

The Unemployment Insurance (UI) data is clearly the database of choice to indicate economic benefits. Where surveys would yield 20% to 30% returns of participants, the UI database matches 60% to 90 % of participants. Grubb (2000) identified the same limitations to the UI database as Sanchez and Laanan (1998) but referenced some areas that are not covered within the UI system and some farm workers as additional limitations.

In Part I and II of Grubb (2000), the way students were compared was different. As identified in Part I of Grubb (2000), the national studies compare earning of community college graduates to high school graduates, where as in state and local studies they compare the participants to themselves, Pre College to three years after graduation. Within the national data sets, researchers are able to conduct longitudinal studies to determine the economic impact over 5, 10 and 20 years. State and local studies typically do not go past three years after graduation. State and local studies can also break down the results into specific program areas and by associate degree and certificate.

Sanchez, Laanan, and Wiseley (1999) studied Post-College Earnings of Former Students of California Community Colleges. They analyzed a specific cohort of 700,000 California community college students during the 1992-93 academic years who were either considered “leavers or completers.” A “completer” was defined as a student who did receive a certificate or degree, whereas a “leaver” was defined as a student who did not receive a certificate or degree but may have completed some units.

The purpose of the study by Sanchez et al. (1999) was to address the following questions: (1) What is the economic value of obtaining a vocational certificate or an associate degree from a California community college? (2) How do students' post-college earnings from the last year in college, first year out of college, and third year out of college differ by educational attainment for all students and vocational students? (3) What is the relationship between educational attainment and earnings for students under 25 and for students 25 and over? and (4) Are there differences by racial/ethnic background, economic status, gender and age group among vocational students?

The Sanchez et al. (1999) study relied on the Unemployment Insurance (UI) wage data, the student records maintained by the California State University (CSU) Chancellor's office and demographic and educational data from all California community college students maintained by the Chancellor's Office Management Information System (MIS). In order to make comparisons of earnings for the last year in college to the third year out of college the consumer price index for urban (CPI-U) was used to adjust earnings to 1996 earnings.

The results of the study by Sanchez et al. (1999) were similar to the Friedlander (1996) study on the same cohort. Both support the notion that there is a positive relationship between formal education and earnings. Therefore, students who complete more education increase their likelihood to yield a greater economic benefit. More specific results were:

- Completing a vocational certificate or associate degree greatly increases the students post-college earnings compared to taking a minimum number of units.
- Vocational students who earned associate degrees yielded a greater wage and a greater gain than that of certificate degrees. However, students with non-vocational

certificates yield a higher wage, one year and three years out, than those with associate degrees, but the gain is greater for the associate degree.

- All students 25 and under yield a gain of 26.4% and wages of \$14,303, one year out and \$18,075 three years out in comparison to students 25 and older who yield a gain of 4.7% and wages of \$29,122, one year out and \$30,505 three years out.
- Females close the wage gap with males through associate degrees.

### **Iowa Economic Impact Studies**

Stoik (2004) conducted a study in the state of Iowa, using Iowa Unemployment Insurance (UI) wage records for individuals who attended Western Iowa Tech Community College (WITCC) to address the extent that students benefit by attending WITCC as measured by post-college earnings. Stoik revealed that there was an economic benefit to an individual who attended WITCC. Furthermore, in the first three years of receiving a degree, completers' growth exceeded that of leavers (Stoik, 2004). Stoik's research provided Iowa with detailed information regarding economic benefit as related to one institution.

In 2004 the Iowa Department of Education sponsored a research study entitled "Vocational Education Accountability in Iowa Community Colleges" at Iowa State University. One of the objectives of the study was to develop the methodology to match Iowa community college students' educational data with the Unemployment Insurance (UI) data from Iowa Workforce Development (IWD) to assess students' post-college earnings (Laanan, Starobin, & Compton, 2006b).

Much of the analyses of the study by Laanan et al. (2006b) were guided by the studies mentioned previously in this literature review. The study created a data file that combined

Unemployment Insurance (UI) wage records, Iowa Department of Education, MIS system and the National Student Clearinghouse. The UI wage records were used to determine post-college median earnings of students. The National Student Clearinghouse was used to analyze transfer behavior of Iowa community college students. This report provided a preliminary analysis of transfer behavior and transfer rates of Iowa Community college students, retention in employment and median annual earnings among Iowa community college students. A cross-sectional analysis was made by grouping students into several categories. When analyzing retention in employment, students who received awards were placed into three categories. These three categories were: (1) associate of arts (AA), (2) associate of applied science (AAS), and (3) Diploma. When analyzing median annual earnings, students were placed into three categories: (1) all students, (2) awardees, and (3) non-awardees.

Laanan et al. (2007) provided the final analysis of transfer behavior and transfer rates of Iowa Community college students, retention in employment and median annual earnings among Iowa community college students. A summary of the findings by Laanan et al. (2007) is as follows:

*Completers and Leavers*

- Completers experience positive gains in median annual earnings across all educational attainment levels.
- Between FY 02 and FY 05 the percentage gain in median annual earnings was almost twice as much for completers (87.07%) than leavers (40.74%).
- During the first year out of college (FY 03) and the third year out of college (FY 05). AAS degree completers experienced the highest median annual earnings.

*Gender*

- Among females and males, completers experienced a larger percentage increase in median annual earnings than leavers between the first year out (FY 02) and the third year out (FY 05).
- Among females, AAS degree completers experienced the largest increase in median annual earnings (103.31%) between FY 02 and FY 05.
- Among males, diploma completers experienced the largest increase in median annual earnings (144.92%) between FY 02 and FY 05.

*Race*

- Overall, White student experienced a larger percentage increase (52.06%) in median annual earnings between the last year in college FY 02 and third year out FY 05 than Non-White students (32.71%).
- For both White and Non-White students, completers had the largest percentage increases in median annual earnings than leavers between the last year in college FY 02 and the third year out FY 03.
- For both White and Non-White students, degree and diploma completers had higher median annual earnings in FY 05, and experienced larger percentage increases between their last year in college FY 02 and the third year out FY 05.

*Age Group*

- Completers in both age groups experienced a larger increase in median annual earnings between FY 02 and FY 05 than leavers.
- Diploma completers in both age groups experienced a larger percentage increase in median annual earnings between FY 02 and FY 05.

*Pell Recipients*

- Overall, Pell recipients experienced a larger percentage increase (78.59%) in median annual earnings between the last year in college FY 02 and the third year out FY 05 than Non-Pell recipients (44.50%).
- Among completers, Pell recipients experienced a larger percentage increase (116.01%) in median annual earnings between FY 02 and FY 05 than Non-Pell recipients (78.84%). However, Non-Pell recipient had higher earnings in FY 05 (\$28,928) than Pell recipients (\$26,935).

*Career Clusters*

- STEM completers experienced the highest percentage increase between FY 02 and FY 05 (129.78%) of all career clusters and the highest median annual earnings in FY 05 (\$38,068) of all clusters.
- Human services completers experienced the lowest median annual earnings in FY 05 (\$18,291) of all clusters, while Hospitality and Tourism

completers experienced the smallest percentage increase between FY 02 and FY 05 (52.19%). (Laanan et al., 2006b)

One of the findings by Laanan et al. (2007) was that students who received an award in FY 02 and were employed in the third quarter of FY 02 were very likely to still be employed in the fourth quarter of FY 03. 95.65% of the students who received a diploma, 97.15% of the students who received an AAS award, and 94.23% of the students who received an AA were still employed in the fourth quarter of 2003. This cohort of students provided the opportunity within the current researcher's study to determine the factors that influence post-college earnings.

A study was conducted by Compton (2008) using data from research by Laanan et al. (2006b). Compton's study and this study began at about the same time. The theoretical perspectives were similar as were the methodologies. Compton's study focused on three career clusters: (1) Business and Administration; (2) Information Technology; and (3) Retail/Wholesales and Services. All clusters were different from the career clusters used in the current researcher's study. Human capital theory was the foundation of the theoretical perspective and similar statistical analysis were utilized to address the research questions. Compton's study sought to research similar questions as this study, which makes the current researcher's study a significant companion study. The two studies augment each other and validated post-college earning literature on approximately two-thirds of Iowa career and technical programs.

Compton (2008) revealed that completers of associate degrees in the Information Technology cluster had significantly higher earnings than those who left without receiving an award. The Marketing cluster had similar results; however, the business cluster yielded the

lowest wages and the lowest increase in wages and no statistically significant value of completing an associate degree (Compton).

The Office of Community College Research and Policy (OCCRP) at Iowa State University has provided the rich data files used in several reports and studies, the Compton, 2008 study being directly aligned with the current researcher's study. These data sets provided the opportunity for the current researcher to expand the literature by utilizing a longitudinal approach that disaggregated students by federal career clusters.

The review of the literature has indicated that, in general, the higher the degree, the higher the earning potential of the individual. In his book, entitled *Working in the middle: Strengthening education and training for the mid-skills labor force*, Grubb (2006) indicated that having a sub-baccalaureate credential as well as post-secondary coursework without credentials help individuals move from the bottom levels of the labor force into mid-skilled positions. A study by Laanan et al. (2006b) supported this general statement and provided the robust analytical approach and methodology for the state of Iowa. Studies by Stoik (2004) and Compton (2008), which focused on specific programs, have contributed to the literature on post-college earnings in Iowa. The study by Compton extended this analytical approach and methodology to selected national career clusters.

Most of the previous state and local studies seem to have been generated from the states of California, Texas, Florida, Washington and North Carolina, with more current studies coming from Iowa, Illinois, Oregon, Wisconsin and Wyoming. As one examines the research that has been done in the area of economic benefits of community colleges, it appears that the research may be strong; however, in reality, the number of studies is small and only a handful of states have acquired this information. Each state needs this type of

information to validate and provide guidance to the educational system as to the economic impact the graduates have to the states economy.

The community colleges are viewed as key providers of the future workforce (Laanan et al., 2006a) and knowing the economic impact that is generated through the many services that are provided by the community college is essential for program evaluation, recruitment of future student and acquiring future funding.

### **CHAPTER 3. METHODOLOGY**

The purpose of this quantitative study was to identify and understand specific factors such as gender, age, degree attainment and annual gain in earnings that influence fifth-year post-college earnings of Iowa community college students in career and technical education in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career cluster. To answer the research questions in this study, data were drawn from the Iowa Department of Education's Management Information System (MIS), the Iowa Department of Workforce Development's Unemployment Insurance (UI) wage record and the National Student Clearinghouse postsecondary student enrollment verification system.

The Iowa community college Management Information System is a point in time system that contains data on many aspects of community colleges and relative to this study. Data from student characteristics, course files, awards files and program major were used for this study. A separate file containing a list of Pell recipients was also obtained from the Iowa Department of Education. Receipt of a Pell grant served as a proxy for economic disadvantage. While receipt of a Pell grant is often used as a proxy for economic disadvantage, some have questioned whether receipt of a Pell grant is an appropriate measure of economic disadvantage, suggesting that, since not all who are eligible for Pell grants actually receive them, they give an overly conservative estimate of the number of low-income enrollees (Romano & Millard, 2006; Tebbs & Turner, 2005). However, Pell receipt was the best indicator of economic disadvantage available.

The Iowa Workforce Development Unemployment Insurance (UI) data contain quarterly wage information on people employed in Iowa. A quarter is three months of employment. The quarterly wage is determined by the sum of all wages earned in the three-month period, and the annual wage is determined by the sum of all wages earned in each of the four quarters.

The National Student Clearinghouse (NSC) is a data warehouse source for postsecondary student degree, diploma and enrollment verification by semester. Higher education institutions voluntarily provide data to the NSC. The Clearinghouse has a 14-year track record of working with higher education professionals to pull together student enrollment and degree verification. All of their programs are designed to reduce member schools' administrative burden of providing educational record verification while maintaining the confidentiality and privacy of records in their care in full compliance with the Family Educational Rights and Privacy Act (FERPA). This data warehouse uses one's social security number, which is the same identifier that the Iowa community college MIS system uses for student identification. More than 3,000 institutions, enrolling 91% of United States college students participated in the NSC (National Student Clearinghouse, 2006).

### **Population and Sample**

The initial data match was based on 95,349 students enrolled in any of Iowa's 15 community colleges during the 2001-2002 academic year. However, the analysis was delimited to approximately 33,515 completers and leavers who were not enrolled in high school, and did not continue in postsecondary schooling in the following academic year. The demographic data on the remaining cohort represented 42.7% males and 57.1% females;

53.0% of those enrolled were less than 25 years of age, and 43.4% were 25 and over; 86.8% of the enrollees were White, 3.1% Black, 1.9% Hispanic, 1.3% Asian/Pacific Islanders, and less than 1% Native American; and 26.3% of the enrollees were Pell grant recipients.

Completers were defined as those who complete an associate's degree, a certificate, or a diploma, and were not found to be enrolled in any postsecondary institution in the year following completion (2002-2003). Leavers were defined as those who left the community college after completing at least one credit during the academic year without receiving an award, and were not found to be enrolled in any postsecondary institution in the following year (2002-2003).

The data used to assess earnings in this study were comprised of the first year after departing the community college (July 1, 2002 – June 30, 2003), the second year after departure (July 1, 2003 – June 30, 2004), the third year after departure (July 1, 2004 – June 30, 2005), the fourth year after departure (July 1, 2005 – June 30, 2006) and the fifth-year after departure (July 1, 2006 – June 30, 2007). The Unemployment Insurance (UI) wage data are reported quarterly. Students who worked three out of four quarters were considered to be working full-time. The rationale for using three out of four quarters to determine full-time status was to account for seasonal workers. Preliminary data were run using the criteria of four out of four quarters and three out of four quarters. Because there was little change in the cohort size, three out four quarters were utilized to address concerns that the study may have excluded seasonal workers in certain career areas such as construction.

Individuals enrolled in the following academic year (2002-2003) in any postsecondary institutions nationwide were identified through the National Student Clearinghouse. These records were removed from the dataset so that the cohort only

included individuals who left schooling to enter the workforce. In addition, students enrolled in secondary education while enrolled in the community college were excluded from the analysis as identified by the MIS data. Social Security Numbers were used to match Iowa Workforce Development data with Iowa Department of Education data and NSC data.

### **Data Access and Security**

The researcher obtained access to these three data sources through an agreement with the Iowa Department of Education, Division of Community Colleges and Workforce Preparation. Since the data include social security numbers, strict regulations regarding appropriate use of this data were maintained. The data security plan was signed by the ISU research team and the administrator of the Department of Education. An affidavit of nondisclosure was signed by this researcher who participated in the original study by Laanan et al. (2006b). Human subjects research approval for the current study was granted by the Iowa State University Institutional Review Board (IRB) (see Appendix B).

### **Data Collection**

Three sources of data were used in this study: (1) MIS data from the Department of Education; (2) UI data from the Iowa Workforce Development; and (3) Enrollment data from the National Student Clearinghouse. The MIS data from the Department of Education are collected by each of the 15 Iowa community college and reported to the Department of Education. The data that were used included the year-end student enrollment file. These data are collected at the end of the academic year on all students enrolled in the community colleges. This file includes information on student characteristics, including date of birth, gender, and race/ethnicity. In addition, a list of Pell recipients was provided by the Iowa

Department of Education, which was collected by the Iowa College Student Aid Commission. All career and technical programs in Iowa's community college system are categorized by the 16 career clusters and each program is assigned a Classification for Instruction (CIP) code, which are defined by the federal Department of Education and reported in the Integrated Postsecondary Educational Data System (IPEDS).

The Iowa Workforce Development UI employment data were provided through a data agreement between the Department of Education and Iowa Workforce Development. The UI data are collected by employers in the state for each employee and reported to Iowa Workforce Development. The records include the social security number of the individual, the quarterly wage, the name of the company, and the industry code. The industry code indicates the type of company or employer, but does not indicate the occupation of the individual. In other words, if the company's industry is classified as manufacturing, it is not possible to determine if the individual employee is an accountant, engineer, maintenance worker, etc.

The National Student Clearinghouse (NSC) data are provided voluntarily by more than 3,000 institutions, enrolling 91% of United States college students (National Student Clearinghouse, 2006). The enrollment data from the NSC include social security number, beginning and ending dates of enrollment, institution of enrollment, and institutional code. The limitation of this dataset is that not all postsecondary institutions are included. In particular, non-profit institutions may be underrepresented in the NSC data.

### **Data Analysis Procedures**

Descriptive and comparative analyses were conducted to analyze the relationship between student background characteristics, degree attainment and post-college earnings. All earnings reported within the UI wage files were adjusted to the Consumer Price Index (Midwest Urban) 2007 dollars in order to standardize comparisons across time. In order to address security concerns, disaggregated student data was suppressed when ten or fewer cases are recorded.

The 2007 consumer price index for Midwest Urban consumers was adapted from the U.S. Department of Labor Bureau of Labor Statistics (BLS). The inflation adjusted earnings are defined in the following equation, in which  $X$  represents the unadjusted earnings,  $A$  represents the most recent (2007) CPI factor, and  $B$  represents the previous (2002 or 2003) CPI factor (U. S. Department of Labor, 2007).

Inflation Index equation:  $X ((A - B)/B) + X = \text{CPI adjusted earnings}$

*Research Question 1: What are the background characteristics of Iowa community college students in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters, who received an award or left without receiving an award?*

In order to address this research question, descriptive statistics were utilized. The descriptive data analysis of student background characteristics included the following variables: age, gender, race, economically disadvantaged by program award received in the selected national career clusters. The age variable was recoded into two categories—traditional age (25 and under) and nontraditional age (26 and over). The race variable was recoded into two categories—white and non-white. The economically disadvantaged variable

employed a proxy variable of Pell recipient to determine this status. Although there are limitations of using Pell recipient to characterize economically disadvantaged it is the best variable that exists in the data set that is available for this study. The program major variable was disaggregated by national career cluster levels identified in the study. The federal career clusters of Manufacturing and Science, Technology, Engineering and Math (STEM) was recoded to create one cluster. The rationale for this recoding is that all of the program codes that constitute these two career clusters are career and technical programs and are related to the manufacturing industries. Table 3.1 provides a complete list of variables used to address this research question. Appendix C provides a complete list of variables used in the study.

*Research Question 2: Among students who worked full-time, what are the median annual earnings and the annual percent gain in earnings of Iowa community college students in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters?*

In order to address this research question descriptive data were utilized to report the median annual earnings. A cross-tabulation analysis was conducted to illustrate the median annual earnings and annual gain in earnings by educational attainment in the selected national career clusters. The median annual earnings were the sum of all quarterly earnings, delimited to students who earned wages in three out of four quarters. The annual gain in median earnings variable was created by subtracting the median annual earnings of the base year from the median annual earnings of the following year divided by the median annual earnings of the base year. This process was utilized to calculate annual gain in median

Table 3.1. Demographic variables used to describe community college students

Student Variables	Description	Coding
Student's gender	Gender of students	1 = Female 2 = Male
Age: traditional/nontraditional	Age is 25 and older or less than 25 as of June 30, 2002	1 = Traditional Age 2 = Nontraditional Age
Ethnicity: white/non-white	Ethnicity is white or non-white	1 = Non-White 2 = White
Economic Status: pell/non-pell	Received a Pell grant within fiscal year 2002 or all other students	1 = Pell Recipient 2 = Non-Pell Recipient
Leavers	Left the community college without receiving an award	1 = Leavers 2 = All Other Students
Certificate	Received a Certificate award within fiscal year 2002 or all other students	1 = No Certificate 2 = Certificate Award
Diploma	Received a Diploma award within fiscal year 2002 or all other students	1 = No Diploma 2 = Diploma Award
2 year Associate Degree	Received an Associate award within fiscal year 2002 or all other students	1 = No Associate 2 = Associate Award
Program major	Programs were categorized by the Iowa Department of Education. Manufacturing and STEM were combined	2 = Architecture and Construction 3 = Arts, A/V tech & Communication 13 = Manufacturing & STEM 16 = Transportation/Dist. & Logistics

earnings for each year in the study and was represented as a percentage. The program major variable was disaggregated by national career cluster levels selected in the study. A complete listing of Classification of Instructional Program (CIP) by federal cluster can be found in Appendix A. The federal career clusters of Manufacturing and Science, Technology, Engineering and Math (STEM) were recoded to create one cluster. The rationale for this recoding was because all of the program codes that constitute these two career clusters are career and technical programs and related to the manufacturing industries. Table 3.1

provides a list of demographic variables that were used for this research question; however, Appendix C provides a complete list of variables.

*Research Question 3:* Among students who worked full-time, to what extent do their background characteristics, highest award (certificate, diploma, or associate of applied science degree) received and annual gain in earnings in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters predict students' fifth-year median annual earnings?

In order to address this research question, a multiple regression analysis was utilized to determine relationship between a student's background characteristics, highest award received and post-college earnings and students' fifth-year annual earnings. Three blocks of variables were entered into the regression model and are identified in Figure 3.1. Block one consisted of background characteristics, block two consisted of the highest award the student received, and block three consisted of the annual gain in post-college earnings.

The linear regression model shown in Figure 3.1 demonstrates how student's background characteristics, their highest award received and four years of a student's median annual earnings were entered into a regression analysis. These three blocks were grouped together in order to analyze the predictive power of each block on the dependent variable.

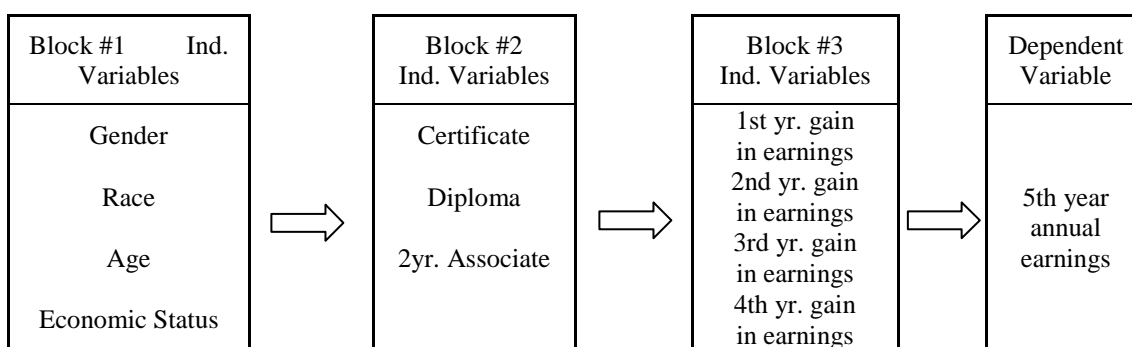


Figure 3.1. Linear regression model

The first block to be entered into the regression model was background characteristics. Because these variables are characteristics that a student brings with block contained variables that represent the inherent characteristics that students bring to them to the community college, it is important to better understand the predictive power of background characteristics in order for the community colleges to serve the needs of students in a more effective way. The second block in which data were entered into the regression model was the highest award received by the student. The variables in this block represent the investments that students gain by receiving a community college award. This block was added second to determine the predictive power of obtaining a community college award and analyze how the predictive power of a student's background characteristics change when their a highest award is added. The third and final block entered in the regression model was four consecutive years of a student's median annual earnings. This block was added last because it was hypothesized that the predictive power of this block would be strong. However, the purpose of constructing this block and placing it last in the model was to determine if the predictive power of the first two blocks change when post-college earnings are introduced into the analysis.

The dependent variable in the study was the fifth-year annual earnings of the students who worked three out of four quarters each of the five subsequent years after leaving an Iowa community college. Table 3.2 lists the independent variables that were used in the study to determine relationship to the students' fifth-year post-college earnings. A complete list of variables is identified in Appendix C.

Table 3.2. Median annual earnings of Iowa community college students

Student Variables	Description	Coding
Leavers	Left the community college without receiving an award	1 = Leavers 2 = All Other Students
Certificate	Received a Certificate award within fiscal year 2002 or all other students	1 = No Certificate 2 = Certificate Award
Diploma	Received a Diploma award within fiscal year 2002 or all other students	1 = No Diploma 2 = Diploma Award
2 year Associate Degree	Received an Associate award within fiscal year 2002 or all other students	1 = No Associate 2 = Associate Award
Median annual earnings 2003	Wages from fiscal year 2003 (July 1, 2002 to June 30, 2003)	Descriptive analyses - Continuous Variable
Median annual earnings 2004	Wages from fiscal year 2004 (July 1, 2003 to June 30, 2004)	Descriptive analyses - Continuous Variable
Median annual earnings 2005	Wages from fiscal year 2005 (July 1, 2004 to June 30, 2005)	Descriptive analyses - Continuous Variable
Median annual earnings 2006	Wages from fiscal year 2006 (July 1, 2005 to June 30, 2006)	Descriptive analyses - Continuous Variable
Median annual earnings 2007	Wages from fiscal year 2007 (July 1, 2006 to June 30, 2007).	Descriptive analyses - Continuous Variable: Regression analyses - the natural log of this variable is used.
1st yr. gain in median earnings	Annual earnings for fiscal year 2004 minus 2003 earnings (adjusted to 2007 dollars); divided by the 2003 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
2nd yr. gain in median earnings	Annual earnings for fiscal year 2005 minus 2004 earnings (adjusted to 2007 dollars); divided by the 2004 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
3rd yr. gain in median earnings	Annual earnings for fiscal year 2006 minus 2005 earnings (adjusted to 2007 dollars); divided by the 2005 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
4th yr. gain in median earnings	Annual earnings for fiscal year 2007 minus 2006 earnings (adjusted to 2007 dollars); divided by the 2006 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
Percent Change 2003 – 2007	Annual earnings for fiscal year 2007 minus 2003 earnings (adjusted to 2007 dollars); divided by the 2003 adjusted wages; multiplied by 100	Continuous variable - measured as a percent with either negative or positive values

For each cohort of students in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics, national career clusters that was entered into the regression analysis included those students who received an award as reported through the Iowa Department of Education Management Information System (MIS), were in a full-time working status as reported through the Iowa Workforce Development Unemployment Insurance (UI) wage files and were not enrolled in any higher education institution as reported through the National Student Clearinghouse.

The dependent variable, fifth-year annual earnings, was transformed into a natural log of 2007 wages. Based on a review of the histograms of the data it was determined that the data did not follow a normal distribution and was highly positively skewed that violated the normality of distribution assumption of regression analysis (Tabachnick & Fidell, 2007). In order to improve the distribution these variables were transformed using a natural logarithm transformation. This statistical procedure was performed to improve the performance of the regression analysis by improving the dependent variables fit within the model (Heckman & Polachek, 1974; Tabachnick & Fidell, 2007).

### **Variables**

A complete list of all variables used in this study can be found in Appendix C. Table 3.1 provides a list of the variables used to provide the demographic information about Iowa community colleges students. All the variables used in the demographic analyses were extracted from the Iowa Department of Education's Management Information System (MIS).

The national career clusters are comprised of 16 categories of related occupations and industries, these categories or “clusters” are intended to represent all occupations within the workforce. The 16 national career clusters are:

- Agriculture, Food & Natural Resources
- Architecture & Construction
- Arts/Audio Video Technology & Communications
- Business Management & Administration
- Education & Training
- Finance
- Government & Public Administration
- Health Sciences
- Hospitality & Tourism
- Human Services
- Information Technology
- Law, Public Safety, Corrections & Security
- Manufacturing
- Marketing
- Science, Technology, Engineering & Math
- Transportation, Distribution & Logistics

Because these are broad categories, it is expected that each cluster contain a wide range of occupations. Educational institutions that provide training in these occupations use the federal Classification of Instructional Program (CIP) system to categorize the educational programs which are cross-referenced to each of the 16 clusters. The CIP to cluster crosswalk enabled this study to select a limited number of clusters and be able to access program data through the CIP codes. The Iowa Department of Education has determined which programs are included under each career cluster by utilizing the national crosswalk data.

The clusters selected in this study were: (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and 4) the Transportation/Distribution and Logistics, national career clusters. Two clusters were combined under one category. The

Manufacturing and Science Technology, Engineering and Math (STEM) clusters were combined because this study was limited to only career and technical programs and based upon a review of the CTE programs in each category it was determined that the programs in both clusters are related. Complete lists of programs contained in each of the selected career clusters are located in Appendix A. The Iowa CIP codes contain ten digits, of which the first six digits are the Federal CIP code, the next two digits are used in the state of Iowa to indicate the length of the program, and the last two digits are unused at this time.

Two variables were recoded into dichotomous variables, the age variable was recoded into two categories, traditional age (25 and under) and nontraditional age (26 and over). The race variable was recoded into two categories—white and non-white. The economically disadvantaged variable employed a proxy variable of Pell recipient to determine status. Although there are limitations of using Pell recipient to characterize economically disadvantaged, it is the best variable that exists in the data set that was available in this study. The program major variable was disaggregated by national career cluster levels identified in the study. The federal career clusters of Manufacturing and Science, Technology, Engineering and Math (STEM) was recoded to create one cluster (Manufacturing; Science, Technology, Engineering and Math [STEM]). The rationale for this recoding was all of the Classification of Instructional Program (CIP) codes that constitute these two career clusters are career and technical programs and are related to the manufacturing industries. Science, Technology, Engineering and Math (STEM) programs in community college associate of science award and four-year institutions may deviate from Manufacturing.

Table 3.2 provides a list of variables used to address the median annual earnings of community college students. The median annual earnings and gain in median earnings

variables were created using the Iowa Workforce Development Unemployment Insurance UI wage data.

The annual gain in median earnings was calculated by adjusting all annual earnings using the 2007 consumer price index. Then the second year annual earnings was subtracted from the first year and dividing by the first year annual earnings. This total was multiplied by 100 to determine the annual percent of gain in median earnings. This process was repeated for each subsequent year in the study. The same formula was utilized to create the percent change 2003 – 2007 variable. This variable provided a cumulative gain in earnings over the five years represented in the study.

The program major variables were used to filter the data to report the findings by each national cluster selected in the study. As noted previously, the Manufacturing and Science, Technology, Engineering and Math clusters were combined for the purpose of this study.

Table 3.3 provides a complete list of the variables used in the regression model. The dependent variable, fifth-year annual earnings was transformed into a natural log of 2007 wages. The rationale provided earlier in chapter three explained why this transformation was needed.

### **Limitations**

This study utilized secondary datasets. Thus, some limitations exist in these datasets. Therefore, the study does not claim to account for all variables that may influence post-college earnings of CTE students. Two of the three data sets utilized in the study were limited to Iowa's community college system. Although the study may have broader

implications than the state of Iowa, the results of this study are not intended to be generalized beyond the framework of the study.

Table 3.3. Regression model variables

Student Variables	Description	Coding
Student's gender	Gender of students	1 = Female 2 = Male
Age: traditional/ nontraditional	Age is 25 and older or less than 25 as of June 30, 2002	1 = Traditional Age 2 = Nontraditional Age
Ethnicity: white/non-white	Ethnicity is white or non-white	1 = Non-White 2 = White
Economic Status: Pell/Non- Pell	Received a Pell grant within fiscal year 2002 or all other students	1 = Pell Recipient 2 = Non-Pell Recipient
Certificate	Received a Certificate award within fiscal year 2002 or all other students	1 = No Certificate 2 = Certificate Award
Diploma	Received a Diploma award within fiscal year 2002 or all other students	1 = No Diploma 2 = Diploma Award
2 year Associate Degree	Received an Associate award within fiscal year 2002 or all other students	1 = No Associate 2 = Associate Award
1st yr. gain in median earnings	Annual earnings for fiscal year 2004 minus 2003 earnings (adjusted to 2007 dollars); divided by the 2003 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
2nd yr. gain in median earnings	Annual earnings for fiscal year 2005 minus 2004 earnings (adjusted to 2007 dollars); divided by the 2004 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
3rd yr. gain in median earnings	Annual earnings for fiscal year 2006 minus 2005 earnings (adjusted to 2007 dollars); divided by the 2005 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
4th yr. gain in median earnings	Annual earnings for fiscal year 2007 minus 2006 earnings (adjusted to 2007 dollars); divided by the 2006 adjusted earnings; multiplied by 100	Descriptive analyses - Continuous Variable
5th Year Annual Earnings (Dependent Variable)	Wages from fiscal year 2007 (July 1, 2006 to June 30, 2007).	Descriptive analyses - Continuous Variable: Regression analyses - the natural log of this variable is used.

The Iowa Workforce Development (IWD) collection of the Unemployment Insurance (UI) wage data have greatly increased the number of responses over the traditional survey instruments used prior to the early 1990s. However, the percent of students who are not found within the UI system is between 10 – 50%. The National Student Clearinghouse (NSC) accounted for a portion of the remaining students. However, because the UI system is designed to calculate unemployment benefits within a particular state, there were some limitations of this system as it is related to the purpose of this study. Students who were employed outside of Iowa were not tracked through the Iowa Workforce Development. Five of Iowa's 15 community colleges have a campus in a border city. In 2001-02, Western Iowa Tech Community College reported that 30% of all program completers work outside of Iowa. (Stoik, 2004) The UI system does not maintain data on people who are employed by the military, churches, government, United States post office, self employed workers and railroad workers who are covered by the railroad unemployment insurances system. Estimates on how much of the workforce is self-employed vary from 3% to 5% (Stevens, 1992) to as high as 6.6% and rising (U.S. Department of Commerce, 2000). The UI system includes all wages earned by an individual whether the employment is full or part-time. These wage data are collected quarterly and employers are not required to report numbers of hours worked; therefore, it was not possible to identify full and part-time status of workers. The UI system reports quarterly earnings by employer, not by a Standard Occupation Classification (SOC) code. Therefore, earnings are not related to a specific occupation. The SOC is the federal government's official classification structure for occupations, Occupational Information Network (O\*NET) has crosswalks between the Standard for Occupation Classification (SOC) codes and the Classification for Instructional Program

(CIP) codes. To determine a full-time worker, this study used a criterion of three of four quarters. This deviates from the criterion used by Compton (2008) and Laanan et al (2007), which was four of four quarters. This decision was necessary to account for the potential of seasonal workers that may have existed in the Architecture and Construction cluster. The NSC database was used to identify students who were attending other higher education institutions which may have impacted the number of part-time workers in this study. The MIS and the NSC contains limited information on prior degree attainment. This limitation prohibited this study from accounting for those students who have a prior degree, and leave community colleges and gain employment.

The Iowa Department of Education MIS data system contains information that is self-reported. Thus, students may choose not to report personal information. The use of Pell recipient as a proxy for economic disadvantage, as discussed earlier, has been challenged as not accounting for all economically disadvantaged individuals (Romano & Millard, 2006). The Classification of Instructional Program (CIP) codes in each national career cluster comprise the scope of the national career cluster, however, each career program may have specific factors would need to be considered when apply the finding of this study.

This study did not consider the impact of any potential lost wages of students while they were enrolled in a community college program. Although, it is understood that the time spent obtaining a degree prolongs the point of entry into the workforce, the students in the study have already chosen to attend an Iowa community college.

Consideration was made of the limitations that exist when using the Unemployment Insurance (UI) wage data. However, it was clear that this system improved the reliability and

validity of research studies to determine the economical impact of a community college experience. This made the UI wage data an excellent choice for this research study.

### **Delimitations**

This study was further delimited in order to create a cohort of comparable students. Students who were concurrently enrolled in high school in 2002 and did not transfer or re-enroll in college in the 2003 academic year were removed from the cohort. This decision was made because high school students may be taking a college level course for a variety of reasons, many of which are not consistent with the reasons a college student has enrolled in a community college career and technical program.

An additional delimitation was placed on the number of quarters an individual in the cohort would have to work. A student would need to have worked three out of four quarters in order to be considered a member of the cohort. This decision was also made in order to provide the most robust measure of earnings while attempting to account for seasonal workers. The construction cluster may have workers who are seasonally employed in their career field and by nature of their employment, may not have been employed on one quarter.

### **Ethical Considerations**

The data used in this study contain personal information of the students and must be handled with great care to protect the student information. A data security agreement was written outlining strict requirements for use of these data and a human subject approval was obtained from the Iowa State University Institutional Review Board. This researcher signed an affidavit of nondisclosure in the security agreement, and adhered to the requirements of the Iowa State University Institutional Review Board and the security agreement. A copy of the Human Subjects Approval is provided in Appendix B.

## CHAPTER 4. RESULTS

This chapter presents the results of the analysis of the data. These results are structured around each research question and disaggregated by each of the national career clusters identified in the study. The first section presents the results for demographic information, the second section focuses on median annual earnings and percent increase in annual earnings, and the final section presents the results of the regression analysis.

### Demographics

*Research Question 1: What are the background characteristics of Iowa community college students, in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters, who received an award or left without receiving an award?*

The secondary data set utilized for this study provides a demographic profile of community college students who either received an award or left the community college without receiving an award in (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Transportation/Distribution and Logistics; (3) Architecture and Construction; and 4) Arts, Audiovisual Technology and Communications the national career clusters. The students that comprised the cohort “N” in this study represents fiscal year 2002 community college students that either completed an award or left the community college and did not transfer to another institution of higher education as identified through the National Student Clearinghouse. Tables 4.1 – 4.8 provide a detailed description of the demographic results.

### **Manufacturing; Science, Technology, Engineering and Math (STEM)**

The Manufacturing; Science, Technology, Engineering, and Math (STEM) clusters consist of 1,647 community college students from all 15 community colleges in the state of Iowa. Tables 4.1 and 4.2 present the summary data used in this section and Appendix D-1 provides greater detail on the demographic information. Because demographic data were self-reported by the students, the disaggregated data reported in this study may not account for the entire cohort of students in the cluster.

Table 4.1 indicates that the majority of community college students in the Manufacturing and STEM career cluster are traditional age student (25 and under). Of the students in this cluster ( $N=1,647$ ), 1,610 students reported their age. Within the age

Table 4.1. Students enrolled in Manufacturing; Science, Technology, Engineering and Math (STEM) by demographics

Demographics ( $N=1,647$ )	N	Percentage
Age	1,610	
Traditional age		57.5
Nontraditional age		42.5
Gender	1,639	
Male		88.3
Female		11.7
Race/Ethnicity	1,556	
White		96.1
Non-White		3.9
Socio-Economic Status	1,647	
Pell recipient		28.1
Non-Pell recipient		71.9

variable ( $n=1,610$ ), traditional age students made up 57.5% ( $n=926$ ) of the cohort and 42.5% ( $n=684$ ) were considered nontraditional (26 and over). Table 4.2 indicates that nontraditional age students are more likely to leave without an award. Among the leavers, approximately one half (45.8%) are nontraditional age students compared to 34.2% of those who received a diploma whereas slightly more than one third (35.2%) of those who received an associate award. Appendix D-1 indicates 71.2% of nontraditional students are leavers compared to 62.2% of traditional age students. A greater percentage of traditional age students, 26.7% complete an associate award compared to only 19.6% for nontraditional age students.

Table 4.2. Students enrolled in Manufacturing; Science, Technology, Engineering and Math (STEM) by award

Demographic ( $N=1,647$ )	Percentage			
	Leavers	Certificate	Diploma	AAS Award
Age ( $n=1,610$ )				
Traditional age	54.2	*	65.8	64.8
Nontraditional age	45.8	*	34.2	35.2
Gender ( $n=1,639$ )				
Male	86.6	*	91.5	92.4
Female	13.4	*	8.5	7.6
Race/Ethnicity ( $n=1,556$ )				
White	94.7	*	*	*
Non-White	5.3	*	*	*
Socio-Economic Status ( $n=1,647$ )				
Pell recipient	26.3	*	34.6	30.9
Non-Pell recipient	73.7	*	65.4	69.1

\*  $n < 10$

The Manufacturing and STEM cluster is comprised primarily of males with 88.3% ( $n=1,447$ ) compared to females students who represent only 11.7% ( $n=192$ ). However, when the data are analyzed by educational attainment (Table 4.2), females who left the program prior to receiving an award ( $n=1,090$ ), represent a larger portion, 13.4% compared to males at 86.6%. The percentage of female who compete an award decreases as the award length increases. Female educational attainment decreases from a high of 13.4% for leavers to 8.5% who receive a diploma to 7.6% who receive an associate award.

Race/ethnicity was recoded into a dichotomous variable, white and non-white. Of the students in the cohort ( $n=1,556$ ), white students comprised 96.1% compared to non-white students at 3.9% as shown in Table 4.1. Among the students who left the program prior to receiving an award ( $n=1556$ ), non-white students represented 5.3% of the group compared to white students at 94.7%. Among the students who received an award, non-white students drop below a level which can be reported. In analyzing leavers (see Appendix D-1), 90.0% of non-white students left the program without an award compared to 64.8% for white students.

This study utilizes Pell awards as a proxy for economic disadvantage. Table 4.1 identifies that the cohort ( $n=1,647$ ) of students who received assistance through a Pell award was 28.1% compared to students who did not receive assistance through the Pell program 71.9%. Table 4.2 indicates that among students who left the program prior to receiving an award ( $n=1,098$ ), Pell recipients comprised 26.3% compared to 73.7% of students who did not receive Pell assistance. Among students who received a diploma ( $n=153$ ) Pell recipients represented 34.6% and among the students who received an associate degree ( $n=382$ ), Pell recipients comprised 30.9% compared to 69.1% of students who did not receive Pell

assistance. In analyzing leavers 62.6% of student who received a Pell award, left the program without receiving an award compared to 68.3% of students who did not receive a Pell award as shown in Appendix D-1. Of the students who received a Pell award 25.5% obtained an associate degree compared to 22.3% of student who did not receive a Pell award.

### **Transportation/Distribution and Logistics**

The Transportation/Distribution and Logistic cluster consists of 1,147 community college students from all 15 community colleges in the state of Iowa. Tables 4.3 and 4.4 present the summary data used in this section and Appendix D-2 provides greater detail on the demographic information. Because demographic data are self-reported by the cohort of students in the clusters, the disaggregated data reported in this study may not account for the entire cohort of students in the cluster.

Table 4.3 reveals that the majority of community college student in the Transportation/Distribution and Logistic cluster are traditional age student (25 and under). Of the students in this cluster ( $n=1,147$ ), traditional age students made up 69.9% ( $n=782$ ) of the cohort and 30.1% ( $n= 336$ ) were considered nontraditional (26 and over). The Transportation/Distribution and Logistic cluster is comprised primarily of males. Table 4.3 illustrates that males represent 95.5% ( $n=1,085$ ) and female students represent only 4.5% ( $n=51$ ). Table 4.4 indicates that among the students who left the program prior to receiving an award ( $n=754$ ), females increase slightly in percentage within the group to 4.9% compared to males at 95.1%. Among the students who received an associate degree ( $n=241$ ), females represent only 2.9% compared to males at 97.1%. Among students who

Table 4.3. Students enrolled in Transportation/ Distribution and Logistics by demographics

Demographics ( <i>N</i> =1,147)	N	Percentage
Age	1,118	
Traditional age		69.9
Nontraditional age		30.1
Gender	1,136	
Male		95.5
Female		4.5
Race/Ethnicity	1,072	
White		93.3
Non-White		6.7
Socio-Economic Status	1,147	
Pell recipient		28.0
Non-Pell recipient		72.0

received a certificate ( $n=56$ ), females increased in percentage within this group to 10.7% compared to males at 89.3%.

Race/ethnicity was recoded into a dichotomous variable, white and non-white. Table 4.3 indicates that white students ( $n=1,072$ ), comprised 93.3% compared to non-white students at 6.7%. Table 4.4 indicates that students who left the program prior to receiving an award ( $n=710$ ), non-white students increase in percentage within the group to 7.3% compared to white students at 92.7%. Non-white students represent a substantially larger percentage at 20.8% of students who received a certificate, however, among the diploma and associate degree category, the cell size for non-white students was lower than ten and was suppressed. In analyzing leavers non-white students comprised 72.2% of those who left the program without an award compared to 65.8% for white students (see Appendix D-2).

This study utilized Pell awards as a proxy for economic disadvantage. Table 4.3 shows that students who received assistance through a Pell award ( $n=1147$ ) comprised 28.0% of the cohort compared to students who did not receive assistance through the Pell program 72.0%. As shown in Table 4.4, among students who left the program prior to receiving an award ( $n=765$ ), Pell recipients comprised 27.8% compared to 72.2% of students who did not receive Pell assistance. Among students who received a diploma award ( $n=85$ ) the percentage grew to 40.0 %, among the students who received an associate degree ( $n=241$ ), the percentage, 28.2%, was virtually the same as the entire cohort ( $n=1147$ ) at 28.0%. In analyzing leavers 66.4% of students who received a Pell award, left the program without receiving an award compared to 66.8% of students who did not receive a Pell award

Table 4.4. Student enrolled in Transportation/ Distribution and Logistics by award

Demographics ( $N=1,147$ )	Percentage			
	Leavers	Certificate	Diploma	AAS Award
Age ( $n=1,118$ )				
Traditional age	67.4	16.1	94.0	81.7
Nontraditional age	32.6	83.9	6.0	18.3
Gender ( $n=1,136$ )				
Male	95.1	89.3	*	97.0
Female	4.9	10.7	*	2.9
Race/Ethnicity ( $n=1,072$ )				
White	92.7	79.2	93.9	97.8
Non-White	7.3	20.8	6.9	6.9
Socio-Economic Status ( $n=1,147$ )				
Pell recipient	27.8	10.7	40.0	28.2
Non-Pell recipient	72.2	89.3	60.0	71.8

\*  $n < 10$

as shown in Appendix D-2. Of the students who received a Pell award, 21.2% received an associate degree compared to 20.9% of students who did not receive a Pell award.

### **Architecture and Construction**

The Architecture and Construction cluster consist of 718 community college students from all fifteen community colleges in the state of Iowa. Tables 4.5 and 4.6 present the summary data used in this section and Appendix D-3 provides greater detail on the demographic information. Because demographic data were self-reported by the students, the disaggregated data reported in this study may not account for the entire cohort of students in the clusters.

Table 4.5 illustrates that the majority of community college students in the Architecture and Construction cluster are traditional age student (25 and under). Of the students in this cluster ( $n=707$ ), traditional age students made up 73.8% ( $n=522$ ) of the cohort and 26.2% ( $n=185$ ) were nontraditional (26 and over).

The Architecture and Construction cluster is comprised primarily of males with 94.8% ( $n=677$ ) and female student at 5.2% ( $n=37$ ) as shown in Table 4.5. Table 4.6 indicates that among students who left the program prior to receiving an award ( $n=400$ ), females represent 4.3% compared to males at 95.8%. Among the students who received an associate degree ( $n=120$ ), females represented a stronger percentage at 10.0% compared to males at 90.0%. In analyzing leavers, Appendix D-3 shows that within the program the majority of male students, 56.6% leave the program without an award compared to 45.9% for females. Only 16.0% of male students received an associate degree compared to 32.4% for females.

Table 4.5. Students enrolled in Architecture and Construction by demographics

Demographics ( <i>N</i> =718)	N	Percentage
Age	707	
Traditional age		73.8
Nontraditional age		26.2
Gender	714	
Male		94.8
Female		5.2
Race/Ethnicity	678	
White		95.1
Non-White		4.9
Socio-Economic Status	718	
Pell recipient		27.9
Non-Pell recipient		72.1

Table 4.6. Students enrolled in Architecture and Construction by award

Demographics ( <i>N</i> =718)	Percentage			
	Leavers	Certificate	Diploma	AAS Award
Age ( <i>n</i> =707)				
Traditional age	54.2	*	77.9	74.2
Nontraditional age	59.5	*	22.1	25.8
Gender ( <i>n</i> =714)				
Male	95.8	*	*	90.0
Female	4.3	*	*	10.0
Race/Ethnicity ( <i>n</i> =678)				
White	93.0	*	*	*
Non-White	7.0	*	*	*
Socio-Economic Status ( <i>n</i> =718)				
Pell recipient	24.8	*	32.6	30.0
Non-Pell recipient	75.2	*	67.4	70.0

\* *n*<10

Race/ethnicity was recoded into a dichotomous variable, white and non-white. Table 4.5 shows that white students comprised 95.1% of the cohort ( $n=678$ ) compared to non-white students at 4.9%. As revealed in Table 4.6, non-white students who left the program prior to receiving an award comprised 7.0%. This is a slight increase from the non-white representation of the cohort ( $n=374$ ). In analyzing leavers (Appendix D-3), 78.8 % of non-white students left the program without an award compared to 54.0% for white students. Non-white students comprise 15.2% of those who received an associated degree compared to 17.1% for white students.

This study utilized Pell awards as a proxy for economic disadvantage. Table 4.5 indicates that in the Pell award cohort ( $n=718$ ), 27.9% of students received assistance through a Pell award as compared to 72.1% of students who did not receive assistance through the Pell program. As shown in Table 4.6, among the students who left the program prior to receiving an award ( $n=404$ ), Pell recipients comprised 24.8%, which is a slightly lower percentage than the Pell recipients (27.9%) in that Cohort ( $n=718$ ). Among the students who received an associate degree ( $n=120$ ), Pell recipients comprised 30.0% as compared to 70.0% of students who did not receive Pell assistance. In analyzing leavers (Appendix D-3), 50.0% of students who received a Pell award, left the program without receiving an award as compared to 58.7% of students who did not receive a Pell award. Of the students who received a Pell award, 18.0% received an associate degree as compared to 16.2% of students who did not receive a Pell award.

### **Arts, Audiovisual Technology and Communications**

The Arts, Audiovisual Technology and Communications cluster consists of 445 community college students from all 15 community colleges in the state of Iowa. Tables 4.7 and 4.8 present the summary data used in this section and Appendix D-4 provide greater detail on the demographic information. Because demographic data were self-reported by the students, the disaggregated data reported in this study may not account for the entire cohort of students in the clusters.

Table 4.7 indicates that the majority of community college student in the Arts, Audiovisual Technology and Communications cluster are traditional age student (25 and under). Of the students in these clusters ( $n=439$ ), traditional age students made up 77.0% ( $n=338$ ) of the cohort and 23.0% ( $n=101$ ) were considered nontraditional (26 and over).

The Arts, Audiovisual Technology and Communications cluster is gender neutral. Table 4.7 illustrates that female students comprise 50.6% ( $n=225$ ) and male students comprise 49.4% ( $n=220$ ) of the cohort. As revealed in Table 4.8, among the students who left the program prior to receiving an award ( $n=329$ ), females represented 48.0% compared to males (52.0%). Among the students who received an associate degree ( $n=115$ ), females comprised a greater percentage (58.3%) as compared to 41.7% of male students.

Race/ethnicity was recoded into a dichotomous variable—white and non-white. Of the students in the race/ethnicity cohort ( $n=419$ ), Table 4.7 demonstrates that white students comprised 93.8% compared to non-white students at 6.2%. Table 4.8 illustrates that among the students who left the program prior to receiving an award ( $n=305$ ), non-white students increased 7.5% in the group as compared to white students (92.5%).

Table 4.7. Students enrolled in Arts, Audiovisual Technology and Communications by demographics

Demographics ( <i>N</i> =445)	n	Percentage
Age	439	
Traditional age		77.0
Nontraditional age		23.0
Gender	445	
Male		49.4
Female		50.6
Race/Ethnicity	419	
White		93.8
Non-White		6.2
Socio-Economic Status	445	
Pell recipient		25.6
Non-Pell recipient		74.4

Table 4.8. Students enrolled in Audiovisual Technology and Communications by award

Demographics ( <i>N</i> =445)	Percentage			
	Leavers	Certificate	Diploma	Associate Award
Age ( <i>n</i> =439)				
Traditional age	75.3	*	*	81.6
Nontraditional age	24.7	*	*	18.4
Gender ( <i>n</i> =445)				
Male	52.0	*	*	41.7
Female	48.0	*	*	58.3
Race/Ethnicity ( <i>n</i> =419)				
White	92.5	*	*	*
Non-White	7.5	*	*	*
Socio-Economic Status ( <i>n</i> =445)				
Pell recipient	28.0	*	*	19.1
Non-Pell recipient	72.0	*	*	80.9

\* *n*<10

Among the students who received a diploma or an associate degree, non-white students dropped below a level that can be reported. In analyzing leavers, Appendix D-4 demonstrates that 88.5 % of non-white students left the program without an award as compared to 71.8% for white students.

This study utilizes Pell awards as a proxy for economic disadvantage. Table 4.7 indicates that students in the Pell award cohort ( $n=445$ ), students who received assistance through a Pell award was 25.6% compared to students who did not receive assistance through the Pell program 74.4%. Table 4.8 demonstrates that among the students who left the program prior to receiving an award ( $n=329$ ), Pell recipients comprised 28.0% compared to 72.0% of students who did not receive Pell assistance. The percentage of Pell recipients decreased among students who received an associate degree ( $n=115$ ), to 19.1% as compared to 80.9% of students who did not receive Pell assistance. In analyzing leavers (Appendix D-4), 80.7% of students who received a Pell award, left the program without receiving an award compared to 71.6% of students who did not receive a Pell award. Of the students who received a Pell award 19.3% received an associate degree compared to 28.1% of student who did not receive a Pell award.

### **Median annual earnings and percent increase in annual income by National Career Cluster for students who received an award**

*Research Question 2: Among students who worked full-time, what are the median annual earnings and the annual percent gain in earnings of Iowa community college students in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters?*

The median annual earnings and annual percent of gain in earnings were analyzed by National Career Cluster: (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Transportation/Distribution and Logistics; (3) Architecture and Construction; and (4) Arts Audiovisual Technology and Communication. Tables 4.9 – 4.16 reveal the median annual earnings and the annual percent of gain in median earnings by award for each National Career Cluster listed.

In the Manufacturing; Science, Technology, Engineering and Math (STEM) cluster, the data in Table 4.9 displayed interesting median annual earnings of students. Leavers and students who received certificates revealed similar fifth-year median annual earnings. Leavers received only \$119 less than those who received a certificate. However, students with certificates earned over \$4,000 in the first year but were not able to gain enough to maintain a financial advantage. With only nine students in the certificate category, it was difficult to determine if there were differences between leavers and those who received a certificate. The data revealed in Table 4.2 indicate that in the leaver category, nontraditional students comprised 45.8% of those who left college without receiving an award. This high percentage of students in the leaver category who were nontraditional, and the fact that the leaver and certificate categories reported similar median annual earning, support a common understanding in community colleges that students do not always aspire or need to obtain an award.

Table 4.9 indicates that students who received a diploma had substantially lower median annual earnings every year in the study. This award revealed large gains in the first year (66.71%) and in the second year (21.45%); however, gains tapered off considerably in the third year (3.91%) and in the fourth year (.59%) as revealed in Table 4.10. Students

Table 4.9. Median annual earnings of students in Manufacturing; Science, Technology, Engineering and Math (STEM) by award

Award Received	n	Median Annual Earnings				
		2003	2004	2005	2006	2007
Leavers	565	23,517	28,408	32,245	34,968	36,329
Certificate	*	*	*	*	*	*
Diploma	70	15,199	25,338	30,772	31,975	32,165
Associate Degree	253	27,130	31,665	35,570	38,162	40,229

\*  $n < 10$ 

Table 4.10. Annual percentage of gain in earnings for students in Manufacturing; Science, Technology, Engineering and Math (STEM) by award

Award Received	n	Annual Percentage of Gain in Median Earnings				
		1st year	2nd year	3rd year	4th year	2003-07
Leavers	565	20.80%	13.51%	8.44%	3.89%	54.48%
Certificate	*	*	*	*	*	*
Diploma	70	66.71%	21.45%	3.91%	0.59%	111.63%
Associate Degree	253	16.72%	12.33%	7.29%	5.42%	48.28%

\*  $n < 10$ 

who received a diploma had the lowest median annual earning of any award category.

Students who left college without an award and those received a certificate had higher median annual earnings than students who received a diploma. Appendix D-1 indicates that traditional age students make up almost twice the number of nontraditional students who

receive a diploma, and the data in Table 4.2 reveal that, in the certificate category, nontraditional students comprised 34.2% of those who received a certificate.

Students who received an associate degree received the highest median annual earnings of any category. This award revealed consistent gains in each year, which enabled students who received an associate degree to maintain a significant advantage in median annual earnings. In the fifth year, Table 4.9 reveals that the median annual earnings of students who received an associate degree were almost \$4,000 greater than all other categories in this study.

In the Transportation/Distribution and Logistics cluster, the data in Table 4.11 displayed comparable median annual earnings of students. The fifth-year median annual earnings of all four categories were within \$2,657. Students in the leaver category had the lowest median annual earnings (\$30,866), whereas students who received an associate degree had the highest median annual earnings (\$33,523). The data in Table 4.4 indicate that, in the leaver category, nontraditional students comprised 32.6% of those who left college without receiving an award. As revealed in Table 4.12, leavers had an overall percent of gain in median earnings of 69.77%, which was the second highest increase. The overall percent of gain in earnings was 39.32% for students who received a certificate to 91.12% for students who received a diploma. This represents a range of 51.8%. However, the data also indicate that the annual percent of gain in earnings is larger in the first year for students who received a diploma (33.31%) than for students who received a certificate (15.14%). This represents a range of 18.15%. The range decreased in the second and third year. In the fourth year, the data in Table 4.11 indicate that the annual percent of gain in earnings stabilized for students who are in the leaver category (7.35%) and students who received an associate degree at

Table 4.11. Median annual earnings of students in Transportation/ Distribution and Logistics by award

Award Received	N	Median Annual Earnings				
		2003	2004	2005	2006	2007
Leavers	308	18,181	22,974	25,869	28,754	30,866
Certificate	21	22,487	25,891	28,035	29,620	31,330
Diploma	47	16,257	21,997	25,842	29,051	31,070
Associate Degree	147	22,422	26,163	28,796	31,950	33,523

Table 4.12. Annual percentage of gain in earnings for students in Transportation/ Distribution and Logistics by award

Transportation/ Distribution and Logistics by Award Received	N	Annual Percentage of Gain in Median Earnings				
		1st year	2nd year	3rd year	4th year	2003-07
Leavers	308	26.36%	12.60%	11.15%	7.35%	69.77%
Certificate	21	15.14%	8.28%	5.65%	5.77%	39.32%
Diploma	47	33.31%	17.48%	12.42%	6.95%	91.12%
Associate Degree	147	16.68%	10.06%	11.00%	4.92%	49.51%

4.92%. This represents a range of only 2.43%, and suggests that annual increases after the fifth year are based mainly on cost of living and not experience or educational influence.

Table 4.11 indicates that students who received a certificate had the highest median annual earnings, \$22,487, in the first year in the study. However, in the second year, students

who received an associate degree had the highest median annual earnings (\$26,163), and maintained this advantage through the third, fourth and fifth year of the study.

As shown in Table 4.11, students who received a diploma had substantially lower median annual earnings in the first year in the study. However, these students were able to make substantial gains in the first three years to reduce the wage gap between the award categories. In the fifth year, students who received a diploma surpassed the leaver category by \$204, and trailed the certificate category by only \$260. The diploma category saw a 91.12% increase in the overall percent of gain in annual earnings. This category is comprised primarily of traditional age students (94%) as revealed in Table 4.4, which may explain the large gains in median annual earnings in the first three years of the study. Only 6% of those who received a diploma were nontraditional students.

Table 4.11 and 4.12 indicate that students who received an associate degree saw a steady increase in their annual median earnings over the five years in the study. Although the certificate category saw higher annual median earnings in the first year of the study, the associate degree category had an overall percent of change that was 10.19% greater than the certificate category. Therefore, in the fifth-year students who received an associate degree earned \$2,190 additional in median annual earnings over those who received a certificate. The data in Table 4.4 indicate that, in the associate degree category, nontraditional students comprised only 18.3% of those who received an associate degree.

In the Architecture and Construction cluster, the data in Table 4.13 reveal comparable median annual earnings among students. Although the (*n*) size of students who were awarded a certificate was too small to report, the fifth-year median annual earnings of the diploma and associate degree categories were \$1,076. In the fifth year, the associate degree

category had the highest median annual earnings; however, in the second year, the diploma category had the highest median annual earnings. This indicates that these two award categories are extremely comparable in their median annual earnings. The regression analysis confirmed that the associate degree is not a significant predictor of a student's fifth-year annual earnings.

Students in the leaver category had the lowest median annual earnings (\$33,573), whereas students who received an associate degree had the highest median annual earnings (\$36,121). The data in Table 4.6 indicate that, in the leaver category, nontraditional students comprised 59.5% of those who left college without receiving an award. Table 4.14 indicates the overall annual percent of gain in median earnings was 63.24% for students who receive an associate degree and 67.79% for students who left college without receiving an award. This represents a range of 4.55%. These data indicate that all award categories had a similar annual gain in median earnings, which augments the findings of the regression analysis which confirmed that a community college award is not a significant predictor of a student's fifth-year annual earnings in the Architecture and Construction cluster.

Students who received a diploma had the highest median annual earnings in the second year in the study, but this level was not sustained in the third year. Table 4.13 indicates that the first year diploma category trailed the associated degree category by \$1,058 in median annual earnings and, in the fifth-year in the study, the diploma category trailed the associate degree category by \$1,076, indicating that the value of an associate degree is minimal and the value does not increase with years of experience. The data in Table 4.6 indicate that, in the diploma category, nontraditional students comprised only 22.1% of those who received a diploma.

Table 4.13. Median annual earnings of students in Architecture and Construction by award

Award Received	N	Median Annual Earnings				
		2003	2004	2005	2006	2007
Leavers	188	20,009	24,560	27,559	31,845	33,573
Certificate	*	*	*	*	*	*
Diploma	110	21,070	26,041	29,592	32,059	35,045
Associate Degree	80	22,128	25,622	30,142	35,103	36,121

\*  $n < 10$ 

Table 4.14. Annual percentage of gain in earnings for students in Architecture and Construction by award

Award Received	N	Annual Percentage of Gain in Median Earnings				
		1st year	2nd year	3rd year	4th year	2003-07
Leavers	188	22.74%	12.21%	15.55%	5.43%	67.79%
Certificate	*	*	*	*	*	*
Diploma	110	23.59%	13.64%	8.34%	9.31%	66.33%
Associate Degree	80	15.79%	17.69%	16.46%	2.90%	63.24%

\*  $n < 10$ 

Students who received an associate degree saw a steady increase in their annual median earnings during the five years of the study. However, students in the diploma and leaver categories saw a larger percent of gain in earnings, and closed the wage gap that existed during the first year of the study. The data in Table 4.6 indicate that, in the associate

degree category, nontraditional students comprised 25.8% of those who received an associate degree.

In the Arts, Audiovisual Technology and Communication cluster, the data in Table 4.15 reveal predictable median annual earnings of students. Although the (*n*) size of students who were awarded a certificate and diploma was too small to report, an analysis could be made on the leaver and associate degree categories.

As shown in Table 4.15, the median annual earnings (\$13,833) in the leaver category were substantially lower than the associate degree category (\$16,801). This represents a difference of \$2,964. In the fifth year of the study, the leaver category saw a median annual earning of \$21,917 as compared to \$26,898 for the associate degree category. This represents a difference of \$4,981, and augments the regression analysis which indicates that the community college associate degree is a significant predictor of fifth-year annual earnings.

Table 4.16 indicates that the overall percent of gain in earnings was 58.44% for students who left college without receiving an award to 60.10% for students who received an associate degree. This represents a range of 1.66%. It indicates that both categories have gained at similar levels, with the associate degree category gaining slightly higher during the five-year period. However, the data do not support this result in the fourth year. The leaver category saw an 11.63% gain in annual median earnings as compared to the associate degree category, which received only a 3.36% gain in annual median earnings. The gain of 11.63% was the highest, fourth year, annual percent of gain for all of the clusters in this study. It indicate that leavers in the Art, Audiovisual Technology and Communication cluster may still be able to close the wage gap that exists among those who receive an associate

Table 4.15. Median annual earnings of students in Arts, Audiovisual Technology and Communication by award

Award Received	N	Median Annual Earnings				
		2003	2004	2005	2006	2007
Leavers	120	13,833	16,898	18,926	19,633	21,917
Certificate	*	*	*	*	*	*
Diploma	*	*	*	*	*	*
Associate Degree	60	16,801	22,129	23,835	26,024	26,898

\*  $n < 10$ 

Table 4.16. Annual percentage of gain in earnings for students in Arts, Audiovisual Technology and Communication by award

Award Received	N	Annual Percentage of Gain in Median Earnings				
		1st year	2nd year	3rd year	4th year	2003-07
Leavers	120	22.16%	12.00%	3.57%	11.63%	58.44%
Certificate	*	*	*	*	*	*
Diploma	*	*	*	*	*	*
Associate Degree	60	31.71%	7.71%	9.18%	3.36%	60.10%

\*  $n < 10$ 

degree. Gender may be an influential factor. It is a significant predictor of fifth-year annual earning as shown in the regression analysis. The data in Table 4.8 indicate that, in the associate degree category, female students comprised the majority (58.3%) among those who

receive an associate degree as compared to males (41.7%). Females in the leavers category comprise slightly under half (48%) as compared to males (52.0%).

### **Regression Analysis**

*Research Question 3: Among students who worked full-time, to what extent do their background characteristics, highest award (certificate, diploma, or associate of applied science degree) received and annual gain in earnings in the (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career clusters predict students' fifth-year median annual earnings?*

A multiple regression analysis was conducted with the intent to identify and understand specific factors such as gender, age, and degree attainment that influence fifth-year post-college earnings of Iowa community college students in career and technical education in (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Transportation/Distribution and Logistics; (3) Architecture and Construction; and (4) Audiovisual Technology and Communications national career clusters. Using statistical software SPSS® a linear regression analysis was utilized to enter independent variables in three models. A list of these variables is provided in Appendix C. Model 1 contained variables associated with the background characteristics of the students: gender, age, race/ethnicity, and economic status. Model 2 contained variables associated with the highest award the student obtained in the career cluster. These variables were certificate awards, diploma awards, and associate degree awards. Model 3 contained variables associated with the annual gain in median earnings the student had while employed three of four quarters in the four subsequent years after their community college experience. These variables were percent increase in earnings 2003-04, percent increase in earnings 2004-05, percent increase in earnings 2005-06, and percent increase in earnings in 2006-07. The dependent variable

was 2007 annual earnings. The results of the evaluation led to transformation of the dependent variable to reduce skewness and improve the fit of the model. A natural logarithm transformation was used on the fifth-year annual earnings variable. This transformed dependent variable was used in all four regression analyses in this study. The coefficient of determination,  $R^2$  represents the variance of the dependent variable explained in each model. The standardized regression coefficient (Beta -  $\beta$ ) represents the direct comparison of the relative strengths of relationships between variables. Tables 4.18, 4.20, 4.22, and 4.24 contain complete values of unstandardized ( $B$ ) coefficients, standardized ( $\beta$ ) coefficients, standard error ( $SE$ ) and probabilities ( $p$ ) for each national career clusters in this study.

Tables 4.25, 4.26, 4.27, and 4.28 contain the Pearson correlation matrix for each of the selected national career clusters. These data indicate that the Pearson correlation coefficients for some of the independent variables in each of the selected clusters are statistically significant. This may suggest that there is multicollinearity in the multiple regression analysis. Multicollinearity in regression occurs when predictor variables (independent variables) in the regression model are more highly correlated with other predictor variables than with the dependent variable. When two variables are highly correlated, they are basically measuring the same phenomenon or construct. In order to raise concern about multicollinearity, the correlation coefficient would need to be .75 or higher (Braunstein, 2008). The correlation coefficients in the selected clusters were considerably lower (.32). Therefore, multicollinearity was not considered to be a concern in the multiple regression analysis.

### **Manufacturing; Science, Technology, Engineering and Math (STEM)**

The results of the evaluation led to transformation of the dependent variable to reduce skewness and improve the fit of the model. A natural logarithm transformation was used on the fifth-year annual earnings variable.

Table 4.25 provides the correlations between the variables. Table 4.17 presents the standard regression coefficients ( $\beta$ ),  $R^2$  and adjusted  $R^2$  and the significant results (tested at  $p < .05$ ). Table 4.18 presents the unstandardized coefficients ( $B$ ), standard error ( $SE$ ) and significance ( $P$ ). Table 4.17 indicates the  $R^2$  is significant ( $p < .001$ ) at .37, the adjusted  $R^2$  at .36 indicates that more than one-third of the variability in fifth-year annual earnings is predicted by background characteristics, highest award received and annual gain in earnings. Although 37% (adjusted 36%) of the variance of the dependent variable is explained by the independent variables, the size and direction of the relationship suggests that being male, 25 and older, not receiving a Pell award, received an associate degree and annual gains in earnings are more important, as indicated by statistical significance of the independent variables.

Eleven independent variables were entered in three models. Seven of these variables were significant ( $p < .001$ ) and one variable was significant ( $p < .01$ ). Model 1 contained student background characteristics. Gender, age and economic status were significant ( $p < .001$ ). The independent variable gender had a beta value of .22 and was significant at ( $p < .001$ ). This indicates that being male is a strong predictor of fifth-year annual earnings for students in Manufacturing; Science, Technology, Engineering and Math program areas. When Model 2 was entered the beta value for gender was reduced to .20, and again reduced to .19 when Model 3 was entered. This indicates that receiving an associate

Table 4.17. Summary of regression analysis for Manufacturing; Science, Technology, Engineering and Math (STEM)

Variable blocks	Standard regression coefficients ( $\beta$ )		
	Model 1	Model 2	Model 3
<i>Background Characteristics</i>			
Gender: male	.22*	.20*	.19*
Age: nontraditional	.24*	.26*	.30*
Race/ethnicity: white	.03	.02	-.03
Economic Status: Non-Pell	.14*	.15*	.14*
<i>Highest Award Received</i>			
Certificate		.00	-.01
Diploma		-.02	.04
2 year Associate Degree		.18*	.14*
<i>Annual Gain in Earnings</i>			
1st yr. gain in median earnings			.19*
2nd yr. gain in median earnings			.21*
3rd yr. gain in median earnings			.32*
4th yr. gain in median earnings			.42*
Model R <sup>2</sup>	.10*	.14*	.37*
Model Adjusted R <sup>2</sup>	.10*	.13*	.36*

Natural Log of 5th Year Annual Earnings ( $n=897$ )

Level of significance: \* $p<.001$ .

award and years of employment reduce the effect of gender on fifth-year annual earnings for students in Manufacturing, Science, Technology, Engineering and Math program areas.

The independent variable age had a beta value of .24, and was significant at ( $p<.001$ ) when Model 1 was entered. When Model 2 was entered the beta value for age increased to .26, and again increased to .30 when Model 3 was entered. This indicates that the predictive power of age increases when highest award received and annual gain in earnings are considered for students in Manufacturing, Science, Technology, Engineering and Math program areas.

Table 4.18. Regression analysis for Manufacturing; Science, Technology, Engineering and Math (STEM)

Independent Variable Blocks	<i>B</i>	<i>SE</i>	<i>B</i>	<i>P</i>
<i>Model 1</i>				
Gender: male	.33	.05	.22*	.000
Age: nontraditional	.24	.03	.24*	.000
Race/ethnicity: white	.10	.10	.03	.299
Economic Status: Non-Pell	.16	.04	.14*	.000
<i>Model 2</i>				
Gender: male	.30	.51	.20*	.000
Age: nontraditional	.26	.03	.26*	.000
Race/ethnicity: white	.07	.10	.02	.465
Economic Status: Non-Pell	.17	.04	.15*	.000
Certificate	-.01	.16	.00	.945
Diploma	-.05	.06	-.02	.458
2 year Associate Degree	.20	.04	.18*	.000
<i>Model 3</i>				
Gender: male	.29	.04	.19*	.000
Age: nontraditional	.30	.03	.30*	.000
Race/ethnicity: white	-.09	.08	-.03	.274
Economic Status: Non-Pell	.17	.03	.14*	.000
Certificate	-.14	.14	-.01	.750
Diploma	-.07	.05	-.04	.173
2 year Associate Degree	.16	.03	.14*	.000
1st yr. gain in median earnings	.02	.00	.19*	.000
2nd yr. gain in median earnings	.00	.00	.21*	.000
3rd yr. gain in median earnings	.00	.00	.32*	.000
4th yr. gain in median earnings	.01	.00	.42*	.000

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Natural Log of 5th Year Annual Earnings ( $n=897$ )

Level of significance: \* $p<.001$

The independent variable economic status had a beta value of .14, and was significant at ( $p < .001$ ) when Model 1 was entered. When Model 2 was entered the beta value increased to .15, but decreased to .14 when Model 3 was entered. Economic status was statistically significant ( $p < .001$ ) in all three models indicating that this variable was a significant predictor of fifth-year annual earnings and, when highest award received and annual gain earnings were considered, there was no statistical difference in the predictive power of a student's economic status in Manufacturing; Science, Technology, Engineering and Math program areas.

This regression analysis demonstrates that there is a significant relationship between an Iowa community college students' gender, age and economic status and their fifth-year annual earnings. The only variable that was not a significant predictor of students' fifth-year annual earnings was race/ethnicity.

The independent variable 2 year associate degree had a beta value of .18, and was significant at ( $p < .001$ ) when Model 2 was entered. When Model 3 was entered, the beta value decreased to .14 indicating that although receiving an associate degree is a strong predictor of fifth-year annual earnings, annual gain in earnings was able to reduce the predictive power of the associate degree. The independent variables, certificate, and diploma were not statistically significant in predicting fifth-year annual earnings.

The independent variable first year gain in median had a beta value of .19, the beta value for second year gain in median earnings was .21, in the third year it was .32 and in the fourth year .42 was the beta value. All four variables were significant ( $p < .001$ ).

In summary, all three models in this multiple regression analysis had significant adjusted  $R^2$  values. The model summary indicated a significant  $F$  change of ( $p < .001$ ).

Model 1 explained 10% of the variance of the dependent variable, Model 2 explained 13% of the variance, and Model 3 explained 36% of the variance of the dependent variable between the 11 independent variables and the dependent variable, of fifth-year annual earnings. These predictors suggest that multiple factors play a significant role in predicting earnings. Male students, nontraditional students, economically advantaged students, associate award recipients, and gain in annual median earnings were all positive predictors of earnings of community college students in Manufacturing; Science, Technology, Engineering and Math program areas.

### **Transportation/distribution and Logistics**

As in the Manufacturing, Science Technology, Engineering and Math cluster, the results of the evaluation in Transportation/distribution and Logistics led to transformation of the dependent variable to reduce skewness and improve the fit of the model. A natural logarithm transformation was used on the fifth-year annual earnings variable.

Table 4.26 presents the correlations between the variables, Table 4.19 provides the standard regression coefficients ( $\beta$ ),  $R^2$  and adjusted  $R^2$  and the significant results (tested at  $p < .05$ ). Table 20 presents the unstandardized coefficients ( $B$ ), standard error ( $SE$ ) and significance ( $P$ ). Table 4.19 indicates the  $R^2$  was significant ( $p < .001$ ) at .36, the adjusted  $R^2$  at .34 indicates that more than one-third of the variability in fifth-year annual earnings is predicted by background characteristics, highest award received and annual gain in earnings. Although 36% (adjusted 34%) of the variance of the dependent variable is explained by the independent variables, the size and direction of the relationship suggest that being male, above 25, not receiving a Pell award, receiving an associate degree and annual gains in

earnings are more important, as indicated by statistical significance of the independent variables. Model 3, which entered the annual gain in earnings, explains 34% of the variance of the dependent variable and was significant at ( $p < .001$ ). However, the adjusted  $R^2$  values for Model 1 which only contained background characteristics explained only 2% of the variance of the dependent variable, and Model 2 which entered highest award received explained only 4% percent. Each of these models were significant ( $p < .01$ ). Model 3 included the relationships and effects of background characteristics, highest award received and annual gain in median earnings had on the student's fifth-year annual earnings. The independent variable age became significant ( $p < .01$ ) in Model 3. In the previous two models age was not significant. Gender and economic status both increased in significance ( $p < .01$ ) in Model 3.

Eleven independent variables were entered in three models. Five of these variables were significant ( $p < .001$ ), and four variables were significant ( $p < .01$ ). Model 1 contained student background characteristics. Gender was the only variable significant in this model and the probability value was only ( $p < .05$ ). Therefore, being male, with a beta value of .11, was positively associated with the fifth-year annual earnings of students in Transportation/Distribution and Logistics program areas. When Model 2 was entered, the influence of gender remained at .11 ( $p < .05$ ), and increased to .12 ( $p < .01$ ) when Model 3 was entered, indicating that receiving an associate award and years of employment have limited ability to reduce the relationship of gender and the fifth-year annual earnings for students in Transportation/Distribution and Logistics program areas.

Table 4.19. Summary of regression analysis for Transportation/Distribution and Logistics

Variable blocks	Standard regression coefficients ( $\beta$ )		
	Model 1	Model 2	Model 3
<i>Background Characteristics</i>			
Gender: male	.11*	.11*	.12**
Age: nontraditional	.09	.09	.13**
Race/ethnicity: white	.05	.04	.05
Economic Status: Non-Pell	.10*	.09*	.13**
<i>Highest Award Received</i>			
Certificate		.03	.02
Diploma		.01	.06
2 year Associate Degree		.15**	.15***
<i>Annual Gain in Earnings</i>			
1st yr. gain in median earnings			.11**
2nd yr. gain in median earnings			.20***
3rd yr. gain in median earnings			.21***
4th yr. gain in median earnings			.47***
Model R <sup>2</sup>	.03**	.05**	.36***
Model Adjusted R <sup>2</sup>	.02**	.04**	.34***

Natural Log of 5th Year Annual Earnings ( $n=523$ )

Level of significance: \* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$

The independent variable age had a beta value of .09 in Model 1 and 2. The age variable (beta value .13) was positively associated with the dependent variable, and was significant at  $p < .01$  when Model 3 was entered. This indicates that receiving an associate award and annual gains in earnings positively influences the predictive power that age (being over 25) has on a students' fifth-year annual earnings. The independent variable race/ethnicity was not significant.

Table 4.20. Regression analysis for Transportation/Distribution and Logistics

Independent Variable Blocks	<i>B</i>	<i>SE</i>	<i>B</i>	<i>P</i>
<i>Model 1</i>				
Gender: male	.33	.13	.11*	.013
Age: nontraditional	.10	.05	.09	.067
Race/ethnicity: white	.11	.09	.05	.265
Economic Status: Non-Pell	.11	.05	.10*	.036
<i>Model 2</i>				
Gender: male	.31	.13	.11*	.020
Age: nontraditional	.11	.06	.09	.059
Race/ethnicity: white	.08	.09	.04	.369
Economic Status: Non-Pell	.11	.05	.09*	.043
Certificate	.08	.12	.03	.523
Diploma	.02	.08	.01	.817
2 year Associate Degree	.16	.05	.15**	.002
<i>Model 3</i>				
Gender: male	.34	.11	.12**	.002
Age: nontraditional	.15	.05	.13**	.001
Race/ethnicity: white	.11	.08	.05	.174
Economic Status: Non-Pell	.15	.05	.13**	.001
Certificate	.05	.10	.02	.629
Diploma	.10	.07	.06	.148
2 year Associate Degree	.17	.04	.15***	.000
1st yr. gain in median earnings	.00	.00	.11**	.006
2nd yr. gain in median earnings	.00	.00	.20***	.000
3rd yr. gain in median earnings	.00	.00	.21***	.000
4th yr. gain in median earnings	.00	.00	.47***	.000

Natural Log of 5th Year Annual Earnings ( $n=523$ )

Level of significance: \* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$

The independent variable economic status had a beta value of .10 in Model 1, and beta value of .09 and ( $p < .05$ ) in Model 2. The beta value increased (.13) in Model 3 and was significant at ( $p < .01$ ), indicating a positive association with the dependent variable. This indicates that receiving an associate award and annual gains in earnings positively influence

the predictive power of a student's economic status (Non Pell recipient) has on fifth-year annual earnings.

The independent variable highest award received had a beta value .15 ( $p < .01$ ) in Model 1, and remained the same in Model 2; however, increased in significance to ( $p < .001$ ), indicating that receiving an associate award is a strong predictor of fifth-year annual earnings and over time the significance of receiving an associate award increases. The independent variables, certificate, and diploma were not significant.

The independent variable first year gain in median earnings had a beta value of .11 and was significant ( $p < .01$ ), the second year gain in median earnings had a beta value of .20, third year gain in median earnings .21 and the fourth year gain in median earnings had a beta value of .47. All of these variables were significant ( $p < .001$ ).

In summary, all three models in this multiple regression analysis had significant adjusted  $R^2$  values. The model summary indicated a significant  $F$  change of Model 1 ( $p < .01$ ), Model 2 ( $p < .01$ ) and Model 3 ( $p < .001$ ). Model 1 explained 2% of the variance of the dependent variable, Model 2 explained 4% of the variance, and Model 3 explained 34% of the variance of the dependent variable between the 11 independent variables and the dependent variable, fifth-year annual earnings. These predictors suggest that multiple factors play a significant role in predicting fifth-year annual earnings. Male students, nontraditional students, economically advantaged students, associate award recipients, and gain in annual median earnings were all positive predictors of earnings for community college students in Transportation/Distribution and Logistics program areas.

## Architecture and Construction

As in the two previous clusters areas, the results of the evaluation in Architecture and Construction led to transformation of the dependent variable to reduce skewness and improve the fit of the model. A natural logarithm transformation was used on the fifth-year annual earnings variable.

Table 4.27 presents the correlations between the variables, Table 4.21 provides the standard regression coefficients ( $\beta$ ),  $R^2$  and adjusted  $R^2$  and the significant results (tested at  $p < .05$ ), and Table 4.22 gives the unstandardized coefficients ( $B$ ), standard error ( $SE$ ) and significance ( $P$ ). Table 4.21 indicates the  $R^2$  was significant ( $p < .001$ ) at .37, the adjusted  $R^2$  at .35 indicates that more than one-third of the variability in fifth-year annual earnings is predicted by background characteristics, highest award received and annual gain in earnings. Although 37% (adjusted 35%) of the variance of the dependent variable is explained by the independent variables, the size and direction of the relationship suggest that being male, over 25 years of age and annual gains in earnings are more important, as indicated by statistical significance of the independent variables.

Model 3, which entered the annual gain in earnings, explains 35% of the variance of the dependent variable and was significant at ( $p < .001$ ); however, the adjusted  $R^2$  value for Model 1 which only contained background characteristics explained only 4% of the variance and was significant at ( $p < .01$ ). Model 2, which entered highest award received, explained only 4% percent was not statistically significant. Model 3 included the relationships and effects of background characteristics, highest award received and annual gain in median earnings had on the student's fifth-year annual earnings. The independent variable age

Table 4.21. Summary of regression analysis for Architecture and Construction

Variable blocks	Standard regression coefficients ( $\beta$ )		
	Model 1	Model 2	Model 3
<i>Background Characteristics</i>			
Gender: male	.15*	.16*	.14*
Age: nontraditional	.14*	.15*	.17**
Race/ethnicity: white	.06	.05	.05
Economic Status: Non-Pell	.06	.07	.04
<i>Highest Award Received</i>			
Certificate		.03	.02
Diploma		.06	.00
2 year Associate Degree		.09	.01
<i>Annual Gain in Earnings</i>			
1st yr. gain in median earnings			.17**
2nd yr. gain in median earnings			.27**
3rd yr. gain in median earnings			.27**
4th yr. gain in median earnings			.50**
Model R <sup>2</sup>	.05*	.06	.37**
Model Adjusted R <sup>2</sup>	.04*	.04	.35**

Natural Log of 5th Year Annual Earnings ( $n=380$ )

Level of significance: \* $p < .01$ , \*\*  $p < .001$

increased in significance ( $p < .001$ ) in Model 3. In the previous two models age was significant at ( $p < .01$ ). Gender was significant at ( $p < .01$ ) in Model 3. All other variable were not statistically significant. Eleven independent variables were entered in three models. Five of these variables were significant ( $p < .001$ ), and one variable was significant ( $p < .01$ ). Model 1 contained student background characteristics. The independent variable gender had a beta value of .15 and was significant ( $p < .01$ ). This indicates that being male is more predictive of fifth-year annual earnings for students in Arts, Architecture and Construction

Table 4.22. Regression analysis for Architecture and Construction

Independent Variable Blocks	<i>B</i>	<i>SE</i>	<i>B</i>	<i>P</i>
<i>Model 1</i>				
Gender: male	.34	.12	.15*	.003
Age: nontraditional	.17	.06	.14*	.008
Race/ethnicity: white	.16	.14	.06	.228
Economic Status: Non-Pell	.07	.06	.06	.247
<i>Model 2</i>				
Gender: male	.35	.12	.16*	.003
Age: nontraditional	.18	.06	.15*	.005
Race/ethnicity: white	.14	.14	.05	.309
Economic Status: Non-Pell	.09	.06	.07	.177
Certificate	.23	.38	.03	.537
Diploma	.06	.07	.06	.324
2 year Associate Degree	.11	.07	.09	.116
<i>Model 3</i>				
Gender: male	.32	.10	.14*	.001
Age: nontraditional	.20	.05	.17**	.000
Race/ethnicity: white	.12	.11	.05	.307
Economic Status: Non-Pell	.05	.05	.04	.319
Certificate	.14	.31	.02	.647
Diploma	.00	.05	.00	.963
2 year Associate Degree	.09	.06	.01	.759
1 <sup>st</sup> yr. Gain in median earnings	.00	.00	.17**	.000
2 <sup>nd</sup> yr. Gain in median earnings	.01	.00	.27**	.000
3 <sup>rd</sup> yr. Gain in median earnings	.01	.00	.27**	.000
4 <sup>th</sup> yr. Gain in median earnings	.01	.00	.50**	.000

Natural Log of 5th Year Annual Earnings ( $n=380$ )

Level of significance: \* $p < .01$ , \*\*  $p < .001$

program areas. When Model 2 was entered the beta value for gender increased to .16, but decreased to .14 when Model 3 was entered.

The independent variable age had a beta value of .14 and was significant ( $p < .01$ ). When Model 2 was entered the beta value for age increased to .15, and again increased to .17 when Model 3 was entered. This indicated that being older is more predictive of fifth-year annual earnings. When Model 2, highest awards received, and Model 3, annual gain in earnings, were entered, age increased in its predictive power of fifth-year annual earnings for students in Architecture and Construction program areas. The age variable also increased in significance to ( $p < .001$ ). The independent variables certificate, diploma and associate degree that were entered in Model 2 were not significant in explaining the variance of the dependent variable.

The independent variable first year gain in median earnings had a beta value of .18. The beta value for the second year gain in median earnings variable was .27, the third year gain in median earnings was .27, and in the fourth year it was .50. All four independent variables in Model 3 were significant ( $p < .001$ ).

In summary, only two models in this multiple regression analysis had significant adjusted  $R^2$  values. The model summary indicated a significant  $F$  change in Model 1 ( $p < .01$ ) and Model 3 ( $p < .001$ ). Model 1 explained only 4% of the variance of the dependent variable and Model 3 explained 35% of the variance of the dependent variable. Model 2, highest award received, added no additional predictive power to the dependent variable, fifth-year annual earnings. These predictors suggest that several factors play a significant role in predicting earnings. Male students, nontraditional age, and gain in annual median earnings were all positive predictors of earnings of community college students in Architecture and

Construction program areas. However, receiving an award is not a significant predictor of fifth-year annual earnings.

### **Arts, Audiovisual Technology and Communication**

As in the previous clusters areas, the results of the evaluation in Arts, Audiovisual Technology and Communication led to transformation of the dependent variable to reduce skewness and improve the fit of the model. A natural logarithm transformation was used on the fifth-year annual earnings variable.

Table 4.28 presents the correlations between the variables, Table 4.23 provides the standard regression coefficients ( $\beta$ ),  $R^2$  and adjusted  $R^2$  and the significant results (tested at  $p < .05$ ), and Table 4.24 presents the unstandardized coefficients ( $B$ ), standard error ( $SE$ ) and significance ( $P$ ). Table 4.23 indicates the  $R^2$  was significant ( $p < .001$ ) at .57, the adjusted  $R^2$  at .54 indicates that more than half of the variability in fifth-year annual earnings are predicted by background characteristics, highest award received and annual gain in earnings. Although 57% (adjusted 54%) of the variance of the dependent variable is explained by the independent variables, the size and direction of the relationship suggest that being male, receiving an associate degree and annual gains in earnings are more important, as indicated by the statistical significance of the independent variables.

Model 3, which entered the annual gain in earnings, explains 54% of the variance of the dependent variable and was significant at ( $p < .001$ ); however, the adjusted  $R^2$  value for Model 1, which only contained background characteristics, explained 10% of the variance of the dependent variable and was significant at ( $p < .001$ ). Model 2 which entered highest award received explained 11% percent was statistically significant at  $p < .05$ . Model 3

Table 4.23. Summary of regression analysis for Arts, Audiovisual Technology and Communications

Variable blocks	Standard regression coefficients ( $\beta$ )		
	Model 1	Model 2	Model 3
<i>Background Characteristics</i>			
Gender: male	.27***	.27***	.15**
Age: nontraditional	.11	.11	.09
Race/ethnicity: white	.13	.12	.06
Economic Status: Non-Pell	.12	.12	.10
<i>Highest Award Received</i>			
2 year Associate Degree		.15*	.16**
<i>Annual Gain in Earnings</i>			
1st yr. gain in median earnings			.18**
2nd yr. gain in median earnings			.17**
3rd yr. gain in median earnings			.30***
4th yr. gain in median earnings			.58***
Model R <sup>2</sup>	.12***	.14*	.57***
Model Adjusted R <sup>2</sup>	.10***	.11*	.54***

Natural Log of 5th Year Annual Earnings ( $n=180$ )

Level of significance: \* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$

includes the relationships and effects of background characteristics, highest award received and annual gain in median earnings have on the student's fifth-year annual earnings. The independent variable associate degree increased in significance ( $p < .01$ ) in Model 3. In the previous model associate degree was significant at ( $p < .05$ ). Gender was significant at ( $p < .01$ ) in Model 3. All other variable were not statistically significant. Eleven independent variables were entered in three models. Two of these variables were significant ( $p < .001$ ) and four variables were significant ( $p < .01$ ) and two variables, Certificate and Diploma, were dropped from Model 2 because the cell sizes were too low to be utilized in the regression

Table 4.24. Regression analysis for Arts, Audiovisual Technology and Communications

Independent Variable Blocks	<i>B</i>	<i>SE</i>	$\beta$	<i>P</i>
<i>Model 1</i>				
Gender: male	.38	.11	.27***	.000
Age: nontraditional	.18	.13	.11	.155
Race/ethnicity: white	.41	.23	.13	.080
Economic Status: Non-Pell	.20	.12	.12	.104
<i>Model 2</i>				
Gender: male	.38	.10	.27***	.000
Age: nontraditional	.19	.13	.11	.140
Race/ethnicity: white	.39	.23	.12	.092
Economic Status: Non-Pell	.20	.12	.12	.107
2 year Associate Degree	.29	.14	.15*	.040
<i>Model 3</i>				
Gender: male	.21	.08	.15**	.006
Age: nontraditional	.15	.09	.09	.105
Race/ethnicity: white	.20	.17	.06	.256
Economic Status: Non-Pell	.16	.09	.10	.067
2 year Associate Degree	.30	.10	.16**	.004
1 <sup>st</sup> yr. Gain in median earnings	.00	.00	.18**	.002
2 <sup>nd</sup> yr. Gain in median earnings	.00	.00	.17**	.002
3 <sup>rd</sup> yr. Gain in median earnings	.00	.00	.30***	.000
4 <sup>th</sup> yr. Gain in median earnings	.00	.00	.58***	.000

Natural Log of 5th Year Annual Earnings ( $n=180$ )

Level of significance: \* $p<.05$ , \*\* $p<.01$ , \*\*\*  $p<.001$

analysis. Model 1 contains student background characteristics. The independent variable gender had a beta value of .27 when model 1 entered and was significant ( $p<.001$ ). This indicates that being male is more predictive of fifth-year annual earnings for students in Arts, Audiovisual Technology and Communication program areas. When Model 2 was entered the beta value of gender remained at .27, however it decrease to .15 when Model 3 was entered indicating that receiving an award and years of employment reduce the effect of being male

on fifth-year annual earnings for students in Arts, Audiovisual Technology and Communication program areas.

The independent variable 2 year associate degree had a beta value of .15 when Model 2 was entered and was significant ( $p < .05$ ). When Model 3 was entered the beta value for associate degree increased to .16 and was significant ( $p < .01$ ). This indicates that receiving an associate degree is more predictive of fifth-year annual earnings in Arts, Audiovisual Technology and Communication program areas.

The independent variable first year gain in median earnings had a beta value of .18 and was significant ( $p < .01$ ). The beta value for second year gain in median earnings was .17 and was significant ( $p < .01$ ). The third year gain in median earnings had a beta value of .30 and was significant ( $p < .001$ ) and fourth year gain in median earnings had a beta value of .58 and was significant ( $p < .001$ ).

In summary, all three models in this multiple regression analysis had significant adjusted  $R^2$  values. The model summary indicated a significant F change of Model 1 ( $p < .001$ ), Model 2 ( $p < .05$ ) and Model 3 ( $p < .001$ ). Model 1 explained 10% of the variance of the dependent variable, Model 2 explained 11% of the variance, and Model 3 explained 54% of the variance of the dependent variable between the nine independent variables and the dependent variable, of fifth-year annual earnings. These predictors suggest that several factors play a significant role in predicting earnings. Male students, Associate award recipients, and gain in annual median earnings were all positive predictors of earnings of community college students in Arts, Audiovisual Technology and Communication program areas.

Table 4.25. Pearson correlations – Manufacturing; Science, Technology, Engineering and Math STEM) ( $n=897$ )

	2007 wages	Gender male	Age non-trad.	Race white	Econ. status non Pell	Cert.	Dipl.	Assoc degree	Gain in earning			
									1st yr	2nd yr	3rd yr	4th yr
2007 wages	1.000											
Gender male	***.167	1.000										
Age non-trad.	***.193	***-.229	1.000									
Race white	.029	.030	-.044	1.000								
Econ. status non Pell	***.145	.039	.001	-.004	1.000							
Certification	.009	-.033	**-.094	-.054	.027	1.000						
Diploma	*-.076	.041	*-.076	.022	*-.065	-.029	1.000					
Assoc. degree	***.159	***.123	***-.145	*.069	*-.065	*-.06	***-.174	1.000				
1st yr gain in earning	*.066	*-.059	-.055	-.007	-.002	.011	***.169	-.003	1.000			
2nd yr gain in earning	**-.100	.002	-.044	-.015	.003	-.001	.046	.010	**-.097	1.000		
3rd yr gain in earning	***.213	.047	-.031	*.068	.011	.010	-.028	.053	***-.154	*-.059	1.000	
4th yr gain in earning	***.328	.044	-.041	**-.098	-.004	-.018	-.046	.051	-.038	***-.133	***-.178	1.000

Level of Significance: \* $p<.05$  (1-tailed); \*\* $p<.01$  (1-tailed); \*\*\* $p<.001$  (1-tailed)

Table 4.26. Pearson correlations – Transportation/Distribution and Logistics ( $n=523$ )

	2007 wages	Gender male	Age non-trad.	Race white	Econ. Status Pell	Cert.	Dipl.	Assoc. degree	Gain in earning			
									1st yr	2nd yr	3rd yr	4th yr
2007 wages	1.000											
Gender male	** .104	1.000										
Age non-trad.	.070	*** -.164	1.000									
Race white	.041	.007	* -.100	1.000								
Econ. Status Pell	** .106	.037	* .095	-.023	1.000							
Cert.	.039	-.020	*** .279	* -.076	* .086	1.000						
Dipl.	-.037	.057	** -.144	-.007	** -.104	-.064	1.000					
Assoc. degree	** .143	.063	* -.102	* .088	.009	** -.128	*** -.196	1.000				
1st yr gain in earning	.071	-.048	** -.122	.041	-.033	* -.084	* .093	** -.106	1.000			
2nd yr gain in earning	*** .148	.035	-.029	.012	-.025	.012	.048	.030	* .078	1.000		
3rd yr gain in earning	** .118	.009	* -.099	-.028	-.056	.001	.011	.000	* -.076	*** -.253	1.000	
4th yr gain in earning	*** .478	-.028	.019	-.015	-.026	.016	* -.118	.020	.004	-.033	-.017	1.000

Level of significance: \* $p < .05$  (1-tailed), \*\* $p < .01$  (1-tailed), \*\*\* $p < .001$  (1-tailed)

Table 4.27. Pearson correlations – Architecture and Construction ( $n=380$ )

	2007 wages	Gender male	Age non-trad.	Race white	Econ. Status nonPell	Cert.	Dipl.	Assoc. degree	Gain in earning			
									1st yr	2nd yr	3rd yr	4th yr
2007 wages	1.000											
Gender male	** .149	1.000										
Age non-trad.	** .127	-.045	1.000									
Race white	.048	-.053	-.068	1.000								
Econ. Status nonPell	.072	.068	-.009	.039	1.000							
Cert.	.021	.018	-.043	.011	-.043	1.000						
Dipl.	.014	.010	-.081	.108	* -.096	-.046	1.000					
Assoc. degree	.051	-.068	-.043	* .040	-.044	-.037	*** -.324	1.000				
1st yr gain in earning	.069	.026	-.056	.051	-.068	.024	.019	.025	1.000			
2nd yr gain in earning	** .166	.001	-.028	-.009	-.012	.022	.003	.039	*** -.233	1.000		
3rd yr gain in earning	*** .183	-.007	-.043	.118	-.064	.002	-.018	.084	-.006	-.075	1.000	
4th yr gain in earning	*** .437	.021	-.002	-.038	* .106	-.006	.061	.035	-.064	-.073	** -.131	1.000

Level of significance: \* $p < .05$  (1-tailed), \*\* $p < .01$  (1-tailed), \*\*\* $p < .001$  (1-tailed)

Table 4.28. Pearson correlations – Arts, Audiovisual Technology and Communications ( $n=180$ )

	2007 wages	Gender male	Age non-trad.	Race white	Econ. Status Pell	Cert.	Dipl.	Assoc. degree	Gain in earning			
									1st yr	2nd yr	3rd yr	4th yr
2007 wages	1.000											
Gender male	***.275	1.000										
Age non-trad.	.072	-.053	1.000									
Race white	.125	-.033	-.002	1.000								
Econ. Status Pell	*.145	*.127	*-.159	.038	1.000							
Cert.	.	.	.	.	.	1.000						
Dipl.	.	.	.	.	.	.	1.000					
Assoc. degree	*.161	.020	-.022	.040	.023	.	.	1.000				
1st yr gain in earning	*.141	.089	-.091	** .205	.051	.	.	.099	1.000			
2nd yr gain in earning	.054	*.141	.000	-.113	-.049	.	.	*-.155	-.022	1.000		
3rd yr gain in earning	***.292	.072	-.092	-.100	** .184	.	.	-.086	*-.182	-.103	1.000	
4th yr gain in earning	***.609	.096	-.096	.124	-.037	.	.	.057	-.026	-.120	.077	1.000

Level of significance: \* $p < .05$  (1-tailed), \*\* $p < .01$  (1-tailed), \*\*\* $p < .001$  (1-tailed)

## **CHAPTER 5. DISCUSSION, IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS**

This chapter provides a discussion regarding the findings of the study provided in Chapter 4, implications for future research, recommendations, and conclusions of the study. The discussion is based on the purpose of the study which was to identify and understand specific factors that influence fifth-year post-college earnings of Iowa community college students in career and technical education in selected national career clusters.

More specifically, the purpose of this quantitative study was to identify and understand specific factors such as gender, age, degree attainment and annual gain in earnings that influence fifth-year post-college earnings of Iowa community college students in career and technical education in (1) Architecture and Construction; (2) Arts, Audiovisual Technology and Communications; (3) Manufacturing; Science, Technology, Engineering and Math (STEM); and (4) Transportation/Distribution and Logistics national career cluster. The factors were represented in the study as the community college student's background characteristics, the highest award they received while attending the community college and their annual financial gain after leaving the community college.

### **Discussion**

The discussion section is organized based on the national career clusters selected for this study and presented by the significant variables that influence fifth-year annual earnings. In each of national career cluster sections the discussion focuses on the results of each of the research questions presented in Chapter 4.

This study investigated leavers, certificate, diploma and associate degree recipients in selected national career clusters. It is important to remember that Iowa's community college provide diverse services, therefore, the conclusions cannot be generalized and are intended only to provide greater clarity regarding the relationship between community college award and the post-college earnings of students.

### **National Career Cluster**

#### **Manufacturing; Science, Technology, Engineering and Math (STEM)**

In the Manufacturing; Science, Technology, Engineering and Math (STEM) cluster, the statistically significant findings were:

- Gender, age and economic status were significant predictors of fifth-year annual earnings.
- All students were more likely to receive a benefit from obtaining an associate degree. However, earning an associate degree and years of experience assisted females in decreasing the wage gap with males. A lower percentage of females received an associate degree.
- Non-traditional students increased the wage gap by receiving an associate degree and years of experience.
- All students were more likely to receive a benefit from obtaining an associate degree. However, traditional age students needed to obtain this degree in order to minimize the effect of their age. A higher percentage of traditional age students received the associate degree than did non-traditional students.
- The associate degree was a significant predictor of fifth-year annual earnings.
- Student who did not receive an associate degree were able to decrease the wage gap with years of experience.
- Students who left the community college without receiving an award had higher median annual earnings than students who received a diploma.

In the Manufacturing; Science, Technology, Engineering and Math (STEM) cluster, gender, age and economic status were significant demographic variables in the regression analysis. Although males comprise an overwhelming percentage of students in this cluster, there are several areas where community colleges can focus efforts to better serve the students enrolled in Manufacturing; Science, Technology, Engineering and Math (STEM). Because background characteristics represent what students bring with them as they enter the educational training program at the community college, it is important to understand which background characteristics predict fifth-year annual earnings and how these characteristics influenced and were impacted when students' highest award and annual gain in earnings were considered. In the regression analysis, gender was significant in all three models, which means that being male is a significant predictor of fifth-year annual earnings. This augments findings of several other studies (Compton, 2008; Friedlander, 1996; Grubb, 1999; Laanan et al., 2007; Sanchez et al., 1999; Stoik, 2004). When the second model, highest award received, was entered in the regression analysis, the beta value for gender decreased from .22 to .20 ( $p < .001$ ). This reduction in the beta value indicates that the predictive power of gender decreased when highest award variable was entered into the regression analysis. This result suggests that a female can minimize the effect of gender and close the wage gap by receiving an associate degree. Furthermore, this finding underscores the fact that females who did not receive an associate degree were disadvantaged to a greater extent than males. When the third model, annual gain in earnings, was entered in the regression analysis, the beta value for gender dropped again, indicating that the effect of gender is minimized as females enter the workforce.

A lower percentage of females (15.1%) receive an associate degree than do males (24.4%), and slightly less than one fourth (24%) of females receive any community college award as compared to males at slightly more than one third (34.8%). If community colleges are able to increase the associate degree completion rates of students, those students will receive higher post-college earnings. Females receive a greater advantage from completing an associate degree and can decrease the gap in wages between men and women.

The Arts, Audiovisual Technology and Communication cluster indicated comparable results regarding gender in this cluster. Transportation/Distribution and Logistics and Architecture and Construction indicated that the predictive power of gender actually increased when highest award received and annual gain in earnings were considered. The literature is consistent in regards to findings that females earn less than males, (Compton, 2008; Friedlander, 1996; Grubb, 1999;); Laanan et al., 2007; Sanchez et al., 1999; Stoik, 2004). However, when analyzed by cluster, Manufacturing; Science, Technology Engineering and Math (STEM) demonstrated that receiving an associate award and the annual gain in earnings can decrease the impact of gender.

Traditional age students comprised the majority of the cohort in this cluster and were more likely to receive an award. The regression analysis indicated that age was a significant predictor of fifth-year annual earnings, which means that being a nontraditional student is a significant predictor of fifth-year annual earnings. Students choose a community for a variety of reason (Cohen & Brawer, 2003) and community colleges understand that not all students aspire to obtain an award. This finding is supported by the data in this study. That is, nontraditional students receive an award at a much lower rate that traditional age students, yet being a nontraditional student is a significant predictor of fifth-year annual earnings. The

data also indicate that receiving an associate degree is a significant predictor of fifth-year annual earnings; therefore, traditional age students would benefit greatly by receiving an associate degree. The regression analysis indicated that, when highest degree received was considered, the standard regression coefficient for age increased from .24 to .26 ( $p < .001$ ), which indicates that being a nontraditional student is a stronger predictor of fifth-year annual earnings when highest award is taken into account. This increase in the standard regression coefficient is interesting because the demographic data indicate that traditional age students receive an award at a substantially higher rate than nontraditional students. Because the associate degree variable was significant and traditional age students received an award at a substantially higher rate, it was anticipated that the predictive power of age would decrease when highest award was considered. However, the findings indicated that standard regression coefficient for age increased. This increase indicates that being a nontraditional student and receiving an associate degree are significant predictors of fifth-year annual earnings. Therefore, the 62.2% of traditional age students who leave community college without an award were at a great disadvantage with respect to fifth-year annual earnings. Therefore, students who enroll at a community college without the aspirations of obtaining an award should be informed of these findings and carefully guided and encouraged to complete the program.

Economic status was a significant predictor of fifth-year annual earnings in all three models. This indicates that students who do not receive Pell assistance are a strong predictor of fifth-year annual earnings. This finding is consistent with other studies (Compton, 2008; Friedlander, 1993b, 1996; Grubb, 1999; Laanan et al., 2007; Sanchez et al., 1999).

The regression analysis indicated that the associate degree variable is a significant predictor of fifth-year annual earnings, which means that being a student who received an associate degree is a significant predictor of fifth-year annual earnings. The predictive power of the associate degree decreases when annual gain in earnings is considered. The beta value dropped from .18 to .14 ( $p < .001$ ). Although receiving an associate degree remained a significant predictor of fifth-year annual earnings, students who did not receive an associate degree were able to reduce the wage gap. The Arts, Audiovisual Technology and Communications and the Transportation/Distribution and Logistics career clusters also demonstrated the associate degree is a significant predictor of fifth-year earnings; however, this cluster was the only one in which the significance decreased when annual gain in earnings were considered.

The results of median annual earnings, Tables 4.9 and 4.10, suggest that students in the Manufacturing; Science, Technology, Engineering and Math (STEM) career cluster who leave the community college without receiving an award or certificate are doing so because of strong employment opportunities. Students who received a diploma are entering the workforce and earning a lower median annual wage.

In the regression analysis, associate award was the only highest award variable that was considered as a significant predictor of students' fifth-year annual earnings. Both the certificate and the diploma were not statistically significant. The diploma variable had a standard regression coefficient of -.02 as compared to the associate degree variable of .18 ( $p < .001$ ). Although these data demonstrated that the associate degree is a significant predictor of fifth-year annual earnings, the diploma may still be an appropriate award to offer in these clusters. The diploma award did receive large gains in median annual earnings in the

first year and in the second year with this study; however, it tapered off considerably in the third year and fourth year. Students who left college without an award and those who received a certificate had higher median annual earnings than students who received a diploma. These results suggest that students in the Manufacturing; Science, Technology, Engineering and Math (STEM) career cluster who leave the community college without receiving an award or certificate are doing so because of strong employment opportunities. Students who received a diploma were entering the workforce and earning a lower median annual wage. This does not reflect negatively on the quality or relevance of the diploma award because the students in the leaver category were enrolled in the award program and elected not to complete the requirements of the award. These data indicate that students who chose to stay and complete a diploma were at an important decision point in their educational careers. They may choose to exit college with only the diploma or continue their education and complete an associate degree. The data on median annual earnings suggest that students who complete the diploma award do not have strong employment opportunities; therefore, they choose to exit the community college for other reasons. Clearly, there is a need for further research to determine why students leave community college without an associate award. Nevertheless, wage data can provide students with a greater understanding of the earning potential they can expect, and community colleges may begin to understand why some students who leave college without an award are financially stronger after five years of full-time employment.

This study does suggest that community colleges should consider the results of this study in providing career guidance to students. Earning potential of an award is an important

variable to consider; however, it is only one of multiple variables that should be considered when providing career guidance to community college students.

In summary, the results of the Manufacturing; Science, Technology, Engineering and Math (STEM) career clusters in this study indicate that community colleges should consider multiple variables when providing career information and guidance to students. Background characteristics, specifically gender and age, should be given strong consideration when community colleges provide career guidance. Females need to understand that the associate degree is a significant predictor of their fifth-year annual earnings and, if they do not receive an associate degree, their earning potential will be significantly less than for males. Traditional age students need to understand that the associate degree is a significant predictor of fifth-year annual earnings and, by obtaining this level of award, they can reduce the impact of their age.

When students aspire to obtain only specific skills and elect not to complete an associate degree, community colleges should take into consideration the findings of this study when providing guidance. Although the study indicated that non-traditional male students may receive strong employment without receiving an award, traditional age female students may not receive the same benefit. This study provides community colleges with a stronger understanding of student background characteristics and awards received as related to post-college earnings and should be used when community college faculty, counselors and administrators are advising students on educational and career decisions.

## **Transportation/Distribution and Logistics**

In the Transportation/Distribution and Logistics cluster, the statistically significant findings were:

- Gender, age and economic status were significant predictors of fifth-year annual earnings.
- Male students were more likely to increase the wage gap with years of experience.
- All students were more likely to receive a benefit from obtaining an associate degree. However, receiving an associate degree was essential for female students who were non-traditional. Very few females received the associate degree.
- Non-traditional students were more likely to increase the wage gap by receiving an associate degree and years of experience.
- The associate degree was a significant predictor of fifth-year annual earnings.
- All students were more likely to receive a benefit from obtaining an associate degree. However, traditional age students needed this to obtain this degree in order to minimize the effect of their age. A higher percentage of traditional age students received the associate degree than did non-traditional students.
- Non-traditional students who received an associate degree were more likely to increase the wage gap with years of experience.
- Students who did not receive a Pell award were more likely to increase the wage gap with years of experience.

In the Transportation/Distribution and Logistics cluster gender, age and socio-economic status were significant demographic variables in the regression analysis. Although males comprise an overwhelming percentage of students in this cluster, there are several areas where community colleges can focus efforts to better serve the students enrolled in Transportation/distribution and Logistics. Because background characteristics represent what students bring with them as they enter the educational training program at the community college, it is important to understand which background characteristics predict fifth-year annual earnings and how these characteristics were impacted when a student's

highest award and annual gain in earnings were considered. In the regression analysis, gender was significant in all three models, which means that being male is a significant predictor of fifth-year annual earnings. When the highest award received was considered, the predictive power of gender remained virtually the same; however, when annual gain in earnings was considered the statistical significance of gender increased to  $p < .01$ , indicating that the predictive power of gender increased as females enter the workforce. Furthermore, these findings underscore the fact that females who did not receive an associate degree were disadvantaged to a greater extent than males. Community colleges should consider these results when providing career guidance to students. All students in this cluster can benefit from receiving an associate degree; however, for females, the associate degree is essential.

Traditional age students comprised the majority of the cohort in this cluster and were awarded a diploma or associate degree at substantially higher rates. Traditional age students comprised only 16.1% of those who received a certificate, but represented 94.0% of those who received a diploma and 81.7% for those who received an associate degree. The regression analysis indicated that age became a significant predictor of fifth-year annual earnings when annual gain in earnings was considered. This indicates that traditional age students are not able to experience the same level of annual economic gain that older students are able to acquire. Students attend community colleges for a variety of reasons (Cohen & Brawer, 2003); however, not all students aspire to obtain an award and only seek specific courses at the community college. This finding is supported by the data; nontraditional students receive diplomas and associate degrees at a much lower rate than traditional age students, yet being a nontraditional student is a significant predictor of fifth-year annual earnings. A high percentage of certificates were received by nontraditional age students;

however, the associate degree was the only variable that was a significant predictor of fifth-year annual earnings. This would indicate that traditional age students benefit greatly from receiving an associate degree. Because traditional age students earn an associate degree at a higher rate (12.1%) than nontraditional students, the predictive power of the associate degree helps minimize the impact of age. The 63.6% of traditional age students who leave community college without an award are at a great disadvantage with respect to fifth-year annual earnings. Therefore, community colleges should convey the importance of the associate degree to all students, especially traditional age students.

Socio-economic status was a significant predictor of fifth-year earnings, which means being a student who did not receive a Pell award is a significant predictor of fifth-year earnings. This variable was not statistically significant when it was entered in Model 1; however, it became significant at  $p < .05$  when highest award received was considered and saw another increase in significance at  $p < .01$  when annual gain in earnings was considered. This indicates that being a student who received a Pell award is a negative predictor of fifth-year annual earnings when the highest award received and annual gain in earnings are considered. This study indicates that students who receive a Pell award fall behind financially as compared to students who do not receive this financial assistance. Further research is needed in this area in order better explain why students who receive Pell awards have lower annual earnings.

The associate degree variable was statistically significant, which means that being a student who received an associate degree is a significant predictor of fifth-year annual earnings. The effect of the associate degree increased in significance when annual gain in earnings was considered. The standard regression coefficient remained at .15, however, the

probability increased from  $p < .01$  to  $p < .001$ . This increase in significance indicates that the impact of an associate degree is stronger the longer a student stays in the workforce.

Both the certificate and the diploma were not found to be significant. These two variables had standard regression coefficients of .03 for the certificate award, and .01 for the diploma award. These compare to a coefficient of .15 ( $p < .001$ ) for the associate degree variable. Although, these data indicate that the associate degree is a significant predictor of fifth-year annual earnings, the certificate and diploma awards may still be appropriate to offer in this cluster. The majority (83.9%) of the certificates that were granted by Iowa community colleges were awarded to nontraditional age students, and being a nontraditional age student is a significant predictor of fifth-year annual earnings. The same cannot be said for the diploma award. The majority (94.0%) of the diplomas that were granted by Iowa community colleges were awarded to traditional age students. These data suggest that community colleges should consider these results when providing career information and guidance to students. Earning potential of an award is an important variable to consider, however, it is only one of multiple variables that should be considered when providing career information and guidance to community college students.

In summary, regarding the discussion of the Transportation/Distribution and Logistics cluster in this study, community colleges should consider multiple variables when providing career information and guidance to students. Background characteristics, specifically gender and age, should be given strong consideration when community colleges provide career information and guidance. Females need to understand that the associate degree is a significant predictor of their fifth-year annual earnings and, if they do not receive an associate degree, their earning potential is significantly less than that of males. Traditional

age students need to understand that the associate degree is a significant predictor of fifth-year annual earnings. By obtaining this level of award, traditional age students reduce the impact of their age.

Students attend community colleges for a variety of reasons. Some students who attend a community college do not aspire to obtain an award and desire only to attend several classes which may enable them to become employed or advance their skills. This study suggests that as community colleges provide guidance to students, they should do so with an understanding that an associate degree will benefit females, traditional age students, and students who need financial assistance. Leavers in the Transportation/Distribution and Logistics cluster had the lowest fifth-year median annual earnings, whereas students who received an associate degree had highest median annual earnings in the fifth-year. This study has provided a stronger understanding of community college student's background characteristics and awards received as related to post-college earnings and can be used to better advise community college students in making educational and career decisions as they relate to future earnings.

### **Architecture and Construction**

In the Architecture and Construction cluster, the statistically significant findings were:

- Gender and age were significant predictors of fifth-year annual earnings.
- Non-traditional students were more likely to increase the wage gap with years of experience.
- The associate degree is NOT a significant predictor of fifth-year annual earnings.

In the Architecture and Construction cluster, gender and age were significant demographic variables in the regression analysis. Although males comprise an overwhelming percentage of students in this cluster, there are several areas where community colleges can focus efforts to better serve the students enrolled in Architecture and Construction. Because background characteristics represent what students bring with them as they enter the educational training program at the community college, it is important to understand which background characteristics predict fifth-year earnings and how these characteristics are impacted when a student's highest award received and annual gain in earnings are considered. In the regression analysis gender was significant in all three models, which means that being male is a significant predictor of fifth-year annual earnings. This augments findings of several other studies (Compton, 2008; Friedlander, 1996; Grubb, 1999; Laanan et al., 2007; Sanchez, Laanan, & Wiseley, 1999; Stoik, 2004). When the second model, highest award received, was entered in the regression analysis, the standard regression coefficient (Beta value) for gender increased from .15 to .16 ( $p < .01$ ). This increase in the coefficient indicates that the predictive power of gender increased slightly when highest award variable was entered into the regression analysis. When annual gain in earnings, was entered in the regression analysis, the standard regression coefficient (Beta value) for gender decreased from .16 to .14 ( $p < .01$ ) indicating that the effect of gender is minimized as females enter the workforce.

The regression analysis indicated that age is a significant predictor of fifth-year annual earnings. This indicates that being a nontraditional student is a significant predictor of fifth-year annual earnings. Students choose a community college for a variety of reasons (Cohen & Brawer, 2003), and community colleges understand that not all students aspire to

obtain an award. This understanding is supported by the data in this study. Nontraditional students receive an award at a lower rate than traditional age students, yet being a nontraditional student is a significant predictor of fifth-year annual earnings. Because the highest award received is not a significant predictor of fifth-year annual earnings, traditional age students will see only a minimal effect of receiving a community college degree. When annual gain in earnings was considered, the significance of the age increased to  $p < .001$  which indicates that age increases in significance with years of experience. Based on the data in this study, young females will have a difficult time earning the same as males as they enter the workforce.

To summarize the results of the Architecture and Construction cluster in this study, community colleges should consider multiple variables when providing career information and guidance to students. Background characteristics, specifically gender and age, should be given strong consideration when community colleges provide career information and guidance. Females and traditional age students are at a disadvantage in this cluster in relationship to their fifth-year annual earnings. In the technical programs that are offered by the community colleges, students are obtaining the skills that are necessary to enter the workforce. Table 4.13 indicates that students' median annual earnings increase with each award, however, the regression analysis indicates that receiving an award does not significantly predict fifth-year annual earnings.

Community colleges will serve their students better when the awards that are granted to students are significant predictors of post-college earnings. Community colleges strive to provide students with a competitive advantage as they enter the workforce. Based on the results of this study, community colleges should be encouraged to work with their industry

partners to evaluate the curriculum in the architecture and construction cluster to ensure these programs are meeting the needs of industry and providing students with the necessary skills to have a competitive advantage over those students who leave the community college without an award. Industry certifications should be explored as an alternative or addition to a formal award. Industry certifications hold several advantages: (1) they are created by industry so they are accepted as quality indicators of a person's level of achievement and proficiency; (2) they are transportable to other geographic areas of the country; and (3) they contain third party assessments which provide validity and program credentials.

Apprenticeship programs in the Architecture and Construction cluster are numerous and additional research is needed to study the relationship of apprenticeship programs and a student's fifth-year annual earnings. Research in this area would provide community colleges with additional information on potential options that could lead to improvement of programs and stronger earning potential of students in Architecture and Construction.

This study does not suggest that programs in this cluster are not quality programs; however, this study found that an award at a community college in the Architecture and Construction cluster is not a significant predictor of post-college earnings. Therefore, it would be prudent for community colleges to evaluate these programs and explore options that will provide students with a competitive advantage that is a significant predictor of post-college earnings.

### **Arts, Audiovisual Technology and Communications**

In the Arts, Audiovisual Technology and Communication cluster, the significant findings were:

- Gender was a significant predictor of fifth-year annual earnings.
- Females can minimize the effect of gender and decrease the wage gap with years of experience.
- All students were more likely to receive a benefit from obtaining an associate degree. However, earning an associate degree assisted females in decreasing the wage gap with male. A higher percentage of females received an associate degree.
- The associate degree was a significant predictor of fifth-year annual earnings.

In the Arts, Audiovisual Technology and Communication cluster, gender was a significant demographic variable in the regression analysis. Because background characteristics represent what students bring with them as they enter the educational training program at the community college, it is important to understand which background characteristics predict fifth-year annual earnings and how these characteristics were impacted when a student's highest award and annual gain in earnings were considered. In the regression analysis, gender was significant in all three models, which means that being male is a significant predictor of fifth-year annual earnings. This augments the findings of several other studies (Compton, 2008; Friedlander, 1996; Grubb, 1999; Laanan et al., 2007; Sanchez et al., 1999; Stoik, 2004). When annual gain in earnings was entered in the regression analysis, the standard regression coefficient (beta value) for gender dropped from .27 ( $p < .001$ ) to .15 ( $p < .01$ ), and the significance reduced from  $p < .001$  to  $p < .01$ . These reductions indicate that the predictive power of gender decreased when the annual gain in earnings variable was entered into the regression analysis. Therefore, a female can minimize the effect of gender and decrease the wage gap with years of experience. In addition, females received a benefit of receiving an associate degree. The highest award received variable was significant at  $p < .05$  in the second model, and increased in significance at  $p < .01$  in the third

model when the annual gain in earnings variable was entered in the regression analysis. Because receiving an associate degree is a significant predictor of fifth-year earnings, females who did not receive an associate degree were disadvantaged to a greater extent than males. However, females did comprise 58% of those who received an associate degree.

To summarize the results of the Arts, Audiovisual Technology and Communication cluster in this study, community colleges should consider multiple variables when providing career information and guidance to students. Background characteristics, specifically gender is a characteristic that should be given strong consideration when community colleges provide career information and guidance. The study indicated that students benefit from receiving an associate degree. Females need to be informed that the associate degree is a significant predictor of their fifth-year annual earnings. They also need to understand that receiving an associate degree and years of experience can minimize the effect of gender and reduce the wage gap with males. If females do not receive an associate degree their earning potential is significantly less than males.

Community colleges are encouraged to consider these results when providing career information and guidance to students. Earning potential of an award is an important factor to consider, however, it is only one of multiple variables that should be considered when providing career information and guidance to community college students. Students who leave community college without an award earn \$2,968 less in the median annual earnings, than those who receive an associate degree in the first year. This wage gap increases to \$4,981 in the fifth year.

Students choose a community college for a variety of reasons (Cohen & Brawer, 2003), and community colleges understand that not all students aspire to obtain an award.

However, this study suggests that obtaining an associate award is important for students, thus career counseling to students needs to be carefully guided. This study has provided a base of knowledge on community college student's background characteristics and awards received as related to post-college earnings. The results of this study may be used to indicate the value of an award at a community college and show how background characteristics predict post-college earnings. In general, the results from this study may provide information to community college administrators, faculty and advisers that could better assist students in making educational and career decisions as they relate to future earnings.

## **Independent Variables**

### **Student Characteristics**

This study utilized Becker's (1964) human capital theory which found that education and training are the most important investments in human capital. Several independent variables (see Appendix C) were utilized to represent the investments by community college students and found that several variables were significant predictors of fifth-year annual earnings. Of these variables, only gender was significant across all of the selected clusters. In two clusters, (1) Manufacturing; Science, Technology, Engineering and Math (STEM) and (2) Arts, Audiovisual Technology and Communications, the significance of gender decreased when highest award received and annual gain in earnings were considered. In the other two clusters, the study found the predictive power of gender to either increase or have no statistical change when highest award received and annual gain in earnings were considered. Several studies indicate that females earn less than males (Compton, 2008; Laanan et al., 2007; Sanchez et al., 1999; Stoik, 2004), however, this study indicates that receiving an

associate degree and years of employment can reduce the wage gap that exist between males and females in two career clusters, (1) Manufacturing; Science, Technology, Engineering and Math (STEM) and (2) Arts/Audiovisual Technology and Communications.

Age was significant in all cluster areas except the Arts, Audiovisual Technology and Communication cluster. The emerging technologies and the frequent technological changes in the Arts, Audiovisual Technology and Communication cluster may explain the higher percentage (77%) of traditional age students in the cluster and the lack of significance of the age variable. It may be valuable to explore in greater depth the distribution of age among the nontraditional students in this cluster to see if this cohort of students is generally younger. It was expected that older students would earn higher wages; however, the regression analysis suggests that in all cluster areas, with the exception of, Architecture and Construction, traditional age student will benefit from receiving an associate degree.

Race/ethnicity was not significant in any cluster. However, the cohort sizes of nonwhite students were so small that it was not possible to report demographic information for most categories.

Economic status was a significant predictor of fifth-year annual earnings in two clusters, (1) Manufacturing; Science, Technology, Engineering and Math (STEM), (2) Transportation/distribution and Logistics. The other two clusters yielded no statistically significant influence on fifth-year annual earnings. These findings are consistent with other studies (Compton, 2008; Laanan et al., 2007; Sanchez, Laanan, & Wiseley, 1999; Friedlander, 1996; Grubb, 1999).

### **Degree Attainment**

The national graduation rate for the 2001 cohort of students within two-year institutions was 32.6% (Knapp, Kelly-Reid, & Whitmore, 2006). The graduation rate for the 2001 cohort of students within Iowa's community college was 38% (Friedel, 2006). Iowa's performance, which is above the national average, indicates strength in this area. This study is consistent with the Iowa overall graduation rate with a range of 25% to 45%. Certificates were seldom awarded (15%) in: (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Arts, Audiovisual Technology and Communications; (3) Architecture and Construction; and (3) Transportation/distribution and Logistics.

A significant finding in this study was that receiving an associate degree is a significant predictor of fifth-year annual earnings in (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Arts, Audiovisual Technology and Communications; and (3) Transportation/distribution and Logistics. The only cluster for which the associate degree was not a significant predictor of fifth-year annual earning was Architecture and Construction. There are some possible explanations for this result. One is that the Unemployment Insurance (UI) wage records do not have wage data on self-employed workers and the self-employed workers are the entrepreneurs. Another explanation may be that wages are underreported in this cluster. That is, workers may have full-time employment but provide services in addition to their full-time position and these wages may not be reported. In two clusters, (1) Manufacturing; Science, Technology, Engineering and Math (STEM); and (2) Arts, Audiovisual Technology and Communications, the influence of the associate degree decreased the predictive power of gender. Females in these two clusters receive a great advantage by receiving an associate degree. These findings

augment the general findings of several other studies (Compton, 2008; Friedlander, 1996; Grubb, 1999; Laanan et al., 2007; Sanchez, Laanan, & Wiseley, 1999; Stoik, 2004).

### **Annual Median Earnings**

Community college students who received an associate degree had the highest median annual earnings in the fifth year than any other category. The associate degree at Iowa's community colleges has value. The five years represented in the study revealed a trend in annual gains in earnings. By the fifth year the annual percent change between the categories had moved very close to each other, indicating that the annual gain in earnings begins to stabilize across all award categories within five years of leaving college. The one exception was in the Art, Audiovisual Technology and Communication cluster, in which leavers saw an 11.63% gain compared to a 3.36% gain for the associate degree. It is possible that the overall low wages in this cluster affected these data. Leavers had median annual earnings of only \$21,917 in the fifth year as compared to \$26,898 for the associate degree. In order to increase the confidence that the annual gains in earning are stable across the clusters it would be necessary to extend the trend line for several years more years to verify the annual percent gain has truly stabilized.

In all clusters except Manufacturing; Science, Technology, Engineering and Math (STEM) the median annual earnings of students were consistent with research (Laanan et al., 2007; Stoik, 2004; Grubb, 1999), the higher the award the greater the earnings. In the Manufacturing; Science, Technology, Engineering and Math (STEM) cluster, both leavers and those with certificates received higher median annual earnings than those with the diploma. One explanation for this would be the significance of nontraditional students. The

data indicate that a high percentage of nontraditional students enrolled in Manufacturing; Science, Technology, Engineering and Math (STEM) with the aspirations of obtaining specific skills in order to advance within an existing job or move into a new position as a promotion. More traditional age students received a diploma, which indicates that this is a critical decision point. It appears that many of the students who left prior to receiving a diploma, did so for strong employment opportunities. Students who persisted through the program and received an associate degree saw the strongest fifth-year annual earnings. However, students who received a diploma saw the lowest median annual earnings. Additional research is needed to determine why students in Manufacturing; Science, Technology, Engineering and Math (STEM) choose to leave without an associate degree.

### **Implications for Research, Policy and Practice**

The lack of research in this area indicates there is a need for further research. The limited number of states (nine were identified in the literature review in Chapter 2), indicated an opportunity for further state level research. This study adds to the literature, however, there is still a need for further research on the economic impact of community college awards. The use of Unemployment Insurance (UI) wage data has greatly increased the number of responses over the traditional survey instruments used prior to the early 1990s. However, the percentage of students who are not found within the UI system is between 10 – 50% (U.S. Department of Commerce, 1996). Improvement in the access to UI wage data has occurred. Iowa is making progress toward establishing data sharing agreements with bordering states. These sharing agreements will greatly increase the number of responses.

As one examines the limitations of the Unemployment Insurance (UI) wage data, several issues emerge. The UI system includes all wages earned by an individual, whether the employment is full or part-time. These wage data are collected quarterly and employers are not required to report numbers of hours worked; therefore, it was not possible to identify full and part-time status of workers in the current study. The UI system reports quarterly earnings by employer, but not by a Standard Occupation Classification (SOC) code. These limitations, along with the UI systems' inability to track several groups of workers (e.g., military, churches, federal employees, railroad workers, self-employed, unemployed, employed in another state, part-time workers and students who continue their education). This omission leads one to raise the following questions:

- How do career and technical programs compare to academic transfer programs in relation to the percentage of students found in the UI system? The findings to this question may provide information on the percentage of self-employed workers.
- Is there a difference between career and technical and academic programs in the percentage of self employed people? Does a self-employed person yield a greater economic benefit? Estimates on how much of the workforce is self-employed vary from 3% to 5% (Stevens et al., 1992) to as high as 10% to 15% and rising (U.S. Department of Commerce, 1996) can provide a limited picture on accounting for self employed people. Self-employed may really skew the result of an economic benefit study. Many of the skilled trade areas that were represented in this study may have a high percentage of entrepreneurs.
- What is the effect of part-time employees within studies using UI database? The national student clearinghouse was utilized in this study to filter out those students who were enrolled in another institution. This potentially minimized the number of part-time students in the cohort, however, it may not have accounted for all part-time workers.
- What percentage of community college students is enrolled in career and technical programs for specific skill development and career redirection or advancement?

Although researchers need to consider the limitations that exist when using the Unemployment Insurance (UI) wage data, it is clear that this system has and will continue to

improve the reliability and validity of research studies to determine the economic benefits to a community college degree.

This study adds to the literature on post-college earnings in selected national career clusters; however, several areas will require additional research in order to gain a more complete understanding of certain areas. The influence that gender and age have on post-college earnings could be explored further using data within the Management Information System (MIS) in the Iowa Department of Education. The Management Information System (MIS) contains a wealth of data and should be utilized in future research. However, as with any data set, it is important to determine the reliability of the data elements before it is utilized in a research study. Data elements such demographic information and award type are typically reliable elements, however, other elements such as high school GPA, intent and single parent may be self-reported or under reported.

Several questions regarding gender have emerged as a result of this analysis:

- In selected career clusters are females more likely to be single parents; and, how does being a single parent affect post-college earnings?
- In selected career clusters are females more likely to work part-time?
- In selected career clusters are females employed in a related field to their training program?

Some of these questions can be addressed by using data in the MIS, however, qualitative or survey data would be useful to acquire a more complete understanding of gender and its relationship to post-college earnings. This UI wage data should be continually maintained for this cohort, which will provide a robust data set to allow future research. Replicating this study in five years may provide a deeper understanding of the impact of gender on post-

college earnings and possibly establish a point where the gains in median annual earnings in the award categories are similar.

This study only considered five of the 16 national career clusters; therefore, to gain a comprehensive understanding of career and technical education in Iowa, the study needs to be replicated for each of the remaining clusters. A study conducted by Compton (2008) provided a comparable approach for three clusters: (1) Information Technology; (2) Business Management and Administration; and (3) Marketing Sales & Services. The Health cluster contains a large enrollment (35.63%) and represents a large percentage of the workforce; therefore, it should be considered for future research (Friedel, 2006). This enrollment is followed by Skilled and Technical Sciences (26.76%). Although the Agriculture, Food and Natural Resources cluster represent a much smaller percentage of enrollment (4.02%) and represents a very small percentage of the workforce, the economic impact of agriculture in Iowa is significant (Friedel, 2007); therefore, it should be considered for future research.

Several additional questions emerged when the analysis was conducted in each career cluster. These research questions may provide a stronger understanding of the factors that affect a student's post-college earnings:

- In the Architecture and Construction cluster, how do median annual earnings of students who complete Bureau of Apprenticeship (BAT) programs compare to students who complete community college programs?
- Among students who leave a Bureau of Apprenticeship (BAT) program and work full-time, to what extent do their background characteristics, highest award received and annual gain in earnings predict students' fifth-year median annual earnings?
- In the Manufacturing; Science, Technology, Engineering and Math (STEM) career cluster, why do students leave the community college without receiving an associate award?

- In selected career clusters, what percentage of students who already have a BS or BA degree enroll in a community college career and technical programs?
- In the Manufacturing; Science Technology, Engineering and Math (STEM) national career clusters, why do females leave community college at high rates than males and do not receive an associate degree at the same level as male students?
- In the Transportation/distribution & Logistics national career cluster, why do students who receive Pell awards yield lower annual earnings?

### **Recommendations**

The following recommendations offer ways that Iowa's community colleges could better serve students and direct future program development and improvement efforts.

Specific audiences that could benefit from these findings are:

1. *Presidents:* They provide visionary leadership and shape public policy around the value of the community associate degree;
2. *Chief Academic Officer and Career and Technical Deans:* They develop and modify programs to meet the needs of the industry in Iowa and ensure that all programs position students with a competitive advantage;
3. *Career and Technical faculty and student advisors:* They provide career guidance and prepare students for technical careers, and ensure that each student maximizes his or her human capital.

The major recommendations of this study are as follows:

- Community colleges should encourage students to aspire to obtain an associate degree. The associate degree is essential for females and traditional age students.

- Community Colleges should consider potential barriers such as lack of child care, financial limitations or limited aspirations that can limit the ability of female and traditional age students to reach the associate degree level.
- Community Colleges should consider these findings when considering the value of classifying students as “Goal Attainment” as an alternate option to the award.

These recommendations may directly impact students as they make educational decisions on which career program to select and which, if any, award they should seek. In some clusters the results suggest that the community college should make adjustments in the programs to better prepare students for success in the cluster.

Gender balance is an issue in (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Transportation/distribution and Logistics; and (3) Architecture and Construction and work needs to be done in order to increase the percentage of females in these areas. Much of what needs to be done are cultural and societal changes, however community colleges can improve retention of females and increase their graduation rates. Graduation rates for females in (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Transportation/distribution and Logistics; and (3) Art, Audiovisual Technology and Communication were under 30%. Only Architecture and Construction has graduation rates greater than 50%. Because the Associate degree is a significant predictor of fifth-year annual earnings, it is a compelling reason for females to aspire to this level of education. Identifying potential barriers such as; lack of child care, financial limitations or limited aspiration, that can limit the ability of females to reach the associate level are important. Once these barriers are identified, strategies can be developed and implemented to remove the barrier.

One example of efforts by Iowa community colleges to address these issues can be found in statewide initiative that was designed to establish a pre-engineering program called Project Lead the Way (PLTW). This program was designed to lead into multiple programs at Iowa's community colleges as well as Iowa's universities. The community college presidents provided incredible visionary leadership that addressed the projected workforce shortages in the Manufacturing; Science, Technology, Engineering and Math (STEM). This project has been promising because the community colleges utilized state funding that was allocated to the community college system, and leveraged local and private industry funding to create a \$3.1 million fund that provided grant funding to implement the program in another sector of education. This funding provided a portion of the funding needed to implement PLTW. This initiative also set a direction for the community college chief academic officers and career and technical deans. There was an expectation of the initiative that this program lead to an associate degree as well as a four-year degree. There was also a strong commitment to achieve enrollments in PLTW that would be representative of the student population in the school. This has caused some of the community college regional PLTW coordinators to provide regional training on strategies to improve minority and female enrollments. Some community colleges have coordinated summer events to allow middle school girls to experience engineering and technical career fields. Career and technical deans and faculty members in some community colleges are evaluating the curriculum in selected programs to better align to PLTW program. This initiative directly impacts a student aspiration and enrollment in community college programs. This initiative also developed partnerships with secondary schools, business and industry and the universities to create a state-wide system. Project Lead the Way in Iowa is improving the enrollment of females,

15% in 2008 (Maguire, 2009), and is involved in several initiatives to increase this number even more. This initiative is a great example of how community colleges can implement the recommendations in this study. Without visionary leadership by the community colleges, dedicated people to implement the program and strong partnerships a state-wide impact would be difficult to achieve.

Not all initiatives need to achieve a statewide impact. Regional and local initiatives can have an immediate impact on community college students. Creating strategic marketing plans for selected career clusters could encourage completion of the associate degree, especially for females and traditional age students. Evaluating student support services could limit the barriers that females and traditional age student encounter when enrolled in community colleges. Limiting or removing barriers such as child care, work schedules, classroom environment and financial assistance may improve number of females that enroll in selected career cluster and increase retention in a program.

Over 70% of the students in these selected career clusters are traditional age students. Therefore, understanding the impact of an award on this population of students is essential. This study revealed some interesting things about age. Because age—nontraditional—was a significant predictor of fifth-year annual earnings in (1) Manufacturing; Science, Technology, Engineering and Math (STEM); (2) Transportation/distribution and Logistics; and (3) Architecture and Construction, it is important to position traditional age students with the skills that will minimize the effect of age. The skills necessary for traditional age students are found in the associate degree. In the Art, Audiovisual Technology and Communication cluster age was not significant, therefore, traditional age students are able to enter these career fields and earn comparable wages with older students.

Public policy in Iowa provides secondary schools with financial incentives to develop concurrent credit opportunities for students through legislation called “Senior Year Plus.” Economic impact studies by Christophersen and Robison (2003) were used to demonstrate a return on investment when the state invests in community colleges. Public policy can be impacted by the findings in this study through demonstrating the predictive power of an associate award and how the associate degree can positively impact the predictive power of gender. Studies by Compton (2008), Laanan et al. (2007), and Stoik (2004) would also impact public policy regarding concurrent enrollment opportunities.

The Federal Perkins Act of 2006 provides funding for secondary schools and community colleges in Iowa. Within this legislation non-traditional participation, retention and completion are important component, and funding is encouraged to be utilized on initiatives that increase the participation of non-traditional students. However, some of the initiatives that are funded are less than effective in achieving a meaningful increase in non-traditional participation. The findings of this study, and the findings from Compton (2008) Laanan et al (2007), and Stoik (2004), should be considered when determining statewide leadership initiatives and initiatives that utilize the reserve funding which was established in the Iowa State Plan for career and technical education.

Generally speaking, the students who received an associate degree were able to develop their human capital through the career and technical education programs within Iowa’s community colleges and benefit financially through increased annual earning. Community college administrators need to ensure faculty and students understand the value of the associate degree and foster a culture where aspirations of obtaining an associate degree are the norm and policies and procedure are designed to encourage students to complete the

associate degree. Even though Iowa exceeds the national graduation rate, there is considerable room for improvement. As community colleges discuss terms like “Goal Attainment” which is designed to quantify the student’s aspirations, they should consider the findings in this study. Students need accurate information and guidance in order to make sound decisions regarding their education. Community colleges must create a balance between what students want from a community college, what industry want from a community college and current research that suggests practices that can better position students with the competitive advantage as they enter the workplace. It may not be enough to just provide what students want from community colleges without ensuring that students have accurate information and understand the potential limitations of their decisions. Community colleges are encouraged to carefully balance the wants and aspirations of the students who attend community colleges with the knowledge of knowing that in certain career clusters students will receive greater economic benefit if they receive an associate award.

### **Conclusions**

The findings of this study provide one perspective on the community college experience. It is understood that community colleges have a wide range of curricular functions that provide multiple services to students. The curricular functions in community colleges include academic transfer preparation, career and technical education, continuing education, developmental education, and community service; therefore, the reasons student’s select a community college varies greatly (Cohen & Brawer, 2003; Varner & Friedel, 2006).

Some curricular functions in the community college are not intended to be directly impacted by the conclusions of this study. These functions include: continuing education, developmental education, community service, and academic transfer preparation. Students who aspired to transfer to four-year institutions, obtain minimum training needed to enable them to earn employment or retraining through continued education courses, were not represented in this study. Therefore, the conclusions of this study should not be directly imposed on these cohorts of students. However, these students may find the conclusions of this study useful as they make their educational decisions. Students in career and technical education programs, and either left without receiving an award or received a certificate, diploma or associate degree, were represented in this study. Therefore, the conclusions of this study may be directed at this cohort of students. Students who seek to attend a community college for technical training through a career and technical education program should find the conclusions useful as they make education decisions.

## APPENDIX A. CLASSIFICATION OF INSTRUCTIONAL PROGRAM (CIP)

### A-1. Manufacturing; Science, Technology, Engineering and Math (STEM)

CIP Number	Program Title
1403010200	BIOPROCESSING ENGINEERING ETHANOL TECHNOLOGY
1438010200	SURVEYING TECHNOLOGY
1438011100	GLOBAL IMAGING SYSTEMS TECHNICIAN
1438011200	GLOBAL IMAGING SYSTEMS TECHNOLOGY
1500000200	ENGINEERING TECHNOLOGY
1501010200	ARCHITECTURAL ENGINEERING TECHNOLOGY
1502010200	CIVIL ENGINEERING TECHNOLOGY
1503020200	ELECTRICAL TECHNOLOGY
1503030000	ELECTRICAL, ELECTRONICS AND COMM. ENGINEERING
1503030100	ELECTRONICS ENGINEERING TECHNICIAN
1503030200	ELECTRONICS ENGINEERING TECHNOLOGY
1503040200	LASER AND OPTICAL TECHNOLOGY
1503050200	TELECOMMUNICATIONS TECHNOLOGY
1504010200	BIOMEDICAL TECHNOLOGY
1504040000	INSTRUMENTATION
1504050200	ROBOTICS TECHNOLOGY
1505000000	ENVIRONMENTAL CONTROL
1505030000	ENERGY SYSTEMS ENGINEERING
1505031200	SUSTAINABLE ENERGY SYSTEMS TECHNOLOGY
1505032000	WIND ENERGY SYSTEMS
1505032200	WIND ENERGY SYSTEMS TECHNOLOGY
1505050000	SOLAR ENERGY ENGINEERING
1505060000	WATER QUALITY, WASTEWATER TREATMENT, AND RECYCLING
1505060200	WATER QUALITY, WASTEWATER TREATMENT TECHNOLOGY
1505070000	ENVIRONMENTAL ENGINEERING
1505070200	ENVIRONMENTAL ENGINEERING TECHNOLOGY
1506110200	METALLURGICAL TECHNOLOGY
1506120000	INDUSTRIAL SERVICES AND SUPPORT
1506130200	MANUFACTURING TECHNOLOGY
1507000000	QUALITY CONTROL
1507010200	OCCUPATIONAL SAFETY AND HEALTH TECHNOLOGY
1507020200	QUALITY CONTROL TECHNOLOGY

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CIP Number	Program Title
1511030000	HYDRAULICS AND FLUID POWER
2612010000	BIOTECH
2612010100	BIOTECHNICAN
2612010200	BIOTECHNOLOGY
4100000000	SCIENCE TECHNOLOGIES
4101010000	BIOLOGIST SUPPORT
4101010200	BIOLOGICAL LABORATORY TECHNOLOGY
4103010000	CHEMICAL AND BIOCHEMICAL SUPPORT
4103010200	CHEMICAL TECHNOLOGY
4507020200	CARTOGRAPHY TECHNOLOGY
4701050100	INDUSTRIAL ELECTRONICS TECHNICIAN
4701050200	INDUSTRIAL ELECTRONICS TECHNOLOGY
4801010100	DRAFTING TECHNICIAN
4802000000	GRAPHIC & PRINTING EQUIPMENT OPERATORS
4803000000	LEATHER AND UPHOLSTERY
4803030000	UPHOLSTERY
4805000000	PRECISION METAL WORKING
4805010000	MACHINIST
4805010100	MACHINE TOOL TECHNICIAN
4805010200	MACHINE TOOL TECHNOLOGY
4805011100	AUTOMOTIVE MACHINIST TECHNICIAN
4805030000	MACHINE SHOP ASSISTANT
4805060100	SHEET METAL TECHNICIAN
4805060200	PRECISION SHEET METAL TECHNOLOGY
4805070200	TOOL AND DIE TECHNOLOGY
4805072200	TOOL AND DIE DESIGN TECHNOLOGY
4805080100	WELDING TECHNICIAN
4805080200	WELDING TECHNOLOGY
4805090100	IRON WORKER TECHNICIAN
4805990000	PRECISION MACHINING
4807030000	CABINETMAKING AND MILLWORKING
4807030100	CABINETMAKING AND MILLWORKING TECHNICIAN
4807040000	PLASTIC MOLD DESIGN

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**A-2. Transportation/Distribution and Logistics**

CIP Number	Program Title
4703000000	HEAVY/INDUSTRIAL EQUIPMENT MAINTENANCE
4703020000	HEAVY EQUIPMENT MAINTENANCE
4703030000	INDUSTRIAL EQUIPMENT MAINTENANCE
4703030100	INDUSTRIAL EQUIPMENT MAINTENANCE TECHNICIAN
4703030200	INDUSTRIAL EQUIPMENT MAINTENANCE TECHNOLOGY
4706000000	VEHICLE MAINTENANCE AND REPAIR
4706030000	AUTOMOTIVE COLLISION
4706030100	AUTOMOTIVE COLLISION TECHNICIAN
4706030200	AUTOMOTIVE COLLISION TECHNOLOGY
4706031200	AUTOMOTIVE COLLISION TECHNOLOGY-GM-BSEP
4706040000	AUTOMOTIVE MECHANICS
4706040100	AUTOMOTIVE TECHNICIAN
4706040200	AUTOMOTIVE TECHNOLOGY
4706041200	AUTOMOTIVE TECHNOLOGY-ASEP
4706042200	AUTOMOTIVE TECHNOLOGY-ASSET
4706043200	AUTOMOTIVE TECHNOLOGY-CHRYSLER-CAP
4706044200	AUTOMOTIVE TECHNOLOGY-AC DELCO
4706050000	DIESEL MECHANICS
4706050100	DIESEL MECHANICS TECHNICIAN
4706050200	DIESEL MECHANICS TECHNOLOGY
4706051200	DIESEL EQUIPMENT TECHNOLOGY-CATERPILLAR
4706060000	SMALL ENGINE MECHANIC
4706080000	AIRCRAFT POWERPLANT MECHANIC
4706090200	AIRCRAFT TECHNOLOGY
4706110200	MOTORCYCLE TECHNOLOGY
4706160200	MARINE AND SMALL ENGINE TECHNOLOGY
4706170100	PARTS AND SALES TECHNICIAN
4799990000	MECHANICS RELATED
4901010000	AVIATION
4901010200	AVIATION TECHNOLOGY
4901020000	AVIATION/PILOT
4901020200	COMMERCIAL PILOT AND FLIGHT CREW TECHNOLOGY

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CIP Number	Program Title
4901040000	AVIATION OPERATIONS
4902000000	GROUND TRANSPORTATION
4902020000	CONSTRUCTION/EARTHMOVING/HEAVY EQUIPMENT
4902020200	CONSTRUCTION/EARTHMOVING/HEAVY EQUIP TECHNOLOGY
4902050000	TRUCK, BUS, AND COMMERCIAL VEHICLE OPERATION
4902051000	TRUCK AND COMMERCIAL VEHICLE OPERATION
4902990000	GROUNDS TRANSPORTATION
4902990200	RAILROAD TRANSPORTATION TECHNOLOGY
4999990000	TRANSPORTATION AND MATERIALS MOVING RELATED
5202030000	LOGISTICS AND MATERIALS OPERATIONS
5202030200	LOGISITICS AND MATERIALS MANAGEMENT

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**A-3. Architecture and Construction**

CIP Number	Program Title
1513010000	DRAFTING AND DESIGN PRODUCTION
1513011000	DRAFTING AND DESIGN ASSISTANT
1513030100	ARCHITECTURAL DRAFTING/CAD/CADD TECHNICIAN
1513030200	ARCHITECTURAL DRAFTING/CAD/CADD TECHNOLOGY
1513040100	CIVIL DRAFTING/CAD/CADD TECHNICIAN
1513040200	CIVIL DRAFTING/CAD/CADD TECHNOLOGY
1513060100	MECHANICAL DRAFTING/CAD/CADD TECHNICIAN
1513060200	MECHANICAL DRAFTING/CAD/CADD TECHNOLOGY
4600000000	CONSTRUCTION TRADES
4600000100	CONSTRUCTION TECHNICIAN
4600000200	CONSTRUCTION TECHNOLOGY
4600010100	COMMERCIAL CONSTRUCTION TECHNICIAN
4601010000	MASONRY
4601010100	MASONRY TECHNICIAN
4602010000	CARPENTRY
4602010100	CARPENTRY TECHNICIAN
4602010200	CARPENTRY TECHNOLOGY
4603010000	ELECTRICAL AND POWER TRANSMISSION
4603020100	ELECTRICAL TECHNICIAN
4603020200	ELECTRICAL TECHNOLOGY
4603030100	LINE WORKER TECHNICIAN
4603030200	LINE WORKER TECHNOLOGY
4604010000	PROPERTY/BUILDING MAINTENANCE
4604010100	PROPERTY/BUILDING MAINTENANCE TECHNICIAN
4604030000	BUILDING/CONSTRUCTION INSPECTION
4604040000	INSULATION/DRYWALL INSTALLATION
4604060000	GLAZIER
4604060100	GLAZIER TECHNICIAN
4604080000	PAINTING AND DECORATING
4604100000	ROOFER
4604110000	METAL BUILDING ASSEMBLY
4604140000	INSULATION INSTALLATION
4604990000	BUILDING/CONSTRU. FINISHING, MGT., AND INSPECTION

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CIP Number	Program Title
4605020000	PIPE AND SPRINKLER FITTER
4605030000	PLUMBING
4605030100	PLUMBING TECHNICIAN
4605031200	GAS UTILITY TECHNOLOGY
4699000000	CONSTRUCTION TRADES
4699990000	CONSTRUCTION RELATED
4701000000	ELECTRICAL/ELECTRONICS
4701010100	ELECTRICAL/ELECTRONICS EQUIPMENT TECHNICIAN
4702010100	HEATING/AC/VENTILATION/REFRIG. MAINTEN. TECHN.
4702010200	HEATING/AC/VENTILATION/REFRIG . MAINTEN. TECHNO.
4702011200	HTNG, AIR CONDIT, AND REFR TECHNOLOGY

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**A-4. Arts, Audiovisual Technology and Communications**


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CIP Number	Program Title
0901010000	COMMUNICATIONS STUDIES
0904010200	JOURNALISM TECHNOLOGY
0904020000	BROADCAST JOURNALISM
0904020200	BROADCAST JOURNALISM TECHNOLOGY
0904040200	PHOTOJOURNALISM TECHNOLOGY
0909020000	PUBLIC RELATIONS/IMAGE MANAGEMENT
1001010000	COMMUNICATION SUPPORT SERVS
1001050000	COMMUNICATIONS
1002020000	RADIO AND TELEVISION BROADCASTING
1002020200	RADIO AND TELEVISION BROADCASTING TECHNOLOGY
1003010000	GRAPHIC COMMUNICATIONS
1003010100	GRAPHIC COMMUNICATIONS TECHNICIAN
1003010200	GRAPHIC COMMUNICATIONS TECHNOLOGY
1003030000	PREPRESS/DESKTOP PUBLISHING/DIGITAL
1003030100	DESKTOP PUBLISHING & DIGITAL IMAGING DESIGN TECHNI
1003030200	DESKTOP PUBLISHING & DIGITAL IMAGING DESIGN TECHNO
1003040200	ANIMATION, INTERACTIVE, AND VIDEO GRAPHICS TECHNO
1003050000	GRAPHICS AND PRINTING EQUIPMENT OPERATION
1003070000	PRINTING PRESS OPERATION
4701030000	COMMUNICATIONS SYSTEMS
4701030200	COMMUNICATIONS SYSTEMS TECHNOLOGY
4704040200	MUSICAL INSTRUMENT FABRICATION & REPAIR TECHNOLOGY
4704041100	PIANO TUNER TECHNICIAN
4704041200	PIANO TECHNOLOGY
5001010000	VISUAL AND PERFORMING ARTS
5004020000	COMMERCIAL AND ADVERTISING ART
5004020200	COMMERCIAL AND ADVERTISING ART TECHNOLOGY
5004060000	COMMERCIAL PHOTOGRAPHY
5004060100	COMMERCIAL PHOTOGRAPHY TECHNICIAN
5004060200	COMMERCIAL PHOTOGRAPHY TECHNOLOGY
5004080200	INTERIOR DESIGN MANAGEMENT
5004090200	GRAPHIC DESIGN TECHNOLOGY
5009030200	MUSIC PERFORMANCE MANAGEMENT

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## APPENDIX B. HUMAN SUBJECTS APPROVAL

### IOWA STATE UNIVERSITY

**DATE:** 30 October 2008  
**TO:** Frankie Santos Laanan  
 N243 Lagomarcino  
**FROM:** Jan Canny, IRB Administrator  
 Office of Research Assurances

Institutional Review Board Office of  
 Research Assurances Vice Provost  
 for Research 1138 Pearson Hall  
 Ames, Iowa 50011-2207

515 294-4566 FAX  
 515 294-4267

**IRS ID: 05-519**

**Approval Date: 30 October 2008**

**Date for Continuing Review: 30 September 2009**

The Co-Chair of Institutional Review Board of Iowa State University has conducted the annual continuing review and approved the modification of the protocol entitles: "The Postsecondary Earnings of Vocational Students at Iowa Community Colleges." Your study has been approved for a period of one year. The continuing review date for this study is no later than **30 September 2009**.

Based on the information you provided in Section II of the documents submitted for continuing review, we have coded this study in our database as being permanently closed to the enrollment of new subjects, where all subjects have completed all research related activities and interaction with subjects you must submit a modification and receive IRB approval prior to contacting subjects.

Even though enrollment of subjects has ended, federal regulations require continuing review of ongoing projects. Please submit the form with significant time (i.e. **three to four weeks**) for the IRB to review and approved continuation of the study, prior to the continuing review date.

Failure to complete and submit the continuing review form will result in expiration of IRB approval on the continuing review date and the file will be administratively closed. As a courtesy to you, we will send a reminder of the approaching review prior to this date.

Any **changes in the protocol or consent form** should not be implemented without prior IRB review and approval, using the "Continuing Review and/or Modification" form. These documents are located on the Office of Research Assurances website or available by calling (515) 294-4566, [www.compliance.iastate.edu](http://www.compliance.iastate.edu).

You must promptly report any of the following to the IRB: (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and 2) **any other unanticipated problems involving risks** to subjects or others.

Upon completion of the project, please submit a Project Closure Form to the Office of Research Assurances, 1138 Pearson Hall, to officially close the project.

ORA 06-07

### APPENDIX C. STUDENT VARIABLES

Student Variables	Description	Coding
Gender: male	Gender of students	1 = Female 2 = Male
Age: nontraditional	Age is 25 and older or less than 25 as of June 30, 2002	1 = Traditional Age 2 = Nontraditional Age
Race/ethnicity: white	Race/ethnicity is white or non-white	1 = Non-White 2 = White
Economic Status: Non-Pell	Received a Pell grant within fiscal year 2002 or all other students	1 = Pell Recipient 2 = Non-Pell Recipient
Leavers	Left the community college without receiving an award	1 = Leavers 2 = All Other Students
Certificate	Received a Certificate award within fiscal year 2002 or all other students	1 = No Certificate 2 = Certificate Award
Diploma	Received a Diploma award within fiscal year 2002 or all other students	1 = No Diploma 2 = Diploma Award
2 year Associate Degree	Received an Associate award within fiscal year 2002 or all other students	1 = No Associate 2 = Associate Award
Median annual earnings 2003	Wages from fiscal year 2003 (July 1, 2002 to June 30, 2003)	Descriptive analyses - Continuous Variable
Median annual earnings 2004	Wages from fiscal year 2004 (July 1, 2003 to June 30, 2004)	Descriptive analyses - Continuous Variable
Median annual earnings 2005	Wages from fiscal year 2005 (July 1, 2004 to June 30, 2005)	Descriptive analyses - Continuous Variable
Median annual earnings 2006	Wages from fiscal year 2006 (July 1, 2005 to June 30, 2006)	Descriptive analyses - Continuous Variable
Median annual earnings 2007	Wages from fiscal year 2007 (July 1, 2006 to June 30, 2007).	Descriptive analyses - Continuous Variable: Regression analyses - the natural log of this variable is used.

Student Variables	Description	Coding
Program major	Programs were categorized by the Iowa Department of Education. Manufacturing and STEM were combined	2 = Architecture and Construction 3 = Arts, A/V tech & Communication 13 = Manufacturing & STEM 16 = Transportation/Dist. & Logistics
1st yr. gain in median earnings	Annual earnings for fiscal year 2004 minus 2003 earnings (adjusted to 2007 dollars); divided by the 2003 adjusted earnings; multiplied by 100	Descriptive analyses – Continuous Variable
2nd yr. gain in median earnings	Annual earnings for fiscal year 2005 minus 2004 earnings (adjusted to 2007 dollars); divided by the 2004 adjusted earnings; multiplied by 100	Descriptive analyses – Continuous Variable
3rd yr. gain in median earnings	Annual earnings for fiscal year 2006 minus 2005 earnings (adjusted to 2007 dollars); divided by the 2005 adjusted earnings; multiplied by 100	Descriptive analyses – Continuous Variable
4th yr. gain in median earnings	Annual earnings for fiscal year 2007 minus 2006 earnings (adjusted to 2007 dollars); divided by the 2006 adjusted earnings; multiplied by 100	Descriptive analyses – Continuous Variable
Percent Change 2003 – 2007	Annual earnings for fiscal year 2007 minus 2003 earnings (adjusted to 2007 dollars); divided by the 2003 adjusted wages; multiplied by 100	Continuous variable –measured as a percent with either negative or positive values
5th Year Annual Earnings	Wages from fiscal year 2007 (July 1, 2006 to June 30, 2007).	Descriptive analyses – Continuous Variable: Regression analyses - the natural log of this variable is used.

## APPENDIX D. BACKGROUND CHARACTERISTICS BY AWARD

### D-1. Manufacturing; Science, Technology, Engineering and Math (STEM)

Demographics ( <i>N</i> =1,647)	Leavers		Certificate		Diploma		AAS Award	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
<i>Age (n=1610)</i>								
Traditional age	576	62.2	*	*	100	10.8	247	26.7
Nontraditional age	487	71.2	*	*	52	7.6	134	19.6
<i>Gender (n=1639)</i>								
Male	944	65.2	*	*	140	9.7	353	24.4
Female	146	76.0	*	*	13	6.8	29	15.1
<i>Race/Ethnicity(n=1556)</i>								
White	969	64.8	*	*	*	*	*	*
Non-White	54	90.0	*	*	*	*	*	*
<i>Socio-Economic Status(n=1647)</i>								
Pell recipient	289	62.6	*	*	53	11.5	118	25.5
Non-Pell recipient	809	68.3	*	*	100	8.4	264	22.3

\* *n*<10

**D-2. Transportation/Distribution and Logistics**

Demographics ( <i>N</i> =1,147)	Leavers		Certificate		Diploma		AAS Award	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
<i>Age (=1118)</i>								
Traditional age	497	63.6	*	*	79	10.1	197	25.2
Nontraditional age	240	71.4	47	14.0	*	*	44	13.1
<i>Gender(n=1136)</i>								
Male	717	66.1	50	4.6	*	*	234	21.6
Female	37	72.5	*	*	*	*	*	*
<i>Race/Ethnicity(n=1072)</i>								
White	658	65.8	38	3.8	77	7.7	227	22.7
Non-White	52	72.2	10	13.9	*	*	*	*
<i>Socio-Economic Status(n=1147)</i>								
Pell recipient	213	66.4	*	*	34	10.6	68	21.2
Non-Pell recipient	552	66.8	50	6.1	51	6.2	173	20.9

\* *n*<10

**D-3. Architecture and Construction**

Demographics ( <i>N</i> =718)	Leavers		Certificate		Diploma		AAS Award	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
<i>Age</i> ( <i>n</i> =707)								
Traditional age	283	54.2	*	*	148	28.4	89	17.0
Nontraditional age	110	59.5	*	*	42	22.7	31	16.8
<i>Gender</i> ( <i>n</i> =714)								
Male	383	56.6	*	*	182	26.9	108	16.0
Female	17	45.9	*	*	*	*	12	32.4
<i>Race/Ethnicity</i> ( <i>n</i> =678)								
White	348	54.0	*	*	*	*	110	17.1
Non-White	28	78.8	*	*	*	*	*	*
<i>Socio-Economic Status</i>								
Pell recipient	100	50.0	*	*	62	31.0	36	18.0
Non-Pell recipient	304	58.7	*	*	128	24.7	84	16.2

\* *n*<10

**D-4. Arts, Audiovisual Technology and Communications**

Demographics (N=445)	Leavers		Certificate		Diploma		AAS Award	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
<i>Age</i>								
Traditional age	244	72.2	*	*	*	*	93	27.5
Nontraditional age	80	79.2	*	*	*	*	21	20.8
<i>Gender</i>								
Male	171	77.7	*	*	*	*	48	21.8
Female	158	70.2	*	*	*	*	67	29.8
<i>Race/Ethnicity</i>								
White	282	71.8	*	*	*	*	*	*
Non-White	23	88.8	*	*	*	*	*	*
<i>Socio-Economic Status</i>								
Pell recipient	92	80.7	*	*	*	*	22	19.3
Non-Pell recipient	237	71.6	*	*	*	*	93	28.1

\*  $n < 10$

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