IMPLEMENTATION OF THE CARL D. PERKINS CAREER-TECHNICAL EDUCATION REFORMS OF THE 1990s: POSTSECONDARY EDUCATION OUTCOMES OF STUDENTS TAKING AN ENHANCED VOCATIONAL CURRICULUM

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

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ABSTRACT

Federal vocational education policy has changed little since its inception in 1917. During the 1990s, vocational education reforms mirrored state academic standards reforms and vocational education began to adopt college as an outcome of its programs. Using data from the 1997 National Longitudinal Survey of Youth, I studied the extent to which students combining a vocational education concentration with an academic concentration (CTE+) matriculated to college and attained postsecondary education.

Taking a CTE+ curriculum is a positive and significant predictor of college attainment. I found these students and academic/general students more likely to matriculate to college and earn a college degree than those who majored in a vocational concentration alone.

The results of this study suggest that states and local districts implemented the Tech Prep reforms of the 1998 Perkins legislation and that CTE+ students experienced higher college matriculation and degree completion rates than students in the academic/general track. This study additionally found that while more than 60 percent of vocational concentrators matriculated to
college, fewer than 15 percent completed an associate or bachelors degree during the study period.

The study found stratification among high school programs by family income, parent education level, gender and high school grades. CTE+ students came from the most highly educated and wealthy parents of the three programs, while vocational students came from families with the lowest education levels and least wealth. CTE+ students reported the highest grades, while vocational students reported the lowest grades of the three high school programs. Males were more highly concentrated in the vocational track than in other high school programs.

Implications of the study include new research models for determining postsecondary education success to include new variables such as credit-based agreements, college entrance test scores, types of vocational programs, and ratio of academic to vocational course-taking. Implications for practice suggest that the Perkins reforms of the 1990s have resulted in better college outcomes for students taking an enhanced vocational program; therefore practitioners must require all vocational students to take rigorous academic courses in addition to vocational courses. Finally, future research should be conducted to determine why so many vocational students never complete a college degree.
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FIELDS OF STUDY

Major Field: Education

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Career Technical Education
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Research Methods and Statistics
Education Reform Studies
Kathleen McGraw, Ph.D.
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Dedicated to my family
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CHAPTER 1
INTRODUCTION

For nearly 100 years, the expectations of vocational education\(^1\) policy in
the U.S. have changed very little. Historically, preparing students for entry-level
work has been the mission of vocational education programs. However, recent
policy initiatives such as the Carl D. Perkins Vocational Technical Education Act
of 1998 and its 2006 re-authorization have added an additional challenge to
states and schools: preparing all vocational students for work and postsecondary
education.

The 1998 re-authorization of the Perkins legislation represented a major
policy shift aimed at changing the role of vocational education in America.
Among the major changes of the legislation, states were now accountable for an
additional accountability requirement: preparing all vocational education
completers for postsecondary education. The prior Perkins Act of 1990 required
that states only be accountable for reporting work placements. The insertion of
postsecondary education into vocational education reform represents a

\(^1\) The use of the terms *vocational education* and *career-technical education* are used interchangeably in
this study. The term *vocational education* dominates the research literature; however, the 2006 re-
authorization of the Carl D. Perkins Career and Technical Education Improvement Act adopts the
terminology, *career and technical education.*
significant shift in state vocational education policy and in local implementation of vocational education programs.

This study examines the relationships between participation in the three primary high school programs of study and student outcomes related to postsecondary education. Secondary workforce development and its federal funding and policies are critical issues facing the United States. Several factors place pressure on the American education system to make significant changes. These factors include major changes in the skill requirements of the U.S. workforce, the challenges of globalization and competition among employers, and the wide availability of postsecondary education in the United States.

Employers suffer from shortages of workers with academic and technical skills (Friedman, 2000). American employers resort to the exportation of high-skill jobs to offshore marketplaces or to the importation of skilled international workers to meet their workforce needs (Friedman, 2005). The shortages are particularly pronounced in engineering, information technology and health-care. Given looming retirements of the Baby Boom generation, skilled worker shortages are predicted to pose a threat to employers’ ability to compete in the global marketplace (National Association of Manufacturers, 2005).

Employers blame public schools for failing to turn out graduates prepared for the realities of the workplace (National Association of Manufacturers, 2005); yet many states have high school exit exams to safeguard against “social promotion” and “social graduations.” While states have attempted to address
skills shortages by enacting tougher academic standards and high-stakes testing, student course selections reflect acknowledgement of the emphasis on academic skills. Students’ course-taking patterns over the past 20 years reflect a lower percentage of vocational courses and higher percentage of academic courses (Silverberg, 2004). When A Nation at Risk was released in 1983, 14 percent of vocational students took the recommended academic core to prepare them for college; in 1992, 41 percent took the core (Bishop, 2004). Clearly, policy changes have influenced student course taking patterns.

Although many states have enacted legislation and policy designed to create K-16 education systems linking K-12 and higher education (Bailey and Karp, 2003; Wallace, 1993), little evidence exists that schools and employers work together to address the workforce preparation issues. Critics argue that the American “system” of workforce development is fraught with duplication, overlaps, and gaps in the provision of services (Grubb, 2001). This poorly articulated workforce development system suffers a lack of cohesiveness and focus and results in shortages of skilled workers.

Although the workforce development system is in need of coordination, the United States enjoys the most extensive and accessible system of higher education in the world (OECD, 2006). Higher education is a leading American product, with more than 1.3 million international students attending American colleges and universities at the baccalaureate level. Choosing from a diverse array of institutions, American students have access to an impressive selection of
postsecondary educational opportunities and options; yet curiously, a small percentage of American high school graduates actually complete a college degree (NCES, 2006).

According to the National Center for Education Statistics (2002), 50 percent of participants in baccalaureate degree programs fail to finish the degree within five years and 40 percent never complete a degree. While there are many factors related to degree non-completion, students’ readiness for college-level coursework is one factor that has received increased attention in the research. Historically, vocational students have not been granted access to college preparatory level coursework (Silverberg, 2004), nor has vocational education policy encouraged rigorous academic course taking. The extent to which vocational programs prepare students for college is largely unknown.

While U.S. employers struggle to maintain a competitive workforce, there is no systematic attempt to bring together public education, higher education and employers to address this issue which threatens America’s future economic power (Friedman, 2005). The transition from school to college to the workforce is a critical feature of preparation for the new labor market (Ryan, 1999). And the way in which vocational students make this critical transition depends in part upon school structure and the way in which high schools have adopted new policy reforms aimed at raising expectations for career and technical education students.
This study is primarily interested in a significant piece of federal education policy aimed at high schools, the Carl D. Perkins Vocational-Technical Education Act of 1998. The Perkins Act directs more federal funding to high school programming than almost any other federal education policy. This study aims to isolate the effects of the policy’s intended program of study, referred to in this dissertation as career tech+. The study will compare the postsecondary education outcomes of students who completed vocational education concentrations combined with rigorous academic courses, known as career-tech+, with those who followed only a vocational concentration or students in a academic/general concentration.

Although federal vocational education legislation changed little from 1917 to 1984, it changed dramatically with the Carl D. Perkins Vocational and Technical Education Act of 1984. Federal legislation spanning nearly the past 100 years maintained the similar goal of providing youth and adults with the requisite technical skills within agriculture, business, home economics, mechanical and trade and industrial education to fulfill dual purposes: to help the working class maintain a standard of living to support a family and to fulfill the workforce needs of the changing American economy. Although recent federal vocational education legislation maintains this goal, the role of vocational education has expanded to include a focus on preparing students for both work and college, apparently in response to the changing demands of the workplace.
The most recent iteration of federal vocational education policy is the newly-authorized Carl D. Perkins Career and Technical Education Improvement Act of 2006. The predecessor to this legislation, the Carl D. Perkins Vocational Technical Education act of 1998 emphasized college matriculation for vocational concentrators as a key outcome. This type of outcome is absent in previous vocational education policy, but is emphasized in the 2006 legislation. College as an acceptable outcome of vocational education was first introduced through the Perkins legislation of 1990 when Tech Prep was funded through articulation agreements between schools and community colleges (Steinberg, 1998; Silverberg et al., 2004). The re-authorizations of the Perkins law reflect a philosophical shift toward making Tech Prep the model for all CTE programs.

This study will examine differences between three high school programs of study and the impact nationally of changing academic expectations with postsecondary education outcomes. Theoretically, vocational education programs should have begun adopting higher standards and increased expectations for vocational students in response to major education reforms of the 1980s and 1990s beginning with A Nation at Risk in 1983. However, we know that the call for higher standards was not broadly heeded in the early-mid 1990s because the National Assessment of Vocational Education (NAVE) presents us with evidence that suggests students in vocational programs were not participating in the same rigorous academic courses as their academic/general peers (Silverberg et al., 2004).
Career and technical education research is limited, but some research exists regarding employment and education outcomes of CTE completers. CTE completers have higher short and medium-term earnings than academic/general concentrators (Bishop and Mane, 2004; Kemple, 2004; Silverberg et. al., 2004). Increased wages could be attributed to an initial “cooling off” period for students who did not pursue a career major in high school or it could be explained by a smoother initial transition to the workforce for vocational students. In addition, certain vocational education programs may be associated with a decreased high school drop-out rate (Kemple, 2004) as well as increased high school attendance (Bishop and Mane, 2004), making CTE participation a successful human capital investment for many students. The NAVE (2004) reflects important differences between CTE participants and their academic/general peers. Students who concentrate in vocational studies are more likely to be identified with special needs and are less likely to have taken the recommended core college-preparatory curriculum; however, studies show that participation in vocational education does not result in a decreased likelihood of attending college (Silverberg et. al., 2004). In fact, many vocational students participating in Tech Prep programs experience college success in higher rates than students taking a vocational or college prep curriculum in high school (Silverberg et. al., 2004).

Career academies and Tech Prep programs are related to better postsecondary matriculation rates for their program completers. Because these programs are designed to connect school to college through college experiences
and through articulation agreements, it is reasonable to expect that career academy and Tech Prep students would have better college matriculation rates than their vocational counterparts not enrolled in these programs.

Federal vocational education legislation of the 1990s directed states to adopt rigorous academic standards for vocational programs in conjunction with continued emphasis on technical courses. The extent to which states have adopted policies mirroring the intent of Perkins III remains unknown. Additionally, the extent to which local CTE policy and practice reflect rigorous academic preparation is unknown.

**Problem Statement**

Students participating in vocational education, defined by the U.S. Department of Education as “concentrators” do not transition into college at the same rate as their academic/general counterparts. The primary reason for their low transition rate has been vocational education’s historical focus on preparing students for entry-level careers. Historically, students in vocational education programs did not have access to rigorous academic courses and often were limited by intensive time blocks allotted to occupational classes. In addition to lack of access to college preparatory coursework, other factors which may limit career-technical students’ transition to college include family background, poor advice from guidance counselors (Rosenbaum, 2001), and lower expectations expressed by their own teachers (Rosenbaum, 2001; Silverberg et. al., 2004).
Some career-technical students have made a smooth transition to college in rates similar to those of academic/general students and have taken remedial courses at similar rates (Silverberg et. al., 2004). Further, these students have experienced better outcomes in terms of higher college retention rates.

Because of the evolution of career and technical education, it is possible that many career-focused, college preparatory students such as Tech Prep and career academy completers may have stronger connections to college through articulation agreements; they may have access to a college advising system that is more advanced than in many high schools; and because of their high school experiences with occupational education, their career maturity may be higher than most freshman college students. Theoretically, greater career maturity leads to better retention and engagement in college study. By combining college preparatory curricula with career-focused education, students concentrating in these types of programs experience better college success than academic/general or vocational students (Silverberg, et. al., 2004).

Purpose of Study
This study will examine the relationship between career-focused, college preparatory education and American students' transition to college. The purpose is to determine if combining a high school concentration in vocational education with a rigorous college-preparatory academic core (career tech +) will increase students' likelihood of college matriculation and degree completion.
Research Questions

The larger research question deals with a comparative inquiry of three school programs of study in terms of impact upon initial transition to and attainment of college. Specific research questions follow.

1. How did the high school program type impact the initial transition to college?
2. How did high school program type impact completion of an associate degree?
3. How did high school program type impact completion of a baccalaureate degree?
4. How did high school program type impact completion of any type of degree?

Definition of Terms

Academic Specialist/College Preparatory curriculum - 4.0 or more credits in English; 3.0 or more credits in mathematics at the algebra 1 or higher level; 2.0 or more credits in biology, chemistry, or physics; 2.0 or more credits in social studies, with at least 1.0 credit in U.S. or world history; and 2.0 or more credits in a single foreign language (see Levesque et al. 2000). In 2000, nearly 30 percent of vocational concentrators also took a college prep curriculum, while 46 percent of non-concentrators took it. Note: although state requirements for graduation increasingly reflect higher standards, at the time of the 1999 transcript study, the above standards defined a college preparatory curriculum.

Articulation agreement - Section 202(a)(3) of Perkins III states that an articulation agreement means a written commitment to a program designed to provide students with a nonduplicative sequence of progressive achievement leading to degrees or certificates in a tech-prep education program.

Career Academy - Career Academies are organized as small learning communities, combine academic and technical curricula around a career theme, and establish partnerships with local employers to provide work-based learning opportunities (Kemple, 2004).

Career-tech + (CTE+) - A high school program of study that combines a vocational concentration with academic specialization. Students participating in CTE + earned at least 3 credits in a SMLP vocational area with two credits being at a 2nd level or higher classification. In additional to vocational concentration,
CTE+ students earned 4 English credits, 3 in math at Algebra 1 or higher, 2 biology, chemistry or physics, 2 social studies, 1 US or world history, and 2 foreign language credits.

**College Prep Curriculum** - 4.0 or more credits in English; 3.0 or more credits in mathematics at the algebra 1 or higher level; 2.0 or more credits in biology, chemistry, or physics; 2.0 or more credits in social studies, with at least 1.0 credit in U.S. or world history; and 2.0 or more credits in a single foreign language (see Levesque et al. 2000). In 2000, nearly 30 percent of vocational concentrators also took a college prep curriculum, while 46 percent of non-concentrators took it. While this definition of college preparatory curriculum may not match the standards of 2007, it would have been the definition of college prep from the late 1990s through the mid-2000s.

**Core Curriculum** – four years of English and three years of math, science and social studies (NAVE 2004). In 2000, 50 percent of vocational concentrators took this curriculum (Levesque, 2003) and 60 percent of non-concentrators took it.

**Matriculation** — to enroll in a college, university or other postsecondary education program.

**Academic/general concentration** – Students who did not earn the requisite numbers of vocational credits to be included in either the vocational concentration of CTE+ designations. These students include academic concentrators and those who did not qualify for an academic or vocational concentration.

**Vocational concentrator**- students who earned at least three vocational credits in a SMLP vocational area with two credits being at a 2nd level or higher classification. Vocational concentrators did not complete the academic courses to designate them as academic specialists/college preparatory students.

**Tech Prep** - Section 202(a)(3) of Perkins III states that a “tech-prep program” means a program of study that:

- combines at a minimum 2 years of secondary education (as determined under State law) with a minimum of 2 years of postsecondary education in a nonduplicative, sequential course of study;
- integrates academic, and vocational and technical, instruction, and utilize work-based and worksite learning where appropriate and available;
- provides technical preparation in a career field such as engineering technology, applied science, a mechanical, industrial, or practical art or trade, agriculture, health occupations, business, or applied economics;
builds student competence in mathematics, science, reading, writing, communications, economics, and workplace skills through applied, contextual academics, and integrated instruction, in a coherent sequence of courses;
leads to an associate or a baccalaureate degree or a postsecondary certificate in a specific career field; and
leads to placement in appropriate employment or to further education.

Work-based learning - a planned program of work experience linked to school.(Stasz 1998). Examples of work-based learning include job shadowing, internship, apprenticeship, school-based enterprise and service learning.

Limitations
The limitations of this study are described as follows:

1. Generalizations from the results of this study are limited to the population of students enrolled in high school in the United States from the period of 1996-2006. The results of this study cannot be generalized to students attending high school today, although policy implications may be drawn from an analysis of the results.

2. The results of the study are limited by the instruments used and the data collected from respondents. The study includes respondent and parent interviews and surveys as well as analysis of 1999 high school transcripts.

Significance
This study has significance for practitioners and policy makers as it illuminates the issue of high school curriculum and the appropriate emphasis on academic and/or technical competence. For more than a century, policy makers have debated about the role of secondary vocational education. In the 1990s
and 2000s, the debate intensified as states embarked on standards and high stakes testing initiatives.

Today, fundamental questions persist about the role of vocational skills within secondary education. By studying the relationship between course-taking patterns of strictly academic, strictly vocational and combined academic and vocational curricula on postsecondary education outcomes, perhaps some indication about the ideal ratio of academic and vocational coursework will emerge.

The results of this study will help practitioners as they develop course offerings and make decisions about the structure of students’ experiences in high school. Additionally, the study will inform policy decisions relating to funding and emphasizing vocational education at the secondary level.
CHAPTER 2
REVIEW OF THE LITERATURE

The introduction of vocational education in the curriculum of American schools is responsible for some of the most fundamental changes in education of the last 100 years (Grubb & Lazerson, 1974). Since the early 1900s, vocational education has been implemented as a separate curriculum track from academic education. First, this “practical” curriculum was an attractive option for wide numbers of working class and immigrant students who did not want to follow the conventional academic curriculum, resulting in unprecedented participation in secondary schooling; second, the vocational movement brought school into closer proximity to the economy (Grubb & Lazerson, 1974; Kincheloe, 1999). Dissatisfied with the liberal arts curriculum many viewed as disconnected from reality, vocational education offered a practical option and forced dialog about the role of schools, whom they should serve and what should be taught. The advent of vocational education brought the introduction of practical and manual courses that appealed to students and provided a career focus for schooling that was once viewed solely as a privilege for the wealthy. Third, vocational education is viewed as a curriculum track that decreases high school drop-outs because of its practical and engaging nature. Vocational education was viewed as practical because it placed teaching into the context of work and because it appealed to
interests of students who were believed to be unmotivated by non-practical subjects such as history, mathematics and literature.

Some question vocational education’s contributions to democratizing and transforming the workplace (Kantor, 1982), saying that the introduction of vocationalism did little more than shift the focus from problems that were rooted in the structure of the labor market to policies aimed at socializing workers for their future roles in industry (Kincheloe, 1999). During the early stages of adoption, nearly every group with interests in education supported the vocational education movement. Groups as diverse as the National Education Association and the National Association of Manufacturers supported this new education system that promised to deliver class mobility, socialization of workers, increased graduation rates and reductions in labor turnover and youth unemployment. These were the promises of vocational education that today, remain largely unfilled.

Though vocational education boasts many positive accomplishments, it has been misused as a tool of social reproduction to maintain second class citizenship for minorities after the Civil War (Grubb and Lazerson, 1974; Kincheloe, 1999). Others argue that it has been systematically used to limit class mobility (Grubb and Lazerson, 1974; Oakes, 1985), to weaken the power of labor unions, and to further reinforce social stratification. Although most scholars agree that vocational education has been the most significant force in restructuring
American education, there continues to be widespread disagreement about its role and purposes as they have shifted over time.

Since the passage of the first federal vocational education legislation, the Smith Hughes Act in 1917, the perception of vocational education as a curriculum track that narrowly prepares students for work, limits curricular and career options, and targets poor and minority students has remained largely unchanged, despite significant shifts in policy and practice. Vocational education policy remained largely unchanged from 1917 through the 1970’s and maintained a narrow goal of preparing students for entry-level careers that did not require academic or postsecondary preparation. During this time, national evaluations of vocational education reported that the movement failed to meet its primary goal of workforce preparation and that it further served to block students from academic, postsecondary and career success with its narrow curriculum scope. For nearly a century, this perception of vocational education persisted, although the perception has not kept pace with major changes in policy implementation since the 1980s.

From late 1980’s to the 2000’s, vocational education policy began to shift rapidly from narrow job preparation to broader preparation emphasizing academic and postsecondary studies. While formerly, only a small percentage of vocational students matriculated to college, now more than half of all vocational students go on to postsecondary education (Silverberg et. al, 2004). Globalization, technology advances, increasing academic and technical skill
requirements of jobs, and retirements of the huge Baby Boom generation will require an increasing percentage of all students to complete postsecondary education (Kirst & Venezia, 2004). CTE students will continue to increase their postsecondary education attainment in response to these factors, as well as in response to implementation of CTE policy aimed at increasing college-going. This study will examine the relationship between high school career-technical education and postsecondary success, using a national longitudinal data set representative of the U.S. population.

To examine the relationship between high school CTE and postsecondary education outcomes from a public policy perspective, it is necessary to examine the context in which the study occurs from historical, political, economic and sociological perspectives. This chapter reviews the research literature and concepts associated with policy changes in vocational education including an analysis of shifts in federal vocational education policy over the past century, a discussion of the role of vocational education as a key education reform movement, discussion of economic theory as a basis for vocational education, and an examination of requirements for employment success in the 21st century. This chapter also presents a conceptual framework for the research questions.

_Education Policy_

Education policy is the field in which this dissertation was constructed. This section will define education policy and policy implementation and will discuss criticisms of the policy process. This section will further describe the
U.S. education system and the role of CTE within the larger system of education and workforce development and will review some of the major research studies of large-scale, federally-funded education reform programs.

There has been tremendous expansion in the arena of education policy research and education program evaluation (Kirst, 2000). Since the 1950s and 1960s, particularly as the programs associated with the War on Poverty grew, the field of education policy research became more important to policymakers (Kennedy, 1999; Cooper, et. al., 2004). As education policy began addressing critical issues in society, so grew the need to evaluate the effectiveness of these interventions. During the Reagan administration, business leaders began advancing the idea that schools were in crisis (Fowler, 2000) and it was during this time that the education crisis literature became plentiful and expansive (Cizek and Ramaswamy, 1999). In 1983, *A Nation at Risk* exposed serious problems within American schools, and during the period following that report, between 1983-1987, virtually every state adopted reform measures (Hawley, 1998; McCarthy, 1990). During the latter half of the 20th Century, other factors began contributing to the rise of policy studies as a field.

Early federal education policy interventions aimed to increase equality and address social justice issues; as the century progressed, an ideological shift from social justice to accountability, excellence and choice characterized federal education policies (Fowler, 2000). After the end of the Cold War, a shift from social justice to national competitiveness dominated education policy as America
competed globally for high-tech jobs and competitive advantage (Rotte, 2006). International studies comparing academic achievement of students such as TIMMS, PISA, and PIRIS create the perception of crisis in the American education system, which contributes to policy interventions aimed at improving outcomes. This study aims to examine how federal CTE policy has impacted student outcomes.

The term policy derives from political science; however, a review of policy literature reveals the political aspect of education policy is value-laden with four key value systems underpinning policy generation and policy implementation: education, economic, social and institutional. Kogan (1975) describes education policy as statements of values that take into account the nature of power. Bell and Stevenson (2006) emphasize the political nature of education policy stating, “It is about the power to determine what is done, who benefits, for what purpose and who pays.” Formal schooling in the U.S. is controlled by the government and by definition, this makes education political. Fowler(2000) defines policy as “the dynamic and value-laden process through which a political system handles a public problem. It includes government’s expressed intentions and official enactments as well and its consistent patterns of activity and inactivity.” Education policy, therefore, includes federal, state and local legislative, administrative and other interventions, including court decisions, in the operation of educational institutions. Although the following section describes the policy development process, this study will not examine development of CTE policy.
This dissertation will study the implementation of CTE policy as it has changed over the past 25 years.

Fowler (2000) describes the policy process as a six-step process that includes issue definition, agenda setting, policy formation, policy adoption, implementation and evaluation. Scholars have widely criticized the policy process for lacking attention to research and evaluation (Marshall, et. al., 1985; Greenberg, et. al., 2000; Bennell, 1996; Weiss, 1998; McDonnell & Ream, 1999; Kirst, 2000; Ryan, 2003). The reasons for this phenomenon are numerous but include factors such as decreased funding for education policy research and political motivations of policymakers. Decreased research and development funding from the 1960s to the 1990s has likely impacted the creation and dissemination of policy research (Guthrie, 1990) by fragmenting agendas. Additionally, with decreased funding, a critical mass of research cannot evolve to fully inform policymakers.

Politics also plays a role in the decreased emphasis on research in policymaking. In many states, legislators get their information primarily from lobbyists promoting special interests rather than from the research community (McCarthy, 1990). McDonnell and Ream (1999) describe information itself as political. They assert that legislators often rely on issue networks that support their own positions; this can cause legislators to ignore research that contradicts their philosophical positions. Weiss (1988 and 1999) stresses that it takes more than one presentation or report for research to impact policy. She describes
policy creep as the process by which research merges with policymakers’ advocacy position and becomes part of a policy argument. Still, others assert that social scientists and policymakers live in separate universes and this results in a lack of communication between the two (McDonnell, 1988; Weiss, 1999). Research is only one source of information used by policymakers to make decisions.

This section defines policy implementation and examines evaluations of implementation of several large-scale federal policy innovations. Policy implementation is defined by Cooper et al. (2004) as “what happens when policy is or is not carried out.” They further assert that policymakers assume after a law passes, things change. The following section will synthesize some of the issues researchers have found regarding implementation and the conditions under which it has been successful and unsuccessful.

Early studies of policy implementation found conflict between policymakers and policy implementers (Odden, 1991). Recent studies, however, indicate that policy implementation, for the most part, aligns with policy goals, but that it is highly sensitive to local and institutional values. A seminal study of policy implementation, the Rand Change Agent Study (Berman & McLaughlin, 1974) was a five-year study of several major federal interventions including the Elementary and Secondary Education ACT (ESEA) and the 1968 Vocational Education Act. The Rand study concluded that effective policy implementation is more affected by local factors that federal guidelines or project methods. The
authors further found that local implementation is generally consistent with the intent of the policy and that the more ambitious the policy, the more likely teachers were to change. Additionally, support of district leadership was essential to successful implementation. Probably the most repeated finding is related to local values. The authors and others (Gross et. al, 1971; Mirel, 1994) find that local values dominate implementation and that policies cannot mandate what matters. Berman and McLaughlin concluded that resources did not predict the outcome, but this finding is contradicted by Gross et. al.(1971) who found resources to be a barrier to local implementation.

In a study of a sweeping local-level reform project in Bensenville, Illinois, Mirel (1994) observed similar findings about the relationship between culture and policy implementation. In this failed reform project, the author concluded the more sweeping the reform, the more political it is likely to become, a factor that affects outcomes more than resources, knowledge, or leadership.

In reviewing implementation research on Title I of the ESEA, Odden (1991) found a lack of capacity at all levels to support implementation. Weick (1976) found that the work of teachers and administrators is largely unchecked, which contributes to problems in implementation. Odden additionally found that in early stages of implementation, conflict exists, but is worked out over time, leading to a conclusion that policy implementation should not be studied until at least a decade after implementation. Now that policy and implementation have been defined and a review of large-scale federal policy results have been
discussed, it is important to place CTE within the context of federal and state education policy.

Education policy in the U.S. primarily takes place at the state and local levels and educational programming is implemented locally. U.S. education systems are state systems (Fowler, 2000), leaving control and policy implementation to the states. The federal investment in education represents only about six percent of local education budgets with the remaining funds coming from state and local sources (Wong, 1999). The Elementary and Secondary Education Acts (ESEA) of 1965 represents the most pervasive federal intervention in education. In 2001, the ESEA was renamed the No Child Left Behind Act. The NCLB legislation represents a significant federal education policy shift in its emphasis on increased accountability for States, school districts, and schools, greater choice for parents and students, particularly those attending low-performing schools, more flexibility for States and local educational agencies in the use of Federal education dollars, and a stronger emphasis on reading.

The NCLB legislation and recent re-authorizations of federal vocational education policy reflect a shift toward emphasizing student outcomes, school accountability and student academic preparation during high school. A later section describes CTE policy alignment with the accountability requirements of NCLB.
Career and Technical Education

This dissertation will discuss the inception of vocational education as a separate curriculum track and the significant impact it has had on the American education system. It is necessary to first define vocational, or what is now called career-technical education. The Carl D. Perkins Career and Technical Education Improvement Act of 2006 includes in its definition of career and technical education, “organized education activities that offer a sequence of courses leading to employment or postsecondary study, or technical skill certificates or industry credentials.” The definition also requires “rigorous academic courses.”

A review of the literature reveals other definitions of CTE.

Vocational education is a collective term in high schools to identify curriculum programs designed to prepare students to acquire an education and job skills, enabling them to enter employment immediately upon high school graduation. As mirrored in the larger, complicated society and its public education system, vocational education in the United States is diverse, large, and complex. (Lynch, 2000).

Grey and Herr (1997) describe high school vocational education as a “system of occupational education, operated largely separate from the regular high school program.”
Levesque (2000) describes vocational/technical education as encompassing three curricula: *occupational education*, which includes courses that teach skills and knowledge required in a particular occupation or set of related occupations, *general labor market preparation*, courses that teach general employment skills not specific to one occupational area, such as typewriting/keyboarding, introductory technology education, and career preparation and general work experience courses and *family and consumer sciences education*, courses intended to prepare students for roles outside the paid labor market. While the term vocational education may encompass different types of curricula, this study focuses exclusively on occupational education, in which a student takes a sequence of courses leading to a career pathway.

Career and technical education programs operate outside the framework of traditional education programming by providing a separate funding stream, along with separate goals and accountability for career-technical educational programs. CTE policy at the state and federal levels establishes a separate vocational education system from academic education, a concept that will be discussed in a later section of this chapter. Recent policy efforts since 1998 have sought to bridge the gap between academic and workplace education, but historically, the American education system has been characterized as a dual system of academic and vocational (Grubb and Lazerson, 1974) in which the two are separated in American high schools.
After defining CTE and describing the way in which it operates as a separate curriculum track outside academic programs, it is important to review the historical context of CTE and ways in which it has changed over the past 100 years. The following section discusses the inception of CTE and its role as a proposed solution to American problems and social ills.

In 1890, fewer than five percent of Americans finished high school. Today, nearly three-fourths graduate with a high school diploma (Kantor, 1982). Prior to the universal schooling movement at the start of the 20th Century, one system of education existed to serve the elite and wealthy, providing children with a traditional academic preparation in the nation’s public schools. Several forces came together in the late-1800s and early 1900s that pointed to a need for universal schooling signaling the “rise of vocationalism” (Grubb and Lazerson, 1974). These forces included the country’s economic shift from agriculture to industry, migration from rural locale to cities, an influx of immigrants and the need to socialize them to American work values, and demand for a relevant public school system.

The 1917 Smith-Hughes Act provided the basis for what would become America’s dual education system. During this time, schools were responding to universal demand for schooling from immigrants, the working class and the poor. Vocational education and differentiated programs of study were introduced to provide a “meaningful” education to all students being served by public schools. The dual education system has persisted in the United States from 1917 to the
present, where CTE co-exists with academic education. CTE remains separated from academic and general education because it is funded and administered through a separate system.

Career and technical education is funded and administered separately from academic/general education at the federal and state levels. Although the federal government provides $1.3 billion in CTE funding annually to states, CTE is administered locally in school districts. Federal CTE legislation allows economic development, workforce development and education agencies to administer CTE programming, most delegate responsibility to state departments of education (NASDCTE, 2006).

The implementation of CTE is varied. Career and technical education programming begins around 8th grade but primarily occurs in high school. In many states, separate high schools exist for vocational education programming. Although most CTE is found in comprehensive high school settings. States traditionally defined components of CTE differently, such as which students are reported as CTE “concentrators” or which students are “Tech Prep” students, making it difficult to compare outcomes across states. This has been corrected in the Carl D. Perkins Career and Technical Education Improvement Act of 2006 through common definitions.

Federal CTE policy changed very little from the Smith Hughes Act of 1917 to the Carl D. Perkins Vocational Technical Education Act of 1984. During this time period, vocational education policy maintained its focus on preparation of
entry-level workers with virtually no emphasis on academic skill preparation. The following sections will examine perspectives on vocationalization of education, beginning with those of the early supporters of the vocational education movement to current criticisms of CTE as it exists today. What is striking is that the today’s debates about the role of workplace and skill education in schooling mirror those of the late 1800s. Although many economic, social and technological changes have taken place, the fundamental questions persist about the role of schools and how they should interact with the workplace.

Vocational education began as a way to address societal problems through education reform. At the turn of the 20th Century, American schools faced the challenges of an increased demand for services from children of the poor, working class and immigrants. During this time, only the wealthy and elite were graduating from high school and these new demands created stress for schools to serve students from different backgrounds. Schools were criticized for being too disconnected from everyday life (Grubb and Lazerson, 1974) and from the workplace. Early advocates of vocational education hoped it would solve a variety of social ills including the integration of immigrants into the labor force, lowering worker turnover, alleviating labor conflict and social alienation, and increasing occupational opportunities for poor and working class youth (Kantor & Tyack, 1982). Later evaluations of vocational education show its failure to solve problems that were rooted in economic and social structures, not in the nature of schooling.
A review of historical literature reveals diverse philosophies contributed to the birth of vocational education. Support for vocational education came from groups such as social reformers like Jane Addams and John Dewey, prominent manufacturers and elite educators. Their reasons for supporting vocational education differed greatly, ranging from democratization of work to weakening labor unions. Social reformers hoped vocational education would empower workers, thus eliminating abuses in the workplace. Manufacturers hoped to use it as a tool for gaining a compliant pool of labor, thus weakening union control over entry into the trades. After great debate, what resulted was a philosophical compromise which maintained its purpose for nearly 70 years.

It is difficult to determine when or where exactly the vocational education movement began. Historians argue that the roots of vocational education are found in the late-1800s when a variety of social and economic problems suggested a reform of American schools as the solution. Growing participation from immigrants and the poor in education, industrialization, labor conflict, the fragmentation of skilled work, and unemployment and labor turnover contributed to support for the vocational education movement from a variety of groups.

Each supporter of vocationalism had its agenda and these were varied. Social reformers argued vocational education would help restore meaning to work that had been fragmented by industrialization. The National Education Association argued that it would be a way to transform industry and promote industrial democracy (Kantor, 1982). MIT President John D. Runkle and
Washington University Dean Calvin Woodward supported it as a practical way to teach engineering and as a way to create a class of skilled technicians who would have a chance at upward mobility. They believed hand training would lead to individual and social reform. These views contrasted sharply with the disciples of Frederick Taylor’s industrial approaches to educational sorting and tracking of students such as the Massachusetts Commissioner of Education, David Snedden and Charles Prosser, secretary of the National Society for Promotion of Industrial Education, who viewed vocational education as a means to test and sort potential workers according to ability.

Educational “Taylorists” such as Snedden and Prosser supported vocational education as a way to provide a differentiated course of study, accomplished through testing students for aptitudes and talents and sorting them into differentiated programs of study. Their views appealed to reformers who worried about drop-out rates and believed this approach would be more meaningful to a majority of students in American Schools (Prosser, 1913; Kantor, 1982). The National Association of Manufacturers also supported Snedden and Prosser’s positions because of the benefit to manufacturers, although they had a different agenda.

A turning point in the history of vocational education came in 1912 when the state of Illinois debated the creation of a separate system of academic and vocational education after the sixth grade. Although widely supported by business and industry, it was soundly defeated by business. Although Charles
Prosser argued in favor of this system which was based on the German education model, John Dewey argued that a divided system would further stratify society and would reinforce class differences. Although segregation at the middle school level failed, the ideas of student differentiation and selection for the workplace remained strong; Dewey’s arguments about the social stratification function of schools would persist throughout the 21st Century. In his influential 1913 essay, *An Undemocratic Proposal*, arguing against two separated education systems, he implored the Illinois legislature not to separate vocational and academic education,

*Its wrong treatment will surely accentuate all undemocratic tendencies in our current situation, by fostering and strengthening class divisions, in school and out. It is better to suffer a while longer from the ills from our present lack of system till the truly democratic lines of advance become apparent, rather than separate industrial education sharply from general education, and thereby use it to mark off to the interests of employers a separate class of laborers.*

*Current Perspectives on Vocationalism*

It has been 90 years since the historical passage of the Smith Hughes act, creating a system of vocational education. Grubb and Lazerson (2004) assert that vocationalism has transformed the conception of schooling to one of getting
All students better jobs and that the promise and demise of American high schools are rooted in vocationalism. Vocational education is more than a separate curriculum track; it is a force that transformed American schools by increasing access to public education, increasing attendance and graduation rates and connecting schools to the realities of the workplace. Its victories include claims of greater access to education, increased productivity and social mobility for workers, and a relevant educational experience, while its failures include accusations of social reproduction, class structure preservation, and oppression.

Scholars argue that vocational education historically served and continues to serve as a tool for hegemony and social stratification of the poor and working class. Some argue that the underlying function of vocational education is to segregate poor and minority students into occupational training in order to preserve the academic curriculum for the middle and upper classes (Oakes, 1985) as well as to encourage working class children not to drop out of high school. Other scholars assert a different set of purposes underlies vocational education: a tool of domination to quell social unrest and to indoctrinate the poor with industrial values (Kincheloe, 1999). Grubb and Lazerson (1982) describe the growth of the American high school after 1900 and the resulting increased access which created vocational education as a mechanism of segregation for working class students.
While its fundamental purpose continues to be scrutinized, vocational education continues to operate as a curriculum track that separates students according to occupational interest (Rosenbaum, 1976). Studies of tracking reach mixed conclusions about effects on student outcomes; however, recent studies of vocational tracking (Rosenbaum, 1980, Rosenbaum, 1996, Wirt, et.al., 1989) conclude that the sociology criticisms of tracking should not be applied to vocational education because students select vocational courses and because research shows wage and employment benefits to students in vocational tracks without negative effects typically observed.

Although vocational education is separate from the academic/general curriculum track, the 1989 National Assessment of Vocational Education (Wirt. et. al., 1989) and the subsequent 2000 NAVE (Silverberg et. al., 2000) found that student participation in vocational education in high school is widespread and a striking number of college-bound students take vocational coursework. In 1989, college bound students took 3.1 vocational credits, compared to 6.4 taken by vocational concentrators. Vocational classes account for four out of an average 26 taken by American students. Rosenbaum (1996) reviewed studies of vocational education in the 1950s and 1960s that found negative effects of participation in vocational education on college attendance; however, this trend appears to have changed by the 1980s. Although students in 1980 in a college prep track were much more likely to obtain a four-year degree than vocational students (37.4 percent compared to 3.4 percent), the largest increase in the rate
of college attendance over the past 20 years has been among vocational students. The college-going rate of vocational completers increased from 37.4 percent in 1980 to 54 percent in 1992, still lagging behind students in the college preparatory track, but greatly improved over the course of 12 years. The 2004 NAVE (Silverberg et. al.) reports that while college participation is increasing for vocational concentrators, it lags behind that of their academic/general peers. Interestingly, those who pursue both a vocational concentration and college preparatory academic concentration, about 13 percent of students, may have better outcomes than those who pursue one or the other. This increase in college matriculation has occurred during the expansion of community colleges and greater access to college as well as at a time when education policy emphasizes increased academic skill attainment for vocational students.

From the passage of the 1917 Smith-Hughes Act through the 1960s and 1970s, vocational education maintained its course, emphasizing specific, narrow skills preparation, to the detriment of academic skills preparation. In the Taylorist tradition, vocational education had at its roots, a student sorting and tracking function. This focus on sorting was criticized by educational philosophers such as John Dewey for failing to recognize the intellectual and social meaning of vocation. The vocational education establishment largely ignored such criticisms until the 1980s when reforms aimed at broader occupational skill development began to take place. While American schools were under intense scrutiny in the 1980s and 1990s, vocational policy did not lead or respond to many of the
reforms that were taking place such as increased graduation requirements, teacher preparation initiatives and the standards movement.

While vocational education policy and practice stayed true to its original mission throughout most of the 20th Century, it is unclear why vocational education policy and local programming did not respond to the academic reform movement of the 1980s and 1990s that begin in 1983 with *A Nation at Risk*, until the 1998 re-authorization of the Perkins legislation. Many scholars argue that vocational education policy and practice did not place value on academic skills (Oakes, 1985, Kincheloe, 1999).

The Carl D. Perkins Vocational Technical Education Act of 1984 signaled a major shift in the philosophy of career and technical education. First, the role of academic courses in vocational education was emphasized as the policy called for applied academics taught within the context of vocational programs. The rigor and content of academics were not specified; only that academics would be taught as they applied to the students’ occupational pathway. During the decades leading up to this Act, states were requiring few academic credits for graduation and only those who were on the college-prep track would take four years of math, science, English and foreign language so they could enter postsecondary education.

The Perkins Act of 1984 signaled the beginning of a federal vocational policy emphasis on academic skills and college as an appropriate outcome for vocational completers. Later re-authorizations of the Perkins legislation are
evidence of changing vocational education policy that would emphasize not only preparation for work but also for higher education. The 1998 re-authorization of the Perkins legislation reflected the dual emphasis of college preparatory academics for CTE students and also the reporting of college matriculation as an outcome of CTE programs. The 2006 authorization of the Perkins legislation, The Carl D. Perkins Career and Technical Education Improvement Act of 2006, further reinforces the emphasis on academic skills combined with technical skills.
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<tr>
<td><strong>Integration of academic and vocational studies</strong></td>
<td>Strengthen academic and vocational skills through integration</td>
<td>Strengthen academic and vocational skills through integration and Required states to focus on rigorous academic courses (many viewed as college prep) and Required states to develop challenging academic and vocational standards</td>
<td>Academic achievement based on NCLB and Technical assessments through industrial standards and credentials</td>
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<tr>
<td><strong>Accountability</strong></td>
<td>Required states to develop performance standards and measures</td>
<td>Required states to measure performance indicators and demonstrate how improvement would be attempted</td>
<td>Mirroring NCLB, states not meeting performance standards face loss of funding; improvement plans and takeover by state</td>
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<td><strong>Post-program work expectations</strong></td>
<td>Required programs to have exit occupation</td>
<td>Required programs to provide students with &quot;all aspects of industry&quot; instead of preparation for specific occupation</td>
<td>Emphasized preparation for non-traditional fields and high-skill, high-wage occupations</td>
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<td><strong>Post-program education expectations</strong></td>
<td>Added postsecondary education as a required performance indicator giving it equal emphasis to work placement</td>
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<td>Eliminated baccalaureate restrictions on pathways and Activities facilitating transition from 2-year to 4-year college</td>
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Table 1.1 Continued

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<th>Tech Prep</th>
<th>Introduced Tech Prep as an alternative to vocational education; emphasized articulation agreements with community and technical colleges</th>
<th>Separate Tech Prep funding title; emphasized articulation agreements with community/technical colleges and baccalaureate institutions</th>
<th>Separate Tech Prep funding title; emphasized outcomes and performance and Programs of study linking secondary and postsecondary must be in place and New accountability for consortia</th>
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<td>Special populations</td>
<td>Emphasized access for special populations though set-aside funding</td>
<td>Eliminated set-aside, but required states to track performance indicators for special populations</td>
<td>Continue to track performance indicators for special populations and prepare them for occupations leading to self-sufficiency</td>
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<td>Career Development</td>
<td>Encouraged parent involvement in career preparation decisions; emphasized guidance and support for such initiatives</td>
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<td>Funding</td>
<td>Allowed states to use 25% of allocation for state-level activities</td>
<td>Allowed states a maximum 15% of allocation for state-level activities</td>
<td>Allowed state 5% of allocation for state-level activities</td>
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Table 1.1 shows differences between the 1990, 1998 and 2006 Perkins legislation. Over time, emphasis on academic skills and college matriculation has increased through the legislation. The 2006 legislation continues to emphasize “all aspects of industry,” putting to rest the historical debate about the role of CTE in workforce preparation. Additionally, the definition of CTE has expanded to include careers beyond the sub-baccalaureate level, which more closely resembles Dewey’s vision for vocational education. Accountability requirements for postsecondary providers as well as Tech Prep programs require extensive longitudinal data reporting and emphasize the reduction of remedial coursework, retention and persistence.

Since 1990, federal CTE policy has emphasized academic preparation for postsecondary education; it is troubling that recent studies show many states continuing to offer a lower-class diploma for vocational students, requiring them to take fewer and different academic credits than the college bound (SREB, 2005). In this study of the sixteen SREB states, researchers found nearly half of the states having as many as four paths to high school graduation, some paths with lower academic rigor, which is inconsistent with federal vocational policy aimed at increasing academic attainment of vocational students. The evidence of dual diplomas represents significant tension between high school completion and achieving standards.
Career-Focused Federal Policy Interventions

During the 1990s, the School-to-Work Opportunities Act of 1994 was implemented, supporting the principles of vocational education and infusing more than $1.5 billion to U.S. schools to support career preparation activities. The philosophy of STW is similar to vocational education policy in that they promote learning grounded within the context or work. STW was different in that it proposed all students have a career-focused education. An analysis of STW research is included because its similarities lend themselves to a study of vocational education.

In The STWOA was promoted to address a “chaotic” youth labor market characterized by high unemployment, job instability and periods of unemployment (Stern et. al, 1995, Neumark and Rothstein, 2003). Studies of School-to-Work implementation have not yielded consistent results about the link between such interventions and college matriculation (Stern, et. al, 1995). A study of high school participation in STW programs by Neumark and Rothstein (2003) found two STW interventions, mentoring and school-based enterprise, to be associated with a significantly higher likelihood of college matriculation. Co-op and apprenticeships programs were also associated with a positive, significant likelihood of college attendance, but a stronger relationship to employment. Surprisingly, tech prep programs were associated with a significantly lower likelihood of college attendance. Using longitudinal data,
Visher et. al. (2004) found that students who participated in STW programs are more likely to enroll in postsecondary education than those who did not participate.

A national evaluation of STW programs conducted by Mathematica Policy Research (Silverberg et. al, 1998), relying on surveys of local school districts, found many schools emphasizing low-intensity STW interventions such as mentoring. This evaluation additionally conducted a survey of 2700 high school students, finding only about 12 percent perceive their high school program of study as related to future career goals. Clearly, the implementation efforts of vocational education and state and local attempts at STW systems have met with mixed success.

Similar to STW research, career academy research may translate to appropriate CTE practice. A recent study of career academies by the Manpower Demonstration Research Corporation (Kemple and Snipes, 2000; Kemple, 2001) uses an experimental study, random assignment method. The most recent results from this evaluation consider students one year after the completion of high school, and find no impact on high school graduation rates, post-secondary education, or employment.

State Policy Responses to Vocational Education Reform
The state role in CTE policy implementation is important to note because the state acts as the intermediary between the federal office of CTE, its large expenditures on CTE, and local school districts. Once legislation is passed in Congress and signed into law, states develop implementation plans for approval by the US Department of Education. After the state plans have been approved, the parties negotiate performance expectations and progress toward them is tracked annually. The US Department of Education provides technical assistance and policy clarification to states, who in turn administer CTE policy that is followed by local school districts and other education entities.

A review of the literature reveals a lack of recent study about state responses to recent career-technical reform policy. Since 1983, states have adopted policies to ensure academic credit increases, partly in response to reports such as *A Nation at Risk*. In addition to increasing credits required for high school graduation, 18 states also require a high-stakes high school exit exam and 45 states hold schools accountable for improving test scores (Amrein & Berliner, 2002). However, states’ responses from a vocational education reform perspective are unclear.

Two years after the 1998 Perkins Act was signed into law, Stasz and Bodilly (2004) conducted a policy implementation case study of Perkins III reforms for the NAVE advisory committee. The study found that states directed funding to Perkins III reforms, primarily emphasizing academic standards and performance. Additionally, states embraced a broader vision of CTE, but faced
challenges to achieving this vision including negative perceptions of CTE as a college-prep program and the separation of CTE from regular education. The study further found federal resources to be small compared to state resources, resulting in weak impetus for implementing Perkins-related reforms compared to state reforms.

Few studies have been completed regarding state vocational education reforms and therefore, other sources may inform our view of this issue. A consortium of state CTE directors has published reports pertaining to state implementation efforts of Perkins III of 1998. According to the National Association for Directors of Career and Technical Education consortium (NADCTEc) website, most state CTE directors are either part of or are leading high school reforms in their states. Additionally, career clusters are seen as an instrumental piece of Perkins III reforms in the sense that they improve the quality of CTE by making programs broader and covering “all aspects of industry.” Career clusters are a way to organize instruction and to provide a K-12 continuum of K-4 career awareness, 4-8 career exploration and 9-12 specialization. Career clusters provide the infrastructure for seamless transitions at all levels of education. Additionally, they provide a career guidance tool.

Many states report they have adopted a career cluster framework either in a legislative, policy, or visioning process. Nearly 2/3 of states adopted career
clusters in their state plans; six have passed career cluster legislation; and 17 have adopted career clusters as a state policy.

In an accountability study of six states, Hawley and Montrichard (2006) found that while states experienced difficulty measuring academic/technical integration, all six states required CTE students to pass high school exit exams. They further found differences in states' accountability systems for secondary/postsecondary linkages, industry credentials and technical skill attainment. They also noted problems with data systems and data quality.

These few studies indicate further research is necessary to determine how states and localities have adopted Perkins III reforms and what outcomes have resulted from the reforms. This dissertation will contribute to the body of literature as it compares postsecondary education outcomes that may be related to structural changes of CTE high school programs.

**Economic Theory and Return on Investment for Education**

Adam Smith formulated the first theoretical element of the economics of education when he discussed the relationship between training and productivity in his *Wealth of Nations*, published in 1776. This idea remained dormant for nearly two centuries (Psacharopoulos, 2002). During the latter half of the 20th Century, the relationship between wages and education became one of the most frequently studied and robust economic topics (Chatterji et. al., 2003).
Education policy relies on economic theory to guide the identification of priorities and to evaluate effectiveness, also known as return on investment, to education interventions. Two prevalent economic theories, the human capital model and signaling or screening theory, frame this discussion. The study of economics lacks any conclusive evidence supporting one theory over another and empirical studies show mixed results supporting both explanations for the relationship between education and earnings. This section will define both theories and will cite relevant research supporting each explanation.

Workers with higher levels of education and greater work experience tend to have higher wages and earnings. For some time, the explanation was that time spent in school and on the job increased productivity (Weiss, 1998). This view is associated with human capital theory. Human capital theory is defined by Becker (1962) as activities that influence future real income through the embedding of resources in people. Central to human capital theory is the premise that education directly impacts earnings by altering individuals’ characteristics, thus increasing productivity (Solados, 1999; Chitterji, 2003). Empirical studies of the relationship between wages and education have produced inconsistencies in the human capital model, giving rise to signaling theory, a model that may better explain the behavior of firms in the hiring process.

Signaling or screening theory is an extension of the human capital model. Its central assumption is that an individual’s level of education serves as a signal
to firms, which make inferences about an employee’s productivity based on unobserved characteristics (Weiss, 1995; Soldatos, 1999; Chatterji et. al., 2003). While human capital theory assumes education directly impacts wages through increased productivity, signaling theory posits an indirect effect on wages because firms make assumptions about other desirable worker characteristics, using educational attainment. In other words, a worker’s education attainment signals to employers abilities and characteristics the worker may possess that another worker with less education may not possess. Signaling theory explains irregularities not explained by other rate of return models such as why returns on education often exceed cognitive skills developed in school or even the marginal returns to courses taken in high school. It is widely hypothesized that employers use educational attainment to signal unobservable characteristics or those which would be impossible to assess or quantify at the time of hiring. Signaling theory suggests that elementary or basic education tends to be associated with gains in numeracy and literacy; additional years of education tend to be associated with the development of other productivity enhancing characteristics such as dependability and persistence. Chatterji et. al. (2003) and Weiss (1995) hypothesize that ability differences may be correlated with length of schooling because more educated persons: receive greater benefits from a given amount of schooling; value future earnings more highly than those with lower educational attainment, and enjoy learning more (Altonji, 1995). These characteristics may be unobserved by employers, but they are valuable to them because they enhance
the return to on-the-job training within the firm and they reduce the likelihood of a worker quitting or being absent (Chatterji et al., 2003; Weiss, 1995).

It is less critical to choose between human capital theory and signaling as a framework for analyzing returns to education interventions than it is to understand them as potential explanations of this relationship. Clearly, empirical research suggests a positive correlation between formal education and earnings. The next section will present several research studies that support both a human capital and a signaling explanation for the relationship between education and earnings.

*Rate of Return for CTE and Academic Interventions*

Studies document the positive relationship between education and wages. On the surface, this relationship suggests a productivity-enhancing function of schooling. However, research suggests that only certain types of education investments yield a higher rate of return to the individual. These include baccalaureate degree attainment, associate degree attainment, and completion of a high school occupational concentration. Academic courses have surprisingly little relationship, and in some cases, a negative relationship to earnings and wages (Antonji, 1995; Mane, 1999). From a policy perspective, this information is critical because it is used to shape educational priorities. Before reviewing results of human capital and signaling studies, it may be helpful to describe how rate of return to education investments is determined.
The generally accepted rate of return estimate for education interventions is the Mincerian Earnings Equation, after Jacob Mincer. This simple equation has wages as its dependent variable and uses as independent variables schooling, race, gender, experience and other variables deemed relevant by the researcher. The Mincerian equation does not use a human capital or signaling model to explain this relationship.

\[ Wages = \text{education} \times \text{race} \times \text{gender} \times \text{other relevant variables}. \]

This dissertation relies on key studies of human capital and signaling explanations to illuminate the relationship between high school CTE and earnings. Additionally, international research on vocational education rate of return (ROR) are discussed and contrasted with results from the United States.

Internationally, vocational education is viewed as a panacea for many problems including youth unemployment, instilling technical knowledge, serving academically less-able students, creating mid-level technicians, reducing poverty in cities and as a tool to cope with economic globalization (Psacharopolous, 1997). Ryan (2003) says that the arguments for vocational education span all countries. Although in many countries, ROR research on CTE is consistently unfavorable as a tool for increasing wages or productivity, this pattern may not hold true for the United States.
From economic and pedagogical perspectives, the international policy literature is not favorable toward CTE as an education intervention. The main arguments against CTE are higher costs for delivery (Psacharopolous, 1987, 1997, Johanson, 2002, Psacharopolous & Patrinos, 2002, Lauglo, 2004) and in many counties, lower returns. Psacharopolous (1987) found on average, vocational education is 34 percent more costly than academic education. In 2002, he reported a continuation of this trend. Often the costs do not result in corresponding benefits and in many countries, the earnings advantage is for academics rather than vocational courses. He remarks on the illogical support of CTE given poor return rates,

*The appeal of vocational education is so strong that in the U.S., in spite of its failures, it keeps being resurrected from its ashes.*

The pedagogical arguments against vocational education are based on social reproduction qualities and on lower achievement for CTE students. Ryan (2003) noted significantly lower literacy rates for 15 year-olds in countries with early vocationalization (prior to upper secondary school). Lauglo (2004) criticizes vocational education pedagogy for its “excessive emphasis on memorization and working to instructions rather than problem-solving.” Additionally, he asserts that disadvantaged students gravitate to vocational education, reinforcing social reproduction functions of vocational education as a curriculum track.

Although criticisms of vocational education appear in the international literature, some studies have shown positive labor market effects associated with
CTE. Ryan (2003) found that countries with extensive vocationalism experienced greater youth access to skilled work and lower youth unemployment. In an Italian CTE study, Cappellari (2004) found technical schools to have higher quality school-to-work transitions.

The international policy literature is full of cautions directed toward CTE interventions (Psacharopolous, 1987; Bennell, 1996; Psacharopolous, 1997; Yang, 1998; Johanson, 2002; Psacharopolous & Patrinos, 2002; Ryan, 2003; Lauglo, 2004) primarily based on economic considerations and to some extent, pedagogical criticisms. The World Bank has been the principal proponent of the “vocational school fallacy” arguments (McGrath & King, 1997) and this view has changed the emphasis placed on vocational education in major loan projects to developing countries (Bennell, 1996; Johanson, 2002). These arguments do not appear to hold true for recent U.S. CTE, or at least for CTE from the 1980’s through present. The next section will focus on CTE policy studies in the U.S. from an economic perspective.

International findings in favor of academic courses over CTE, are opposite in the United States. High school academic courses do not appear to have a positive relationship to earnings (Antonji, 1995, Mane, 1999). Using longitudinal data, Antonji (1995) concluded that most high school academic courses have little or no relationship to earnings after high school, with the exception of math, which had a positive correlation and some elective courses which had negative correlations. Additional years of math produced a rather large coefficient, raising
wages nearly two percent, which is substantial considering one year of postsecondary education was associated with a seven percent increase in wages (Antonji, 1995). Additionally, he found that additional academic courses yield a small return that is less than the value of one year of high school education, supporting a signaling explanation for the education/earnings relationship. He found a weak relationship between high school curriculum and wage growth rates and found that courses in art, commercial arts and industrial arts are associated had a negative relationship to earnings. He hypothesized that high school courses are related to wages in the regard that there is return on investment to postsecondary education and the probability of completing college when a strong academic background is present. This relationship between high school course of study and college success is the center of this dissertation.

Gray et. al. (1995) also found high school curriculum related to success in postsecondary education noting that nearly one-half of “under prepared” college prep students taking remedial courses in college, compared to only four percent of those who were academically prepared for college. And the particular ratio between academic and CTE courses may have an effect on the type of college students attend. This will also be explored in this study. Before exploring the relationship between CTE and type of college attended, it is important to review research on the relationship between CTE and earnings, which is well-documented.
The U.S. labor market changed significantly from the period prior to the 1980s to the 90s and 2000s. Early studies of return on investment to vocational education show small relationships, but this began to change in the 1980s (Bishop & Mane, 2004) with higher rates of return for vocational studies. This change is attributed to technological innovation in the workplace and the rise in skill requirements of American jobs. Using NLS79 data from males in the 1979-91 interviews, Light (1999) found a human capital advantage for men who participated in high school CTE, resulting in higher wages, one to nine years after graduation, than the wages of those who did not. Not only is this earnings advantage materialized in the early years after high school graduation, but Mane’s (1999) study shows CTE concentrators with higher short and medium-term earnings that remained high 12-22 years after graduation. Given the small relationship between academic coursework and earnings, Antonji (1994) found that substituting four trade courses for a mix of academic courses raised wages five to ten percent.

While evidence points to a positive relationship between high school CTE and increased wages, another dimension of this study is the relationship of postsecondary education to wages. A handful of studies suggest that education interventions beyond high school are subject to variation among baccalaureate and sub-baccalaureate labor markets, perhaps suggesting a signaling explanation for wage differentials. Using longitudinal study data, Grubb (1993) attempted to disentangle the effects of different types of postsecondary
education and differences among completers and non-completers. He found that for both men and women, there is a substantial earnings advantage for baccalaureate degree attainment. For men, there was a return on investment for associate degrees, but not for vocational certificates. For women, vocational certificates and associate degree attainment were related to higher wages. For both genders, non-completion of credentials may signal negative characteristics to employers.

In Grubb’s study, non-completers did not earn significantly more than high school graduates and one explanation is that non-completion signals negative characteristics to employers. Similarly, Frazis et. al., (2002) found major differences between rate of return for the 15th year of education vs. baccalaureate degree completion, supporting the notion that baccalaureate and sub-baccalaureate labor markets function very differently. This difference in variation of wages may be explained by the skills required by jobs in both markets, the heterogeneous nature of jobs in the sub-baccalaureate market (Grubb, 1993), and the exaggeration of job requirements by employers (Chatterji et. al., 2003; Frazis, et. al., 2002). In the sub-baccalaureate labor market, the human capital benefits are to firms, not individuals (Grubb, 1993).
Human Capital Benefits of Academic Coursework

It is important to view human capital investment outcomes not only as wages immediately following graduation or program completion, but also for their later effects on postsecondary education success. The following section reviews the literature associated with college success.

While attendance and grades are important predictors of postsecondary success (Rosenbaum, 2001), Lee et. al. (1997) found that progress in a math sequence is a stronger predictor of achievement than academic status at the beginning of high school and student social background. A 1997 study using data from the High School and Beyond study concluded that a constrained math curriculum, which offers only college preparatory mathematics and no math electives, has positive effects on high school achievement in mathematics and that math achievement can mediate the effects of economic status on college success. Virtually all students in Catholic schools, regardless of race, social class, aspirations or academic preparation, follow close to the same academic offerings, most of which are required. Why, then, are CTE and general track students permitted to participate in lower-level mathematics courses? The answer may lie in the guidance system and the role social class plays in counseling. And guidance counseling may directly impact what type of human capital interventions students may access.

Lee, et. al. (1997) found that counselors generally allow poor and minority students to take lower level math courses and minority status makes a difference
in math course taking. Only 17 percent of students who reach pre-calculus or calculus are black or Hispanic; nearly 42 percent of those in low-level math courses are minorities. Asian students fare much better than minorities and whites. In addition to the influence of guidance counselors and parents on student course-taking patterns, Unseem (1991) found a disturbing pattern regarding school policies regarding placement into math courses. His study revealed what he described as an “agenda” to restrict the access of poor and minority students to higher-level academic courses.

Parental involvement efforts to participate in course selection patterns are conditioned by organizational features and policies of particular school systems. The degree to which parental involvement in ability track placement varies significantly from one school system to the next. Some school districts rely heavily on test scores for placement into an ability track; others encourage students to push themselves in course selections (Useem, 1991).

Useem (1991) also found that a relationship between course-taking and social class. Social class differences in math course assignments are magnified by restrictive school policies. Generally, low SES parents and those who do not have high levels of education themselves are in a poor position to advocate for higher ability track placement for their children. Higher SES parents, and those who are better educated, routinely impact the decisions made by schools to assign an ability track.
Lee and Ekstrom (1987) found that students in the three academic tracks (academic/college prep, general and vocational) have unequal access to assistance from guidance counselors. Although 21 percent of vocational students reported assistance, 19 percent of general education students reported access. This is in contrast to the 28 percent reported by students in the college prep track.

High school grades are the key indicator of student success in postsecondary education. A national transcript study of more than 12,000 high school graduates reveals that in 1982, 71 percent of high school seniors planned to get a college degree. Among all high school seniors with plans to get a degree, 37 percent had attained that goal within ten years of high school graduation. Students with low high school grades had lower chances of degree attainment. Only 13.9 percent of students with low grades attained a degree. Although students have high expectations of future success, their grades, test scores and homework indicate that their expectations are unrealistic (Rosenbaum, 2001).
The Importance of College in the 21st Century

Labor market economists have noted for the past 30 years a shift in the American economy away from unskilled manufacturing jobs to service and technology jobs. At the same time, social and economic forces such as trade agreements, globalization, productivity enhancements and technology advances have further helped shrink America’s high-wage, unskilled workforce (Friedman, 2005). In the “new” economy, low-wage service industry jobs experience growth; at the same time, however, new high-wage, high-skill jobs are being created in the American economy. They differ, however from the high-wage jobs of the decades leading to the 1970s in that they require academic and technical skills; many require education beyond high school such as an associate degree or bachelors degree. According to the U.S. Bureau of Labor Statistics (2005), the proportion of the U.S. population with some college more than doubled between 1970 and 2005 and the gap between the unemployment rates of those without a high school diploma and those who have completed college is wider today than it was in 1970. Further, the BLS predicts a greater proportion of high-wage jobs requiring some college or an associate degree. Nearly ninety percent of the fastest-growing jobs in the new knowledge-driven economy will require some postsecondary education (Hecker, 2002).

In addition to increased skill demands on the global workplace, American employer associations exert pressure on policy makers to address skills
shortages through policy interventions in the education system. Notably, two recent studies, the 2005 Skills Gap Report from the National Association of Manufacturers and the 2004 National Commission on Writing illuminate serious workplace competency issues facing American employers including basic academic deficiencies of employees.

The results of these projects are discussed because they represent the intersection of employer concerns for a competitive workforce advantage and the pressures American schools face to increase students’ academic achievement and employability skills. The National Association of Manufacturers 2001 members’ survey asked employers about the most serious skill deficiencies of current hourly production employees. Nearly 30 percent cited poor reading and writing skills as a concern; and 26 percent cited math deficiencies. Sponsored by the national business roundtable, an association of chief executive officers of major corporations, the National Commission on Writing surveyed 120 major U.S. employers which found writing as a “threshold skill” in American workplaces with more than 70 percent of employees having writing as a skill in their job descriptions. Nearly one-third reported their employees do not have the requisite writing skills. Employers have clearly said that in order to gain a competitive advantage, it will not be low wages, but rather, high skilled employees that give them such an advantage. From this perspective, career-technical education is not only a human capital intervention benefiting individuals, but an economic development strategy.
Although demand for highly skilled workers is at an all-time high level, scholars argue that unless changes occur in postsecondary education attainment, millions of high-skill jobs will go unfilled. Economist Anthony Carnevale estimates that by 2020, U.S. employers will need about 14 million more workers with some college education than American institutions are likely to produce, given current enrollment patterns (Kazis, 2004). Others posit the answer lies in an appeal to populations traditionally under-served by higher education. Vander Ark (2004) warns that unless changes can occur in educational opportunities for poor and minority youth, the U.S. faces significant challenges to dramatically increase the number of Americans who graduate high school and go on to earn postsecondary credentials. This issue will become more pronounced when the baby boom generation exits the workforce, leaving a void of college-educated workers.

**Conceptual Framework**

This study models the relationship between high school program of study and the range of postsecondary education outcomes including the initial transition to college, and completion of an associate or baccalaureate degree. This study incorporates information about student background characteristics, high school academic achievement and high school curriculum. A graphic model of the study follows below.
Figure 2.1 Conceptual Framework
CHAPTER 3
METHODOLOGY

This chapter describes the methodology used to answer the research questions. The first section describes the sampling and instruments used; the second section describes operationalization of variables; and section three describes data analysis.

Sample Description

This study uses the National Longitudinal Survey of Youth 1997, a survey maintained by the U.S. Department of Labor, in cooperation with the U.S. Department of Education, U.S. Department of Health and Human Services, and other relevant national agencies. The NLSY97 project allows researchers to study characteristics defining the transition from school to the labor market and adulthood.

The study is representative of people living in the United States in 1997, who were born between 1980 and 1984 and were 12 to 16 years old at the inception of the study in December 1996. The cohort of 8984 individuals includes two samples: a cross-sectional sample of 6,748 respondents and a supplemental sample of 2236 respondents designed to over sample Hispanic or Latino and black Americans. In 1997, the sample included 6,819 households; the sample design included all household residents of the appropriate age range.
It is important to note that not all these respondents represent unique households. The NLSY97 interviewed all adolescents of qualifying age within a household. As a result, just over 5,000 individuals were from single respondent households and just under 4,000 were from multiple sibling households. The inclusion of siblings as respondents represents a unique opportunity to study variability of outcomes within a household. BLS recommends caution when generalizing from studies of siblings within the NLSY97, however, because these households are not representative of all sibling households. The sampling strategy is designed to maximize statistical efficiency of samples through several stages of sample selection based on counties, enumeration, districts, blocks, and sample listing units. Probability of selection is based upon the total housing units in a geographical area. The NLSY79 has gone through nine rounds of surveys since 1997 and has an overall retention rate of 83.5 percent.


*Description of Instruments*

This study uses NLSY97 survey instruments of parents, youth respondents, and school administrators. In additional to surveys, this study uses two rounds of high school student transcripts for data analysis. Because the survey includes eight rounds to date, there are several instruments providing an extensive array of data and variables.
Round one included an extensive array of demographic information of the respondent, household members and non-resident relatives. An initial parent questionnaire that collected extensive information from the respondent’s biological parents or another appropriate adult household member. The instrument collected data ranging from family background information to income to parental expectations of their children. A household income update has been conducted in rounds two through five; after round five, respondents report their own adult income information. In addition to the parent questionnaire, a non-resident roster was created to track parents, step-parents and siblings who do not reside with the respondent.

The youth questionnaire has been conducted every two years since 1997. The latest round was conducted in 2006. This questionnaire is a one-hour interview that collects extensive data on family background, social behavior and health status.

A survey of school administrators seeks principals or their designees to respond to mail and phone surveys in 1997-97 and 2000-01. All high schools with a 12th grade component in the sampling units were contacted to participate. In 2000, vocational schools were included in the sample. School administrators provided data on school characteristics, staff and student characteristics as well as school policies and school-to-work program information.

In addition to the survey instruments, school transcript studies are used for 1999-2000. The 2000 school transcript study and school administrator survey
includes vocational schools. In many cases, student transcripts include achievement test scores for PSAT, SAT and ACT.

*Interview Methods*

In all cases of interview respondents, participants received monetary compensation totaling less than $20 per round to participate in the study. Each respondent was contacted by the interviewer and interviews were conducted in-person as is the case for parent and youth respondents or via mail or phone surveys in the case of school administrators.

Round One began in February through October of 1997 and again in March through May of 1998. The last round used for this study, round nine, was conducted October 2005 through July 2006.

The youth survey has an 83 percent retention rate for the cross-sectional sample and an 85 percent retention rate for the supplemental sample, which averages to an overall retention rate of 84 percent. On average, 88.4 percent of youth respondents have information available from a parent interview. The NLSY97 conducts validation re-interviews on approximately 12 percent of the sample.

*Data Analysis*
The data was imported from the U.S. Department of Labor into SPSS version 16 and STATA version 10 and binary logistic regression was used to build the statistical models. Because of the dichotomous nature of the two dependent variables, logistic regression is the most appropriate method for answering the research questions (Kleinbaum, 1994, Hosmer & Lemeshow, 2000, George & Mallery, 2006, Todman & Dugard, 2007). Logistic regression is used to determine which variables are most strongly associated with the probability of a particular category in another variable occurring (Cramer, 2003). This category can be a binary variable having only two categories. Logistic regression is similar to multiple regression in many ways; however, the statistics involved in logistic regression are more complicated.

Logistic regression in general has less stringent requirements than multiple regression. Logistic regression assumes the distribution of errors is binomial, rather than normal (Hosmer & Lemeshow, 2000) and does not assume linearity of the relationship between dependent and independent variables. Logistic regression does not require normally distributed variables, does not assume homoscedasticity. It does, however, require that observations be independent and that the independent variables be linearly related to the logit of the dependent variable.

Logistic regression produces regression coefficients that have analogous interpretations to multiple regression, except that logistic regression coefficients
predict the change in log odds of an event or category occurring rather than a change in the dependent variable. Logistic regression also has the benefit of producing a statistic for an odds ratio of the occurrence of a category for specific variables in the model.

The following definitions (Kleinbaum, 1994, Hosmer & Lemeshow, 2000, George & Mallery, 2006, Todman & Dugard, 2007) are provided for logistic regression terminology.

**Logit** – the regression coefficient in a logistic regression model. The logit statistic represents the change in log odds of the dependent variable.

**Odds Ratio** – the ratio of odds of an event or category occurring in one group over another group (reference category).

**Maximum likelihood estimation** - the method used to calculate the logit coefficients. This contrasts to the use of ordinary least squares (OLS) estimation of coefficients in regression. OLS seeks to minimize the sum of squared distances of the data points to the regression line. MLE seeks to maximize the log likelihood, LL, which reflects how likely it is (the odds) that the observed values of the dependent may be predicted from the observed values of the independents.

**Hosmer and Lemeshow chi-square test of goodness of fit** - the recommended test for overall fit of a logistic regression model, also called the chi-square test. It is considered more robust than the traditional chi-square test, particularly if
continuous covariates are in the model or sample size is small. A finding of non-significance corresponds to the researcher concluding the model adequately fits the data.

Likelihood ratio test - also called the log-likelihood test, is based on $-2LL$ (deviance). The likelihood ratio test is a test of the significance of the difference between the likelihood ratio ($-2LL$) for the researcher's model minus the likelihood ratio for a reduced model.

**Operationalization of Variables**

This section describes the operationalization of the dependent and independent variables and describes control variables used in analysis. This study uses quantitative analysis to investigate three constructs: 1) The type of high school curriculum in which student respondents participate, 2) initial college transition and 3) college completion.
Type of High School Curriculum

This construct includes several variables that define the high school curriculum in terms of academic and vocational courses taken. High school curriculum represents the independent variables. Dummy variables were created to represent three levels of high school curriculum: 1) vocational concentrator (vocational concentrator =1, else =0) does not include a concentration of academic courses. Vocational concentrators earned at least 3 credits total in a single Specific Labor Market Preparation (SLMP) vocational area, but did not complete an academic specialist curriculum of 4.0 or more credits in English; 3.0 or more credits in mathematics at the algebra 1 or higher level; 2.0 or more credits in biology, chemistry, or physics; 2.0 or more credits in social studies, with at least 1.0 credit in U.S. or world history; and 2.0 or more credits in a single foreign language (see Levesque et al. 2000), 2) career tech + curriculum, (CTE+=1, else =0) which combines an academic specialist and vocational concentrator curriculum, which includes three vocational credits and meets the requirements for an academic specialist and 3) academic/general studies programs (academic/general studies programs =1, else =0) This category includes all high school students who do not have any type of vocational concentration and may include academic specialists.²

² This category includes students classified as academic specialists and those who met neither the classification requirements for academic specialist or vocational concentrator.
Table 3.1 provides descriptive statistics of high school programs of study by race, gender, and income. Descriptive statistics were derived from the 1999 high school transcript study which included 6004 students. Not every respondent’s record includes high school transcript information; therefore, analysis is based upon the 6004 cases for which transcript data exists. Race information is missing on 56 students or .9 per cent of the sample.

<table>
<thead>
<tr>
<th>Total in transcript study</th>
<th>TOTAL Academic/ General N=3796</th>
<th>TOTAL Vocational Concentrator N=1471</th>
<th>TOTAL CTE + N=476</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>White 75%</td>
<td>White 78.3%</td>
<td>White 75.5%</td>
</tr>
<tr>
<td>Black/African American</td>
<td>Black/African American 14%</td>
<td>Black/African American 13.4%</td>
<td>Black/African American 15.8%</td>
</tr>
<tr>
<td>Indian/Eskimo/Aleut</td>
<td>American Indian/Eskimo/Aleut .01%</td>
<td>American Indian/Eskimo/Aleut .7%</td>
<td>American Indian/Eskimo/Aleut .6%</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>Asian/Pacific Islander .02%</td>
<td>Asian/Pacific Islander .7%</td>
<td>Asian/Pacific Islander 2.9%</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>Hispanic/Latino .07%</td>
<td>Hispanic/Latino 6.2%</td>
<td>Hispanic/Latino 4.9%</td>
</tr>
<tr>
<td>Males</td>
<td>Males 51%</td>
<td>Males 63.9%</td>
<td>Males 55.4%</td>
</tr>
<tr>
<td>Females</td>
<td>Females 49%</td>
<td>Females 36.1%</td>
<td>Females 44.6%</td>
</tr>
<tr>
<td>Average Income</td>
<td>Average Income 55516.9440</td>
<td>Average Income 61545.105</td>
<td>Average income 67360.866</td>
</tr>
</tbody>
</table>

Author’s tabulations of National Longitudinal Survey of Youth 1997, Round 3, 1999  
TABLE 3.1 Descriptive Statistics of High School Program of Study by Race and Gender in 1999
Dependent Variables

This study’s dependent variables are initial transition to college and degree attainment. A brief description of the operationalization of each follows.

Initial Transition to College

The initial transition to college is a dichotomous dependent variable that captures the respondent’s college enrollment status in either a two-year or four-year college. The NLSY97 provides self-reported measures of college participation for each year of the study. I created a dummy variable representing college transition (college matriculation =1, other =0) for any time period following high school graduation for the years 1997-2006. The variables were combines into one summary variable representing college matriculation for any year from 1997-2006.

Degree Attainment

Degree attainment is a dichotomous dependent variable represented by completion of an associate degree or baccalaureate degree. I created dummy variables to represent the completion of an associate, bachelors degree or any type of degree during the timeframe of 1997 through 2006. This study will not measure respondent’s attainment of masters, professional or doctoral degrees.

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3 An NLSY97 technical report cautions that student-reported data is often inconsistent and inaccurate. No other created variable exists to represent initial college matriculation, which is overstated by respondents’ reports.
The NLSY-created variable for associate degree attainment (CV_AA_DEGREE) 1997-2006 was used to construct a dummy variable representing completion of an associate degree between 1997-2006 (associate degree =1, others =0).

The NLSY-created variable for baccalaureate degree attainment (CV_BA_DEGREE) 1997-2006 was used to construct a dummy variable representing completion of an baccalaureate degree between 1997-2006 (baccalaureate degree =1, others =0).

To create the dependent variable for any degree, I summed the dummy variables for associate and baccalaureate degrees from 1997-2006 and recoded those with both associate and bachelor degrees (n=35) as 1 (associate or bachelors degree =1, others =0).

Table 3.2 provides descriptive statistics for the dependent variables for the time period 1997–2006. Table 3.2 is based upon self-reported first-time college matriculation data and self-reported degree completion.

<table>
<thead>
<tr>
<th>1997-2006</th>
<th>College Matriculation</th>
<th>Associate Degree Completion</th>
<th>Baccalaureate Degree Completion</th>
<th>Any Degree Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>3426</td>
<td>312</td>
<td>1040</td>
<td>1352</td>
</tr>
<tr>
<td>Percent</td>
<td>65.37%</td>
<td>5.95%</td>
<td>19.84%</td>
<td>25.79%</td>
</tr>
</tbody>
</table>


TABLE 3.2. Descriptive Statistics of NLSY97 Respondents from 1997 – 2006; College Matriculation and Completion Measures
**Control Variables**

Several variables are controlled in the statistical model including high school grades, respondent's race and gender, and family background characteristics including parent education level and household income. Descriptive statistics pertaining to control variables is contained in Table 3.1.

Table 3.3 provides descriptive statistics for high school completion from 1997-2006.

<table>
<thead>
<tr>
<th>Year</th>
<th>High School Graduation N</th>
<th>GED Attainment N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1998</td>
<td>585</td>
<td>5</td>
</tr>
<tr>
<td>1999</td>
<td>1068</td>
<td>60</td>
</tr>
<tr>
<td>2000</td>
<td>1032</td>
<td>61</td>
</tr>
<tr>
<td>2001</td>
<td>937</td>
<td>101</td>
</tr>
<tr>
<td>2002</td>
<td>980</td>
<td>102</td>
</tr>
<tr>
<td>2003</td>
<td>389</td>
<td>58</td>
</tr>
<tr>
<td>2004</td>
<td>71</td>
<td>67</td>
</tr>
<tr>
<td>2005</td>
<td>42</td>
<td>43</td>
</tr>
<tr>
<td>2006</td>
<td>31</td>
<td>23</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5135</td>
<td>520</td>
</tr>
</tbody>
</table>

Author’s tabulations of National Longitudinal Survey of Youth 1997, Rounds 1-9

TABLE 3.3 Descriptive Statistics of NLSY97 Respondents from 1997 – 2006; High School Completion Measures

The high school grade variable is a self-reported measure by respondents who participated in the ASVAB assessment in 1999. Figure 3.4 presents descriptive statistics of the high school grades variable.
<table>
<thead>
<tr>
<th>Numeric Code</th>
<th>All Respondents</th>
<th>Academic/General</th>
<th>Vocational</th>
<th>CTE+</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mostly Below Ds</td>
<td>.6%</td>
<td>.9%</td>
<td>.5%</td>
</tr>
<tr>
<td>2</td>
<td>Mostly Ds</td>
<td>1.4%</td>
<td>1.6%</td>
<td>2%</td>
</tr>
<tr>
<td>3</td>
<td>Half Cs and Ds</td>
<td>6.3%</td>
<td>6.8%</td>
<td>10.2%</td>
</tr>
<tr>
<td>4</td>
<td>Mostly Cs</td>
<td>6.9%</td>
<td>6.3%</td>
<td>11.3%</td>
</tr>
<tr>
<td>5</td>
<td>Half Bs and Cs</td>
<td>19.8%</td>
<td>21%</td>
<td>32.6%</td>
</tr>
<tr>
<td>6</td>
<td>Mostly Bs</td>
<td>13.9%</td>
<td>17.9%</td>
<td>17%</td>
</tr>
<tr>
<td>7</td>
<td>Half As and Bs</td>
<td>12.4%</td>
<td>17.2%</td>
<td>15.1%</td>
</tr>
<tr>
<td>8</td>
<td>Mostly As</td>
<td>15.8%</td>
<td>28.3%</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

Author’s tabulations of National Longitudinal Survey of Youth 1997

FIGURE 3.1 High School Grade Variable Coding of NLSY97 Respondents from 1997 – 2006

Previous sections have discussed effects socioeconomic status (SES) has on access to guidance counseling and to rigorous courses in high school. SES is probably the most influential variable on the high school plan of study, college success and work success (Sewell & Shah, 1967). Research shows differences between the access poor and affluent students have to college prep coursework, access to counseling, and information about college (Rosenbaum, 2001, Unseem, 1991, Lee and Ekstrom, 1987).

Parental education level is also an important indicator of college success. Students whose parents have lower education levels tend to achieve lower education levels themselves. The research models in Chapter four use a variable that was created to represent the parent with the highest education. Grades are also a control variable in this research model. High school grades are shown to be the most effective predictor of college success, more so than
standardized tests (Lewis, 1966). Therefore, the research model controls for high school grades. Table 3.5 provides descriptive statistics of parent education and high school grades.

<table>
<thead>
<tr>
<th></th>
<th>Academic/General</th>
<th>Vocational</th>
<th>CTE+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother education</td>
<td>12.73</td>
<td>12.71</td>
<td>12.33</td>
</tr>
<tr>
<td>Father education</td>
<td>12.89</td>
<td>12.89</td>
<td>12.33</td>
</tr>
<tr>
<td>1999 High School</td>
<td>5.77</td>
<td>5.88</td>
<td>5.32</td>
</tr>
</tbody>
</table>


TABLE 3.4 Descriptive Statistics of NLSY97 Respondents from 1997 – 2006; Parent education level and high school grades

This study aims to address the following research questions:

1. How did the high school program type impact the initial transition to college?

To answer this question, I will regress the high school program of study variables on college matriculation controlling for SES, gender, race, high school grades and parent education level.

2. How did high school program type impact completion of an associate degree?

To answer this question, I will regress the high school program type variables on associate degree completion, controlling for SES, gender, race, high school grades and parent education level.
3. How did high school program type impact completion of a baccalaureate degree?

To answer this question, I will regress the high school program type variables on baccalaureate degree completion, controlling for SES, gender, race, high school grades and parent education level.

4. How did high school program type impact completion of any type of college degree?

To answer this question, I will regress the high school program type variables on completion of either bachelor’s or associate degree completion, controlling for SES, gender, race, high school grades and parent education level.

Sample Weights and Design Effects

Sampling weights are constructed each year to provide the researcher with an estimate of how many individuals in the United States are represented by each respondent (Moore, et. al., 2000). Sampling weights were used to conduct the analysis.
CHAPTER 4
RESULTS

This chapter presents descriptive analysis and the results of each of the four research questions. The first section provides descriptive statistics of students included in the analysis, descriptive statistics of student matriculation to college by high school program of study, and descriptive statistics of college degree completion by high school program of study.

Table 4.1 presents descriptive statistics of college matriculation and completion by high school program of study. Students were included only if information from their high school transcripts is part of their NLSY97 data record (N=5948).

<table>
<thead>
<tr>
<th>High School Program</th>
<th>Matriculated to College</th>
<th>Attained Associate Degree</th>
<th>Attained Bachelors Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents</td>
<td>65.37%</td>
<td>5.95%</td>
<td>19.84%</td>
</tr>
<tr>
<td>Academic/general</td>
<td>71.4%</td>
<td>5.4%</td>
<td>28.7%</td>
</tr>
<tr>
<td>Vocational</td>
<td>60%</td>
<td>8.1%</td>
<td>10.2%</td>
</tr>
<tr>
<td>CTE+</td>
<td>94.2%</td>
<td>8.2%</td>
<td>39.8%</td>
</tr>
</tbody>
</table>

Author’s tabulations of National Longitudinal Survey of Youth 1997

TABLE 4.1 College Matriculation and Degree Attainment by High School Program of Study of NLSY97 Respondents from 1997 – 2006
Results for Each Research Question

Research Question #1
How does enrollment in high school programs of study impact initial matriculation to college?

I used the self-reported first-time college enrollment variable to measure initial college matriculation by high school program of study. Table 4.2 presents the results of the logistic regression analysis for initial college matriculation from 1997 – 2006. I selected the cases for which high school transcript data are available (n=5948) and regressed initial college matriculation on the independent variables. All variables in the model show a significant relationship with initial college matriculation at an alpha level of .05, with the exception of participation in the academic/general curriculum track and racial status of Native American, Eskimo/Aleutian, and Asian/Pacific Islander. The CTE+ variable (b=1.765, p.000), is interpreted to mean that participating in a CTE+ concentration has a positive, significant impact on initial college matriculation. The odds ratio data obtained from Table 4.3 suggests that CTE+ concentrators are nearly six times more likely than students in the vocational education track to matriculate to college.

Nearly every control variable is a significant predictor of initial college enrollment. Being male (b=−.427, p.000) has a negative, significant impact on college enrollment. Males are less likely than females to make the initial transition to college during the 1997-2006 time period. Being black has a
significant, negative impact in initial college enrollment ($b=-.600$, $p=.012$).

Information obtained from the odds ratios in Table 4.3 suggests black students are less likely than Hispanic students to matriculate to college. The household income variable ($b=.525$, $p=.000$) is a significant, positive predictor of college enrollment. Higher income levels are associated with increased odds of initial college matriculation. The parent education variable ($b=.271$, $p=.000$) has a positive, significant impact on college enrollment. Information obtained from Table 4.3 suggests that students with parents at higher education levels are more likely to enroll in college. The high school grades variable ($b=.450$, $p=.000$) has a positive, significant impact on college enrollment. Information obtained from Table 4.3 suggests that students with higher grades are 1.5 times more likely to enroll in college.

The value of the log likelihood in the fitted model is -1164.543. The value of log likelihood for the constant only model is -2577.286. The global F test for the model is significant at the $\alpha = .05$ level. It concludes that at least one and perhaps all $\rho$ coefficients are different from zero, an interpretation analogous to that in multiple linear regression.
Table 4.2. Logistic Regression of 1997-2006 college matriculation by high school program of study, race, gender, grades, household income, and parent education level

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std. Err</th>
<th>P&gt;Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/general</td>
<td>.175</td>
<td>.120</td>
<td>.146</td>
</tr>
<tr>
<td>CTE+</td>
<td>1.765</td>
<td>.323</td>
<td>.000</td>
</tr>
<tr>
<td>Male</td>
<td>-.427</td>
<td>.114</td>
<td>.000</td>
</tr>
<tr>
<td>White</td>
<td>-.858</td>
<td>.220</td>
<td>.000</td>
</tr>
<tr>
<td>Black</td>
<td>-.600</td>
<td>.238</td>
<td>.012</td>
</tr>
<tr>
<td>Native American/Eskimo</td>
<td>-.551</td>
<td>.611</td>
<td>.366</td>
</tr>
<tr>
<td>Asian/Pacific Island</td>
<td>-.022</td>
<td>.613</td>
<td>.971</td>
</tr>
<tr>
<td>High School Grades</td>
<td>.450</td>
<td>.034</td>
<td>.000</td>
</tr>
<tr>
<td>Income</td>
<td>.525</td>
<td>.079</td>
<td>.000</td>
</tr>
<tr>
<td>Parent education</td>
<td>.271</td>
<td>.027</td>
<td>.000</td>
</tr>
</tbody>
</table>

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudo R-square</td>
<td>.242</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald chi2</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prob&gt;chi2</td>
<td>450.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Num. of obs.</td>
<td>2717</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Log Likelihood = -1164.54
<table>
<thead>
<tr>
<th>Academic/General</th>
<th>1.191</th>
<th>.940</th>
<th>1.509</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTE+</td>
<td>5.844</td>
<td>3.101</td>
<td>11.015</td>
</tr>
<tr>
<td>Male</td>
<td>.652</td>
<td>.521</td>
<td>.815</td>
</tr>
<tr>
<td>White</td>
<td>.423</td>
<td>.274</td>
<td>.653</td>
</tr>
<tr>
<td>Black</td>
<td>.548</td>
<td>.343</td>
<td>.874</td>
</tr>
<tr>
<td>Native American/Eskimo</td>
<td>.575</td>
<td>.173</td>
<td>1.907</td>
</tr>
<tr>
<td>Asian/Pacific Island</td>
<td>.977</td>
<td>.293</td>
<td>3.255</td>
</tr>
<tr>
<td>High School Grades</td>
<td>1.569</td>
<td>1.466</td>
<td>1.679</td>
</tr>
<tr>
<td>Income</td>
<td>1.690</td>
<td>1.445</td>
<td>1.976</td>
</tr>
<tr>
<td>Parent Education</td>
<td>1.312</td>
<td>1.244</td>
<td>1.384</td>
</tr>
</tbody>
</table>

Table 4.3: Estimated odds ratios and 95% confidence intervals for model in Table 4.2

Research Question #2

*How does enrollment in high school programs of study impact completion of an associate degree?*

To answer this question, I initially performed binary logistic regression analysis for NLSY respondents with a high school transcript. I regressed associate degree completion in from 1997-2006 on high school program of study, gender, high school grades, race, parent education level and household income.

Table 4.4 shows the results of the first model in which I used binary logistic regression analysis to regress associate degree completion 1997-2006. The only variable in the model that is a significant predictor of associate degree completion from 1997-2006 is the academic/general program variable. This high school program variable (b=-.476, p.012) has a negative, significant impact on
1997-2006 associate degree completion. Information obtained from Table 4.5 suggests students in this curriculum track are less likely to complete an associate degree than vocational students.

The value of the log likelihood in the fitted model is -698.719. The value of log likelihood for the constant only model is -1006.450. The Global F value for the model is insignificant at the $\alpha = .05$ level. It concludes that the model is a poor fit to the data.

|                          | Coef. | Std. Err | P>|Z| |
|--------------------------|-------|----------|-----|
| Academic/general         | -.476 | .188     | .012|
| CTE+                     | -.247 | .280     | .376|
| Male                     | -.205 | .163     | .210|
| White                    | -.375 | .279     | .179|
| Black                    | -.584 | .319     | .068|
| Native American/Eskimo   | -.483 | 1.082    | .656|
| Asian/Pacific Island     | .170  | .560     | .761|
| High School Grades       | .046  | .052     | .372|
| Income                   | -.009 | .129     | .940|
| Parent education         | -.0145| .035     | .684|
| Pseudo R-squared         | .009  |          |     |
| Wald chi2                | 14.05 |          |     |
| Prob > chi2              | .170  |          |     |
| Num. of obs.             | 2717  |          |     |

Log Likelihood = -698.719

Table 4.4. Logistic Regression of 1997-2006 Associate Degree Attainment by high school program of study, race, gender, grades, household income, and parent education level.
Table 4.5: Estimated odds ratios and 95% confidence intervals for model in Table 4.4

Research Question #3
How does enrollment in high school programs of study impact completion of a baccalaureate degree?

I used binary logistic regression to regress 1999-2006 baccalaureate degree completion on high school program of study, race, gender, parent education level, household income and high school grades.

Table 4.6 shows the results of this analysis. The two high school program of study variables are statistically significant predictors at an alpha level of .05. Being enrolled in the academic/general high school track (b=.777, p.000) has a positive, significant impact on completion of a baccalaureate degree. CTE+ status (b=.871, p.000) has a positive, significant impact on baccalaureate degree completion. Being male (b=-.246, p.029) is a negative, significant predictor of baccalaureate degree attainment. Race is not a significant predictor of
baccalaureate degree attainment, except in the case of the Asian/Pacific Islander variable (b=.955, p.014) which has a positive, significant impact on baccalaureate degree attainment.

<table>
<thead>
<tr>
<th></th>
<th>Coef.</th>
<th>Std. Err</th>
<th>P&gt;Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/general</td>
<td>.777</td>
<td>.157</td>
<td>.000</td>
</tr>
<tr>
<td>CTE+</td>
<td>.871</td>
<td>.209</td>
<td>.000</td>
</tr>
<tr>
<td>Male</td>
<td>-.246</td>
<td>.112</td>
<td>.029</td>
</tr>
<tr>
<td>White</td>
<td>.381</td>
<td>.229</td>
<td>.097</td>
</tr>
<tr>
<td>Black</td>
<td>.306</td>
<td>.263</td>
<td>.244</td>
</tr>
<tr>
<td>Native American/Eskimo</td>
<td>.998</td>
<td>.706</td>
<td>.157</td>
</tr>
<tr>
<td>Asian/Pacific Island</td>
<td>.955</td>
<td>.389</td>
<td>.014</td>
</tr>
<tr>
<td>High School Grades</td>
<td>.592</td>
<td>.041</td>
<td>.000</td>
</tr>
<tr>
<td>Income</td>
<td>.508</td>
<td>.083</td>
<td>.000</td>
</tr>
<tr>
<td>Parent education</td>
<td>.168</td>
<td>.022</td>
<td>.000</td>
</tr>
</tbody>
</table>

Pseudo R-square Wald Chi2 Prob > chi2 Num. of obs.
.235 467.62 .000 2717

Log Likelihood = -1229.743

Table 4.6: Logistic Regression of 1997-2006 Baccalaureate Degree Attainment by high school program of study, race, gender, grades, household income, and parent education level.

The odds ratio data obtained from table 4.7 suggests that students in a academic/general program are 2.1 times more likely and CTE+ concentrators are about 2.3 times more likely to complete a baccalaureate degree than vocational students. Males are less likely than females to complete a baccalaureate degree and students whose parents have higher education levels and whose high school grades are higher are more likely to attain a baccalaureate degree between 1997
and 2006. Students whose families report higher income are about 1.6 times more likely to earn a baccalaureate degree. Students from an Asian/Pacific Island background are about 2.6 times more likely to earn a baccalaureate degree than Hispanic students.

The value of the log likelihood in the fitted model is -1443.354. The value of log likelihood for the constant only model is -2387.005 The global F value for the model is significant at the $\alpha = .05$ level. It concludes that at least one and perhaps all $\beta$ coefficients are different from zero, an interpretation analogous to that in multiple linear regression.

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio</th>
<th>[95% conf. interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/General</td>
<td>2.176</td>
<td>1.598</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.962</td>
</tr>
<tr>
<td>CTE+</td>
<td>2.391</td>
<td>1.586</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.604</td>
</tr>
<tr>
<td>Male</td>
<td>.781</td>
<td>.626</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.975</td>
</tr>
<tr>
<td>White</td>
<td>1.464</td>
<td>.933</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.297</td>
</tr>
<tr>
<td>Black</td>
<td>1.359</td>
<td>.811</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.276</td>
</tr>
<tr>
<td>Native American/Eskimo</td>
<td>2.715</td>
<td>.680</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.834</td>
</tr>
<tr>
<td>Asian/Pacific Island</td>
<td>2.600</td>
<td>1.210</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.584</td>
</tr>
<tr>
<td>High School Grades</td>
<td>1.808</td>
<td>1.667</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.961</td>
</tr>
<tr>
<td>Income</td>
<td>1.663</td>
<td>1.412</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.959</td>
</tr>
<tr>
<td>Parent Education</td>
<td>1.183</td>
<td>1.334</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.235</td>
</tr>
</tbody>
</table>

Table 4.7: Estimated odds ratios and 95% confidence intervals for model in Table 4.6
Research Question #4  
*How does enrollment in high school programs of study impact completion of any type of college degree?*

To answer this question, I calculated a dummy variable that represented associate degree and baccalaureate degree completion for the time period 1997-2006. I regressed this dependent variable on the independent variables. Table 4.8 shows the results of this analysis.

The academic/general program variable has a positive, significant impact on the attainment of any type of degree (b=.384, p.003). CTE+ status (b=.541, p.003) is a positive, significant predictor at an alpha level of .05. Being male (b=-.290, p.004) is a significant, negative predictor of any type of degree attainment. Having more educated parents (b=.142, p.000) is a positive, significant predictor of any type of degree completion from 1997-2006. The only significant race variable is Asian/Pacific Islander status and it is a positive predictor of degree attainment (b=.898, p.020). Family income (b=.409, p.000) and high school grades (b=.480, p.000) were positive and significant predictors of any type of degree completion.
Table 4.8: Logistic Regression of 1997-2006 Any Degree Attainment by high school program of study, race, gender, grades, household income, and parent education level.

Information obtained from the odds ratios in table 4.9 suggests that of the statistically significant predictors of any type of college degree completion, students in an academic/general high school program are about 1.5 times more likely than vocational students to earn any type of degree and CTE+ students are about 1.7 times more likely to complete any type of degree than vocational students. Males are less likely than females to earn a degree and students with more educated parents are more likely to earn any type of college degree by 2006 than those who come from less educated parents. Asian/Pacific Island students are 2.4 times more likely to earn any type of degree than Hispanic...
students. Students with higher grades and income are around 1.5 times more likely to earn any type of degree than those with lower grades and incomes.

The value of the log likelihood in the fitted model is -1443.354. The value of log likelihood for the constant only model is -2640.337. The Global F value for the model is significant at the $\alpha = .05$ level. It concludes that at least one and perhaps all $\rho$ coefficients are different from zero, an interpretation analogous to that in multiple linear regression.

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio</th>
<th>[95% conf. interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic/General</td>
<td>1.468</td>
<td>1.137 1.895</td>
</tr>
<tr>
<td>CTE+</td>
<td>1.718</td>
<td>1.202 2.455</td>
</tr>
<tr>
<td>Male</td>
<td>.747</td>
<td>.613 .911</td>
</tr>
<tr>
<td>White</td>
<td>1.109</td>
<td>.748 1.646</td>
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<tr>
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<td>Native American/Eskimo</td>
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<td>Income</td>
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<td>1.295 1.751</td>
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<tr>
<td>Parent Education</td>
<td>1.153</td>
<td>1.107 1.200</td>
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</table>

Table 4.9 Estimated odds ratios and 95% confidence intervals for model in Table 4.8

To check the assumptions on which multiple regression is based, I assessed statistical tests for normality of the continuous independent variables (Appendix A). The high school grades variable is normally distributed; mother and father’s education levels were skewed, but this is expected from an educational attainment variable where lower education levels are not represented in the distribution. I created a natural log transformation of household income to
represent the socioeconomic variables, which approximates a more normal
distribution. Using Kolmogorov-Smirnov statistics, the variable distributions fit
the data.

I also performed tests for multicollinearity of the independent variables
(Appendix B). Using Variance Inflation Factors (VIF) and tolerance statistics, I
determined the variables to be independent of each other. An analysis of
residual errors is included in Appendix B.
CHAPTER 5
SUMMARY, DISCUSSION AND IMPLICATIONS

This chapter is comprised of three sections. The first section summarizes the results of the data analysis and describes the findings of the four research questions. The second session presents a discussion of the findings. The third section presents implications for research, policy and practice.

Results

The purpose of the study was to examine the underlying premise of federal vocational education policy aimed at encouraging more students to pursue postsecondary education. The assumption of the Carl D. Perkins Vocational Technical Education Act of 1998 was that students who combine a concentration of coursework in career-technical education with a concentration of college-preparatory academic coursework would have better postsecondary education outcomes such as college completion. This philosophy was further reinforced in 2006, with the re-authorization of the Carl D. Perkins Career and Technical Education Improvement Act, which contained even stronger requirements for states to embrace a college-preparatory philosophy of career and technical education. This dissertation aimed to determine if an enhanced vocational concentration did indeed lead to improved postsecondary education outcomes. The following presents a summary of the results.
Research Question #1
How does enrollment in high school programs of study impact initial matriculation to college during the years of 1997 - 2006?

High school program of study is a significant predictor of college matriculation. Academic/general students and those in the CTE+ track have an increased probability of matriculating to college and are considerably more likely than vocational education students to do so. The regression coefficients for these variables are positive and significant predictors of matriculation from 1997 – 2006. Being male is associated with a negative relationship to college matriculation; male students are less likely to matriculate to college than female students. Curiously, the racial status of white is a negative, significant predictor of college matriculation and white students are less likely than Hispanic students to matriculate to college. Being black is negatively associated with going to college, and black students are less likely than Hispanic students to matriculate to college. Students’ racial status as Native American or Asian/Pacific Islander is not a significant predictor of college matriculation during the study period. Socioeconomic status, increased education levels of both parents and the students' high school grades are positive predictors of college matriculation and students whose household income and parents’ education levels are higher experienced increased odds of going to college during the study period.

Research Question #2
How does enrollment in high school programs of study impact completion of an associate degree?

The only variable in this model that is significant is the academic/general programs variable. Participating in an academic/general program is a negative predictor of associate degree completion during the years 1997 – 2006 and academic/general track students are less likely than vocational students to complete an associate degree. No other variables in the model are significant predictors of associate degree completion from 1997 – 2006.

Research Question #3
How does enrollment in high school programs of study impact completion of a baccalaureate degree?

Taking an academic/general concentration or a CTE+ concentration are significant positive predictors of baccalaureate degree completion and students in these curriculum tracks are more likely to earn a degree than students in vocational education programs. With the exception of Asian/Pacific Islander status, race is not a significant predictor of baccalaureate degree attainment from 1997-2006. Students from an Asian/Pacific Island origin are more likely to earn a baccalaureate degree than Hispanic students. Gender is a significant predictor of baccalaureate degree attainment; being male is a negative predictor and also meant being less likely than females to complete a baccalaureate degree. Parent education level is also a significant, positive predictor of baccalaureate degree attainment as are high school grades and household
income. Students whose parents have higher education levels, students who have better high school grades, and students whose families have higher incomes are slightly more likely to complete a baccalaureate degree from 1997–2006.

Research Question #4  
How does enrollment in high school programs of study impact completion of any type of college degree?

For this question, I combined associate and baccalaureate degree attainment into one summary variable with similar results for baccalaureate degree attainment. Some respondents (n=35) had attained both an associate and a baccalaureate degree, but their degrees were only counted once in the analysis. Again, high school program of study is a significant predictor of any degree attainment by 2006, with academic/general concentration and CTE+ concentration being positive predictors. Academic/general students and those in CTE+ programs are more likely to complete any type of degree than vocational students. Again, being male is a significant, negative predictor of any degree attainment; males are less likely than females to earn any type of degree from 1997-2006. Again, with the exception of Asian/Pacific Islander status, race is not a significant predictor of any degree attainment. Asian/Pacific Islander status is a positive predictor of the attainment of any type of degree and these students are more likely than Hispanic students to earn any type of degree. Grades, family income and parent education are positive, predictors of any type of degree attainment. Students with higher grades and whose parents have higher income...
incomes and educations are more likely to attain any type of degree than students with lower grades and whose parents have lower incomes and education.

Discussion

This section presents an interpretation of the results and an explanation of the findings. The results from the four research questions reflect the mixed results from recent research on vocational education’s impact on postsecondary studies (Arum, 1998, Neumark & Rothstein, 2003, Silverberg, 2004, DeLuca et. al., 2006) Results that reinforce the research literature are related to socioeconomic status, parent education level, and high school achievement. Most research of vocational students’ postsecondary education outcomes is dated and does not take into account the academic reforms of the 1990s. This study contributes to a more recent body of knowledge on this topic.

This study reinforces past research findings related to college outcomes and gender, socioeconomic status, parent education level and high school grades (Sewell & Shah, 1967, Oakes, 1985, Lee et. al., 1987, Lee et. al. 1997, Rosenbaum, 2001). It is unclear how much high school program of study contributes to the dependent variables because of the ways in which females, students with higher household incomes, higher grades, and parents with higher levels of education are concentrated into each of the three programs of study. Table 3.1 provides descriptive statistics on the distribution of gender, race and
household income by high school program of study. Males are more highly concentrated in the vocational track than in other high school program. Females are most concentrated within the academic/general track. The curriculum tracks do not differ widely by racial composition. However, a striking difference is in the average household income of each high school program. The average household income for students in the CTE+ track is more than $10,000 higher than the average income for students in the vocational track and is still nearly $6000 higher than the average household income of students in the academic/general track.

Table 3.5 provides descriptive statistics of parent education levels and high school grades for students in each of the three high school programs. CTE+ students reported higher grades than students in other programs; vocational students reported the lowest grades of the three programs. The parents of CTE+ students have higher levels of educational attainment than academic/general or vocational students; again, vocational students’ parents have the lowest levels of education of the three high school programs.

The existing research on vocational education and college indicates it is negatively associated with college success. Recent studies of vocational education after the late-1990’s indicate it may not actually hinder students’ access and success in college (Arum, 1998, DeLuca et. al., 2006) and in fact, many types of vocational programs such as business technologies may encourage college enrollment and attainment. Data from the National Center for
Educational Statistics (LeVesque et. all, 2008) suggests that students taking four or more occupational credits were less likely than those with no occupational credits (53% compared to 84%) to matriculate to college. The more occupational credits students earned in high school, the lower their rate of attaining a postsecondary credential. For example, 47 percent of graduates with four or more occupational credits attained a college degree by 2000, compared with 73 percent of their peers who earned no occupational credits in high school. DeLuca et. al (2006) found that the ratio of vocational to academic coursework was a critical determinant of postsecondary success. Students with lower vocational to academic course ratios were more likely to go to college than those with higher vocational to academic course ratios.

There are a limited amount of studies on CTE+ and Tech Prep students’ college outcomes and they show mixed results\(^4\). It is important to note that Tech Prep and CTE+ are not the same construct. CTE+ students have taken the requisite vocational and academic coursework to qualify as combining a vocational and academic concentration; Tech Prep students should have taken a similar high school curriculum, but may have the added benefit of credit-based agreements between high school and colleges. Silverberg (2004) in the National Assessment of Vocational Education found students combining vocational and academic concentration are more likely to have improved college outcomes. In

\(^4\) The CTE+ high school program may be analogous to a Tech Prep program of study (Bragg, 1994). The NLSY97 defined CTE+ as combining academic and vocational concentration, a similar definition as Tech Prep. However, Tech Prep programs also articulate to postsecondary degree pathways.
my study, CTE+ concentration is a positive predictor; these students are 1.7
times more likely than vocational students to attain a college degree.
Contradicting Silverberg’s findings, Neumark and Rothstein (2003) found Tech
Prep students were less likely to matriculate to college than students in other
types of occupational programs. The results of my analysis do not support their
findings as CTE+ students are more likely than their vocational counterparts to
transition into college and to complete any type of college degree.

Gender as a predictor of college attainment is well-established in the
research. Previous findings are reinforced by my study, which found males are
less likely than females at attain a college education. This is not a surprising
result given that women outnumber men in their college enrollment and degree
completion nationally (Knapp et. al, 2008). A higher percentage of women enroll
in four-year and two year colleges (69% to 62% respectively) and they complete
58 percent of baccalaureate degrees compared to 42 percent being completed
by men.

Consistent with research literature, parent education level, family income
and high school grades are significant, positive predictors of college success
(Sewell & Shah, 1967; Rosenbaum, 1976; Oakes, 1985). With the exception of
the associate degree attainment model, parent education is a positive predictor
of college matriculation and attainment.

*Implications*
The first section discusses implications for future research; section two discusses implications for policy; section three presents implications for practice.

*Implications for Future Research*

Although the data used in this dissertation are from a longitudinal study, the study does not include long-range variables that truly represent a realistic timeframe for policy implementation. Other researchers using NLSY97 data to study vocational education reforms have concluded the short period makes it difficult to examine long-term policy implementation (Plank, et. al, 2005; DeLuca et. al., 2006). The Rand Change Agent Study of education policy implementation suggests that major policies take on average ten years to implement (Berman & McLaughlin, 1974). While the NLSY97 captures variables during critical times of educational policy implementation of the Perkins 1998 reforms, the data currently are available only through 2006. This research should be continued for at least another three to five years.

While the Perkins 1998 policy was signed into law in 1998, states and local districts did not begin the process of implementation until 1999 and 2000. Many of the NLSY respondents were experiencing high school during the early years of vocational education policy reform. It would be of value to study the differences in college outcomes of students in high school in the early stages of the reform versus the middle stages. By 2006, nearly all of the respondents had completed high school or obtained a G.E.D. which does not allow researchers to
continue to examine the effects of the policy implementation at the high school level in later stages of policy implementation. It would also be interesting to study policy outcomes of the 2006 Perkins reforms as one would expect a dramatic increase in students defined as CTE+ rather than vocational concentrators.

While vocational students continue to lag behind their academic counterparts in college matriculation and completion, 60 percent of vocational concentrators did matriculate to college during the study period. This is a substantial increase from previous studies of vocational education (Wirt. et. al., 1989, Silverberg et. al., 2000). It is plausible that the state academic reform and standards movements of the 1990s began to affect the college transitions and success of vocational students, which is reflected in this study. American students are taking more academic credits and more rigorous academic credits than during periods of previous study of vocational education (McCarthy, 1990; Hawley, 1998; Fowler, 2000). Stasz and Bodilly (2004) found that states directed federal vocational education funding toward academic standards and performance during the early stages of Perkins III implementation. It is also plausible that while larger numbers of vocational students go to college than in previous years, many leave with the skills they need to obtain employment in a technical job before they complete a degree. It is interesting to note that vocational students earn a higher percentage of associate degrees than academic/general track students and nearly an equal percentage as CTE+
students. I recommend further longitudinal study to determine if this attainment of associate degrees increases over time.

Continuing to study degree attainment of the NLSY97 respondents beyond 2006, the last round of available data, would be recommended. In 2006, although more than 65 percent of high school completers had entered postsecondary education, only 1352 had completed an associate or baccalaureate degree, which represents 25 percent of the sample and 23 percent of high school completers from 1997-2002. It may be of value to study the college persistence and course-taking patterns of students by their high school program of study to determine what differences exist among them.

A second implication for further research is to expand the research model to include new independent variables such as credit-based agreements, college entrance tests and the ratio of vocational to academic course-taking and degree attainment. The vocational/academic course ratio variable has been included in two studies using NLSY97 data and has yielded consistent results showing lower vocational to academic course ratios are associated with an increased likelihood of college matriculation. These studies should be extended to model degree completion. A survival analysis would be a more appropriate research method to conduct this type of study (Willett and Singer, 2003).

An additional explanation for the postsecondary education success of CTE+ students could be that many participated in Tech Prep programs in which they accessed college credit through formal articulation agreements (Bragg,
The 2006 Perkins re-authorization expands emphasis on credit-based agreements, which would benefit all vocational students and would potentially lead to improved college outcomes for vocational students.

Researchers continue to regard test scores as an important predictor of college success (Noble & Sawyer, 2001; Willingham et. al., 2002). Most U.S. colleges use test scores, in addition to high school grades and class rank to make admissions decisions (Breeland et. al., 2002). Although most public two-year colleges are open admissions, nearly 25 percent use ACT or SAT scores in admissions decisions. Only about one half of public four-year colleges use a minimum high school G.P.A. for admission and 25 percent use class rank. More than 35 percent use a minimum ACT composite score and 44 percent of private schools use it for admissions decisions. It may be important to examine the relationship between high school programs and college entrance test scores. CTE+ and academic/general track students may be more likely to have taken college entrance tests for a variety for a variety of historic and socioeconomic reasons; vocational students traditionally have not taken college entrance tests. This research could have important implications for practice.

Implications for Policy and Practice

The results of the logistic regression analysis repeat findings of recent studies of vocational education. The results of this dissertation study indicate an
enhanced vocational and academic curriculum (CTE+) is a positive, significant predictor of college attainment as is participating in an academic/general concentration. The findings related to vocational students’ success in college build upon earlier research (Rosenbaum, 1996; Silverberg, 2004) using national data sets created prior to the vocational reforms and academic standards movement of the 1990s; other recent studies provide additional guidance to policy-makers and practitioners (Arum, 1998; Plank, et. al., 2005; DeLuca, 2006). These studies do not necessarily indict vocational education as a hindrance to college attainment, but they provide useful criteria for ways practitioners may structure vocational programs to encourage college attainment. Policymakers should heed this research and use it to guide future policy decisions.

Perhaps the most stunning finding of this dissertation is that CTE+ students had better college outcomes than their counterparts in the academic/general track. Nearly 95 percent of CTE+ students matriculated to college between 1997 and 2006 and they outpaced their academic/general track counterparts in both associate degree and baccalaureate degree attainment. Table 4.1 provides descriptive statistics for college matriculation and degree attainment by high school program of study. Almost 40 percent of CTE+ students earned a baccalaureate degree from 1997-2006, compared to 28 percent of academic/general students and 10 percent of vocational students. The results suggest that policymakers’ emphasis on combining academic and vocational curricula results in better college outcomes. Policy makers have re-
authorized 2006 federal vocational education legislation to further expand the
emphasis on combining academic and vocational studies and to incorporate
accountability requirements that ensure states and local school districts comply
with this mandate. The results of my study suggest that if states and local
districts comply with this mandate, college matriculation and degree attainment
will dramatically increase. This finding has implications for not only vocational
policy but for broader education policy.

Future research on vocational education will inform state and federal
policy decisions regarding high school curricula. However, the national trend
toward requiring more credits and specific types of high school credits, combined
with the Perkins 2006 emphasis on academic credits does not suggest a reversal
of the position of emphasizing high school curricula as an important education
reform. This emphasis is visible in the No Child Left Behind legislation as well as
the academic standards movement of the late 1990s and early 2000s. The
results of my study indicate that course-taking is indeed an important predictor of
college success.

Educational reform policies should emphasize articulation agreements and
credit-based partnerships between high schools and colleges. Such initiatives
benefit vocational students and should increase the percentage of students
taking advantage of credit-based agreements in college.
While high school grades continue to be an important consideration in college admissions and in the success of college students, admissions tests such as ACT and SAT are also important. As such, policy reform efforts should include college entrance testing. For example, under the current vocational education policy reforms of the Carl D. Perkins Career and Technical Education Improvement Act of 2006, 27 states will report accountability for Tech Prep students by setting performance goals for students entering college remediation-free. This accountability requirement should be extended by policymakers to include all vocational students.

Implications for practice mirror those for policy. Practitioners must continue to emphasize academic rigor for all vocational students, not only those in the CTE+ track. Vocational students should be required to take an academic core of college preparatory courses so they will be better prepared to succeed in college. Additionally, high school grades and achievement, college entrance exams and K-16 systems linkages must be a priority to practitioners so they may create the conditions to foster greater college success for vocational students.

Teachers, parents, school and college personnel should continue to emphasize the importance of high school grades as they relate to future postsecondary success, but they should also increase emphasis on college admissions testing. Vocational students’ grades are the lowest of the three high school curriculum tracks. Grades reflect specific knowledge and skills stressed in the high school classes students take; they also reflect non-cognitive
behaviors such as participation, disruption and submission of assignments. Teachers, parents and administrators must emphasize the relationship between high school grades and students’ success in college. In the past, this message may not have been important to vocational students who were work-bound, but it is very important in terms of increasing their chances of college success.

While federal policy initiatives may fail to address many of these recommendations, states should take a leadership role in adopting them. Many states already emphasize K-16 partnerships through policy and structure of educational systems. Incentives should be provided for K-12 education systems and colleges to collaborate on partnerships that may result in greater numbers of students achieving a college education.

College and K-12 practitioners must work to bridge the gap between vocational and CTE+ students’ high school course-taking patterns, high school grades and achievement and access to college credit. For practitioners, it is important to emphasize college success to all vocational students and to provide opportunities for students to explore college and experience it while they are in high school. Practitioners must be sure that high school academic curricula adequately prepare students for college-level work; this has been emphasized during the 1990s and 2000s as part of the academic standards movement at the state level. Practitioners appear to have effectively embraced this strategy for CTE+ students; now, they must expand their efforts to include all vocational students. The success of CTE+ students may partially reflect the benefits of
Tech Prep partnerships (Bragg, 1994) as well as their high school course-taking patterns. Practitioners must ensure that all vocational students take rigorous academic courses and have access to credit-based agreements to help them make a successful transition to college and to complete a degree.

It is also important for practitioners to prevent further socioeconomic stratification in terms of participation in high school academic programs. Practitioners must work to ensure that all vocational students, regardless of family background characteristics, have access to the same rigorous courses as their CTE+ counterparts. This may require extensive professional development for teachers, counselors and administrators.

Finally, while schools are working to implement federal vocational education policy, they must ensure that students taking vocational concentrations have access to the same rigorous college-preparatory academic courses as students in the traditional college-bound tracks. For years, the differences between academic courses and expectations for these two groups of students have been remarkable (Oakes, 1985; Rosenbaum, 2001; Silverberg, 2004). This expectations gap must be closed and all students must be encouraged and expected to take high-level academic courses to help ensure their success in college and the workplace.
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## APPENDIX A

### TEST OF VARIABLE NORMALCY

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<sup>a</sup> Lilliefors Significance Correction
Normal Q-Q Plot of CV_HGC_B|O_DAD 1997
HGC FATHER

Mean = 12.56
Std. Dev. = 3.212
N = 7,120
# Mother’s Education 1997

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<sup>a</sup> Lilliefors Significance Correction

## Tests of Normality

**Normal Q-Q Plot of CV_HGC_BIO_MOM 1997**

![Normal Q-Q Plot](image)
Detrended Normal Q-Q Plot of CV_HGC_BIO_MOM 1997
### Tests of Normality

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*a. Lilliefors Significance Correction*

#### Normal Q-Q Plot of LNAVINCOME

![Normal Q-Q Plot of LNAVINCOME](image-url)
LNAVINCONE

Mean = 10.54
Std. Dev. = 0.892
N = 8,768
Tests of Normality

Normal Q-Q Plot of HIGH SCHOOL GRADES

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\(^a\) Lilliefors Significance Correction
Detrended Normal Q-Q Plot of HIGH SCHOOL GRADES

Observed Value

Dev from Normal
HIGH SCHOOL GRADES

Mean = 5.68
Std. Dev. = 1.699
N = 8,687
APPENDIX B

TESTING NORMALITY OF MODELS

1st model

$pnorm \ r$

\[
\text{Normal } F\left[\frac{(r-m)}{s}\right] = \frac{i}{N+1}
\]

\[
\text{Empirical } P[i] = \frac{i}{N+1}
\]
Kernel density estimate

kernel = epanechnikov, bandwidth = 0.0408
2nd model

kdensity r

Kernel density estimate

Kernel = epanechnikov, bandwidth = 0.0034

pnorm r

Normal F[(r-m)/s]

Empirical P[i] = i/(N+1)
3rd model
K density r

Kernel density estimate

kernel = epanechnikov, bandwidth = 0.0382

pnorm r

qnorm r

Empirical P[i] = i/(N+1)
4th model
kdensity r

Kernel density estimate

Kernel density estimate

pnorm r

Kernel density estimate

pnorm r
qnorm r

Pr(ANYDEG9706)

Inverse Normal
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Multicollinearity Test