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**THE EFFECT OF CAPSTONE COOPERATIVE EDUCATION EXPERIENCES, AND  
RELATED FACTORS, ON CAREER AND TECHNICAL EDUCATION SECONDARY  
STUDENT SUMMATIVE ASSESSMENT SCORES**

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by  
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## **ABSTRACT**

Many researchers have discussed the benefits of contextual or experiential learning. Research has also addressed the benefits of cooperative education experiences. Yet, in this era of high stakes testing and program accountability, the amount of time that career and technical students are permitted to participate in these experiences has diminished. Unfortunately, there is little empirical evidence to suggest that there is a relationship between capstone cooperative education experiences and performance on end of program assessments. The purpose of this baseline study was to determine if there is a significant difference in the mean summative test scores of secondary career and technical education students who participated in capstone cooperative education experiences and those students who did not participate, as measured by NOCTI scores. The population studied was secondary career and technical school seniors during the 2009/2010 academic year in seventeen schools throughout Pennsylvania. Additionally, this study sought to determine if student grade point average (GPA), Individualized Education Plan (IEP) status, length of time on coop or quality of student training plan could significantly account for any established mean differences. It was determined that students who participate in cooperative education experiences score significantly higher on both the written and practical portions of their summative NOCTI exams than those students who do not participate in cooperative education. While student GPA and IEP status appear to be the best predictors of both written and practical NOCTI scores, collectively the four moderating variables could only predict about 22% of the variance in test scores between students who participate in cooperative education and those who do not, which is not a particularly significant amount.

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## Chapter 1

### *Introduction*

Cooperative Education, or the practice of combining classroom-based education with related workplace experience, dates back to the Middle Ages when guilds used master craftsmen to teach their trades to apprentices (Greenblatt, Cox & Seaberg, 1985). In modern times, the first framework for this model can be dated to 1901, when Lehigh University professor, Herman Schneider (1872-1939), observed that traditional classroom learning was not meeting the needs of students in technical programs (Smollins, 1999). He developed a model, later known as the Cincinnati Plan, which paired two students with one employer. Students would alternate weeks on the job site with weeks in the classroom. Once a week, the students would meet with their instructor to discuss the workplace learning and relate it to the classroom theory and instruction (University of Cincinnati, 2003). After World War I, The Great Depression, and then World War II, the national focus on economic development allowed job-specific training, even at the expense of general academic knowledge, to remain a national priority (Elliott, 2007).

In 1994, the Federal Government passed the School-to-Work Opportunities Act (STWOA). This act was part of an educational reform movement designed, in part, to provide initiatives for work-based learning activities and opportunities that bridged the gap between school and work. Among other things, this act provided money to states to establish cooperative education programs and provide financial incentive to employers to hire cooperative education students. It was based on several findings, but the main attempt was to provide meaningful learning and employment opportunities for students who were either in danger of dropping out of high school or who were entering the workforce with no post secondary education or marketable skills. Although Federal funding for this act stopped in 2001, many states continued to fund the programs established under this Act (Brown, 2002).



Cooperative education, as defined above, has sound roots in educational learning theories. Early constructivists believed that learning environments should emphasize the performance of authentic tasks in meaningful contexts, and believed that learning should occur as opportunities presented themselves in real-world settings, as opposed to a predetermined sequence of instruction in a fabricated setting (Piaget, 1973). Central to Piaget's theory of constructivism is the idea that understanding develops in stages and is reinforced through active involvement. Similarly, John Dewey believed that education depended on action (Southwest Educational Development Laboratory, 1995). In his book *Democracy and Education* (1916), Dewey proposed that knowledge emerges only from situations and experiences that occur in a social context and that are meaningful and important to the learner. He further explained that schools help students to transform their minds and build their potential for future learning possibilities when they allow students to participate in learning activities that occur outside of the traditional classroom.

Constructivism can be divided into two philosophical camps. Cognitive constructivists, such as Dewey and Kant (1781-1946) stress the subjectivity and relativity of the learning process. They believe that learning is created through one's experiences and interpretations of those experiences within the context of one's own reality, resulting in unique and personal knowledge (Doolittle & Camp, 1999).

Emphasis on the belief that interaction with others, or social context, is crucial for learning to occur forms the foundation of social constructivism. Social constructivists Vygotsky and Bandura criticize Dewey's early theories because they seem to indicate that knowledge can be created in the vacuum of one's own mind; that a student's learning and his development of knowledge can be constructed solely from his own experiences. Social constructivists posit that

knowledge is the result of social interaction and the use of language, and is therefore framed within a cultural context (Doolittle & Camp, 1999). This position is summarized by Bakhtin (1984) “truth is not to be found inside the head of an individual person, it is born between people collectively searching for truth, in the process of their dialogic interaction” (p.10). Both cognitive constructivists and social constructivists agree that learning can only occur through active experimentation in a meaningful context.

Emphasis on the importance of situations and experiences in constructing human knowledge forms the basis of experiential learning theory. Proponents of experiential learning, such as Joplin and Kolb, believe that only through personal experience does one construe knowledge and achieve learning (Roberts, 2006). Both Kolb (1984) and Joplin (1981) developed models to explain how they believe learning occurs. Common to both are the concepts that learning is an on-going process, and that learners must experience the concepts they are trying to master. Additionally, they both state that through experimentation and reflection, the learner will develop new hypotheses, which can then be tested through more experimentation, reflected upon and refined.

The idea that learning involves active engagement in practical application is also emphasized by Atherton (2009) in his comparison of Bloom’s Taxonomy of Learning Objectives (1956) to Anderson and Krathwohl’s Taxonomy of the Cognitive Domain (2001), both of which are hierarchical classifications used in developing educational curricula. Developed on the premise that one cannot master a higher level of cognitive thinking until the levels beneath it have been mastered, both of these models classify application of learning above comprehension or understanding. Robert Gagne’s conditions of learning (1985) also prescribe eliciting performances and providing feedback as necessary instructional elements in the learning process.

Unfortunately, “the irony for vocational education . . . is that studies of cognitive development in vocations are leading reforms of general education, but the full import of the theoretical advances is not being applied in vocational education itself” (Stevenson, 1994, p. 8). Strides in this direction have been made with the most recent Perkin’s legislation (2006). Vocational programs have been charged with imbedding academic anchors in career and technical instruction. Many may argue that this, in itself, is a great delivery model for contextual learning. However, if one is to believe, as Cagne does, that learning requires “eliciting performances and providing feedback” (1985), then an equally compelling argument could be made that this is occurring even less under current legislation because more classroom time is spent on academic achievement and less time is available for actual performances and feedback.

The benefits of cooperative education are numerous. As a majority of the nation’s workforce reaches retirement age, employers can add young, skilled workers to their ranks through the employment of cooperative education students. Employers have the opportunity to train young people to their company standards, and can hire someone on a temporary basis before committing to an offer of fulltime employment. High school students can earn money and enhance their technical skills before graduating high school, and, hopefully, will have the opportunity for fulltime employment upon graduation (Mason & Haines, 1972). Cooperative education students reported they believed cooperative education experiences improved their social and communication skills and helped develop mature workplace attitudes (Velde & Cooper, 2000). Additionally, students who have participated in cooperative education experiences graduate with an understanding of their career choice and the industry to which it is aligned, as well as maturity gained from experience working among adults (John, Doherty &

Nichols, 1998). However, little empirical data are available to support these benefits (Finn, 1997; Kazis, 2004).

Starting with the National Commission on Excellence in Education's report *A Nation at Risk* (1983), and the ensuing No Child Left Behind (NCLB) Act of 2002, a new era of accountability in American education began. The focus of NCLB is to increase the rigor in all core academic courses and to prepare all students for post secondary education (Mantel, 2005). Title I of this Act requires states to develop proficiency assessments that correlate to state standards in academic courses. These assessments have become high stakes tests, as both students and schools are held accountable for demonstrating progress. According to Goertz & Duffy (2003), tests can be considered "high-stakes" if the consequences for inadequate test performance can be severe. Schools that do not meet adequate yearly goals are in danger of losing Title I funding (Kymes, 2004), which can be a severe consequence indeed. This era of high stakes testing and program accountability applies equally to purely academic high schools and to secondary career and technical education centers. In Pennsylvania, this is evidenced by three requirements: (a) the Carl D. Perkins Career and Technical Education Improvement Act of 2006 requires each state to develop a system of core performance measures and standards for the purpose of evaluating its secondary, adult and postsecondary career and technical education programs; (b) the State Board of Education mandates the use of a student occupational competency assessment for all secondary and adult career and technical education program concentrators who are scheduled to graduate and (c) "Pennsylvania is a unified state where state and federal career and technical education programs are part of the Governor's Executive Order to the Workforce Investment Board which calls for an integrated workforce system with core performance measures and standards" (Pennsylvania Department of Education [PDE], 2009,

p.2). In Pennsylvania, the only two valid summative assessments for secondary career and technical education students are the National Occupancy Testing Institute (NOCTI) Job Ready Assessments and the National Institute of Metalworking Skills (NIMS) tests, both of which are developed to industry standards (PDE, 2009).

In this era of test accountability and data driven decision-making, many schools do not allow students to participate in capstone cooperative education until after they have passed their NOCTI exams. Capstone cooperative education is not viewed as academically legitimate and is often perceived as just time spent away from the classroom (Crow, 1997). It is feared that students who spend any time outside of the classroom setting will not score well on these end of program assessments.

One of the required components of a capstone cooperative education placement is the establishment of a training plan (PDE, Bureau of Career and Technical Education, 1999). This is a detailed description of the course competencies agreed upon by the employer and the co-op coordinator that the student will learn at the worksite. It is assumed that these competencies and the training received match industry standards.

Based on studies of contextual and experiential learning, it stands to reason that if students are tested to industry standards and if students learn better when information can be applied in contextual settings, then students who participate in capstone cooperative education should score better than their peers on these summative exams. This study seeks to determine if such a correlation exists. If there is such a relationship, is it modified by the student's grade point average (GPA), whether or not the student has an Individualized Education Plan (IEP), the length of time the student has spent in the cooperative education program, or by the extent to which the training plan mirrors the NOCTI blueprint for that vocational program?

### *Significance of the Study*

Many researchers have discussed the benefits of contextual or experiential learning (Piaget, 1973; Dewey, 1916; Kolb, 1984; Kraft & Sokofs, 1988). Research has also addressed the benefits of cooperative education experiences (Stone, et al., 1990; Berryman, et al., 1993; John, et al., 1998; Velde & Cooper, 2000). Yet, in this era of high stakes testing and program accountability, the amount of time that career and technical students are permitted to participate in these experiences has diminished (PDE, 2000, 2008). Unfortunately, there is little empirical evidence to suggest that there is a relationship between capstone cooperative education experiences and performance on end of program assessments.

This study will expand the knowledge base on the relationship between capstone cooperative education experiences and student scores on end of program assessments. Perhaps results of this study can be used to revise components of existing capstone cooperative education programs in hopes that students can enjoy the benefits associated with cooperative education while still demonstrating proficiency on end of program assessments.

### *Statement of the Problem*

For secondary career and technical education programs, student performance on NOCTI exams has become the primary source of data by which the instructor and the students are measured. These tests include both a written and a practical component, and are usually administered in the spring of a career and technical education student's senior year. While proficient scores on NOCTI exams are not currently a requirement for graduation in Pennsylvania, students who underperform are not awarded a Pennsylvania Skills Certificate. More importantly, career and technical program instructors are often held accountable for their students' performances. If students do not score "Competent" or "Advanced" levels in both the

written and practical portions of the test, curriculum must be adjusted to address the areas of student deficiency (PDE, 2008, PA School Code, Ch. 339). Therefore, student participation in cooperative education may be impeded if a career and technical education instructor or administrator fears that time spent out of the classroom and away from the prescribed curriculum will jeopardize the student's chances of performing well on these exams. For this reason, many schools will not allow students to participate in cooperative education experiences until after the NOCTI written and practical exams are taken; thereby depriving the students of valuable authentic work experiences.

Generally, students are not permitted to participate in capstone cooperative education until their program instructor recommends them. Once recommendation is obtained, the student must also meet other entrance requirements which are determined by school policy. This usually includes a minimum GPA requirement (U. S. General Accounting Office, 1991), and acceptable attendance and discipline records.

As cited previously, evidence supports the theory that students learn better in contextual, real-world settings. Research also indicates that students who choose a career and technical high school are predominately kinesthetic learners, and do best when they are presented with authentic hands-on activities (Elliott, 2007). Based on this empirical evidence, capstone cooperative education experiences should enhance, not hinder, student performance on NOCTI exams; and students should be encouraged to participate in these activities, not prevented from doing so.

This study is designed to answer these questions: Is there a relationship between students' participation in capstone cooperative education and their performance on NOCTI exams? If so, is that relationship affected by student GPA, IEP status, length of time in the co-op

program, and/or the degree to which the student training plan mirrors the NOCTI blueprint competencies for that program.

#### *Purpose of the Study*

The purpose of this descriptive ex post facto correlational study is to determine if there is a relationship between secondary school career and technical education student participation in capstone cooperative education experiences and their performance on summative assessments, as measured by NOCTI scores. Additionally, this study will seek to determine if cumulative GPA, IEP status, length of time in cooperative education, and degree to which the student training plan reflects the NOCTI blueprint competencies affect this relationship.

#### *Research Questions/Hypotheses*

Utilizing a three-phase process, this quantitative study will seek to determine if there is a relationship between career and technical education student participation in capstone cooperative education and scores on end of program student assessments. This study will be guided by the following research questions:

1. To what extent does student participation in capstone cooperative education affect scores on NOCTI exams?
2. To what extent is this relationship affected by student GPA, IEP status, length of time on co-op, and quality of student training plan?

The following hypotheses were generated to guide this investigation:

Hypothesis 1: There is a relationship between secondary career and technical education student participation in cooperative education experiences and student scores on summative assessments, as measured by NOCTI exams.



Hypothesis 2: This relationship will be affected by student GPA, IEP status, length of time on co-op and quality of training plan.

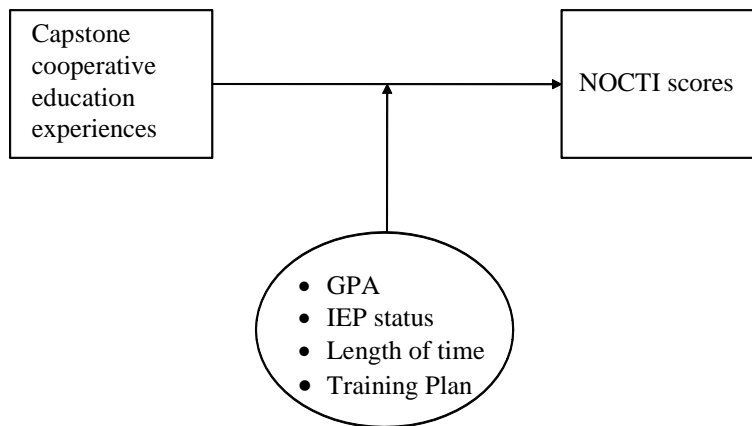
Consequently, the null hypotheses are as follows:

Hypothesis 1: There is no relationship between secondary career and technical education student participation in cooperative education experiences and student scores on summative assessments, as measured by NOCTI exams.

Hypothesis 2: This relationship will not be affected by student GPA, IEP status, length of time on co-op and quality of training plan.

### *Conceptual Framework*

These questions and resulting hypotheses are illustrated in the figure below:



*Figure 1. Relationship Between Variables in Study*

### *Assumptions of the Study*

The following assumption was made in conducting this study:

- 1) Data provided by participants on initial questionnaire and corresponding data collection sheet is honest and accurate.

### *Limitations of the Study*

This study will have the following limitations:

- 1) This study was limited to capstone cooperative education coordinators in Pennsylvania who are members of the Pennsylvania Cooperative Education Association.
- 2) This study was limited to capstone cooperative education students in secondary career and technical schools in Pennsylvania.
- 3) Attempts were made to collect GPA information on individual students, however specific GPAs of all students in the study were not available. Additionally, for shared time participating schools, it is not known whether reported GPAs are for the student's entire high school coursework or only that portion that occurs at the career and technology center.
- 4) Some data collection was dependent on participant self-reporting, and therefore subject to possible inaccuracies.
- 5) Random selection of career and technical programs did not occur, so generalizing results to all career and technical programs and students will not be possible.
- 6) Other factors not addressed in this study, such as number of questions on each NOCTI test, and variances in policy interpretations, may affect any established relationships.

### *Operational Definitions*

Capstone cooperative education- A method of instruction for career and technical high school students who are in the final stages of training for a specific occupation. Through written cooperative arrangements between the school and the employer, students alternate instruction in the classroom with experience on the job. It is the "capping off" of their formal vocational training (PDE, 1999, p.3).

Career and technical education- Academic education and hands-on training for a specific occupation or career cluster. (Carl D. Perkins Career and Technical Education Act, 2006). This term is used interchangeably with **vocational education** and **vocational training**.

Contextual learning- The theory that students learn best when instruction is imbedded in real-life problem solving activities (Jonassen, 1994).

Cooperative education- A method of instruction in vocational education whereby individuals alternate between classroom learning and on-the-job supervised experience (PDE, 1999, p.1).

End of program assessments- tests given to students at the end of a career and technical program of study designed to measure content and skill acquisition. This term is used interchangeably with **summative assessments**.

Experiential learning- the process whereby knowledge is created through the transformation of experience (Kolb, 1984).

Kinesthetic learning- Learning that occurs through manipulation of objects and hands-on activities (Fleming & Mills, 1992).

### *Organization of Dissertation*

This dissertation is organized into five chapters.

Chapter 1 provides an overview of cooperative education, including a brief summary of theories about contextual learning, experiential learning, kinesthetic learning and cooperative education.

It includes an explanation about summative assessments in Pennsylvania and about NOCTI tests in particular. This chapter also includes a statement of the problem, need for the study, the purpose and objectives of the study, and the limitations, assumptions and operational definitions of the study.

Chapter 2 contains a review of literature and previous research pertinent to the variables studied and to the theoretical framework.

Chapter 3 describes the research design, population and sample, instrumentation, data collection procedures, and data analysis procedures.

Chapter 4 states the results and findings pertinent to the study.

Chapter 5 contains recommendations for future study and conclusions.

## Chapter 2

### *Review of Literature*

Early researcher Jean Piaget became interested in how humans adapt to their environment (Huitt & Hummel, 2003). He believed that human behavior is controlled by a person's mental organization, or schemes, that represent the world and drive a person to react. As a person matures, these processes become increasingly more complex. In adults, Piaget believed that these processes, or struggles to adapt to the environment, can be divided into two distinct categories: assimilation and adaptation. Assimilation refers to the process of mentally changing one's situation or environment so that it matches a previous cognitive structure. Accommodation is the process of changing cognitive structures to adapt to a new situation. Piaget believed all humans use both these processes alternately and simultaneously throughout life to make sense of and survive in their environment (Piaget, 1973). These beliefs helped form the foundation for the constructivist model of learning and teaching.

Constructivism can be divided into two similar, but opposing theories, cognitive constructivism and social constructivism. One early cognitive constructivist, John Dewey, believed action was the foundation of education (Dewey, 1916). He believed that learning was derived from experience and that knowledge could not be transmitted, intact, from teacher to student. Instead, the student had to experience a meaningful situation from which he or she could derive ideas and knowledge. Solving a relevant problem in a social context would produce the insight and ideas that constitute understanding and knowledge. This theory of constructivism is based on the idea that humans innately try to make sense of the world. Instead of passively absorbing information, knowledge is actively constructed when people use information gained from previous experiences and apply it to current situations (Billett, 1996). Jonassen (1994)

summarized much of early constructivism when he proposed a list of eight components that comprise a constructivist learning environment. One of these characteristics is that authentic tasks should be presented in a meaningful context rather than in an abstract and non-contextual manner. Another of the characteristics is that the environment should take place in real-world situations, as opposed to an artificial and predetermined sequence of instruction (Jonassen, 1994).

Believing that Piaget's theory of cognitive constructivism downplayed the impact of learning through interaction with others, psychologist Leo Vygotsky (1894-1934) developed a theory known as social constructivism. Based on the premise that knowledge is primarily a result of interaction with others, this theory emphasizes the social nature of knowledge (Doolittle & Camp, 1999). Vygotsky believed that learning is primarily a social function, requiring verbal and physical interaction between one person and another. In his book, *Mind in Society* (1978), he states:

“Every function in the child's cultural development appears twice: first on the social level, and later, on the individual level; first between people (interpsychological) and then inside the child (intrapyschological). This applies equally to voluntary attention, to logical memory and to the formation of concepts. All the higher functions originate as actual relationships between individuals” (p.57).

Unlike cognitive constructivists, this theory holds that knowledge is not primarily created through a personal process of experiences and reflections, but occurs only through the observations of and interactions with others. While the individual does construct meaning from experiences, the meaning and learning is based on the socially defined nature of that knowledge (Roberts, 2006).

This idea is further reinforced by modern psychologist, Albert Bandura, who shares Vygotsky's belief in the importance of social interaction in the learning process. Bandura believes that learning is created through the observation of modeling behaviors by others, which is then decoded by the observer and transferred into knowledge, which the observer either reinforces through his own behavior or rejects as unproductive (Bandura, 1969). Both Vygotsky and Bandura believe that knowledge is not constructed inside one's own head, but is created through dialogue and expression with others (Doolittle & Camp, 1999). The tenets of both cognitive constructivism and social constructivism can be found in the practice of cooperative education.

Based on the seminal works of Dewey and Piaget, educational theorist, David Kolb, developed a theory of experiential learning. Kolb's theory defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb, 1984, p. 41). Believing that all learning is experiential, but that not all experiences are necessarily educational (Dewey, 1938), Kolb developed a model to depict how he believes learning occurs (Kolb, 1984). Divided into four stages, this model includes concrete experience, reflective observation, abstract conceptualization and active experimentation (Kolb, 1984). Cyclical in nature, with no particular starting point, Concrete Experience and Abstract Conceptualization are the modes for grasping experience; while Reflective Observation and Active Experimentation are the modes for transforming those experiences into knowledge (Kolb, Boyatzis & Mainemelis, 2001). There are other models depicting the process and contexts of experiential learning (Dale, 1946; Joplin, 1981; Phipps & Osborne, 1988; Steinaker & Bell, 1979, as stated in Roberts, 2006), but they are all similar in the assumption that learning can only occur when the learner is exposed to an

experience from which he can develop a theory or idea, and then practice that idea, reflecting and retrying, until a form of knowledge or learning is constructed. As succinctly stated by Phipps and Osborne (1988), the emphasis is on learning by doing, and this emphasis is apparent when attention is given to such activities as laboratory work, field trips and occupational experience programs. This would include cooperative education experiences.

Modern contextual learning theory emphasizes the importance of presenting experiences in authentic situations, based on the learner's established frame of reference (Freeman, Field & Dyrenfurth, 2001). According to Hull (1995), learning can only occur when the student processes new information in a way that conforms with their frame of reference, since the mind naturally seeks meaning in context by searching for relationships that seem sensible and useful. Consequently, students would be eager to learn if they could find meaningful correlations between abstract concepts and practical, real-world applications (Komalasari, 2009). Newman & Wehlage (1993) reported that authentic learning occurs through performance of tasks and experiences that are meaningful and significant to the learner, as opposed to trivial and useless. Woolfolk (2001) further defined an authentic task as one that is connected to real-life situations and problems that students face outside the classroom. Wehlage, Newmann & Secada (1996) contend that authentic academic achievement can only be assessed by three criteria: (a) construction of knowledge, (b) disciplined inquiry, and (c) the value of that learning beyond the school walls. Additionally, Freeman, Field & Dyrenfurth (2001) state "the most significant benefit of efforts to provide contextual cooperative, cross-functional, and experiential learning opportunities for the students is the ability to practice their profession in a work-like environment while they are learning industrial technology principles as part of the undergraduate curriculum" (p.7). So prevalent is this belief in the importance and value of contextual learning that the



Secretary's Commission on Achieving Necessary Skills Report (SCANS, 1991) included this statement:

We believe, after examining the findings of cognitive science, that the most effective way of learning skills is "in context," placing learning objectives within a real environment rather than insisting that students first learn in the abstract what they will be expected to apply (p.15).

Modern career and technical schools, and corresponding cooperative education programs, offer an excellent platform for application of these initiatives.

Vocational education in general, and cooperative education in particular, can be traced in the United States to early Colonial days when skilled craftsmen trained apprentices under formal agreements. (Gray & Herr, 1998). However, the first legislation to impact vocational education in America was the Morrill Act of 1862 (Downey, et al., 1984). This act granted land to states for the purpose of establishing agriculture and mechanical trade colleges. Initially, vocational education was practiced only at post secondary institutions, but in the 1880's the idea spread to secondary education, where it was used mainly to train orphans, delinquents, children with mental deficiencies, and the children of defeated Native American leaders (Gray & Herr, 1998). With the advent of the Industrial Revolution, the need for skilled workers became urgent. In 1906, the first state program of vocational training in secondary education was established in Massachusetts (Downey, et al., 1984). The Smith-Hughes Act of 1917 provided federal funding for secondary programs in agriculture, home economics, trade and industrial training. This act also supported a form of cooperative education (Walter, 1994), but placed the onus for implementing it on cooperative extension agents, not the vocational schools, as it was believed these activities should occur outside of the normal school day and should be supervised by

practitioners in the field (Hillison, 1996). After World War II, the Servicemen's Readjustment Act of 1944 and the George-Barden Act of 1946 increased federal funding for vocational education, but much of this funding was directed to the private sector, where training occurred within individual companies (Downey, et al., 1984).

The Vocational Education Act of 1963, along with the amendments of 1968, increased funding for the building of vocational schools, teacher training and curriculum development. This curriculum development included cooperative education programs, but many of these programs were merely attempts to access funds and did not meet the standards necessary to ensure a quality experience for those enrolled (Walter, 1994). Social phenomena of the 1970's, such as increased welfare rolls, women entering the workforce in large numbers, and large numbers of out of school youth gave rise to government sponsored vocational training programs such as Job Corps and Neighborhood Youth Corps (Downey, et al., 1984). Unfortunately, government funding of these programs has not continued at this initial level over the last forty years, and many cooperative education programs were eliminated due to lack of adequate funding (Walter, 1994).

The Vocational Act of 1963 was amended by the Carl D. Perkins Act of 1984. Renamed the Carl D. Perkins Vocational and Technical Education Act in 1998, this act appropriated more funding than any other Federal legislation to vocational education (Fletcher, 2006). Although amended several times since its inception, it remains the largest federal funding for secondary career and technical schools.

A need for educational reform in the United States was spurred by the publication of *A Nation at Risk* (1983). Written by The National Commission on Excellence in Education, this report found that American high school students lagged far behind their international

counterparts in core areas of reading, math and technology. Specifically, it called for more rigorous levels of academic achievement in both reading and math. It addressed the need for better prepared teachers and for higher level math and science requirements for high school graduation.

In 1991, the Federal Government issued the Secretary's Commission on Achieving Necessary Skills (SCANS) Report. This report found that many students graduating from high school in the United States were not prepared to enter the workforce or post secondary education. It called for greater linkages between education and industry so that students were prepared for modern careers. Among other things, this report called for greater technology education, improved career guidance and opportunities for students to spend time in the workplace. This workplace learning could range from short-term job shadowing experiences to longer term internships.

This report gave rise to the next big piece of federal legislation directed at vocational education in the United States. This was the School-to-Work Opportunities Act of 1994 (STWOA). Two of the findings used to establish rationale for this report are the fact that increased international competition in the American workplace is leaving little room for unskilled workers, and the finding that "the work-based learning approach, which is modeled after the time-honored apprenticeship concept, integrates theoretical instruction with structured on-the-job training, and this approach, combined with school-based learning, can be very effective in engaging student interest, enhancing skill acquisition, developing positive work attitudes, and preparing youths for high-skill, high-wage careers" (STWOA, p.5). This act did much to promote linkages between education and the workplace, and was instrumental in establishing many of the career guidance programs found in high schools today. Unfortunately,

funding for this Act ceased in 2001, and while many states continue to structure educational programs in accordance with the guidelines of this Act, they must do so with very limited financial resources (Brown, 2002). While the STWOA seemed to address findings of the SCANS Report, it did little to address the educational overhaul called for by *A Nation at Risk*.

Aimed at totally reforming the American education system, the No Child Left Behind (NCLB) Act was signed into law in 2002. Designed to raise the academic achievement levels of all students, NCLB policy aimed to raise standards by testing, hold students and schools accountable for achievement, increase public awareness of school performances, and ensure all teachers are highly qualified to teach what they are assigned. Specifically, the goal is to increase academic rigor in all core courses and ensure that all students who graduate from high school are prepared for post secondary education (Mantel, 2005). Goals are measured solely by proficiency exams. Students who do not score well on these exams may risk not graduating from high school, and schools whose students do not perform well risk severe state sanctions. All schools and all students are held to the same standards, regardless of demographic characteristics or curricula. Students attending vocational high schools are measured to the same standard as those attending strictly academic or college preparatory high schools. Much of the funding for vocational education is provided by the Federal Carl D. Perkins Career and Technical Education Improvement Act of 2006. This Act mandates that states implement performance standards and accountability measures for secondary career and technical education students that are in alignment with the regulations of NCLB. Since this Act is directly aligned with the proficiency requirements addressed in NCLB, the urgency of high-stakes testing in vocational high schools matches that found in academic high schools (Fletcher, 2006).

In Pennsylvania, students who attend career and technical high schools must take not only the state academic proficiency exams, but also standardized assessments in their occupational area. The performance exam used to measure vocational education proficiency is the National Occupational Competency Testing Institute's (NOCTI) Job Ready Assessments. These tests are aligned to national industry standards and consist of two components, a written portion and a practical, or hands-on, portion. These tests are administered to students in their senior year and are considered summative or end-of-program assessments. Scores on these tests are grouped into four categories: Below Basic, Basic, Competent and Advanced. Students must obtain a combined rating of Advanced in order to have demonstrated proficiency and receive a Pennsylvania Skills Certificate. This certificate can be an important credential for those students seeking employment in the industry.

More importantly, however, is that programs whose students do not score at the Competent or Advanced levels are judged to be lacking academic credibility. Teachers of those programs are held accountable by their administrators for improving their students' scores the following year. Thus, the onus falls on the instructor to provide evidence of instructional changes that increase rigor and enhance students' chances for success on the next year's test. Teachers have reason to be reluctant to allow students to participate in cooperative education if they fear the time spent out of the classroom will hinder the chances of the student demonstrating proficiency on the NOCTI exam.

The state of Pennsylvania recognizes cooperative education as a legitimate career and technical education program, and specific certification must be obtained to teach cooperative education (PDE, 1999). However, cooperative education actually consists of two different types of programs, Capstone and Diversified Occupations. Diversified Occupations is a program that

can be offered in any high school. Students receive classroom instruction on job readiness skills, and transferable work skills. They are placed in employment that aligns with their career aspirations, and all specific career and job related training occurs at the workplace. Capstone cooperative education programs are linked directly to vocational programs. A workplace internship in the student's area of training is viewed as a capping off, or capstone experience, of their career and technical education. Most of the job specific skills have already been learned in the laboratory, and students are given workplace internships to practice and refine the skills they have already acquired.

One of the components required of a cooperative education student placement is the development of a training plan (PDE, 1999). This document is developed with input from the cooperative education coordinator, program instructor and the employer. It outlines the types of workplace learning activities and experiences the student will have and the expected outcomes the student will complete.

Research validates the benefits of cooperative education. In 1979, Morris, Bransford & Franks concluded that most students learn best when skills and concepts are presented within realistic contexts where the students are able to practice and master the outcomes expected of them. Stone, et al. (1990) found that students in cooperative education placements are more likely than other students to have workplace experiences that incorporate problem-solving skills, reading, math and other practices related to the classroom. Additionally, they receive more practice in assuming responsibility and making independent decisions than teenage workers not in cooperative education placements. According to the William T. Grant Foundation report, *The Forgotten Half* (1988) "meaningful work experiences with adequate adult guidance can contribute to improved school performance" (p. 46). Berryman, Flaxman and Inger (1993) found

that the quality of cooperative education jobs is far above that found in non-cooperative education jobs traditionally obtained by teenagers.

However, due to the testing requirements mandated by NCLB and The Perkins Act, many students have been discouraged or prohibited from participating in cooperative education because it is often “viewed as having little academic value and is perceived as taking time away from classroom learning” (Crow, 1997). This prevents many high school students from participating in what may be a very beneficial experience. From the academic school years 1998/99 to 2006/07, student enrollment in secondary career and technical education centers in Pennsylvania declined 4.15%, but the number of students participating in cooperative education programs declined nearly 38% (PDE, 2000, 2008). While several factors may have contributed to this decline in cooperative education participation, it seems to suggest that many students are not afforded the opportunity to participate in real-world, contextual learning experiences.

#### *Summary of Literature Reviewed*

Many early theorists believed that people learn best when presented with practical, real-world problems to which they must apply prior learning in order to solve (Piaget, 1973). Furthermore, schools can help students expand their minds by allowing them to participate in learning activities that occur naturally, outside of the classroom setting (Dewey, 1916). These ideas of early theorists formed the basis for cognitive and social constructivism. Constructivism contends that learners actively construct knowledge by integrating new experiences and information into previous learning, and reinterpreting old learning to reconcile it with the new (Billet, 1996).

Constructivist learning theories form the foundation for contextual learning theories, especially those of experiential and authentic learning. Common to all of these is the assumption

that learning can only occur in situations that are meaningful, practical and applicable to the learner's frame of reference; and which has connections to the situations and experiences that occur outside of a classroom setting.

While theories of constructivism and contextual learning form a theoretical basis for vocational education, the practice of vocational education precedes modern theory. In Colonial times vocational education took the form of apprenticeships and became a way for master craftsmen to teach their trades to others. In modern times it became a vehicle for re-engaging out of school youth, providing a future for orphans or disabled children, educating displaced homemakers and providing a marketable skill to those not entering post secondary education.

When the SCANS report was published (1991), vocational education became part of mainstream education. Vocational education was re-named career and technical education and it became a viable instructional model for providing high school students with the technical skills the SCANS report indicated were necessary if students were to be successful in the modern workforce.

Cooperative education in some form has always been a part of the vocational education system. Capstone cooperative education allows vocational students who are nearing the end of their training to work at a place of employment related to their chosen occupation. This is seen as "capping off" their vocational education, and allows students to transition from high school to the work force seamlessly. This work-based experience is closely monitored by a certified cooperative education coordinator and the list of tasks to be learned on the job is planned by both the coordinator and the employer (PDE, 1999). In addition to refining the skills a student has learned in the school laboratory, cooperative education allows students to simultaneously earn money and school credit.



With the enactment of the No Child Left Behind legislation in 2001, education in the United States entered an era of high-stakes testing and data-driven accountability for students, teachers and school administrators. This act mandated that all states develop a system of testing for increasing levels of proficiency in core academic subjects. The Carl D. Perkins Act of 1996, which is the leading source of funding for vocational education, mirrored the NCLB testing mandates for vocational students.

In Pennsylvania, the prescribed summative assessment for career and technical program completers is the NOCTI test (PDE, 2008). (The only exception is the NIMS tests for metalworking students). This test consists of both a written and a practical portion. Students must score at a Competent or Advanced level on both tests in order to be designated proficient. Teachers whose students do not meet the proficiency requirements must demonstrate changes to curriculum, lesson plans or teaching methods that have been empirically proven to lead to student improvement (PDE, Ch. 339). Because teachers and schools are held accountable for student performance on these tests, many are reluctant to allow students to participate in cooperative education. They fear that allowing students to have time out of the classroom to perform real-world work will not give them the skills and academic knowledge needed to score well on the exams. Cooperative education is not considered a worthwhile academic endeavor (Crow, 1997).

## Chapter 3

### *Research Methodology*

This chapter outlines the methods and procedures used in the study. It includes the following: 1) Purpose of the study, 2) Research questions and hypotheses, 3) Study Design, 4) Population and Sample, 5) Instrumentation, 6) Data Collection, and 7) Process for Data Analysis.

#### *Purpose of the Study*

The purpose of this descriptive ex post facto correlational study was to determine if there is a relationship between secondary school career and technical education student participation in capstone cooperative education experiences and their performance on summative assessments. Additionally, this study sought to determine if student GPA, IEP status, length of time in the cooperative education program, and quality of student training plan affected this relationship.

The study will be guided by the following research questions:

1. To what extent does student participation in capstone cooperative education affect student scores on NOCTI exams?
2. To what extent is this relationship affected by student GPA, IEP status, length of time on co-op, and quality of student training plan?

The following hypotheses were generated to guide this investigation:

Hypothesis 1: There is a relationship between secondary career and technical education student participation in cooperative education experiences and student scores on summative assessments, as measured by NOCTI exams.

Hypothesis 2: This relationship will be affected by student GPA, IEP status, length of time on co-op and quality of training plan.

Consequently, the null hypotheses are as follows:

Hypothesis 1: There is no relationship between secondary career and technical education student participation in cooperative education experiences and student scores on summative assessments, as measured by NOCTI exams.

Hypothesis 2: This relationship will not be affected by student GPA, IEP status, length of time on co-op and quality of training plan.

These questions and resulting hypotheses are illustrated in the figure below:

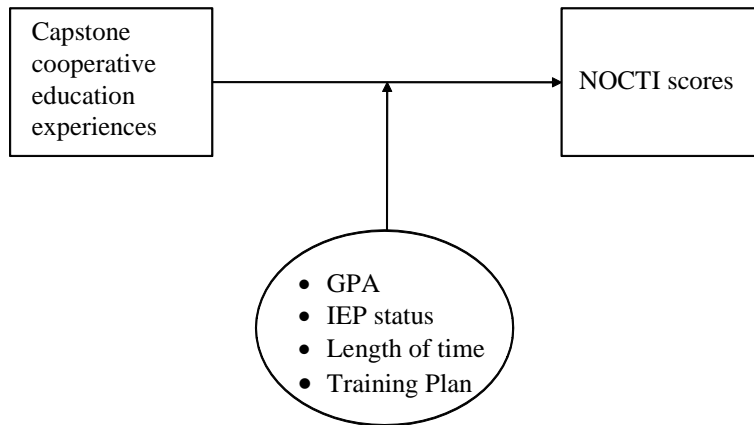


Figure 1. Relationship Between Variables in Study

*Design of the Study*

A static group comparison design (Campbell & Stanley, 1963) was used to address the hypotheses of this quantitative study. All students studied were seniors in career and technical education programs in Pennsylvania. The treatment (X) was participation in capstone cooperative education. The observations (O) were student scores on NOCTI assessments.

$X_{(CTE\ seniors+ co-op\ experience)}$	$O_1$ (scores on NOCTI exams)
-----	
	$O_2$ (scores on NOCTI exams)

X= Co-op experience = (IV)

O= Exam scores = (DV)

### *Data Collection*

The process of data collection for this study occurred in three phases.

#### **Phase I**

##### *Population and sample*

Phase I of this study was a census study of all practicing Cooperative Education Coordinators in Pennsylvania who are members of the Pennsylvania Cooperative Education Association (N=147). As this was a census, no random sampling occurred. To control for frame error, efforts were made to obtain accurate names and contact information for all currently practicing cooperative education coordinators in Pennsylvania from the Pennsylvania Cooperative Education Association and the Pennsylvania Department of Education. The focus of this census, however, was those cooperative education coordinators who supervised capstone cooperative education programs during the 2009/2010 school year. Those who supervised only diversified occupation cooperative education programs were excluded. Therefore, the accepting sample from this initial census, and their responses to question #1 on the survey instrument determined the target population.

##### *Instrumentation development and measurement*

A brief questionnaire addressing the variables in this study was developed (see Appendix A). All questions measured categorical variables and were measured on a nominal scale.

##### *Instrument review*

The instrument was reviewed by a panel of experts consisting of five faculty members of the Department of Workforce Education and Development at The Pennsylvania State University and five practicing Pennsylvania capstone cooperative education coordinators. Panel selection was based on the member's knowledge of career and technical education in Pennsylvania. This panel reviewed the questionnaire to establish face and content validity, and revisions were made

accordingly. The instrument, along with a cover letter, was sent to the Regulatory Affairs and Compliance Office at The Pennsylvania State University to ensure compliance with University regulations and policies.

#### *Pilot test of the instrument*

Upon obtaining Institutional Review Board approval (see Appendix B), this questionnaire was pilot tested on cooperative education coordinators in Oklahoma. This state was chosen for two reasons: a) the researcher has accessibility to the frame and b) the structure and implementation of cooperative education in this state is similar to that in Pennsylvania. This pilot study was helpful in predicting response rates to the study in Pennsylvania, and provided useful feedback for instrument revision. This helped increase the chances of obtaining valid and reliable data.

Conducted via an Internet survey and following a modified Dillman's (2000) five step process for achieving higher response rates, the questionnaire was sent to all active career and technical cooperative education coordinators in Oklahoma (N= 140). Forty seven coordinators responded. Of those respondents, 100% indicated the questionnaire was concise, easy to read, and easy to understand. Two respondents made suggestions for improvement. One indicated the year 2009/2010 should be added to clarify the term "last year", and the other suggested including a sentence at the end to indicate the end of the questions. These additions were made to the survey instrument.

#### *Data collection*

Data collection was conducted in three stages, using several methods. First, the questionnaire, along with a cover letter was sent as an e-mail attachment to all the active cooperative education coordinators in Pennsylvania who are members of the Pennsylvania

Cooperative Education Association (N= 147). The mailing included an explanation of the study including state association endorsement, instructions for completing the questionnaire, deadline for completion, and instructions for returning the completed questionnaire. Responses were coded so that respondents and non-respondents could be identified.

Three weeks after this e-mailing, another e-mail was sent to nonrespondents reminding them of the study. The questionnaire and appropriate instructions were sent as an attachment to the e-mail. Two weeks after sending this e-mail, a third email was sent, requesting participants to respond. A final reminder, with the questionnaire attached was mailed two weeks later.

Twenty nine people returned the initial questionnaire. Two responded that they were not capstone cooperative education coordinators, and were therefore eliminated from the study. Four indicated they were coordinators of capstone programs, but were not willing or able to share school data for the purpose of this study, so were also eliminated. Twenty three respondents indicated they were coordinators of capstone programs and were willing to provide data for the study. These 23 became the target population.

## **Phase II**

### *Population and sample*

In this phase, information was solicited from all respondents in Phase I who answered “yes” to question #4 on the initial questionnaire (n=23). This question asked if participants were willing to share NOCTI scores and GPA information with the researcher, provided no student or school identifying information was revealed. Collection of this information provided the specific data for the variables that became the focus of the study.

### *Instrumentation development and measurement*

A spreadsheet was developed to collect student NOCTI scores, for both the written and practical portions, for cooperative education students. Participants were also asked to provide data on student GPA, career and technical program, IEP status, and number of days spent in the cooperative education experience (see Appendix C). All respondents were again contacted and asked to provide individual scores for each student in the career and technical programs from which the co-op scores were reported. These scores of the students who did not participate in cooperative education were used to compare against the scores of those students who did participate.

### *Data collection*

The data collection sheet (Appendix C) along with instructions for completion and return were e-mailed to the target population. Two weeks later, this information was sent again to those in the target group who had not responded. One participant asked to be dropped from the study (n=22). Repeated attempts, including telephone calls and personal visits, were made to collect the necessary data from the remaining participants. Seventeen of the 22 participants responded with requested data (77%). Data were not received from five participants.

All cooperative education coordinators in Pennsylvania must hold the same state certification and all must follow the same state regulations in operating their programs. Additionally, all students who are seniors in a secondary career and technical education program in Pennsylvania must take the same NOCTI exams. For these reasons, it can be assumed that there were no significant differences between responders and non-responders to this study (Huck, 2008 ).

Once all data were received, eight programs were selected based on the number of cooperative education students reported from each program, and the number of schools that reported from those programs. The selected programs were Automotive Technology, Auto Body/Collision Repair, Carpentry, Childcare, Cosmetology, Health Assistants, Heating, Ventilation and Air Conditioning (HVAC) and Information Systems Technology.

### **Phase III**

#### *Population and sample*

The final stage of data collection was a visual inspection of student training plans. All respondents who provided data for Phase II were asked to provide copies of training plans for cooperative education students whose test results they reported. One hundred seven student training plans were received.

#### *Instrumentation development and measurement*

Each training plan was compared to its corresponding NOCTI blueprint. Blueprints are written guides to the tests. In addition to other information, these guides list the specific competencies that each test is designed to assess. The number of matching competencies on each student training plan compared to the number of possible blueprint competencies for that test was recorded.

#### *Data collection*

Twelve participants sent copies of student training plans via U. S. Mail, e-mail and/or FAX. Personal visits were made to five schools for visual inspections of training plans. One hundred seven training plans were inspected, and competency ratios for each were recorded.



### *Data analysis*

All data were recorded on a master spreadsheet for statistical analysis (see Appendix D). Schools were coded with numbers 1-17 and specific programs were coded with numbers 1-8. Students who had IEPs were coded as 1 and those without IEPs were coded as 2. All coded data was measured on a nominal scale. The specific NOCTI test number for each student was also recorded, as there can be variation among test numbers for programs with similar titles.

To determine if length of time on co-op occurred before or after NOCTI testing, data received from each school were reviewed again for student work starting dates. Start dates were reported for 159 students. NOCTI tests are generally administered in March and/or April of a student's senior year. Therefore, the date of March 15<sup>th</sup> was arbitrarily chosen as the cutoff date for determining if student work experience occurred before or after testing occurred. One hundred and thirty six students (86%) were reported to have started work before March 15<sup>th</sup> of their senior year. Ninety two of the students (58%) started work during the months of September, October or November. This data is important to the interpretation of any effect length of time on co-op may have on student test performance.

Descriptive analysis was performed individually on the written and practical scores of those students who did not participate in cooperative education and of those students who did participate. Because of high skewness values in practical scores,  $\log_{10}$  transformation was done to these scores to satisfy the assumptions of normality.

Using SPSS version 19 software, an independent t-test was conducted to compare the mean of all NOCTI written scores for non-cooperative education students to the mean of all written scores for those who did participate in cooperative education to determine if these means differ significantly. This same analysis was conducted for the practical test scores. Independent

t-tests were also conducted on both the written and practical scores of each of the eight individual career and technical programs to determine if individual program scores would differ significantly from the scores as a whole

Multiple linear regression analysis was conducted on the moderating variables for both written and practical scores to determine what effect, if any, they have on the relationship between the co-op and non-co-op NOCTI scores. Simple linear regression analysis was also conducted for each moderating variable separately. These data determined which of the moderating variables might best predict the differences in scores.

Chapter 4

Results

**Comparison of NOCTI Scores by Participation in Co-op**

A total of 166 individual written and practical NOCTI scores for students who participated in cooperative education were obtained from eight chosen programs at 17 different career and technical schools in Pennsylvania. A total of 152 individual student written and practical NOCTI exam scores were obtained from the same programs and schools for students who did not participate in cooperative education. Using SPSS 19 software, independent t-test analysis was conducted to compare the scores of those students who had participated in cooperative education experiences to the scores of those students who had not. Results are shown in the table below.

Table 1

*Comparison of NOCTI Test Scores of Students Who Participated in Cooperative Education (n=166) and Students Who Did Not Participate in Cooperative Education (n=152)*

Variable	M	SD	t	df	p	d
Scores on written test			5.50	165	0.000	-0.43
Co-op students	66.44	14.36				
Non co-op students	60.31	14.16				
Scores on practical test			6.49	165	0.000	-0.50
Co-op students	92.84	9.21				
Non co-op students	88.2	9.34				

*Note.* Means cannot be interpreted on a traditional pass/fail scale. Refer to PA BCTE Cut Scores in PA (PA, 2009).

These results indicate that there is a significant difference at the  $p < .01$  level in both written and practical scores for those students who participated in cooperative education and those who did not. Therefore, the null hypothesis is rejected, and it can be concluded that there is a significant difference between summative NOCTI test scores, both written and practical, of those students who participated in cooperative education and non-participating students. Students who

participated in cooperative education experiences scored significantly higher on both written and practical exams.

Independent t-test analysis on each of the eight individual career and technical programs indicated similar results, except for Carpentry and Childcare. Results of these analyses are shown in Table 2.

Table 2

*Means by Program*

Program	Written		Performance	
	Mean	SD	Mean	SD
Automotive Tech.				
Co-op	54.78	10.09	94.58	5.27
Non-co-op	46.74	5.37	86.12	6.62
Autobody				
Co-op	57.65	5.96	92.65	5.72
Non-co-op	55.07	7.48	91.14	6.13
Carpentry				
Co-op	71.70	11.43	80.23	14.34
Non-co-op	64.23	12.50	75.64	9.11
Child Care				
Co-op	81.93	6.65	96.29	3.77
Non-co-op	72.71	5.77	94.57	1.34
Cosmetology				
Co-op	75.50	6.98	96.13	3.69
Non-co-op	68.75	6.25	92.06	2.02
Health Assistants				
Co-op	80.41	7.44	97.63	3.35
Non-co-op	78.62	2.78	96.00	3.82
HVAC				
Co-op	52.47	6.88	87.93	11.88
Non-co-op	50.27	11.37	84.40	12.25
Information Systems Tech.				
Co-op	69.11	14.56	97.78	2.95
Non-co-op	62.13	15.81	96.34	2.56

Analysis of scores from the Carpentry and Child Care programs indicated no difference in practical scores between co-op and non co-op students. However, both programs showed very significant differences in written test scores between co-op and non co-op students. In both cases, those students who had participated in cooperative education scored significantly higher at the  $p < .01$  level on their written exams than those students who had not. These results appear to indicate that the cooperative education experience enhances vocabulary, written and visual interpretation skills in ways not done in a traditional classroom.

### **Effect of Moderating Variables on NOCTI Scores of Co-op Students**

Simple linear regression analysis was conducted to investigate how well the GPA of cooperative education students predicts or explains their written NOCTI scores. The results were statistically significant,  $F(1, 97) = 18.072, p < .001$ . The adjusted  $R^2$  value was .148. This indicates that 14.8% of the variance in NOCTI written scores was explained by student GPA. According to Cohen (1988), this is a small effect, and is not practically significant. When this same analysis was conducted on practical NOCTI scores the results were not statistically significant,  $F(1, 97) = .118, p > .05$ . The adjusted  $R^2$  value was -.009. This indicates that less than 1% of the variance in NOCTI practical scores was explained by student GPA. According to Cohen (1988), this is a very small effect and in this analysis is not statistically significant.

Simple regression analysis was conducted to investigate how well co-op students' IEP status predicts their written NOCTI scores. From the 166 cooperative education students for whom data were collected, 47 students were reported to have IEPs (28.3%), while 119 students were reported to have no IEP (71.7%). The results were statistically significant,  $F(1, 164) = 21.383, p < .001$ . The adjusted  $R^2$  value was .110, indicating that 11% of the variance in NOCTI written scores was explained by IEP status. While statistically significant, this value is not

practically significant, according to Cohen (1988). Regression analysis conducted to investigate how well co-op students' IEP status predicts their practical NOCTI scores was not statistically significant at the  $p < .05$  level. The adjusted  $R^2$  value was .008, indicating that less than 1% of the variance in practical NOCTI scores can be explained by IEP status.

Simple regression analysis was conducted to investigate how well the length of time students spend in cooperative education predicts their written NOCTI scores. The results were not significant at the  $p < .05$  level. The adjusted  $R^2$  value was -.006, indicating that less than 1% of the variance in written NOCTI scores can be explained by the length of time students spend in cooperative education programs. Simple regression analysis conducted on NOCTI practical scores indicated similar results. The results were not significant at the  $p < .05$  level. The adjusted  $R^2$  value was .008, indicating that less than 1% of the variance in practical NOCTI scores can be explained by length of time students spend in cooperative education programs.

To determine how well the quality of student training plans predicts students' written NOCTI scores, simple regression analysis was conducted using a ratio of matching items on student training plans to possible number of blueprint competencies for that particular test.

Each of nine different tests was compared to written NOCTI scores of the cooperative education students who took each of those tests. Seven of the nine analyses failed to show statistical significance at the  $p < .05$  level. The two exceptions were test #3045, given to students in HVAC programs, which reported an adjusted  $R^2$  value of -.044; and test #4109 given to students in Automotive Technology programs, which reported an adjusted  $R^2$  value of -.023.

The same regression analysis was conducted on cooperative education students' practical NOCTI scores. Six of the 9 analyses failed to show significance at the  $p < .05$  level. Again, tests #3045 and #4109 showed statistical significance at the  $p < .05$  level. Adjusted  $R^2$  values for

these tests were .020 and -.009, respectively. Additionally, test # 4058, given to students in Health Assisting programs, reported an adjusted  $R^2$  value of - .019. One explanation for the significant values reported for the HVAC tests could be the unusually large number of possible blueprint competencies for that test. The possible number of blueprint competencies for the other eight tests ranged from 19-74 (M=44). The possible number of blueprint competencies for the HVAC test was 130. In general, these data seem to indicate that matching student Training Plans to NOCTI blueprint competencies can improve the scores of some cooperative education students, especially for those taking tests with a large number of competencies being tested.

Multiple regression analysis was conducted on all four of the moderating variables collectively to determine the overall impact they might have on predicting cooperative education students' written NOCTI scores. Following are the results of this analysis.

Table 3

*Regression Analysis of Moderating Variables on Cooperative Education Student NOCTI Scores*

<i>Variable</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>Sig.</i>
GPA	76	3.02	0.71		
written				2.48	0.02*
practical				-1.28	0.20
IEP	76	1.75	0.44		
written				3.33	0.00*
practical				1.36	0.18
Length of time	76	86.68	51.83		
written				0.51	0.61
practical				1.32	0.19
Training Plan	76	9.47	8.31		
written				-1.56	0.12
practical				0.3	0.77

\*  $p < .05$

An adjusted  $R^2$  value of .222 was reported for cooperative education students' written scores.

This indicates that, while GPA and IEP are the strongest predictors of cooperative education

students' written NOCTI scores at the  $p < .05$  level, all the variables collectively can only predict or explain about 22% of the variance in written test scores. This value is statistically significant, but it is the researcher's belief that it is of little practical significance, and agrees with Cohen's guidelines (1988). An adjusted  $R^2$  of .013 was reported for cooperative education students' practical scores. This indicates that all the variables collectively only predict or explain about 1% of the variance in practical scores at the  $p < .05$  level. As a collective group, these four variables can explain only about 22% of the difference (variance) in written scores and 1% of the difference (variance) in practical scores between students who participated in cooperative education and those who did not. These values indicate that all the variables together contribute very little to the difference in test scores between students participating in cooperative education and those who did not participate in cooperative education. (Cohen, 1988). Therefore, the null hypothesis could not be rejected and it was concluded that student GPA, IEP status, length of time in cooperative education, and quality of student training plan do not account for the variance in written or practical test scores of those students who participated in cooperative education and those who did not.



## Chapter 5

### *Conclusions and Recommendations*

Cooperative Education, or the practice of combining classroom-based education with workplace related experience, has been occurring for centuries. It was practiced during the Middle Ages as a means for master craftsmen to teach their trades to apprentices (Greenblatt, Cox & Seaberg, 1985). In modern times it has been used by industry as a means to boost economic productivity; and at the secondary and post secondary education levels as a means for technical education students to apply theories and to practice skills learned in the classroom.

Cooperative education as a tool for learning embodies many educational learning theories. Cognitive constructivists believe that learning occurs best when performing authentic tasks in meaningful, naturally occurring, contexts (Piaget, 1973), and that learning is dependent on action occurring in meaningful social contexts from which the learner can process his experiences and transform it into knowledge (Dewey, 1916). Social constructivists believe the interaction with others, not the personal experience, is the basis for learning. They believe that learning best occurs in social contexts because the use of language and interactions with others form the framework for the learning. Both cognitive and social constructivists agree that authentic, naturally occurring experiences are the building blocks on which knowledge is constructed.

This emphasis on the importance of situations and experiences also forms the basis of experiential learning theories. Proponents of experiential learning believe that knowledge is constructed through a cyclical process of experimenting and reflecting, through which the learner will develop new hypotheses, which can be tested through more experimentation, reflected upon and refined.

The belief that learning involves active engagement in practical application is also emphasized by Bloom's Taxonomy of Learning Objectives (1956) and Anderson and Krathwohl's Taxonomy of the Cognitive Domain (2001). Both are based on the premise that one cannot master higher levels of thinking until lower levels have been mastered and both classify the application of knowledge above comprehension. Both are used in developing educational curricula.

Cooperative education is beneficial to both employer and student. It is a chance for employers to groom and train their future workforce, and hire someone on a temporary basis before committing to a permanent offer of employment. Students can earn money and school credits simultaneously, and can develop a deeper understanding of career choices and the industries to which they align.

Despite these benefits, many schools are reducing the amount of time allowed for students to participate in cooperative education. Federal and state legislation designed to improve school accountability for student achievement has placed increased pressure on schools to produce students that score well on standardized tests. One measure of a career and technical school's effectiveness is students' scores on the summative NOCTI assessments. Teachers and administrators fear that students will not perform well on these tests if they are permitted time out of the classroom during the school day. Little data exist to support or refute these fears.

This study sought to determine if there is a difference in the written and practical summative assessment scores of those students who participated in cooperative education and those who did not. This study was limited to NOCTI test scores for students in Pennsylvania who graduated in the spring of 2010. Seventeen career and technical schools provided data for 177 students in eight different programs. While this is a small number of schools, they did

represent all geographical areas of the state and included both comprehensive and shared time career and technology centers.

Independent t-test analysis was conducted to determine if there is a difference in scores of those students who participated in cooperative education and those who did not. Results indicated that, overall, students who participated in cooperative education scored significantly higher on both written and practical NOCTI exams than those students who did not participate in cooperative education. While several programs showed no significant difference in scores, in no instance did students who had participated in cooperative education score lower than those who did not participate. Especially noteworthy is that the cooperative education experience seemed to benefit students on the written portion of the exam slightly more than on the practical portion.

Since correlation cannot prove causation, several moderating variables were also tested to determine their effect on the differences in test scores. Regression analysis was conducted on student GPA, IEP status, length of time in the cooperative education program, and the degree to which the student training plan matched the blueprint competencies for the exam. While student GPA and IEP seemed to be the best predictors of student test scores, collectively these variables only account for about 22% of the difference in written scores and 1% of the difference in practical scores. These are not significant amounts (Cohen, 1988).

The results of this study validate constructivist and experiential learning theories. Secondary CTE students who can perform meaningful tasks in authentic settings appear to learn more than those students who do not have these opportunities. Therefore, perhaps cooperative education should be more systemically encouraged. Policymakers might use this data to charge career and technical schools and businesses with fostering and strengthening partnerships that create more worksite opportunities for students. Cooperative education data might also be

incorporated into funding formulas for career and technical education subsidies and reimbursements; or be used as a tax incentive for participating employers.

Career and technical education administrators and curriculum coordinators might use this data to develop innovative solutions for maximizing student time spent in career and technical education. Perhaps retaining students in school for a portion of the day for theory and classroom instruction, then allowing them to work at a cooperative education worksite for the remainder of the day could prove beneficial. If time spent out of the school building is not feasible, perhaps cooperative education coordinators could be given extended contracted time to place and monitor students at worksites during summer and holidays when school is not in session. With many schools facing serious budget constraints, it seems reasonable that administrators would encourage extended learning to occur outside of the physical school facilities. If many students participated in cooperative education, the cost for shop consumables, including utilities, would decline.

Career and technical education instructors and cooperative education coordinators could use this baseline data to develop more effective cooperative education work stations. Informing employers of the program NOCTI competencies and soliciting employer cooperation in tailoring the students' work assignments to meet the competency expectations would ensure that the assessed skills and competencies were familiar to the students before testing occurs. Cooperative education coordinators could design more purposeful training plans by incorporating the test competencies into the worksite training plans and by informally assessing the students' mastery of these competencies during monthly site visits. Students could be required to turn in weekly reflection papers about their cooperative education experiences, using the assessed vocabulary words in context. Since length of time in cooperative education seems to have little bearing on

test results, perhaps instructors and cooperative education coordinators could pursue more opportunities for job sharing arrangements, whereby two students alternate time at the job site. This would give two students the cooperative education experience for a single job opening, while still allowing for ample classroom time.

Transition coordinators and special education instructors could find value in the findings of this study. As they develop transition plans and IEPs for their students, perhaps these students and their parents could be encouraged to explore worksite possibilities. While it is the experience of the researcher that most students with IEPs perform equally to regular education students on the job, there are some students for whom paid employment at the secondary school level is not a realistic option. For students in this category, perhaps all stakeholders in the education process could work together to develop more meaningful unpaid internships for these students.

Caution should be taken, however, in applying these results to all career and technical education schools. While the data represented all geographical areas of Pennsylvania, the number of participating schools was very small, and involved only one state. Instead, this study should be considered a baseline study for future research. A study of more schools in Pennsylvania, or perhaps a wide scale national study using the same variables, might produce more useful results. Additionally, future research might include different moderating variables such as student gender, teacher years of experience, or length of exam. It would also be interesting to determine if there is a difference in summative test scores between those students who took NOCTI pre-assessment tests as juniors and those who did not.

Another recommendation for future research would be to conduct a similar study of a qualitative nature; perhaps investigating stakeholder opinions about the value of cooperative

education beyond increased test scores. It may be of interest to interview employers, administrators, teachers and students to determine their views on the value of cooperative education. The true measure of an experience should not be judged solely by the scores of a single test.

Additionally, it would be foolish to use the results of this study to draw conclusions as to why greater numbers of students do not participate in cooperative education opportunities. There are many reasons why eligible students choose not to participate in cooperative education. Questions concerning this topic could form the basis for an entirely different study.

Hopefully this study will spark future research into the practice of cooperative education at the secondary school level. While school and student accountability is a viable component of modern education, perhaps cooperative education experiences will be viewed as a means for achieving these goals. Perhaps it will be viewed as enhancing the educational process, instead of as an educational distraction and a possible deterrent to achievement.

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## Appendix A

## Questionnaire

**Please answer the following questions to the best of your ability and return as an attachment to e-mail.**

1. Are you currently employed as a Capstone Cooperative Education Coordinator?

\_\_\_\_\_Yes          \_\_\_\_\_No

**If you answered “No” to the above question, STOP here and return the survey via e-mail attachment. If you answered “Yes”, please continue.**

2. Are Training Plans for your students directly linked to NOCTI blueprint competencies for their program of study?

\_\_\_\_\_Yes          \_\_\_\_\_No

3. Are Training Plans for your students directly linked to industry standards or crosswalks?

\_\_\_\_\_Yes          \_\_\_\_\_No

4. In a follow up mailing, would you be willing to share with me NOCTI scores and GPA information for last year’s co-op students, provided NO student identifying information was attached?

\_\_\_\_\_Yes          \_\_\_\_\_No

5. In a follow up contact, would you be willing to let me see selected Training Plans, provided NO identifying information was attached?

\_\_\_\_\_ Yes            \_\_\_\_\_ No

6. According to your school's co-op policy, when during a student's senior year are they first eligible to start co-op ?

\_\_\_\_\_ at the beginning of the school year

\_\_\_\_\_ after the first marking period

\_\_\_\_\_ after the second marking period

\_\_\_\_\_ after the third marking period

\_\_\_\_\_ after NOCTI testing is over

\_\_\_\_\_ other (please explain) \_\_\_\_\_

7. According to your school's co-op policy, what is the **minimum** GPA a student must have to be eligible for co-op?

\_\_\_\_\_ 50%-59%

\_\_\_\_\_ 60%-69%

\_\_\_\_\_ 70%-79%

\_\_\_\_\_ 80%-89%

\_\_\_\_\_ 90%-100%

\_\_\_\_\_ none of the above (please explain) \_\_\_\_\_



## Appendix B



**Consent Form for Social Science Research**  
The Pennsylvania State University

**Title of Project:** The Effect of Capstone Cooperative Education Experiences, and Related Factors, on Career and Technical Education Secondary Student Summative Assessment Scores.

**Principal Investigator:** Elizabeth D. Richard  
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**Advisor:** Dr. Richard A. Walter  
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Workforce Education and Development  
Penn State University  
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1. **Purpose of the Study:** To determine if there is a relationship between participation in capstone cooperative education experiences and student scores on summative assessments (NOCTI). If so, is this relationship moderated by student Grade Point Average and/or the existence of a student IEP. Additionally, does the extent to which the student Training Plan reflects the NOCTI blueprint have an effect on the relationship?
2. **Procedures to be followed:** Participants will be asked to complete a very brief questionnaire. If willing, they will also be asked to provide NOCTI scores of co-op students, and allow for visual inspection of student Training Plans.
3. **Duration:** The questionnaire will take less than ten minutes to complete. Providing NOCTI scores may take up to 30 minutes and allowing the researcher to conduct visual inspection of Training Plans should involve a minimal amount of the participants' time.
4. **Statement of Confidentiality:** Your participation in this research is confidential. The survey does not ask for any information that would identify to whom the responses belong. In the event of any publication or presentation resulting from the research, no

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information will be shared to identify the person or the school that provided the information, or the student to whom the information applied.

5. **Right to Ask Questions:** Please contact the Principal Investigator listed above with questions or concerns about this study.
6. **Voluntary Participation:** Your decision to participate in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer.

You must be 18 years of age or older to participate in this research study.

Completion and return of the attached questionnaire implies that you have read the information in this form and consent to participate in the research. Please keep this form for your records or future reference.

## Appendix C

Please fill in the requested information for capstone co-op students who graduated in **2010**

Scores on NOCTI exam				Did student have an IEP?		APPROX. # OF DAYS ON CO-OP (1 day=8hrs.)	GPA
STUDENT	C&T PROGRAM	WRITTEN	PRACTICAL	YES	NO		
A							
B							
C							
D							
E							
F							
G							
H							
I							
J							
K							
L							
M							
N							
O							
P							
Q							
R							
S							
T							

U							
V							
W							
X							
Y							
Z							
AA							
BB							
CC							
DD							
EE							
FF							
GG							
HH							

## Appendix D

### DISSERTATION SPREADSHEET

SCHOOL	PROGRAM	NOCTI TEST CODE	STUDENT	WRITTEN SCORE	PRACTICAL SCORE	NON-COOP AVRGE WRIT.	NON-COOP AVRGE PRACT.	STUD. GPA	# DAYS ON CO-OP	IEP (1=y,2=n)	# COMPS MATCHING BLUEPRNT	TOTAL COMPS. POSSIBLE
1	1	4109	1	48.2	97.8	47.64	86.87	89.00	180	2	28	32
1	1	4109	2	50.4	94.4	47.64	86.87	88.00	135	2	28	32
1	1	4109	3	48.2	95.2	47.64	86.87	76.00	10	1	28	32
1	2	4006	1	73.2	100	76.43	95	85.00	145	2	2	19
1	5	2082	1	81.3	94.8	84.17	93.34	95.00	145	2		26
1	7	3045	1	60	82.8	86.5	94.8	96.00	180	2	10	130
1	8	3414	1	87	100	62.54	92.76	95.00	180	2	7	33
2	8	3414	1	84.5	97.6	72.38	97.44	80.36	80	2	3	33
3	1	4109	1	53.9	92.2	53.55	87.8	*	*	1	8	32
3	1	4109	2	57.5	89.3	53.55	87.8	*	*	1	25	32
3	3	4015	1	52.7	67.4	55	64.4	*	*	2	22	33
3	3	4015	2	56	61.4	55	64.4	*	*	2	10	33
3	5	2082	1	75.4	93.3	65.52	92.61	*	*	2	3	26
3	5	2082	2	82.1	98.1	65.52	92.61	*	*	2	3	26
3	6	4058	1	73.7	100	79.88	100	*	*	2	3	63
3	6	4058	2	77.3	100	79.88	100	*	*	1	1	63
3	7	3064	1	44.9	92.2	50.36	81.33	*	*	1	1	74
3	8	3414	1	53.1	100	50.86	99.62	*	*	2	0	33
3	8	3414	2	53.7	100	50.86	99.62	*	*	2	2	33
4	1	4109	1	81.6	85.9	51.8	86.1	2.85	80	2	2	32
4	2	4006	1	55.3	84.8	52.7	84.3	3.23	140	2	19	19
4	2	4006	2	51.2	81	52.7	84.3	2.05	130	1	2	19



4	5	2082	1	87.3	92.4	74.4	93.6	3.66	15	2	2	26
4	5	2082	2	79.1	95.2	74.4	93.6	3.06	20	2	5	26
4	5	2082	3	79.9	100	74.4	93.6	3.58	19	2	5	26
4	6	4058	1	87.4	100	80.2	100	3.93	170	2	5	63
4	6	4058	2	88.4	100	80.2	100	3.91	175	2	*	63
4	6	4058	3	85.9	100	80.2	100	3.92	175	2	*	63
4	6	4058	4	82.8	100	80.2	100	3.79	80	2	*	63
4	8	3415	1	63.6	100	57.5	96.2	2.21	160	1	3	43
5	1	4109	1	55.3	97.8	39.41	79.59	2.19	52	2	14	32
5	1	4109	2	43.3	97.4	39.41	79.59	2.62	45	2	14	32
5	1	4109	3	39.7	88.2	39.41	79.59	2.47	58	1	14	32
5	1	4109	4	46.8	98.5	39.41	79.59	2.41	80	2	14	32
5	1	4109	5	57.5	89.6	39.41	79.59	2.60	11	2	14	32
5	1	4109	6	52.5	100	39.41	79.59	3.16	30	2	14	32
5	1	4109	7	43.3	98.5	39.41	79.59	2.43	120	1	14	32
5	4	3016	1	74.7	99.2	72.45	92.56	3.26	31	2	13	58
5	4	3016	2	86.3	87.2	72.45	92.56	2.27	49	2	13	58
5	5	2082	1	85.1	100	58.79	89.84	2.25	107	1	*	26
5	5	2082	2	70.2	100	58.79	89.84	2.61	60	2	*	26
5	7	3064	1	47.5	84.4	48.77	82.69	2.23	40	1	2	74
5	7	3064	2	60.2	96.5	48.77	82.69	2.40	80	2	3	74
5	8	3415	1	78.1	94.4	69.03	95.2	2.60	43	2	*	43
6	3	4015	1	59.3	63.3	67.33	85.06	2.60	80	2	*	33
6	5	2082	1	76.9	86.7	70.93	88.91	3.00	20	2	*	26
6	5	2082	2	67.9	96.2	70.93	88.91	3.00	20	2	*	26
6	6	4058	1	73.4	93.6	77.83	94.67	3.40	40	2	*	63
7	1	4109	1	56	88.9	52.5	91.9	3.00	82	1	15	32
7	1	4109	2	66	95.6	52.5	91.9	3.00	81	1	15	32
7	1	4109	3	60.3	98.2	52.5	91.9	3.80	24	2	15	32

7	2	3083	1	62.7	97.6	50.29	91.49	3.00	78	2	2	23
7	3	4015	1	62.7	52.7	62	60.98	3.00	28	2	5	33
7	4	3016	1	70	91.5	79.13	94.9	3.00	47	2	12	58
7	4	3016	2	73.7	93.2	79.13	94.9	3.80	66	2	12	58
7	6	4058	1	68.2	98.6	74.73	91.83	3.80	27	2	5	63
7	7	3045	1	55.5	74.8	55.56	78.96	3.80	60	2	7	130
8	1	4109	1	61	100	49.91	97.82	3.30	160	2	23	32
8	2	3006	1	51.2	95.9	53.25	93.16	3.10	27	1	*	19
8	3	4015	1	85.3	89.1	73.33	76.47	2.64	60	2	*	33
8	3	4015	2	82.7	86	73.33	76.47	3.00	60	2	*	33
8	6	4058	1	86.4	98.3	83.43	97.45	2.80	140	2	19	63
8	6	4058	2	91.9	98.3	83.43	97.45	2.60	145	2	19	63
8	6	4058	3	81.3	98.9	83.43	97.45	2.20	70	2	20	63
8	7	3045	1	58	90	43.5	85.5	2.80	148	2	36	130
8	7	3045	2	63.5	95.9	43.5	85.5	3.30	160	2	36	130
9	1	4109	1	68.8	97			*	140	2	*	32
9	1	4109	2	64.5	98.9			*	160	2	*	32
9	1	4109	3	44.7	96.7			*	170	1	*	32
9	2	4006	1	55.3	83.3			*	120	1	*	19
9	2	4006	2	61	89.8			*	60	2	*	19
9	2	4006	3	65.9	92.7			*	140	2	*	19
9	3	4015	1	63.3	91.4			*	180	2	*	33
9	6	3043	1	87.4	100			*	180	2	*	37
9	6	3043	2	77.8	100			*	170	2	*	37
9	6	3043	3	82.8	99.2			*	180	2	*	37
9	6	3043	4	74.8	100			*	110	2	*	37
9	6	3043	5	89.4	100			*	130	2	*	37
9	6	3043	6	78.8	100			*	180	2	*	37
9	8	3414	1	82.4	94.8			*	120	2	*	33

10	1	4109	1	56.7	98.5	46.64	91.26	*	165	2	18	32
10	1	4109	2	48.2	95.9	46.64	91.26	*	165	2	24	32
10	1	4109	3	61.7	100	46.64	91.26	*	165	2	32	32
10	1	4109	4	51.8	100	46.64	91.26	*	165	2	*	32
10	1	4109	5	52.5	99.6	46.64	91.26	*	165	2	26	32
10	2	3006	1	52.9	90.8	54.17	82.87	*	165	1	2	19
10	4	3016	1	88.4	97.5	69.68	92.35	*	165	2	*	58
10	6	4058	1	77.8	99.4	78.62	96.87	*	165	2	57	63
10	6	4058	2	75.3	96.9	78.62	96.87	*	165	2	56	63
10	7	3064	1	49.2	60.9	39.68	58.08	*	165	1	30	74
10	7	3064	2	50	67.8	39.68	58.08	*	165	1	30	74
10	8	3023	1	49.6	92.7	40.8	96.48	*	165	2	0	36
11	1	4008	1	45.3	91	40.29	74.21	3.20	35	2	*	48
11	1	4008	2	44.8	89.7	40.29	74.21	2.80	93	2	*	48
11	1	4008	3	64.5	94.3	40.29	74.21	3.40	84	2	*	48
11	1	4008	4	51.7	87.7	40.29	74.21	2.70	60	2	*	48
11	1	4109	5	47.5	91.5	43.57	83.73	2.60	72	2	4	32
11	1	4109	6	42.6	90.4	43.57	83.73	2.61	49	1	4	32
11	1	4109	7	42.6	76.3	43.57	83.73	2.40	35	1	6	32
11	3	4015	1**	84	95	79.31	91.74	3.50	16	2	7	33
11	3	4015	2**	64	92.4	49.8	93.06	3.52	67	2	9	33
11	6	4058	1	76.3	100	73.47	99.23	3.10	59	2	11	63
11	6	4058	2	84.3	98.3	73.47	99.23	3.30	29	2	6	63
12	2	4006	1	56.9	87.6	54.59	82.59	2.01	60	1	3	19
12	3	4015	1	70	81.1	44.5	58.23	3.14	90	2	*	33
12	7	3045	1	54.5	89.3	44.83	87.4	*	170	2	28	130
12	7	3045	2	51.5	88.6	44.83	87.4	3.15	90	2	28	130
13	1	4109	1	59.6	92.6	49.58	94.02	*	68	1	*	32
13	1	4109	2	66	97.8	49.58	94.02	*	68	2	*	32

13	1	4109	3	53.2	97.8	49.58	94.02	*	20	2	*	32
13	1	4109	4	51.1	95.2	49.58	94.02	*	68	1	*	32
13	1	4109	5	44	96.3	49.58	94.02	*	55	1	*	32
13	1	4109	6	58.9	97.8	49.58	94.02	*	35	2	*	32
13	2	3083	1	54.7	96.7	54.66	94.6	*	20	2	*	23
13	2	3083	2	58.7	93.4	54.66	94.6	*	12	1	*	23
13	3	4015	1	84.7	85.8	73.96	79.86	*	12	1	*	33
13	3	4015	2	76.7	81.7	73.96	79.86	*	12	1	*	33
13	3	4015	3	79.3	88.1	73.96	79.86	*	15	2	*	33
13	3	4015	4	75.3	85.5	73.96	79.86	*	30	2	*	33
13	3	4015	5	81.3	93.1	73.96	79.86	*	65	1	*	33
13	3	4015	6	80.7	86	73.96	79.86	*	10	1	*	33
13	3	4015	7	82.7	97.7	73.96	79.86	*	10	1	*	33
13	3	4015	8	82.7	86.9	73.96	79.86	*	10	2	*	33
13	5	2082	1	60.5	100	66.03	94.03	*	12	1	*	26
13	5	2082	2	73.9	95.2	66.03	94.03	*	10	2	*	26
13	7	3045	1	54	97.6	47.33	94.17	*	60	1	*	130
13	7	3045	2	37	96.9	47.33	94.17	*	15	1	*	130
14	1	4109	1	53.9	83	57.38	90.76	3.00	170	2	*	32
14	1	4109	2	34.8	92.2	57.38	90.76	2.40	162	1	*	32
14	5	3082	1	68.3	96.9	64.81	93.38	3.80	20	1	*	26
14	5	3082	2	77.4	96.9	64.81	93.38	3.80	26	1	*	26
15	1	4109	1	79	100	45.14	84.14	*	90	2	4	32
15	1	4109	2	58	90	45.14	84.14	*	75	2	6	32
15	4	3016	1	86	100	63.5	95.5	*	60	2	11	58
15	4	3016	2	86	98	63.5	95.5	*	45	2	11	58
15	4	3016	3	75	95	63.5	95.5	*	90	1	11	58
15	6	4058	1	87	96	76.57	91.57	*	75	2	32	63
15	6	4058	2	87	96	76.57	91.57	*	75	2	*	63

15	6	4058	3	92	93	76.57	91.57	*	75	2	20	63
15	7	3045	1	47	100	56.67	98.67	*	90	1	10	130
16	1	4109	1	54.6	97.8	47.86	77.53	3.10	102	1	1	32
16	1	4109	2	63.8	98.2	47.86	77.53	3.08	40	2	4	32
16	2	4006	1	59.4	95.2	44.55	88.26	3.65	90	1	2	19
16	2	4006	2	57.7	94.6	44.55	88.26	3.45	60	2	3	19
16	3	4015	1	52	54.9	62.4	69.31	3.96	85	1	7	33
16	3	4015	2	66.7	79	62.4	69.31	4.02	80	2	10	33
16	3	4015	3	60	54.4	62.4	69.31	3.50	85	2	4	33
16	4	3016	1	75.8	99.2	77.68	94.06	4.00	85	1	5	58
16	4	3016	2	81.6	98.3	77.68	94.06	4.00	88	2	9	58
16	4	3016	3	81.6	93.2	77.68	94.06	3.50	85	2	5	58
16	4	3016	4	89.5	98.3	77.68	94.06	4.00	30	2	9	58
16	5	2082	1	68.7	93.3	71.86	89.45	3.10	10	1	2	26
17	1	4109	1	73.1	99.6	50.13	86.87	2.7	80	2	2	32
17	2	4006	1	52	99.1	59.37	98.73	3.2	180	1	2	19
17	2	4006	2	61	99.1	59.37	98.73	2.3	60	2	1	19
17	2	4006	3	51.2	91.8	59.37	98.73	1.2	40	1	1	19
17	3	4015	1	82.7	93.9	37.77	74.4	3	160	2	9	33
17	3	4015	2	63.3	93.3	37.77	74.4	3	160	2	11	33
17	4	3016	1	89	98.3	71.4	95.9	3.5	180	1	3	58
17	4	3016	2	87.9	100	71.4	95.9	3.2	160	2	4	58
17	5	2082	1	75.4	100	68.13	91.13	2.6	160	2	9	26
17	6	3043	1	66.9	91.4	78.01	89.81	2.65	120	2	2	37
17	6	3043	2	71.4	89.2	78.01	89.81	1.8	50	2	4	37
17	6	3043	3	68.2	89.7	78.01	89.81	3.35	100	2	3	37
17	7	3064	1	51.7	100	54.42	96	3.3	180	2	0	74
17	8	3414	1	69.1	100	92.04	94.41	2.65	110	2	5	33

\* missing data

\*\* same program and NOCTI test, but different campuses and instructors

Program Code: 1 = Automotive Technology, 2= Autobody and Collision Repair, 3= Carpentry, 4= Child Care, 5= Cosmetology,  
6= Health Occupations, 7= HVAC, 8 = IST

## Vita

**Elizabeth D. Richard**  
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### EDUCATION

- **Ph. D. The Pennsylvania State University, State College, PA**  
Attended: August, 2008- December, 2011  
Major: Workforce Education and Development (Concentration in Vocational Education Administration-obtained PA Vocational Director Certification)
- **M. S. The Pennsylvania State University, State College, PA**  
Attended: January, 1999-May 2004  
Major: Workforce Education and Development (Concentration in School to Work-obtained PA Cooperative Education Certification)
- **Post-Baccalaureate Certification, Millersville University, Millersville, PA**
  - Attended: 1987-1989
  - Major : Secondary Ed. Social Studies Instructional II Teaching Certification
- **B. A. West Virginia University, Morgantown, WV**
  - Attended: August 1974-August 1978
  - Major: History *Graduated magna cum laude*

### EMPLOYMENT

- 22 years in secondary school education

### PRESENTATIONS

- ACTE Annual Convention, *From Competent to Proficient: Implementing Experiential Learning Strategies to Maximize Student Achievement on Summative Occupational Assessments*, Las Vegas, NV, Dec. 3, 2010 (also presented at the Penn State Director's Academy, Spring, 2010).
- Capital Area Partnership for Career Development Symposium, *Building the Bridge: Accessing the Emerging Workforce through Education Connections*, Camp Hill, PA, Nov. 13, 2007

### PUBLICATIONS

Richard, E. D., Clark, R. W., Welsh, S. M. (2011). An analysis of program issues perceived by cooperative education coordinators in Pennsylvania secondary schools and career and technology centers. *Career and Technical Education Research Journal (issue TBA)*.