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Department of Learning and Performance Systems

**CONTRIBUTORS OF SUCCESS ON THE AUTOMOTIVE SERVICE**

**EXCELLENCE (ASE) STUDENT CERTIFICATION EXAM**

A Dissertation in

Workforce Education and Development

by

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## ABSTRACT

The purpose of this study was to identify what essential elements contribute to success on the Automotive Service Excellence (ASE) Student Certification Exam. More specifically, variables such as the students' performance in major specific courses, placement exam scores, work experience, or preadmission experiences were considered. Research on the effects of these variables may be useful in helping a program determine what contributes to a student's success on the exam. This information may prove to be useful to automotive training programs as a means to identify students who may need additional or specialized training. It may also serve as a means to guide curriculum changes. At the time of this writing, there has been no published research which attempts to identify what variables predict success on the exam. A quantitative research method was used for this study. Participants in the study were students at the Pennsylvania College of Technology, School of Transportation and Natural Resources Technologies majoring in one of the following Associates Degrees: Automotive Technology, Automotive Technology Ford ASSET emphasis, Automotive Technology Honda PACT emphasis; or the Automotive Service Technician Certificate program. Students who complete all of their automotive major classes during the spring 2017 semester and complete the ASE Student Certification Exams were selected for the study. Of the 57 students who met the criteria in order to participate, 56 volunteered to participate. The data were obtained from Pennsylvania College of Technology records, ASE Student Certification Exam results, and an investigator developed questionnaire. Pearson Product

Moment Correlations and a Spearman rank-correlation were calculated to determine the best predictors of success on the ASE Student Certification Exam.

As a result of this study, it has been discovered that there is a direct correlation between performance in both Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124) and the ASE Student Certification Exam. It was also found that students who are required to participate in remedial math and/or remedial reading courses were likely to perform at a lower level than their counterparts on the exam. While work experience generally did not correlate to performance on the exam, automotive work experience did, suggesting the importance of applying the concepts learned in education out in the workforce. It was also found that students who participated in a secondary automotive CTE program were no more likely to perform well on the ASE Student Certification Exam. In fact, there was a negative correlation suggesting that those students were likely to perform at a lower level than their counterparts.

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## **Chapter 1**

### **Introduction**

#### **Purpose**

The purpose of this study was to identify what essential elements contribute to success on the Automotive Service Excellence (ASE) Student Certification Exam. More specifically, variables such as the students' performance in major specific courses, placement exam scores, work experience, or preadmission experiences were considered. Research on the effects of these variables may be useful in helping a program determine what contributes to a student's success on the exam.

#### **Historical Perspective**

The automobile has played a major role in shaping the culture, economy, and the day-to-day lives of Americans. In its early stages it allowed people to congregate and socialize much more conveniently. It gave people more freedom to move about and to pursue employment opportunities beyond the immediate area. Transportation developments are essential components of growth and advancement in societies (Volti, 2004; Karwatka, 2003).

While he is often given credit, Henry Ford did not invent the first automobile. In fact, there is some debate as to whom actually created the first automobile depending on how it is defined. "If we take the most general definition – a self-propelled vehicle running on a road surface- credit for its invention usually goes to Nicholas Cugnot..." (Volti, 2004, p. 2). Cugnot built two steam powered vehicles from 1765 to 1770 which

were designed to transport artillery for the French military. Despite traveling at a mere 2 miles per hour, in 1771 it went out of control and ran into a wall during a test run.

Further development of the vehicle was abandoned (Parissien, 2013; Volti, 2004).

Credit for building the first automobile is often given to German engineer Karl Benz. "...there is no doubt who built the first production vehicle powered by an internal combustion engine. It was Karl Benz, who in 1886 began manufacturing the first series of motor cars to be sold to the public." (Karwatka, 2003, p.50). The three wheeled vehicle weighed only 580 pounds and was able to travel up to 10 miles per hour via a single cylinder engine producing less than one horsepower (Karwatka, 2003).

Brothers Charles and Frank Duryea of Springfield, Massachusetts are credited for producing the first American made automobile powered by an internal combustion engine. The brothers began production of the *buggyaut* in 1893. The vehicle weighed 700 pounds, was fitted with a 1.75 horsepower two-cylinder engine, and was capable of traveling up to 20 miles per hour (Karwatka, 2003, p. 163-165). This vehicle paved the way for future development in automobiles.

No historical account of the automobile would be complete without mentioning the major contributions made by Henry Ford. He established the Ford Motor Company in 1903 and approached the industry with a completely different perspective than other vehicle manufacturers at that time. Ford wanted to produce a vehicle that would be affordable for the average person; something much different than the luxurious and expensive vehicles produced by the competition. The Model A began production in 1903 and the well-known Model T in 1908. In fact, more than 15 million Model Ts were built between 1908 and 1927. Using a moving assembly line, the Model T was produced in

great numbers and achieved Ford's goal of making the automobile affordable for the average person. This was a major development in the wide use of the automobile in the United States (Karwatka, 2003). The growing number of automobiles created a need for training individuals to service and repair them. As these automobiles became more complex, so too did the job requirements for the automotive technician.

### **Current Automotive Technician Job**

The current job of an automotive technician is far more technically complicated than ever before. Many technicians prefer not to be called mechanics as this often conjures up images and thoughts of the way the job was many years ago. It was once considered a job for those who were not capable of getting a better job. In the early days of the automobile, "...most mechanics were self-taught or learned on the job. Someone with a mechanical aptitude could take something apart and figure out how it worked" (Lundquist, 2000, p. 14). This approach certainly does not fit the current level of complexity of the automotive technician trade today. Today's automotive technicians must be very professional and have a diverse set of skills.

Duffy (2014) further solidifies the need for adequate training in order to be successful as an automotive technician. "No longer can the untrained person hope to fix modern passenger vehicles. Multiple on-board computers are now used to control and monitor the engine, transmission, suspension, brakes, emission controls, and other vital vehicle systems." (p. iii). The concept of learning on the job results in too many costly mistakes which businesses cannot afford.

Although service technicians work on traditional mechanical systems, such as engines, transmissions, and drivebelts, they must also be familiar with a growing

number of electronic systems. Braking, transmission, and steering systems, for example, are controlled primarily by computers and electronic components.

(Occupational Outlook Handbook, 2016 “Duties,” para. 3)

In the article, *Get your program nationally certified!*, Lundquist (2000) explains how the training requirements for technicians have drastically changed. She elaborates on the various skills required for an automotive technician to be successful in today’s industry. She also stresses the importance of National Automotive Technicians Education Foundation (NATEF) accreditation in ensuring that the instruction is relevant to what is currently expected of technicians. Lundquist states, “...technicians must have academic, technical, and critical thinking skills to meet the demands of the automotive industry. Technicians need excellent communication skills -- verbal, reading, writing - as well as good computer and keyboarding skills to communicate with customers, other technicians, service managers, and manufacturers” (p.1).

In order to be properly prepared and competitive for this career, an individual needs to acquire extensive training.

Completing a vocational or other postsecondary training program in automotive service technology is considered the best preparation for entry-level positions.

Programs usually last 6 months to a year and provide intensive career preparation through classroom instruction and hands-on practice.” (Occupational Outlook Handbook, 2016, “Education,” para. 2).

Since the employers are expecting employees to have some training, it is up to the secondary and post-secondary schools to provide such training. In order to prevent automotive training schools from becoming automotive hobby shops, there needs to be

set standards and requirements. The question becomes, who should decide what standards and requirements there should be? Some believe that the program's advisory committee should make these decisions since they are closely involved with curriculum planning and often employ students of the program. Others believe that having a standardized set of parameters to follow as set forth by an industry certification is important. The National Automotive Technicians Education Foundation (NATEF) is a division of the National Institute for Automotive Service Excellence (ASE).

Founded in 1983 as an independent, non-profit 501(c)(3) organization the mission of the National Automotive Technicians Education Foundation (NATEF) is to improve the quality of automotive technician training programs nationwide at secondary and post-secondary, public and proprietary schools. To accomplish this mission NATEF examines the structure, resources and quality of training programs and evaluates them against standards established by the industry. These standards reflect the skills that students must master to be successful in the industry. (National Automotive Technicians, 2016)

### **The Problem**

Upon completion of a NATEF accredited program, students are given the opportunity to take the ASE Student Certification Exam. This exam is similar to the standard ASE exam except that it is based less on experience and more focused on what a student should have learned and be able to do upon completion of the program as he or she is preparing to enter the career.

ASE Student Certification can be thought of as the first step in building a career as a service professional in the automotive industry. Whether marking the completion of career-entry studies in automotive technology, collision repair and

refinishing, or medium/heavy-duty trucks, these tests can provide the student with their first industry-recognized certification through the National Institute for Automotive Service Excellence. (ASE Student Certification, 2016)

This exam benefits both the students and the program itself. If a student passes the exam, he or she is given a certificate which demonstrates a certain level of knowledge that is recognized by employers. The program is given the results of the exams the students completed which is broken down by categories. This information can be extremely useful in program development, because it can identify potential areas for improvement. This data does not, however, account for other variables such as the students' performance in major specific courses, placement exam scores, work experience, or preadmission experiences. Research on the effects of these variables may be useful in helping a program determine what contributes to a student's success on the exam.

### **Significance of the Study**

The ASE Student Certification Exam is being used as a measure of student success in NATEF accredited programs. This study aimed to identify what, if any, additional factors contribute to a student's success on the exam. This information may be useful for program development and ultimately a better and more thorough education for the students.

### **Research Questions**

This study sought to answer the following research questions:

1. What, if any, correlation exists between student major specific course grades and performance on the ASE Student Certification Exam?

2. What, if any, correlation exists between required student remedial courses as determined by the college placement exam and performance on the ASE Student Certification Exam?
3. What, if any, correlation exists between student work experience and performance on the ASE Student Certification Exam?
4. What, if any, correlation exists between student preadmission experience (participation in CTE classes, family history of automotive technicians, etc.) and performance on the ASE Student Certification Exam?

### **Conceptual Framework**

Students completing an education program should be able to demonstrate their knowledge by passing the associated industry exam. This is not only an indication of success for the student, but for the training program as well (MacMillan & Fujita, 2005). Many researchers have tried to identify what predictors of success exist for students taking exams. MacMillan and Fujita (2005) studied students who completed dental assisting degrees to determine what variables predict student success on the Dental Assisting National Board (DANB) exam. McKinney, Small, O'Dell, and Coonrod (1988) researched students who completed a baccalaureate degree in nursing and took the National Council Licensing Examination (NCLEX). The researchers were able to determine what variables predicted student success on the exam.

Peng, Le, and Milburn (2011) researched students who completed a business or technical degree at a Canadian college. They discovered that math placement scores and required remedial math courses were correlated to a students' GPA. They determined that students who perform poorly in math are more likely to have a lower final overall

GPA. Leopold and Edgar (2008) determined that math performance was directly correlated with success in a chemistry class. This proved that math performance can be a predictor of success in other college courses beyond just math. Montague and Hays (2008) conducted a study to predict student success in a college biology course. One of the predictors was the student's Verbal SAT scores, but not the Math SAT scores.

Research has also been done to determine what factors predict success in college as a whole. Belfield and Crosta (2012) determined placement tests are not very effective in determining how well a student will perform in college. They did, however, determine high school GPA is correlated with college GPA and college credit accumulation. This research suggests that academic predictors vary from course to course and program to program. There is no one size fits all predictor(s) for college success.

At the time of this writing, there has been no published research which attempts to identify what variables predict success on the ASE Student Certification Exam. This information may prove to be useful to automotive training programs as a means to identify students who may need additional or specialized training. It may also serve as a means to guide curriculum changes.

### **Definition of Terms**

Automotive Service Excellence (ASE) Certification: Certification for automotive technicians who successfully complete a specialized written test as well as document a minimum of two years of experience in that area. (National Automotive Technicians, 2016)



Automotive Service Excellence (ASE) Student Certification: Certification for students who successfully complete an automotive training program from a NATEF accredited program. (ASE Student Certification, 2016)

National Automotive Technicians Education Foundation (NATEF): "...founded as an independent, non-profit organization with a single mission: To evaluate technician training programs against standards developed by the automotive industry and recommend qualifying programs for certification (accreditation) by ASE, the National Institute for Automotive Service Excellence" (National Automotive Technicians, 2016).

## **Chapter 2**

### **Review of Literature**

The focus of this literature review is to explore the importance of ASE Student Certification as well as predictors of success on certification exams in other fields. Other fields are discussed due to the lack of existing research regarding predictors of success on the ASE Student Certification exam.

#### **ASE/NATEF**

The National Institute for Automotive Service Excellence (ASE) was established a few years prior to the National Automotive Technicians Education Foundation (NATEF) and is well respected throughout the automotive industry. While the focus of NATEF is on automotive training, the focus of ASE is on the technician. ASE conducts testing twice a year that allows automotive technicians to demonstrate their experience on various systems of the automobile. Upon passing the test(s) and fulfilling the required two years of industry experience, technicians can earn the ASE certification. This is very important to technicians since these credentials are expected by employers. “The independent, non-profit National Institute for Automotive Service Excellence (ASE) was established in 1972 to improve the quality of vehicle repair and service through the voluntary testing and certification of technicians and other automotive service professionals” (National Automotive Technicians, 2016).

ASE ensures the credibility of technicians while NATEF ensures the credibility of training programs. In order for a training program to obtain the NATEF certification, the program must meet the 12 standards as seen in Table 1.

Table 1  
*NATEF Program Standards*

Category
<p><b>Standard 1 - Purpose</b>            The automobile technician training program should have clearly stated program goals, related to the needs of the students and employers served.</p>
<p><b>Standard 2 - Administration</b>            Program Administration should ensure that instructional activities support and promote the goals of the program.</p>
<p><b>Standard 3 - Learning Resources</b>            Support material consistent with both program goals and performance objectives should be available to staff and students.</p>
<p><b>Standard 4 - Finances</b>            Funding should be provided to meet the program goals and performance objectives.</p>
<p><b>Standard 5 - Student Services</b>            Systematic skills assessment, interviews, counseling services, placement, and follow-up procedures should be used.</p>
<p><b>Standard 6 – Advisory Committee</b>            An officially sanctioned program advisory committee must be used to provide input on program goals.</p>
<p><b>Standard 7 - Instruction</b>            Instruction must be systematic and reflect program goals. A task list and specific performance objectives with criterion referenced measures must be used.</p>
<p><b>Standard 8 - Equipment</b>            Equipment and tools must be of the type and quality found in the repair industry and must also be the type needed to provide training to meet the program goals and performance objectives.</p>
<p><b>Standard 9 – Facilities</b>            The physical facilities must be adequate to permit achievement of the program goals and performance objectives.</p>
<p><b>Standard 10 - Instructional Staff</b>            The instructional staff must have technical competency and meet all state and local requirements for accreditation.</p>

### Standard 11 – Work-based Learning

(A structured method of combining classroom-based education with practical work experience. Applies only to programs that are using work-based learning activities.)  
Written policies and procedures must be used for all program-sanctioned work-based learning activities.

### Standard 12 – E-learning

Written policies and procedures must be followed when e-learning curricular materials are used outside of scheduled classroom/lab/shop time for the purpose of meeting NATEF instructional hour requirements. (This applies only to programs that are using e-learning to meet program hour requirements. This is a go/no go Standard that requires validation of a ‘yes’ response to each of the criteria.)

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*(NATEF Program Accreditation Standards, 2013, pp. 28 - 29)*

Each of the 12 standards is broken down into several more detailed standards.

There are actually 67 standards in all. This results in a very thorough set of requirements ensuring that the training institution is in fact providing quality education. Obtaining industry certification is a worthwhile goal for any educational program.

A study conducted by Lewis and Gill evaluated the effectiveness of automotive programs that are certified compared to those that are not. The certified and non-certified programs that were selected for the study were very similar. The results of the study certainly make the case for certification. “Students from programs certified by ASE scored significantly higher on a standardized test of knowledge of automotive repair than students from similar noncertified programs” (Lewis & Gill, 1995, p. 11).

### **Benefits of Student Certification**

Student certification is rather commonplace in today’s educational environment due to the many benefits it provides. Certification benefits employers, educators, and most importantly students.

In today's marketplace and within our educational communities, possession of certificates has become increasingly popular. Business and industry consider certification as a method of verifying competence of employees as part of their hiring practices. Schools and colleges use them not only to verify student competence, but also to validate quality instructional programs. If students pass certification tests, they can be reasonably assured that their curriculum and teaching methods are sound. (Church, 2007, p. 1)

The process of recruiting the best talent for an organization is a very difficult task which requires consideration of all that a candidate could bring to an organization. Certifications are a part of the criteria often used. According to Ray and McCoy (2000), "Certification credentials give employers another criterion for selecting the most capable employees – always a recruitment and hiring goal" (p. 2). Not only do certifications demonstrate a level of competence, they demonstrate a certain level of motivation and willingness of the applicant to better his or her career.

Quality educators are constantly looking to keep instruction relevant and effective. While there is no one single component in keeping a program effective, certification exams are often used as one of the ways to strengthen a program. "For educators, certification objectives and content reviews provide an additional assessment tool for evaluating course and program content... Student accomplishments on certification exams provide valid measures of student competencies – a factor in assessing courses and programs" (Ray & McCoy, 2000, p. 2). Educators are often given detailed results of each student's performance on the exam which can be extremely useful in identifying areas for instructional improvement.

Most importantly, certification benefits students who are preparing to begin a career in a chosen field. According to Foster and Pritz (2006), “Certificates have become an important career credential for students and employees, and an important indicator of one’s ability to get the job done” (p. 14). This can be especially important for students who lack work experience upon graduation. Further substantiating the benefit of certification, Wilcox (2006) states, “IBCs [Industry-Based Certifications] also provide employers with a standard that is useful in evaluating and “benchmarking” a candidate who has no substantial background” (p. 22).

While this gives the student a better chance of securing employment, it also prepares him or her for a successful career. “A student that has obtained a certification as an addition to a post-secondary education has a strong theoretical foundation to build on, an increased marketability, and better chances for long term career success” (Randall & Zirkle, 2005, p. 287). Certification exam pass rates and job placement of graduates is often touted by schools, but it should be noted that the implications of certification may extend throughout one’s career.

Kolo (2006) researched whether or not ASE Certification enhanced job performance of technicians. It was determined that certified technicians were rated significantly higher than non-certified technicians by their supervisors. It was also discovered that certified technicians learned new skills more effectively than non-certified technicians, which enhances the value of the individual. Kolo was able to determine that certification had an impact on customer complaints.

...knowledge, and experience gained while obtaining ASE certification enhanced a technician’s job knowledge and better understanding of his or her expectations

in the dealership. In addition, the lower level of customer complaints directed at certified technicians, in contrast to the higher level of complaints filed against non-certified technicians, may be attributed to increased levels of professional knowledge and experience obtained while completing the requirements for certification (Kolo, 2006, p. 91).

Church (2007) studied the benefits of ASE certification as perceived by service managers. Service managers of both automotive dealerships and independent repair facilities were asked to respond to a series of statements. When presented with the statement, “ASE certification is an appropriate indicator of competence within any service area (for example, ASE test for brakes competence or ASE test for suspensions competence, etc.).” 73% of dealership service managers and 60% of independent service managers agreed with the statement. This substantiates the claim that certification is an accurate measure of the individual’s capability. When given the statement, “Individuals with ASE certifications are typically more highly sought after by employers than those without the certifications.” 76% of dealership service managers and 79% of independent service managers agreed with the statement. This response shows how certification can make an individual more marketable when searching for employment. It should also be noted that 79% of dealership service managers and 81% of independent service managers agree with the statement, “ASE certifications are an important part of a technician’s employment portfolio.” This is a very strong and favorable response for ASE certification.

It is apparent that certification has positive implications for the technician as well as the business at which he or she works. Being able to perform the job properly while

reducing customer complaints results in a stronger and more profitable business. While some may claim that certification does not matter, they should be reminded that, “Regardless of any predisposition for or against ASE certification, managers can minimize their risk and maximize their potential gain by employing technicians who are ASE certified” (Kolo, 2006, p. 92).

### **Predictors of Success in other Programs**

At the time of this writing, there has been no published research which attempts to identify what variables predict success on the ASE Student Certification exam. There is, however, research identifying what variables predict success for certification exams in other fields. The following section explores this research.

#### **Nursing**

The certification exam for nursing is the NCLEX-RN (National Council Licensing Examination for Registered Nurses). The National Council of State Boards of Nursing (NCSBN) defines a Registered Nurse (RN) as, “An individual who has graduated from a state-approved school of nursing, passed the NCLEX-RN Examination and is licensed by a state board of nursing to provide patient care” ([www.ncsbn.org](http://www.ncsbn.org)). Since successful completion of the exam is required for individuals to be employed as a RN, research to predict student success on the exam has a lot of value. Rogers (2009) performed such research with 196 students who completed the nursing program; graduating classes 2007, 2008, and 2009.

The purpose of this study was to determine the ability of various preadmission achievement-related variables to predict student success, as measured by program completion and NCLEX-RN results. Academic achievement variables in this



study included ACT and TEAS exam scores, preadmission cumulative GPA, prerequisite course GPA, support course GPA, high school GPA, LPN licensure, and the number of support course credits completed prior to admission. (pp. 8-9)

Of the aforementioned variables, only a few were predictive of success of program completion and/or NCLEX-RN results. Predictive of both program completion and NCLEX-RN success was the Test of Essential Academic Skills (TEAS) science scores. TEAS reading scores were not predictive of program completion, but were for NCLEX-RN success. Science GPA and health-related GPA were each predictive of only one measure of success, program completion and success, respectively. Surprisingly, the variables ACT sub scores, TEAS math and English scores, cumulative GPA, prerequisite GPA, high school GPA, LPN licensure, general education support course GPA, and the number of support course hours completed prior to admission were not predictors of success.

Hardin (2005) conducted similar research in that she searched for predictors of success on the NCLEX-RN exam, but did not do so for program completion. There were only two significant predictors of success, Admission GPA and Health Education Systems, Incorporated (HESI) exam. The HESI is given to students prior to taking the NCLEX-RN as a means to identify students at risk on failing it. Therefore, the relationship between the two variables should be expected.

### **Dental hygiene**

Austin (2011) researched predictors of success on the National Board Dental Hygiene Examination (NBDHE). He examined data from 214 students who completed a dental hygiene program at Western Kentucky University over a nine year period.

Historically, there are more applicants for the program than the program can accommodate, necessitating a selection committee to determine who is accepted into the program. In order to determine which factors predict success on the NBDHE, grades from pre-requisite classes such as English composition, microbiology, anatomy and physiology, and introduction to psychology were used. American College Test (ACT) scores as well as well as the subcomponent scores of the ACT (English, math, reading, and science) were also considered. The strongest predictors of performance on the NBDHE were ACT reading scores and microbiology course grades.

Findings from this study suggest that the grade a student attains on the reading portion of the ACT is an important predictor of success on the NBDHE... While knowledge of course material is essential, results of this study suggest that a student's ability to read and assess the meaning of questions is critical (Austin, 2011, p. 338).

Knowing this information may prove to be useful to help select the most likely candidate to pass the NBDHE to be accepted into the dental hygiene program. This data can also be useful in terms of program development as well as identifying students who potentially could benefit from additional preparation prior to taking the NBDHE.

### **Athletic trainer**

Upon completion of an accredited physical therapy program, students are permitted to take the National Athletic Trainers' Association Board of Certification (NATABOC) exam. In fact, it is three separate exams which are taken at different times. Upon successful completion of all three, he or she can then seek employment as a certified athletic trainer (Erickson & Martin, 2000). A study by Middlemas, Manning,

Gazzillo, and Young (2001) attempted to predict performance on the exam. A total of 270 first-time candidates were selected for the study. They found a significant positive correlation between students' GPA and performance on the three exams. Simply put, students with a higher overall GPA are more likely to do better on the exam. However, there was no significant correlation between the amount of clinical hours the student completed and performance on the exam. The researchers did note that they looked at number of hours of clinical experience (quantity), not the rigor of it (quality). Therefore, identifying students with low GPAs early on in order to provide assistance may result in higher passing rates (Rogers, 2009).

### **Accounting**

Brahmasrene and Whitten (2001) conducted similar research for the accounting profession. This research was relevant since, "All states require students to pass the Uniform Certified Public Accountant (CPA) Examination to become licensed" (p. 45). Students preparing for the CPA exam in Indiana were surveyed to identify factors predicting success. The variables that were significant predictors of success were age (older being more likely to pass), gender (male), undergraduate GPA, and experience.

### **Summary**

After reviewing the related literature, here is what we now know. Predictors of success on certification exams have been researched for many different fields. Variables such as GPA, entrance exam scores, prerequisite course scores, and experience were considered in the research. This research has proven useful in program development as well as student selection. This study attempted to fill the void of knowledge specifically relating to the Student ASE Exam.

## **Chapter 3**

### **Methodology**

#### **Purpose of Study**

The purpose of this study was to identify what essential elements contribute to success on the ASE Student Certification Exam. More specifically, variables such as the students' performance in major specific courses, placement exam scores, work experience, or preadmission experiences were considered. Research on the effects of these variables may be useful in helping a program determine what contributes to a student's performance on the exam.

#### **The Problem**

Upon completion of a National Automotive Technicians Education Foundation (NATEF) accredited program, students are given the opportunity to take the Automotive Service Excellence (ASE) Student Certification Exam. This exam is similar to the standard ASE exam except that it is based less on experience and more focused on what a student should know upon completion of the program as he or she is prepared to enter the career. This exam benefits both the students and the program itself. If a student passes the exam, he or she is given a certificate which demonstrates a certain level of knowledge that is recognized by employers. According to ASE Student Certification (2016), the pass/fail scores, "...were made by instructors with detailed knowledge of the level of preparedness of the students." The program is given the results of the exams the students completed which is broken down by categories. This information can be extremely useful in program development, because it can identify potential areas for improvement.

This data does not, however, account for other variables such as the students' performance in major specific courses, placement exam scores, work experience, or preadmission experiences. Research on the effects of these variables may be useful in helping a program determine what contributes to a student's success on the exam.

### **Target Population**

A quantitative research method was used for this study. Participants in the study were students at the Pennsylvania College of Technology, School of Transportation and Natural Resources Technologies majoring in one of the following Associates Degrees: Automotive Technology, Automotive Technology Ford ASSET emphasis, Automotive Technology Honda PACT emphasis, Mopar CAP emphasis, or the Automotive Service Technician Certificate program. Students who completed all of their automotive major classes during the spring 2017 semester and completed the ASE Student Certification Exams were selected for the study. Of the 57 students who met the criteria in order to participate, 56 chose to participate.

### **Research Questions**

This study sought to answer the following research questions:

1. What, if any, correlation exists between student major specific course grades and performance on the ASE Student Certification Exam?
2. What, if any, correlation exists between required student remedial courses as determined by the college placement exam and performance on the ASE Student Certification Exam?
3. What, if any, correlation exists between student work experience and performance on the ASE Student Certification Exam?

4. What, if any, correlation exists between student preadmission experience (participation in CTE classes, family history of automotive technicians, etc.) and performance on the ASE Student Certification Exam?

### **Variables**

For this study, the dependent variable was performance on the ASE Student Certification Exam. This was treated as nine individual variables since the exam has 9 different sections. There were also four independent variables; major specific course grades, required remedial courses, work experience, and preadmission experience. These variables are explained further in the following sections.

#### **Dependent variable**

The dependent variable was performance on the ASE Student Certification Exam. This exam is similar to the standard ASE exam except that it is based less on experience and more focused on what a student should know upon completion of the program as he or she is prepared to enter the career. The exam is broken down into nine separate categories as seen in Table 2.

Table 2  
*Student ASE Exam Categories*

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Category
Suspension and Steering
Brakes
Electrical/Electronic Systems
Engine Performance
Engine Repair
Automatic Transmission/Transaxle
Manual Drive Train and Axles
Heating and Air Conditioning
Maintenance and Light Repair

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(ASE Student Certification, 2016)

**Independent variable: major specific course grades**

The first independent variable was each student's individual final grade for each of the courses. Students completing an automotive program at the college are required to complete a series of major specific courses. All of the programs are NATEF accredited and many of the courses directly align with the individual categories of the ASE Student Certification Exam.

**Independent variable: required remedial courses**

The second independent variable was which, if any, remedial classes students were required to take. As part of the enrollment process at the Pennsylvania College of Technology, students are required to take a placement exam. The college explains the process on the Placement Testing and Developmental Course Work section on their website as follows:

Penn College evaluates students' skills to ensure each student has the entry-level skills necessary to be successful in his/her college-level course work. The goal of the placement process is to identify the correct initial placement in math, English, and reading. An applicant may satisfy the placement requirements through transfer courses or established minimum SAT/ACT scores (Pennsylvania College of Technology, 2016).

The purpose of the exam is to ensure that students are prepared for college level work. Those who are not properly prepared are either required to take developmental coursework or are not accepted into the school. The developmental coursework is designed to further one's skills in order to meet the standard required to be successful at the college level (Pennsylvania College of Technology, 2016).

**Independent variable: work experience**

The third independent variable is related work experience that students may have. Students in the manufacturer sponsored programs complete several internships as part of the program. The schedule is structured so that the students receive eight weeks of instruction on campus followed by an eight week internship experience. This schedule is continued throughout the program. Students in the general program are not required to complete internships, however, some students work or have worked in the automotive industry as a means to obtain relevant experience.

**Independent variable: pre-admission experience**

The fourth independent variable was pre-admission experience. These experiences may be participation in CTE classes, a family history of automotive technicians, or “tinkering” on mechanical projects.

**Instrumentation**

A quantitative research method was used for this study. Data was collected using multiple sources. For research questions one and two, secondary data from both Pennsylvania College of Technology records and ASE Student Certification Exam results was used. For research questions three and four, primary data from an investigator developed questionnaire and Pennsylvania College of Technology records was used.

The questionnaire was designed to measure what, if any, work experience the student had already obtained. This could be the result of a cooperative education experience, internship, or work experience outside of the educational setting. The questionnaire was also designed to measure preadmission experience of the participants. These experiences could be participation in a Career and Technical Education (CTE)



class at the secondary level, a family history of automotive technicians, etc. Subject Matter Experts (SMEs) were consulted in the development of the questionnaire.

### **Data Collection**

Both primary and secondary data were used for this study. The primary data were obtained by use of a questionnaire that the researcher developed under the guidance of the dissertation committee. Faculty members of the Automotive Department at Pennsylvania College of Technology then reviewed the questionnaire. Their input was reviewed and modifications were made. Lastly, the questionnaire was piloted to automotive students at Harrisburg Area Community College. This process ensured that the questionnaire had both face validity and content validity.

The researcher visited each of the second year classes and administered the questionnaire no more than one week prior to the ASE Student Certification Exam. During this time, the purpose of the study was explained to the participants and written consent was obtained. No questionnaires were completed on the day of the exam. This was done to prevent lackluster completion of the questionnaire due to potential test anxiety.

Secondary data was collected from two different sources. The first source was the student database at Pennsylvania College of Technology, which has information relating to placement exams, course grades, and demographics. The other source of data was the ASE Student Certification Exam results. These results were given to the automotive department head and subsequently disseminated to department faculty members for their review.

### **Analysis of Data**

The data was manually entered into a Microsoft Excel spreadsheet and coded. The spreadsheet was then transferred into the IBM SPSS statistics software. A Pearson Product Moment Correlation and Spearman rank-correlation was run to determine the best predictors of success on the ASE Student Certification Exam. Means and frequencies for the demographics were also calculated.

### **Summary**

The purpose of this study was to identify what essential elements contribute to student performance on the ASE Student Certification Exam. This study was limited to students at the Pennsylvania College of Technology, School of Transportation and Natural Resources Technologies majoring in one of the following Associate Degrees: Automotive Technology, Automotive Technology Ford ASSET emphasis, Automotive Technology Honda PACT emphasis; or the Automotive Service Technician Certificate program. Students who complete all of their automotive major classes during the spring 2017 semester and complete the ASE Student Certification Exams were selected for the study. The data was obtained from Pennsylvania College of Technology records, ASE Student Certification Exam results, and an investigator developed questionnaire. A Pearson Product Moment Correlation and Spearman rank-correlation was run to determine the best predictors of success on the ASE Student Certification Exam. This information may be useful in helping a program determine what contributes to a student's success on the exam.

## **Chapter 4**

### **Results**

#### **Purpose of Study**

At the time of this writing, there has been no published research identifying what essential elements contribute to success on the Automotive Service Excellence (ASE) Student Certification Exam. This research has sought to determine if variables such as the students' performance in major specific courses, placement exam scores, work experience, or preadmission experiences had an impact on exam performance. The data obtained from this study may be useful to automotive technology programs, students, and the industry.

#### **Introduction**

This chapter focuses on the results of the study. The results discussed in this chapter are based on the following research questions.

1. What, if any, correlation exists between student major specific course grades and performance on the ASE Student Certification Exam?
2. What, if any, correlation exists between required student remedial courses as determined by the college placement exam and performance on the ASE Student Certification Exam?
3. What, if any, correlation exists between student work experience and performance on the ASE Student Certification Exam?

4. What, if any, correlation exists between student preadmission experience (participation in CTE classes, family history of automotive technicians, etc.) and performance on the ASE Student Certification Exam?

This chapter is organized by first reporting the profile data of the participants followed by data for each research question. Correlations are discussed and reported as follows:

Little or no relationship	0 to $\pm .25$
Fair relationship	$\pm .26$ to $\pm .50$
Moderate to good relationship	$\pm .51$ to $\pm .75$
Very good to excellent relationship	$\pm .76$ to $\pm 1.00$

(Fink, 1995)

## Results

A total of 57 students met the criteria in order to participate in the study and 56 chose to participate. Since only one person did not participate, the data were treated as a census for the purpose of this study and therefore *p values* are not reported. Participant age as of May 1, 2017 ranged from 19 years to 24 years (see table 3) with the majority of participants enrolled in the general automotive technology program (see table 4). The results of the exam are displayed in Table 5 to better illustrate certification exam scores.

Table 3  
*Participant Age as of May 1, 2017 (n=56)*

Age	19	20	21	22	23	24
Frequency	10	29	9	4	0	4
Percentage	17.9	51.8	16.1	7.1	0	7.1

Table 4  
*Student Program (n=56)*

Program	Automotive	Honda PACT	MOPAR CAP	Ford ASSET
Number	41	4	6	5
Percent	73.2	7.1	10.7	8.9

Note. None of the 57 students were enrolled in the Automotive Technician Certificate Program.

Table 5  
*ASE Student Certification Exam Scores*

Exam	Mean	Low	High	St.Dev.
Suspension and Steering	71.45	38	95	13.63
Brakes	72.59	35	95	14.31
Electrical/Electronic Systems	74.63	35	95	14.55
Engine Performance	71.20	30	92	14.51
Engine Repair	81.80	55	98	9.90
Automatic Transmission/Transaxle	69.55	38	92	13.02
Manual Drivetrain and Axles	70.39	32	90	13.41
Heating and A/C	74.55	18	92	14.58
Maintenance and Light Repair	75.93	28	92	11.78

Note. Scores based upon a possible 100.

*Research Question 1: What, if any, correlation exists between student major specific course grades and performance on the ASE Student Certification Exam?*

A Pearson Product Moment Correlation was calculated between student course grades and ASE Student Certification Exam grades. There were many significant strong

correlations between automotive courses and certification exams of the same area. For example, it was often found that a student who performed well in Suspension and Steering class also performed well on the Suspension and Steering ASE Student Certification Exam. Due to the numerous expected correlations, that data is omitted from this study. This data may be useful for individual programs, but is not the focus of this research. However, correlations were determined for two non-automotive courses, Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124).

Of the nine dependent variables, three of them had a moderate relationship with PHS103; Electrical/Electronic Systems (.629), Engine Performance (.514), and Engine Repair (.561). Five other dependent variables had a fair degree of relationship with PHS103; Suspension and Steering (.445), Brakes (.333), Automatic Transmission/Transaxle (.465), Heating and Air Conditioning (.301), and Maintenance and Light Repair (.447). It should be noted that eight of the nine dependent variables had a fair to good correlation to PHS103 grades (see table 6).

Of the nine dependent variables, three had a moderate relationship with MTH124; Suspension and Steering (.505), Electrical/Electronic Systems (.569), and Engine Performance (.544). Four other dependent variables had a fair degree of relationship with PHS103; Brakes (.338), Engine Repair (.380), Automatic Transmission/Transaxle (.477), and Maintenance and Light Repair (.343). It should be noted that seven of the nine dependent variables had a fair to good correlation to MTH124 grades (see table 6).

In response to question one, the results appear to reveal many correlations between student major specific course grades (i.e. automotive technology classes as well as other core classes required in associate degree programs) and performance on the ASE

Student Certification Exam. Most notable are the correlations for the Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124) courses. These correlations indicate a positive relationship between performance in these courses and the ASE Student Certification Exam.

Table 6  
*Correlation Between ASE Student Certification Exams and Two Courses*

Exam	PHS103	MTH124
Suspension and Steering	.445	.505
Brakes	.333	.348
Electrical/Electronic Systems	.629	.569
Engine Performance	.514	.544
Engine Repair	.561	.380
Automatic Transmission/Transaxle	.465	.477
Manual Drivetrain and Axles	.252	.161
Heating and A/C	.301	.169
Maintenance and Light Repair	.447	.343

*Research Question 2: What, if any, correlation exists between required student remedial courses as determined by the college placement exam and performance on the ASE Student Certification Exam?*

Of the 56 students in this study, 22 required one remedial course in Mathematics while nine required two remedial Mathematics courses as determined by the college placement examination (see table 7). This totals to 55.4% of students requiring some

level of remedial math. Only eight of the students required a remedial course in reading (see table 8).

Table 7  
*Students Requiring Remedial Math Courses (n=56)*

Number of Courses	Frequency	Percent
None	25	44.6
One Course	22	39.3
Two Courses	9	16.1

Table 8  
*Students Requiring Remedial Reading Courses (n=56)*

Number of Courses	Frequency	Percent
None	48	85.7
One Course	8	14.3

A Pearson Product Moment Correlation was calculated to determine correlations between required remedial courses and ASE Student Certification Exam grades. All nine independent variables had a fair negative correlation with required remedial reading except for the Automatic Transmission/Transaxle Exam (-.520), which had a moderate negative correlation. Required number of remedial math classes (0, 1, or 2) when compared to the independent variables resulted in all negative correlations, the strongest of which was the Suspension and Steering Exam (-.510). A summary of this data can be found in Table 9.



Table 9  
*Summary of Correlations Between ASE Student Certification Exams and Remedial Courses*

Exam	Course	
	Reading	Math
Suspension and Steering	-.270	-.510
Brakes	-.251	-.329
Electrical/Electronic Systems	-.269	-.294
Engine Performance	-.300	-.450
Engine Repair	-.491	-.369
Automatic Transmission/Transaxle	-.520	-.381
Manual Drivetrain and Axles	-.407	-.271
Heating and A/C	-.379	-.194
Maintenance and Light Repair	-.277	-.335

In response to question two, the results appear to reveal many negative correlations between number of required student remedial courses and performance on the ASE Student Certification Exam. These results indicate that students required to complete remedial math and/or remedial reading courses are more likely to perform unfavorably on the ASE Student Certification Exam.

*Research Question 3: What, if any, correlation exists between student work experience and performance on the ASE Student Certification Exam?*

A Spearman rank-correlation was calculated to answer this research question. A fair correlation was found between months of automotive related work experience and the following dependent variables; Automatic Transmission/Transaxle (.479), Manual

Drivetrain and Axles (.298), and Maintenance and Light Repair (.280). There were no significant correlations between non-automotive work experience and performance on the ASE Student Certification Exams. There was also no significant correlation between participation in an automotive internship and performance on the ASE Student Certification Exams.

In response to question three, the results appear to reveal a connection between automotive related work experience and three of the tests on the ASE Student Certification Exam (Automatic Transmission/Transaxle, Manual Drivetrain and Axles, and Maintenance and Light Repair). It also appears there is no connection between non-automotive work experience or participation in an automotive internship and performance on the ASE Student Certification Exam.

*Research Question 4: What, if any, correlation exists between student preadmission experience (participation in CTE classes, family history of automotive technicians, etc.) and performance on the ASE Student Certification Exam?*

A point-biserial correlation was calculated to determine correlations between student participation in a secondary automotive program and ASE Student Certification Exam grades (see table 10). A fair negative correlation was discovered between student participation in a high school automotive program and the following two dependent variables; Electrical/Electronic Systems (-.348) and Manual Drivetrain and Axles (-.267).

Table 10  
*Summary of Correlations Between ASE Student Certification Exams and Participation in a Secondary Automotive Program*

Exam	Participation in CTE Program
Suspension and Steering	-.110
Brakes	-.058
Electrical/Electronic Systems	-.348
Engine Performance	-.244
Engine Repair	-.154
Automatic Transmission/Transaxle	-.105
Manual Drivetrain and Axles	-.267
Heating and A/C	-.076
Maintenance and Light Repair	-.119

Note. Data coded as follows: yes = 1, no = 0.

There was no significant correlation between exam results and whether or not a student had either a parent or close relative who works or has worked as an automotive technician. While there is no correlation, it may be a factor in deciding the automotive technician career path. A Likert scale question on the questionnaire asked participants to respond to the statement, “As a child I would often repair mechanical things such as bicycles, vacuum cleaners, lawn mowers, etc.” There was no direct correlation between exam results and response to the statement. However, 42.9% strongly agreed and 32.1% agreed with the statement. Combined, 75% of participants either strongly agreed or agreed with the statement.

In response to question four, the results appear to reveal a negative correlation between participation in an automotive CTE program and performance on the ASE Student Certification Exam (see table 10). The other independent variables were not found to be significant.

### **Summary**

This chapter explained the data analysis and finding used to answer the four research questions. An examination of the data revealed several positive correlations to performance on the ASE Student Certification Exam. It was found that students who perform well in Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124) were likely to perform well on the exam. It was also found that an increased amount automotive related work experience helped student performance on some categories of the exam.

Negative correlations were found between number of required student remedial courses and performance on the ASE Student Certification Exam. These results indicate that students required to complete remedial courses are more likely to perform unfavorably on the ASE Student Certification Exam. It was also found that students who participated in an automotive CTE program were likely to perform unfavorably on the exam.

Some of the variables were determined to have no correlation. Non-automotive work experience had no correlation to performance on the ASE Student Certification Exam. Neither did participation in an automotive internship or a family history of automotive technicians.

## Chapter 5

### Summary, Conclusion, and Recommendations

#### Purpose of Study

The purpose of this study was to identify what essential elements contribute to success on the Automotive Service Excellence (ASE) Student Certification Exam. Variables such as the students' performance in major specific courses, placement exam scores, work experience, and preadmission experiences were considered. This information may be useful to administrators, educators, students, and the industry as a whole.

#### Summary

A total of 57 students met the criteria in order to participate in the study and 56 chose to participate. Since only one person did not participate, the data were treated as a census for the purpose of this study. Participant age as of May 1, 2017 ranged from 19 years to 24 years with the majority of participants enrolled in the general automotive technology program. A summary of the findings for each research question is discussed below.

*Research Question 1: What, if any, correlation exists between student major specific course grades and performance on the ASE Student Certification Exam?*

In response to question one, the results appear to reveal many correlations between student major specific course grades and performance on the ASE Student Certification Exam. It was of no surprise that there were many correlations between

automotive courses and performance on the ASE Student Certification Exam. For example, a student who scored well in a braking systems course would be expected to perform well on the ASE Student Certification Brakes Exam. The same could be said for many of the other categories of the exam. The list of such correlations was numerous and deemed not worth reporting. While this data may be useful for individual programs, it is not the focus of this research. However, there was a correlation found between two non-automotive courses, Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124). These correlations indicated a positive relationship between performance in these courses and the ASE Student Certification Exam. These results are congruent with research performed by Peng, Le, and Milburn (2011) who determined that students who perform poorly in math are more likely to have a lower final overall GPA. It is unclear whether it is the content of these courses or some other factors as to why there is such a correlation. While physics and math are both involved in automotive technology, it is possible there are other driving forces at play. Perhaps there are similarities in the thought process required to be successful in these courses that are also effective in the automotive courses. Or perhaps the problem solving skills in these courses are similar to the diagnostic skills required of automotive technicians. Another potential explanation might simply be test taking skills. That is to say that some students are simply better at taking written exams than others and therefore will typically perform better on such tests than their counterparts.

*Research Question 2: What, if any, correlation exists between required student remedial courses as determined by the college placement exam and performance on the ASE Student Certification Exam?*

In response to question two, the results appear to reveal many negative correlations between number of required student remedial courses and performance on the ASE Student Certification Exam. These results indicate that students required to complete remedial math and/or remedial reading courses are more likely to perform unfavorably on the ASE Student Certification Exam. These results solidify the need for foundational academics in the automotive trade.

*Research Question 3: What, if any, correlation exists between student work experience and performance on the ASE Student Certification Exam?*

In response to question three, the results appear to reveal a connection between automotive related work experience and three of the tests on the ASE Student Certification Exam (Automatic Transmission/Transaxle, Manual Drivetrain and Axles, and Maintenance and Light Repair.) Somewhat surprising is the lack of connection between non-automotive work experience and the ASE Student Certification Exam. Some may expect there to be a connection since having work experience may indicate a stronger work ethic that could transfer to the educational setting. Even more surprising was the lack of correlation between participation in an automotive internship and performance on the ASE Student Certification Exam. One might expect participation in an internship would have a strong impact on exam performance since the skills learned in the educational setting are reinforced at the workplace. This, however, was not the case in this study. Nor was it the case in a study by Middlemas, Manning, Gazzillo, and Young (2001) who found no correlation between the number of student clinical hours and performance on the National Athletic Trainers Association Board of Certification (NATABOC) exam.

*Research Question 4: What, if any, correlation exists between student preadmission experience (participation in CTE classes, family history of automotive technicians, etc.) and performance on the ASE Student Certification Exam?*

In response to question four, the results appear to reveal a negative correlation between participation in an automotive CTE program and performance on the ASE Student Certification Exam. This is somewhat surprising since students who have participated in an automotive CTE program have already been exposed to some of the curriculum prior to entering the program at the college level. Despite this exposure, these students did not perform as well as their counterparts who did not participate in an automotive CTE program. This is not to say that the CTE programs have had a negative impact on the students. However, it could have something to do with the overall academic preparedness of CTE students. The other independent variables were not found to be significant.

### **Conclusion**

Research has been conducted identifying what variables predict success for certification exams in other fields. However, at the time of this writing, there has been no published research which attempts to identify what variables predict success on the ASE Student Certification Exam. As a result of this study, it has been discovered that there is a direct correlation between performance in both Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124) and the ASE Student Certification Exam. It was also found that students who are required to participate in remedial math and/or remedial reading courses were likely to perform at a lower level than their counterparts on the exam. While work experience generally did not correlate to



performance on the exam, automotive work experience did, suggesting the importance of applying the concepts learned in education out in the workforce. It was also found that students who participated in a secondary automotive CTE program were no more likely to perform well on the ASE Student Certification Exam. In fact, there was a negative correlation suggesting that those students were likely to perform at a lower level than their counterparts. While there was no correlation to whether or not a student has a relative who works as an automotive technician, it was found that most students had some interest in mechanical things in their childhood.

### **Recommendations for the Field**

Employers should make every attempt to hire the most qualified and best suited employees they can. There is no one measure that can predict or determine which candidate would be the best possible choice. A person's performance on a certification exam, albeit important, should not be the sole criteria considered. A person's work ethic, work experience, and desire to succeed should also be considered.

It should be noted that the exam is computer based with no tactile portion. While this is an easy way to administer exams, it is not necessarily the most accurate method to determine the overall preparedness of a student. Some students may very well be competent in the skills needed to be successful, but do not test well in such a setting. A hands-on portion added to the exam could possibly provide a more accurate assessment of the students. The National Occupational Competency Testing Institute (NOCTI) conducts assessments in this manner (NOCTI, 2017).

### **Recommendations for Education**

Automotive instructors and administrators need to avoid a knee-jerk reaction whenever reviewing new data. Taking quick action without thoroughly understanding the bigger picture as well as performing further research could result in decisions resulting in a negative impact. With that being said, students should be encouraged to work in the automotive industry while attending the program if at all possible. Part-time or summer employment could provide useful experience that helps make the connection between the concepts taught in the educational setting and the industry. This employment needs to be related to the automotive field in order to have such an impact.

It was determined that students required to take remedial courses were less likely to perform well on the ASE Student Certification Exam. It was determined that 55.4% of the students required at least one remedial math course and 14.3% required a remedial reading course. This is something that is out of the hands of the college, but needs to be addressed by earlier levels of education. It is concerning when over half of the students arrive at college deficient in mathematics. How is such a student expected to succeed? Students, whom have successfully graduated high school, should be better prepared for college level entrance exams.

### **Recommendations for Future Research**

The process of conducting this study has brought about recommendations for future research. Since participants for this were solely from Pennsylvania College of Technology, the findings are only applicable to that college. Therefore, it is recommended that the study be replicated on larger scale in order for the results to be generalizable. It is also recommended that further research be performed to determine

what the connection is between both Physics Survey (PHS103) and Technical Algebra and Trigonometry 1 (MTH124) and the ASE Student Certification Exam. This research could seek to determine whether it is the content of these courses or some other factors that contribute to this correlation.

It is also recommended that research be conducted to determine if performance on the exam has any correlation to employment success. It would be interesting to see if performance on the exam has any correlation to obtaining and maintaining successful employment over an extended period of time. Compensation as a result of this could also be researched.

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## Appendix A

### Questionnaire

#### Contributors of Success on the ASE Student Certification Exam Survey Questions

1. Have you participated in an automotive internship at a dealership or other repair facility while enrolled at Pennsylvania College of Technology?

Yes / No

2. How many total months of automotive work experience do you have?

3. How many total months of non-automotive work experience do you have?

4. Did you participate in an automotive technology program in high school?

Yes / No

5. Do you have a parent who works or has worked as an automotive technician?

Yes / No

6. Do you have a relative other than a parent who works or has worked as an automotive technician (Grandparent, Aunt, Uncle, Sibling, Cousin)?

Yes / No

7. Circle a response below that best represents how you feel about the following statement:  
“As a child I would often repair mechanical things such as bicycles, vacuum cleaners, lawn mowers, etc.”

Strongly Agree    Agree    Neutral    Disagree    Strongly Disagree

8. Why did you choose a career in automotive technology?

9. What prior experiences do you think will help you on the Student ASE exam?

10. What other items do you feel will contribute to your success on the Student ASE exams?



## Appendix B

### IRB Approval

PENNSTATE



IRB Program  
Office for Research Protections

Vice President for Research  
The Pennsylvania State University  
205 The 330 Building  
University Park, PA 16802

Phone: (814) 865-1775  
Fax: (814) 863-8699  
Email: [protections@psu.edu](mailto:protections@psu.edu)  
Web: [www.research.psu.edu/irb](http://www.research.psu.edu/irb)

#### EXEMPTION DETERMINATION

**Date:** March 15, 2017

**From:** Joyel Moeller, IRB Analyst

**To:** Robert Vlacich

Type of Submission:	Initial Study
Title of Study:	Contributors of Success on the ASE Student Certification Exam
Principal Investigator:	Robert Vlacich
Study ID:	STUDY00006900
Submission ID:	STUDY00006900
Funding:	Not Applicable
Documents Approved:	<ul style="list-style-type: none"> <li>• HRP-591 - Protocol for Human Subject Research 3-7-17.pdf (0.02), Category: IRB Protocol</li> <li>• Survey3-7-17.docx (0.01), Category: Data Collection Instrument</li> </ul>

The Office for Research Protections determined that the proposed activity, as described in the above-referenced submission, does not require formal IRB review because the research met the criteria for exempt research according to the policies of this institution and the provisions of applicable federal regulations.

Continuing Progress Reports are **not** required for exempt research. Record of this research determined to be exempt will be maintained for five years from the date of this notification. If your research will continue beyond five years, please contact the Office for Research Protections closer to the determination end date.

Changes to exempt research only need to be submitted to the Office for Research Protections in limited circumstances described in the below-referenced Investigator Manual. If changes are being considered and there are questions about whether IRB review is needed, please contact the Office for Research Protections.

Penn State researchers are required to follow the requirements listed in the Investigator Manual ([HRP-103](#)), which can be found by navigating to the IRB Library within CATS IRB (<http://irb.psu.edu>).

This correspondence should be maintained with your records.

## Appendix C

### Course Descriptions

The following course descriptions are from the Pennsylvania College of Technology course catalog ([www.pct.edu/catalog/courses](http://www.pct.edu/catalog/courses))

#### **MTH124 - Technical Algebra and Trigonometry I**

Study of intermediate algebra and trigonometry, designed to prepare students for course work in their technical majors. Topics include algebraic expressions, linear equations, systems of equations, right triangle trigonometry, functions, graphs, geometry, ratio and proportion, and variation. Emphasis on problem solving and technical application as well as the use of technology. Not designed to prepare students for calculus. 3 Credits (3 Lecture) *Prerequisite(s): MTH005 or Placement by Examination.*

#### **PHS103 - Physics Survey**

General selection of physics topics, including matter and measurement; behavior of solids, liquids, and gases; mechanics, including forces, motion, energy, power, and machines; heat; sound; light; optics; magnetism; electricity; and atomic phenomena. 3 Credits (3 Lecture) *Prerequisite(s): MTH180 or MTH124 or Placement by Examination.*

## VITA

**Robert K. Vlacich**

### **EDUCATION**

Pennsylvania State University

Ph.D., Workforce Education and Development, 2017

Pennsylvania State University

Master of Science, Workforce Education and Development, 2010

Pennsylvania College of Technology/Penn State

Bachelor of Science, Automotive Technology Management, 2004

### **LICENSES & CERTIFICATIONS**

Commonwealth of Pennsylvania, Vocational Instruction 2 Certificate, 2011

Commonwealth of Pennsylvania, Vocational Instruction 1 Certificate, 2008

Commonwealth of Pennsylvania, Occupational Competency Evaluation, 2005

Honor Graduate Certificate, Heavy Wheel Vehicle Course, US ARMY, 1998

Commonwealth of Pennsylvania, Certified Safety Inspection Mechanic, Class 4

Commonwealth of Pennsylvania, Vehicle Safety Inspection Mechanic Instructor

Automotive Service Excellence,

- Certified Master Medium/Heavy Duty Truck Technician
- Certified Master Automotive Technician
- Certified Service Consultant
- Certified Undercar Specialist
- Certified Advanced Engine Performance Specialist

Commonwealth of Pennsylvania Commercial Drivers License, Class BM

IMACA Educational Foundation, Certified Motor Vehicle Air Conditioning Technician

### **AWARDS & SPECIAL RECOGNITION**

- US Army Achievement Medal, 2000
- US Army Good Conduct Medal, 2000
- US Army Achievement Medal, 1999
- US Army Certificate of Achievement for winning the squadron Mechanic of the Quarter Competition, 1999