AN INVESTIGATION OF SELECTED FACTORS AFFECTING AUTOMOTIVE
SERVICE EXCELLENCE TEST OUTCOME AND JOB PLACEMENT RATE

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

By

Patrick J. Karbon, B.A., M.S.A.
Denton, Texas
August, 1995
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Under investigation in this study was the effect of ASE certification of automotive technician training programs and other selected factors on ASE test outcome and job placement rate. This research ponders whether the time and money invested in certifying technician training programs is returning desired improvements in this automobile manufacturer's dealer service staff.

The study focussed on technicians employed at Chrysler dealerships around the United States. The 2 samples totalling 387 males between the ages of 22 and 30 were drawn from 1,007 graduates of automotive technician training programs. Technicians that completed a formal training program beyond the high school level certified by the National Institute for Automotive Service Excellence (ASE) were compared to others whose training was not certified by ASE. Comparisons were made on the basis of ASE Automobile Technician Test scores and on the length of time from training program completion to employment.

This research sought to identify the significance of association between three main predictors - the status of training program ASE certification, work experience and year of training program completion - and the most desirable
levels of ASE test outcome (at or above 90% on the ASE test) and job placement rate (immediately following completion of training). The logistic regression procedure in SAS was used to analyze categorical data in testing the statistical hypotheses. Resulting odds ratios provided indications of significant associations between ASE program certification, technician experience and year of program completion and each of the dependent variables, ASE test outcome and job placement rate.

The findings indicated that ASE automotive training program certification status was a significant predictor of ASE test outcome and of job placement rate. Recommendations for further study suggest a look at how technician skill levels affect implementation of the Clean Air Act or dependency on foreign sources of fuel, how training program certification impacts desirable results in industries other than automotive, and how realignment of resources might enhance the performance of training programs already certified.
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CHAPTER I

INTRODUCTION

Certification of automotive technology training programs is expected to provide accountability and professionalism for automotive technicians by measuring program performance against standards of professional practice. Government mandates currently require service facilities to show evidence that individual technicians meet a minimum level of skill in specific areas of automotive service and repair as a qualification for licensing under state and/or federal law. The Federal Clean Air Act Amendments of 1990 are examples of government requirements for the automotive service industry to accept accountability for the competency of employees assigned to perform service or repair on automobile systems and components that affect the quality of vehicle emissions. State and federal vehicle repair legislation imposes strict penalties on dealers and automobile manufacturers that do not provide effective repair service on the first attempt.

"The world's best school systems operate under a strong centralized ministry of education that sets tough standards that everyone must meet" (Thurow, 1992, p.260). Thurow recognized the association between high-quality output and
high-quality standards, yet we remain in search of affirmation that enforcement of standards through a process of program certification effectively improves knowledge-based test outcome.

There is a lack of evidence that individuals are capable of meeting standards set for automotive service and repair in today's high-tech environment. The automobile industry has also failed to establish the benchmark against which technician qualifications can be systematically and universally measured.

**Brief History of NATEF**

In 1978 the Industry Planning Council (IPC) of the American Vocational Association determined that improvement was needed in the automotive technician training programs nationally. IPC, which is concerned exclusively with automotive technician training, is comprised of representatives from the automotive industry and vocational-technical education.

In an effort to evaluate automotive technician training programs, the Motor Vehicle Manufacturers Association funded the project. The IPC directed the study, while the Southern Association of Colleges and Schools implemented it.

The evaluation guide, task list, and tools and equipment list were completed in 1982 and a search was made by the IPC Committee for an organization to develop and administer an evaluation plan for automotive technician
training programs. Members of the IPC suggested that the National Institute of Automotive Service Excellence (ASE) Board accept responsibility for developing and implementing a program evaluation.

After conducting a market study, the ASE Board accepted the responsibility and the Motor Vehicle Manufacturers Association gave the developed evaluation materials to ASE. The market study indicated that automotive technician training programs were interested in an evaluation program but the process would need to be economical, since school budgets did not include funds for such purposes. The study noted that a certification program would not be self-supporting and would require continued financial support from the automotive industry. Contributions to NATEF are tax deductible as a non-profit 501 (c) 3 Foundation.

The Automotive Service Association (ASA) donated the National Automotive Technicians Education Foundation (NATEF) to ASE. It was determined that appointments to the NATEF Board would be made by ASE and that NATEF would coordinate the evaluation and certification program. Final certification of programs would come from ASE.

Byrl R. Shoemaker, Ph.D. was hired as educational consultant to organize the material and create a plan for program evaluation and certification. The plan developed and approved by both the NATEF and ASE Boards included:

1) a set of minimum standards for program certification;
2) a plan for self-study, review of the self-study at the national level, a team review of those programs whose self-study met industry standards, and certification of programs that were reported by the review team as meeting ASE standards;

3) provision for training evaluation team leaders in each state, after application by the state and two programs being ready for team review;

4) standards for evaluation team leaders and team members;

5) methods of measuring evaluations;

6) procedures for appeal of certification decisions.

The process requires a $35 investment for self-study materials. After approval for team review, it costs a local institution approximately $535: $100 for the materials and approximately $400 for the service of an evaluation team leader for the two-day review. Local service dealers are asked to provide team members for the two-day review without charge.

After becoming certified, a program receives a promotional packet which helps publicize their certification plus a plaque from ASE indicating the areas in which a program is certified. ASE Certified programs may provide a graduating student with a certificate which includes the following statement: "This person graduated from a training program certified by the National Institute for Automotive Service Excellence in the following areas."
A survey of the first 112 programs certified reported major program improvements in all ten evaluation standards. The survey also gave high marks to the evaluation process.

In November 1989, NATEF began certification of Autobody programs. The process followed the Automotive certification for the most part. Programs may pursue certification in all five areas, a combination of three areas (which must include Non-Structural Analysis and Damage Repair) or Painting and Refinishing alone. The Autobody areas are:

Non-Structural Analysis and Damage Repair
Structural Analysis and Damage Repair
Mechanical and Electrical Components
Plastics and Adhesives
Painting and Refinishing

In April, 1992 Truck program certification was made available to medium/heavy truck programs. Pursuit of five areas, Diesel Engines, Brakes, Electrical/Electronic, Suspension and Steering, and Preventative Maintenance and Inspection, is necessary in order to achieve minimum certification. The additional areas of Drive Train, and Heating and Air Conditioning are required for Master Certification.

Students qualify for entrance into an ASE certified automotive technology training program by satisfactorily completing a formal pretesting program used to assess their abilities in reading, mathematics, and mechanical aptitude
to evaluate and assure the student a reasonable probability of success as an automobile technician. Testing procedures can be unique to each school, but must be reviewed as part of the program certification process under Standard #5: Student Services. The ASE guidelines recommend that a student be interviewed and approved for the training program prior to admission.

Statement of the Problem

While the automobile industry recognizes certification as a positive influence on quality (Steiger and Shoemaker, 1989), little information is available to indicate whether ASE program certification makes a difference in the outcome achieved through training. The educational issue under consideration in this study was the effect that training program certification and other selected factors such as work experience and training program completion year had on automotive technician ASE test outcome and job placement rate. The influence of training program certification on ASE test outcome and job placement rate for technicians completing automotive technology training programs was examined for a sample of the population of technicians employed by the independently owned dealer organization aligned with one of the top 3 North American automobile manufacturers.

The speed and intensity of changes in automotive technology fueled by rising customer expectations and
tighter government restrictions have increased the general public's awareness of the need for automotive service technicians that acquire and apply appropriate current levels of technical knowledge and skills to keep motor vehicles operating within specifications (Hightower, 1993). Indeed, in the twentieth century world of customer focus, the ability to properly repair or maintain automobiles has grown to become the "price of admission" - the minimum required - for survival in the automotive industry. Instructional processes ranking high in validity and efficiency, used in place of techniques less valid and efficient, are expected to enhance the qualifications of automotive technicians. Certification is one tool with potential for guiding and perpetuating improvements in training program effectiveness, efficiency and validity (Byrne and Others, 1992).

Employers, driven by increased levels of customer expectations regarding the service experience, need assurance that the individuals they hire following completion of automotive technician training can properly service vehicles according to established standards. To maximize the benefits of automotive service training, the instructional process must facilitate meeting customer demands for fast, accurate diagnosis of problems and vehicle repair. The National Institute for Automotive Service Excellence (ASE) has, in use, a set of voluntary industry-
based standards for automotive technician training programs. The brief history of ASE and NATEF, extracted from published NATEF informational materials, provided a concise explanation of how and why the organization was created.

Significance of the Study

The study contributed to the body of knowledge concerned with the development of minimum guidelines for the quality of automotive technician instruction and provided a framework for expanded research in the area of training program certification. Practical utilization of results by applied technology, training and development professionals includes:

* Expansion of current certified curricula;
* Enhancement of current certified facility plans;
* Development of more effective incentives for both learners and schools to improve working relationships.

Specific Purpose/Objectives of the Study

The purpose of this study was to analyze the impact of certification of automotive technician training on ASE test outcome and job placement rate. The ASE automobile technician test is the certification exam administered to individuals on a voluntary basis by the National Institute for Automotive Service Excellence. According to information published in the Fall, 1994 ASE test registration booklet,
ASE has already awarded over 340,000 automotive technician certifications throughout the United States.

**Delimitations**

Results of this study were potentially impacted by a number of factors that could not be controlled with an ex post facto experimental design. Such factors included differences in the various automotive technology programs completed by technicians included in the sample, differences in or enhancements to instructional facilities, tools or equipment, and qualifications of teachers responsible for training delivery.

The ex post facto design of the study also precluded random assignment of subjects to comparison and experimental groups. While damaging to the generalizability of study findings, the nature of the design tends to avoid the Hawthorne effect.

**Limitations**

This study was limited to a sample of Chrysler dealer technicians that attended training at one of the 24 Chrysler training centers throughout the country during a 13-week period from January 30 through April 28, 1995. Technicians not in attendance at the selected training facilities during that period, as well as those employed by automotive companies other than the one sampled and those employed by independent service or repair facilities, were not
represented in the study. Voluntary participation may also have affected study results by allowing some technicians to opt not to complete the survey.

Participants in this study were compared on ASE test outcome and job placement rate with regard to whether or not the automotive technology training program they attended beyond the high school level was ASE certified. Subjects were not measured on:

a) mechanical aptitude;
b) experience in a practice or profession outside of automotive service and repair;
c) socio-economic status;
d) motivation to succeed in the profession;
e) financial position;
f) motivation to succeed.

Administering survey instruments through Chrysler training centers brought several advantages that outweighed, in the opinion of the researcher, the negative impact of narrowing the scope of the study samples. In addition to providing a consistent process for collecting data, the training centers allocated the time necessary for technicians to respond to all of the survey questions without the pressures and distractions that would likely have been present in the dealership service department environment. Though no comparative analysis was done to support the claim, survey responses are believed to have
been more accurate, complete and in larger quantities because of the data collection process utilized in the study. Ironically, input from other technicians who were consciously omitted by the design of the study might have otherwise improved the generalizability of the findings to a more broadly defined population of technicians.

The use of ASE test outcome ranges or groups, rather than specific individual ASE test scores, prevented the use of more powerful statistical analyses and further inhibited the generalizability of the findings to a larger population. Reasons for offering the respondent a choice of test outcome range rather than requiring input of a specific score focus on the potential for technicians to be unwilling or unable to respond accurately under the circumstances present during administration of the survey instrument. These reasons are discussed in more detail in the section on Survey Instrument and Data Collection in Chapter III.

Since the study was limited geographically to the sample of technicians attending training at the U.S. Chrysler training centers, findings cannot be generalized beyond areas known to be similar demographically and characteristically to Chrysler dealerships within the United States. The use of an ex post facto study design further limits the extent to which the results can be generalized to the population.
Definition of Terms

Areas of Instruction - Areas comprised of distinctly different function, operation, purpose or mechanism in or on the automobile. Includes: automatic transmission and/or transaxle, brakes, electrical system, engine performance, engine repair, heating and air conditioning, manual drivetrain and axles, and suspension and steering.

ASE test outcome - Score on the ASE Automobile Technician Test administered by the National Institute for Automotive Service Excellence (ASE) on a voluntary basis. Individuals receive a score on the exam subject to a pass/fail cutoff of 70%; 70% and above is a passing grade, while below 70% constitutes a failing grade.

Automotive technician - Individual engaged professionally in the service and/or repair of automobiles, automotive component parts or assemblies.

Certification - Refers to the certification of a school's automotive technology training program by the National Institute for Automotive Service Excellence (ASE). ASE will grant certification to programs that comply with the evaluation procedure, meet established standards, and adhere to the policies in the document "Automotive Policies and Procedures for NATEF Technician Training Certification Program". The purpose of the Automobile Technician Training Certification Program is to improve technical instruction at the secondary and post-secondary levels, and private schools
to prepare automobile technicians for employment. It is not intended to provide instruction to individuals, groups, or institutions. The Program will be identified as a certification program and will not conflict with the accreditation role of other agencies (NATEF, 1991).

**Job placement rate** - The span of time between completion of an automotive technology training program and employment in automotive service/repair or a related field.

**Learner** - Individual that completed a formal program of instruction in automotive technology beyond the high school level.
CHAPTER II
REVIEW OF RELATED LITERATURE

The goal of this research was to investigate the effect that automotive technician training program certification by ASE and other selected factors had on technician's knowledge of automobile mechanical diagnosis and repair necessary for competent job performance and, concurrently, the effect of these factors on the rate of technician job placement. This summary of literature presents a coherent argument from recent writings on the topic of certification that leads to a description of the study proposed herein.

Discussion of the literature is presented in five sections: (1) Need for Skilled Automotive Technicians, (2) Value of Certification, (3) Research in Certification within the Automotive Service Industry, (4) Research in the Effect of Program Certification on Training Outcome, and (5) Research in the Effect of Program Certification on Job Placement Rate.

Need for Skilled Automotive Technicians

The need for skilled technicians is becoming increasingly apparent in many fields of technology, but notably in the automotive arena. Truck and car manufacturers, dealers and fleet operators are focused on
creating a systematic approach to training mechanics and continuously improving their diagnostic and repair skills (Siegel, 1993).

Today's passenger vehicle service has gone high-tech. Virtually every system under the hood affects the power train and major sub-systems that support the safe and comfortable operation of late model vehicles (Grimaud, 1993). Repair of current model automobiles requires increasingly higher levels of technical expertise on the part of service technicians, especially in the areas of electronics and exhaust emissions.

As automotive design increases in electronic and mechanical complexity, the responsibility assigned to the automotive technician mounts. The impact of microprocessors in automobiles on the auto repair industry, termed "digital transmogrification" by members of the electronics elite, is reason enough for concern over a shortage of qualified technicians to meet the challenge (Louderback, 1993). Individuals who service and repair automobiles need specific skills that, at a minimum, keep pace with the technology currently in view at this end of the assembly line.

Innovations in passenger car systems that, in some cases, were not considered practical or desirable as few as seven years ago, are rapidly appearing on vehicles around the world. Passive-restraint "air-bag" systems of this generation are a far cry from the Ralph Nader incumbrance
designated "seat belt interlock" system that prevented starting the vehicle's engine until the driver's seat belt was buckled. While currently enjoying dual air bags as standard equipment on some base model vehicles, the promise of "smart" air bag systems that consider passenger size and weight characteristics along with vehicle speed, road conditions, and impact deceleration when deploying the life-saving nylon pillow of air at variable rates of speed has already been seen. Such systems challenge the diagnostic and repair abilities of even the most proficient automotive service technicians (Grimaud, 1993).

The automotive technician in our current and future environment is left to comprehend the intricacies of whatever the design and manufacturing engineers around the world can jointly conceive of and produce. Diagnosing electronically-automated transmissions, for example, requires different skills than were traditionally considered adequate for similar (transmission) repairs. Help is available with the advent of computer modem links to original equipment manufacturers' engineering groups in some situations, but the emphasis is clearly on the skilled technician to manage the bulk of the service and repair task (Birkland, 1993).

The scarcity of skilled service and repair professionals in the personal transportation business has bred a new form of technician; the mobile service
to more efficiently handle the maintenance and repair of advanced vehicle systems, some dealers and fleet operators have contracted with mobile service companies like VehiCare and Prestone Technology Systems, Inc. to handle routine service while their own mechanics concentrate on the complex inspections and repairs (Birkland, 1992).

The ability to maintain and repair automobiles to meet safety standards, fuel economy and exhaust emission requirements has risen to paramount importance in the vehicle service business. Customer expectations edge higher next to increases in both foreign and domestic competition. The vehicle owner's perception of a service center or automobile dealers' technical expertise is a key component of the customer satisfaction equation.

In an article addressing the "real cost of customer service", Paul Brown (1990) suggests that providing atypical service will be necessary for companies to succeed. An important component of this customer service strategy is the utilization of a professional recruiting company to find qualified personnel with precise requirements and paying above-scale wages to keep and train employees. Realizing that customers are willing to pay more for value, service and convenience, one service center operator is quoted by Brown as paying $172,000 per year to secure and retain reliable, qualified technicians. $4,000 of this annual amount is expended on recruitment fees, while the balance is
allocated to wages in excess of industry standard (Brown, 1990). There is indeed a need for technicians who meet the requirements of this rapidly advancing, high performance segment of the automotive service and repair market.

Value of Certification

The demand for training program certification is prompted by a variety of influences. One of the leading factors is the need for uniform application of minimum specifications within industries and across geographic and corporate boundaries.

While it appears obvious to some that certification involves a form of licensure or guarantee, it represents, for many, evidence of achieving things far beyond (Sawyer, 1991). Reasons for establishing and achieving certification in a given area of work or expertise include: achievement of legitimacy and sense of professionalism in the profession; enhanced professional image; agreement on and adherence to a set of standards; improved skills or expertise (Donelan and Elsea, 1992); and the ability to compete more effectively with others in the same or similar field.

In short, certification signifies different things to the various individuals that interpret its meaning (Hoachlander and Rahn, 1994). Indeed, the National Society for Performance and Instruction (NSPI) actually spoke out against the notion of certification in the field of performance and instruction. In a brief article published
in NSPI's own journal, a member of a task force investigating the professional certification process conveyed concerns over methods being utilized by the "certification movement", what is wrong with them, and why certification would hinder the profession (Boothe, 1984). This was the only stance taken in opposition to certification found in the literature covering the past ten years.

Even with current widespread interest in the attainment of certification, the private and public sector struggles with the language used to describe skills necessary for success in the workplace. Information found in Voluntary Industry-based Skill Standards and Certification: A Final Report to the U.S. Department of Labor, Employment and Training Administration, Office of Work-based Learning, published in September, 1992 by the U.S. Government Printing Office, suggests that the efforts taken to identify job-specific and general skills in the certification process may not be offset by the benefits realized from certification.

Though there is no strong tradition of establishing worker skill standards in the United States, interest in developing certification programs in a number of industries is growing in strength (Parmerlee, 1991). For the 1991 research report sponsored by the National Governor's Association, the Center for Remediation Design conducted
telephone interviews with individuals representing industry associations. This survey provided information on industry-wide approaches to identifying and specifying employer skill requirements using various combinations of the following:

(1) worker certification or credentialing;
(2) program accreditation; and
(3) curriculum design tailored to the specific skills needed.

Listed among the 16 industries represented in the research were a number of organizations actively involved in the process of certifying industry professionals. The National Institute for Automotive Service Excellence, for example, administers competency tests and certifies automotive technician training programs. The Printing Industries of America has developed, through the efforts of a group of member volunteers, an industry certification program. The American Bankers Association's American Institute of Banking concentrates, as a matter of routine emphasis on continuous improvement, on the upgrading of employee skills toward qualification for certification.

Further evidence of the value that organizations place on certification was provided in a statement by Jeff Wilder (1994) describing how the Hotel and Motel Management board of directors announced the birth of the Certified Broker Program. The program is meant to assure the
lodging-investment public that when they use a Hotel and Motel Brokers Association (HMBA) broker, they are dealing with a professional. To qualify for hotel broker certification, HMBA brokers undergo 70 hours of study, attend continuing education programs, attain certain levels of brokerage achievement, and provide ongoing service to the hospitality industry.

**Research in Certification Within the Automotive Service Industry**

Skilled automotive technicians are an essential element of the automobile industry's network of service and repair installations. Certification offers the potential to formalize and impose a set of criteria that, in the field of automotive repair, improves the likelihood that technicians will possess the skills needed to perform the appropriate service or repair task when required.

The value of certification to the automobile service industry is evidenced by the support that auto makers provide to technician training program certification. Chrysler, Ford, General Motors, Nissan and Toyota are among the automobile manufacturers with active apprenticeship programs that produce automotive technicians certified through the National Automotive Technician Education Foundation, Inc. by the National Institute for Automotive Service Excellence.
To maintain desired levels of technical expertise in their certified apprenticeship training programs, automotive manufacturers contribute time, expertise, financial resources and equipment to schools that qualify. These benefits encourage schools not only to attain initial program certification, but to remain in qualification for certification by continuously evaluating and improving curriculum, facilities, and personnel.

The ASE certification process facilitated by NATEF serves as a model program for industry-wide, national certification programs (Sutphin, 1994). To become qualified for ASE certification, schools must complete the following steps:

1. Purchase self-evaluation materials;
2. Conduct a self-evaluation using the Advisory Committee, staff, or a combination of the two;
3. Submit the self-evaluation for review by the National Automotive Technicians Education Foundation which directs the certification effort for ASE;
4. Arrange for and coordinate the outside team review of the areas approved for review by NATEF; and
5. Receive notification and a plaque from ASE on the areas certified and publicize the certification to prospective students, employers, and the public.

There are ten specific areas examined during an ASE certification review for comparison to industry requirements
or standards. Details of ASE's automobile program standards, included in Appendix A, are summarized here for review:

PURPOSE: The automobile technician training program should have clearly stated program goals, related to the needs of the students and employers served.

ADMINISTRATION: Program administration should ensure that instructional activities support and promote the goals of the program.

LEARNING RESOURCES: Support material, consistent with both program goals and performance objectives, should be available to staff and students.

FINANCES: Funding should be provided to meet the program goals and performance objectives.

STUDENT SERVICES: Systematic pre-admission testing, interviews, counseling services, placement and follow-up procedures should be used.

INSTRUCTION: Instruction must be systematic and reflect program goals. A task list and specific performance objectives with criterion referenced measures must be used.

EQUIPMENT: Equipment and tools used in the automobile technician training program 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.
FACILITIES: The physical facilities must be adequate to permit achievement of the program goals and performance objectives.

INSTRUCTIONAL STAFF: The institutional staff must have technical competency and meet all state and local requirements for certification.

COOPERATIVE AGREEMENTS: Written policies and procedures should be used for cooperative and apprenticeship training programs.

Research in the Effect of Program Certification on Training Outcome

Following an extensive search of the literature over the past fifteen years in the fields of business and education, research on the relationship between certification and training outcome was found to exist within only a few industries. Literature describing the effect of training program certification on student training outcome is narrowly focused on printing, accounting and banking, and automotive service. That improving the level of student skills and knowledge is only one of many reasons for the development of certified training plans might explain the scarcity of information in the literature restricted to the relationship between certification and achievement. Distancing themselves as professionals from laypersons in the same or similar field has prompted an interest in certification in some areas of business, citing
"professional image" as a positive effect. A survey of 256 Accredited Personal Financial Specialists (APFS) was conducted to determine how they viewed the costs and benefits involved with the completion of a certified training program. While the obstacle rated most significant by 28% of the respondents was the preparation required for the national APFS examination, 79% felt that the training improved their skills and expertise (Donelan and Elsea, 1992). To what extent this improvement was realized as a direct result of the training was not discussed in the report.

Certification of content standards for an interim period until associated performance standards were developed was an action taken by the National Council on Education and Standards in its task of establishing world-class academic standards for the United States. Without hard evidence of the effect that certification had on student achievement, the council agreed that high standards are a critical first step toward the attainment of national education goals (Wurtz and Others, 1993). Content standards that define what students should know and be able to do, coupled with performance standards that identify the levels of achievement desired for the subject matter defined in the content standards, form the basic certification requirements for each training program.
A certified secretarial training program designed to increase the skills of secretaries employed by a local producer of aluminum and copper materials in Carrollton, Georgia has demonstrated positive effects on learner outcome as measured by improved productivity, reduced absenteeism, and higher morale. The training curriculum, part of an effort to meet specific educational needs of local business, was developed and certified as a cooperative educational renewal program between Carroll Technical Institute (CTI) and the Southwire Company (Agan, 1994).

Competency-based certification programs for automotive service technicians, described in an earlier section of this chapter, comprise the most common occurrences of stories about the positive effects of program certification on learner outcome in the literature. Under various names aligned with the different corporate sponsorships, vocational training centers and community colleges operate training programs certified by ASE through NATEF to produce automotive technicians with competency levels suitable to meet the vehicle service and repair standards established by the industry (Cantor, 1993).

Research in the Effect of Program Certification on Job Placement Rate

In a guide that offers employers practical advice on how to begin a youth apprenticeship program that will serve their labor needs, Sandra Byrne and others (1992) emphasize
three different types of skills that such a program should provide: academic, technical and employability skills. Program certification and job placement are discussed in this guide as an obvious cause and effect relationship that performs predictably within the framework devised by the employer and a properly-chosen educational partner. The effect of program certification, characterized by documented specific classroom and on-the-job instructional interventions, on graduating student job placement rate represents a strong positive association.

Substantial reductions in overall training costs as well as improved job placement rate are the hallmark of the certification of a cooperative vocational training program operating in Honduras. The issue of relevance, recognized as the key to improving the country’s job training system, was resolved with the development of competency-based instructional modules and certification exams currently in use at four public and private vocational training institutions. Certification of the training and formation of a job placement program made possible the establishment of a quality control mechanism that provides immediate feedback on the relevance and quality of the training being provided. Due to the effects of program certification on placement rate, an ambitious objective of expanding the program to train, certify, and find employment for 15,000
youths and adults over the next five years has been established (Van-Steenwyk, 1987).

An interesting twist in support of the contention that training program certification positively effects job placement is the article by Robert Half (1992) describing the potential for utilizing career development courses in the certified curriculum as a forum for networking. Half suggests that the practice of networking when developing a career remains one of the most potent ways to find new and better employment. He further suggests that those who have earned the Certified Management Accountant (CMA) designation probably have taken courses designed to prepare management accountants for the test, thereby coming into contact with other management accountants who have the same goal. Although the relationship that certification has on job placement is not quantified, the opportunity to network with other professionals during the educational phase of career development is argued to have a positive effect.

Summary

The evolution of technologies related to the design and manufacture of automobiles has exposed the need for skilled automotive service technicians. Higher levels of knowledge and skills are required to diagnose and repair automobile systems that continue to expand in their complexity and interdependence. The inflated cost of assemblies and larger subassemblies, due in part to the expanded use of electronic
componentry, makes random replacement of parts on a "try-it-and-see" basis prohibitive.

Certification of the training programs and schools challenged with developing the skills of automotive technicians is thought to be an effective method of improving learner outcome. The growing number of industries and occupations seeking to establish minimum skill standards through a certification process demonstrates the value of this method of measuring and recording an individual's qualifications.

Automobile manufacturers view certification of programs for training automotive service and repair technicians as a necessary component of the continuous improvement process. These corporations support certification by donating money, equipment, vehicles, technical information and human resources toward the continuation and improvement of certified technician training programs.

Many of the articles researched for this study indicate a positive effect that training program certification has on both learner outcome and job placement rate. While a favorable influence of automotive training program certification on technician skills and placement rate is believed to exist, specific indicators of the magnitude of the relationship are difficult to find. How to know that certification is helping to provide qualified technicians defines the basis for this study.
CHAPTER III

METHODS AND PROCEDURES

This chapter describes the methods and procedures used in the collection and treatment of data. The study examined the differences in ASE test outcome and rate of job placement between two groups of automotive technicians: those who completed automotive training programs beyond the high school level that were certified by ASE and those who completed automotive training programs that were not certified by ASE. Information is presented in five sections: (1) Selection of Population and Sampling Procedures, 2) Survey Instrument and Data Collection, (3) Research Design, (4) Research Questions and Statistical Hypotheses and (5) Analysis.

Selection of Population and Sampling Procedures

The population targeted by this study was made up of technicians who had completed an automotive training program beyond the high school level at any time prior to January 30, 1995. The technicians sampled were employed by an authorized Chrysler Corporation dealership at the time the survey was distributed during a 13-week period that ended April 28, 1995.
To enhance the generalizability of the findings, this study included all technicians that attended automobile training at each of the 24 Chrysler Corporation training centers across the United States during the period that data was collected. Appendix G provides a listing of these training centers ordered by city. Technicians were asked to complete all applicable items on the research questionnaire (Appendix D) administered by training center instructors at the beginning of each class. The responses were accumulated over the survey period and entered into one file to be analyzed with a PC-based version of the SAS statistical program. The number of respondents indicating that they had completed a formal automotive training program beyond the high school level totalled 1,007. Responses were statistically analyzed as two independent samples; one sample consisting of 342 subjects who had completed an automotive training program that was certified for ASE through NATEF, and another sample consisting of 664 subjects whose training program was not certified by ASE/NATEF.

These samples formed the comparison and experimental groups represented in this study; subjects indicating completion of an automotive training program certified by ASE comprised the experimental group, while subjects that completed an automotive training program not certified by ASE served as the comparison group.
Survey Instrument and Data Collection

A total of 2,428 research questionnaires were collected from Chrysler technicians during the data collection phase of this study. Only the surveys containing complete responses to all relevant items, including an indication that a formal automotive training program beyond the high school level had been completed, were considered for the study. These 1,007 qualified responses were then sorted into two categories with regard only to the characteristic of training program certification. The remaining 1,421 surveys were not used in the study.

To eliminate any of the effects of gender on the statistical analysis, the three female respondents were excluded from the sample. Finally, subjects were equated on the characteristic of age by combining two categories of response to form a range of from 22 to 30 years for inclusion in the analysis.

To isolate the effects of certification on the two dependent variables, ASE test outcome and job placement rate, subjects were equated on the characteristics of age and gender. To reduce the effects of potential differences between individual schools, the study included all schools attended by the technicians that responded, involving automotive training programs at locations throughout the United States.
The relationship between ASE’s training program certification and ASE test outcome and job placement rate served as the stimulus for this study. To properly evaluate this effect, evidence that the ASE test instrument was reliable and valid was pursued. Details concerning the content validation process of the ASE automobile technician test are provided in Appendix B.

Representations concerning technician’s employment status were taken as factual directly from survey data, while reliability and validity of the ASE automotive technician certification exam was provided by ASE. Detailed ASE test statistics, compiled by American College Testing (ACT) and on file at ASE, were sampled to provide specific reliability measures for the ASE automotive technician certification exam. Examples of ASE Automobile Technician Test questions are in Appendix C. Sample statistics revealed that overall ASE test reliability (KR20 reliability coefficient) was .8942, considered a very good result.

**Research Design**

This study incorporated a quantitative analysis in the form of a modified posttest-only comparison-group (ex post facto research) design. This design required that the subjects selected from the population be exposed to the treatment only as a member of the experimental group, and complete a posttest that allows comparison of results. To improve the generalizability of the findings of this study
to the population while reducing the variations in ASE test outcome and job placement rate attributable to school locations, resources, and technological advantages, all automotive training programs beyond the high school level attended by the technicians surveyed were included in the sample.

To meet the modified posttest-only comparison-group design requirement that treatment be administered only to the experimental group and specifically withheld from the comparison group, subjects were sorted into 2 independent samples according to whether their training program was ASE/NATEF certified or not. Assignment of subjects to the experimental and comparison groups was directed by their status with regard to this contingency.

The ASE Automobile Technician Test is the posttest taken by all subjects in both the comparison and experimental groups in this study. Administration of an equivalent posttest meets the final requirement of this experimental research design.

The independent variable in this study is ASE (i.e. ASE program certification through NATEF) versus non-ASE certification of the school's automotive training program. The study focused on the influence that program certification exerted on the dependent variables of ASE test outcome and job placement rate.
ASE test outcome, the first dependent variable used in this study, is an estimate of the learners' automotive-related knowledge and behaviors as measured by their score on the ASE automobile technician test. Data on ASE test outcome were collected by survey in five categories rather than by actual test score. In certain special situations, individual's test scores can be made available, matched to social security numbers by the testing institution, ASE. Precautions would normally be taken in the way that data is provided to insure that test score data is impossible to trace back to a name. In this study, however, the desire to obtain specific test scores competed with the need to maximize survey responses during the data collection phase of the study. The manner in which actual ASE test scores were categorized is shown in Table 1.

Table 1
Group Assignment of ASE Test Outcome

<table>
<thead>
<tr>
<th>Group</th>
<th>ASE test score range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Below 70%</td>
</tr>
<tr>
<td>2</td>
<td>70-79%</td>
</tr>
<tr>
<td>3</td>
<td>80-89%</td>
</tr>
<tr>
<td>4</td>
<td>90-99%</td>
</tr>
<tr>
<td>5</td>
<td>100%</td>
</tr>
</tbody>
</table>
To achieve the highest number of survey responses from technicians, it was decided that a request for a subject's social security number would not be incorporated into the research questionnaire. Since actual test scores could not be obtained, score data was coded into categories.

Collecting categorical test score data as an item on the research questionnaire promised to meet the dual study objectives of high survey response rate and credible data on ASE test outcome. To alleviate concerns expressed in a dealer technician advisory panel discussion over a respondent's inability to remember or provide specific test scores, a survey instrument was designed to include five categories or groups of ASE test scores within which the technician's actual score could fall. The final (distributed) version of the Automotive Technician Research Questionnaire shown in Appendix D is the result of these reviews.

Job placement rate, the second dependent variable in the study, reflects the period of time elapsed following completion of formal automotive training beyond the high school level and employment in automotive or a related field. Data on job placement was collected and organized in five categories under question #6 on the research questionnaire. Responses were compiled according to the number and percent of subjects that began working for pay in automotive or a related field immediately and at 3-month
intervals within the twelve months following their completion of a formal automotive training program beyond the high school level.

To allow for a more detailed examination and to identify possible associations more readily, data on placement rate was analyzed and the findings displayed by each of the five response categories. The statistical hypothesis involving job placement rate was tested by comparing responses to category one, representing job placement immediately following training program completion, with responses to categories two through five, representing job placement beyond the day of training program completion.

Measures of performance on the two dependent variables were obtained from technician responses on a survey that was distributed to technicians attending automotive training over a period of thirteen weeks at the beginning of 1995 as indicated in the previous section. Responses also provided information about experience in automotive service/repair both professionally and as a hobby, school name and the year of formal automotive training program completion, high school grade point average (GPA), age and gender. A copy of the survey instrument is in Appendix D.

Research Questions and Statistical Hypotheses

Following a review of the literature on certification in automotive technician training, four research questions were formulated to guide this investigation. The research
questions and corresponding statistical hypotheses that were addressed by this study are:

RQ #1: What was the effect of ASE training program certification on automotive technician ASE test outcome? This research question led to the hypothesis stating that the probability of obtaining a score on the ASE Automobile Technician Test of 90 or above was the same for graduates of automotive training programs without regard to the program's ASE certification status. The statistical hypotheses aligned with this research question were:

Null form: $H_{01}: \beta = 0$

Alternative: $H_{a1}: \beta \neq 0$

ASE test outcome was treated as a dichotomous variable: ASE test scores of 90 and above scored as a 1 and ASE test scores below 90 scored as a 0. The SAS procedure for logistic regression utilized the following general odds ratio equation and logistic model formula:

$$\log(p/(1-p)) = \alpha + \beta X$$

$$f(z) = \frac{1}{1 + e^{-(\alpha + \beta X)}}$$

Where:

$f(z) = \log(p/(1-p))$

$[p = \text{probability of success, or an ASE test score of 90 and above; } 1-p = \text{probability of failure, or an ASE test score below 90}]$

$\alpha = \log(\text{logarithm}) \text{ of the background or baseline odds}$
\[ \beta = \text{coefficient of the variable } X, \text{ representing the change in the log odds that would result from a one unit change in the ASE training program certification status (} X) \text{ when other variables are fixed} \]

\[ X = \text{ASE training program certification status (} 1 = \text{ASE certified; } 0 = \text{not ASE certified}) \]

The null hypothesis stated that the probability of achieving a test score of 90 or above was the same at all levels of the predictor variable. To test \( H_0: \beta = 0 \), the p-value associated with the computed odds ratio was examined against the .05 level of significance.

Alternatively, it was hypothesized that a significant association existed between ASE test outcome and ASE training program certification status. The alternative hypothesis \( H_A: \beta \neq 0 \) would be retained in favor of the null if a p-value below .05, indicating a significant association between ASE test outcome and the independent variable, was computed.

Table 2 provides information on the frequency and percent of subjects, according to the status of their training program certification, that fell within each of the five ASE test outcome categories. Data was analyzed to determine if a statistically significant association existed between the ASE test score groups and training program certification. The SAS statistical package was used to produce a logistic regression analysis of the ability to
predict ASE test outcome category from the ASE/NATEF certification status.

Table 2

ASE Test Outcome: Subjects per Category

<table>
<thead>
<tr>
<th>ASE test outcome</th>
<th>Program certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASE</td>
</tr>
<tr>
<td>(1) Below 70%</td>
<td>4</td>
</tr>
<tr>
<td>(2) 70 - 79%</td>
<td>13</td>
</tr>
<tr>
<td>(3) 80 - 89%</td>
<td>146</td>
</tr>
<tr>
<td>(4) 90 - 99%</td>
<td>167</td>
</tr>
<tr>
<td>(5) 100%</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>343</td>
</tr>
</tbody>
</table>

RQ #2: What was the effect of other variates - work experience, corporate sponsorship of the training program and the year training was completed by the individual - on ASE test outcome? This research question was transformed into a null hypothesis stating that the probability of obtaining a score on the ASE Automobile Technician Test of 90 or above was the same for all graduates of an automotive training program without regard to work experience in automotive service or repair ($X_1$), the year training was completed ($X_2$), or corporate sponsorship of the training
program \( (X_i) \). The statistical hypotheses aligned with this research question were:

Null form: \( H_{02}: \beta_i = 0 \) for all values of \( i \)

Alternative: \( H_{a2}: \beta_i \neq 0 \) for any value of \( i \)

ASE test outcome was treated as a dichotomous variable:

ASE test scores of 90 and above scored as a 1 and ASE test scores below 90 scored as a 0. The calculated p-values were compared to the .05 critical value to determine the significance of the effect each variate had on predicting ASE test outcome. The following odds ratio equation for logistic regression and logistic model formula were applied to the analysis:

\[
\log(p/1-p) = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3
\]

\[
f(z) = \frac{1}{1 + e^{-(\alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3)}}
\]

Where:

\( f(z) = \log(p/1-p) \)

[p = probability of success, or an ASE test score of 90 and above; 1-p = probability of failure, or an ASE test score below 90]

\( \alpha = \log \) (logarithm) of the background or baseline odds

\( \beta = \) coefficient of the variable \( X \), representing the change in the log odds that would result from a one unit change in \( X \) when other variables are fixed

\( X_i = \) work experience in automotive service or repair (dummy coded into 6 levels; each level of the experience variable compared with the 0-1 year group)
$X_2$ = year that automotive training program was completed
(dummy coded into 6 levels: 1950 < $X_2$ ≤ 1960, 1960 < $X_2$ ≤ 1970,

$X_3$ = corporate sponsorship of the training program (1 =
corporate sponsored; 0 = not corporate sponsored)

The null hypothesis stated that the probability of
achieving an ASE test outcome of 90 or above was the same at
all levels of the predictor variables. To test $H_{02}: \beta_i = 0$
for all values of $i$, the p-values associated with the
computes odds ratios were examined against the .05 level of
significance.

Alternatively, it was hypothesized that a significant
association existed between ASE test outcome and one or more
of the main effects variables; $X_1$, $X_2$, and $X_3$. The
alternative hypothesis, $H_{A2}: \beta_i \neq 0$ for any value of $i$,
would be retained in favor of the null if a p-value below
.05 was computed. This result would indicate that the
particular independent variable was an important predictor
of ASE test outcome.

Data was analyzed to determine if a statistically
significant association existed between the ASE test outcome
and predictor variables $X_1$, $X_2$, and $X_3$. The SAS statistical
package was used to produce a logistic regression analysis
of the ability to predict ASE test outcome category from any
one of the three independent variables: experience,
completion year and sponsorship.
RQ #3: What was the effect of ASE training program certification on automotive technician job placement rate? This research question led to the hypothesis stating that the probability of immediate employment following completion of training was the same for all graduates of an automotive training program without regard to ASE certification status. The statistical hypotheses aligned with this research question were:

Null form: \( H_{03}: \beta = 0 \)

Alternative: \( H_{A3}: \beta \neq 0 \)

Job placement rate was treated as a dichotomous variable: immediate employment following training program completion scored as a 1 and placement that did not immediately follow program completion scored as a 0. The SAS procedure for logistic regression yielded the following odds ratio equation and logistic model formula:

\[
\log\left(\frac{p}{1-p}\right) = \alpha + \beta X
\]

\[
f(z) = \frac{1}{1 + e^{-(\alpha + \beta X)}}
\]

Where:

\( f(z) = \log\left(\frac{p}{1-p}\right) \)

\( [p = \text{probability of success, or immediate employment following completion of training}, \text{and } 1-p = \text{probability of failure, or delayed employment in automotive service or repair beyond completion of training}] \)

\( \alpha = \log \text{ (logarithm) of the background or baseline odds} \)
\( \beta \) = coefficient of the variable \( X \), representing the change in the log odds that would result from a one unit change in the ASE program certification status \( (X) \) when other variables are fixed

\( X \) = ASE training program certification status \( (1 = \text{ASE certified}; 0 = \text{not ASE certified}) \)

The null hypothesis \( H_{03}: \beta = 0 \) stated that the probability of immediate employment was the same at all levels of the predictor variable. To test \( H_{03}: \beta = 0 \), the p-value associated with the computed odds ratio was examined against the .05 level of significance.

Alternatively, it was hypothesized that a significant association existed between job placement rate and the ASE training program certification status of the subjects’ school. The alternative hypothesis \( H_{A3}: \beta \neq 0 \) would have been retained in favor of the null if a p-value below .05, indicating a significant association between job placement and the independent variable, was computed.

Data was analyzed to determine if a statistically significant association existed between job placement rate and training program ASE certification. Table 3 provides information on the frequency and percent of subjects, according to the status of their training program certification, that fell within each of the five job placement categories.
Table 3

Job Placement Rate: Subjects per Category

<table>
<thead>
<tr>
<th>Job placement rate</th>
<th>Program certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASE</td>
</tr>
<tr>
<td></td>
<td>#  %</td>
</tr>
<tr>
<td>(1) Immediately</td>
<td>252  73.5</td>
</tr>
<tr>
<td>(2) &lt; 3 months</td>
<td>49   14.3</td>
</tr>
<tr>
<td>(3) 3-6 months</td>
<td>19   5.5</td>
</tr>
<tr>
<td>(4) 7-12 months</td>
<td>9    2.6</td>
</tr>
<tr>
<td>(5) &gt; 12 months</td>
<td>14   4.1</td>
</tr>
<tr>
<td>Total</td>
<td>343  100.0</td>
</tr>
</tbody>
</table>

The SAS statistical package was used to produce a logistic regression analysis of the ability to predict job placement rate from the ASE/NATEF certification status. The calculated p-values were compared to the .05 critical value to determine the significance of the effect that ASE certification had on predicting job placement.

RQ #4: What was the effect of professional work experience, year that training was completed and ASE test outcome on job placement rate? This research question led to the examination of whether the probability that individuals obtained immediate employment following completion of an automotive technician training program was
the same for all graduates of an automotive training program without regard to work experience in automotive service or repair \((X_1)\), year that training was completed \((X_2)\) or ASE test outcome \((X_3)\). The statistical hypotheses aligned with this research question were:

Null form: \(H_{04}: \beta_i = 0\) for all values of \(i\)

Alternative: \(H_{A4}: \beta_i \neq 0\) for any value of \(i\)

Job placement was treated in this analysis as a dichotomous variable: job placement immediately following completion of training scored as a 1 and delayed employment following completion of training scored as a 0. The calculated p-values were compared to the .05 critical value to determine the significance of the effect each variate had on predicting job placement. The following odds ratio equation for logistic regression and logistic model formula apply to this analysis:

\[
\log(p/1-p) = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3
\]

\[
f(z) = \frac{1}{1 + e^{-(\alpha + \beta_1x_1 + \beta_2x_2 + \beta_3x_3)}}
\]

Where:

\(f(z) = \log(p/1-p)\)

\(p = \text{probability of success, or immediate employment following completion of automotive training}, \text{ and } 1-p = \text{probability of failure, or delayed employment in automotive service or repair beyond completion of training}\)

\(\alpha = \log \text{(logarithm) of the background or baseline odds}\)
\[ \beta = \text{coefficient of the variable } X, \text{ representing the change in the log odds that would result from a one unit change in the variable } X \text{ when other variables are fixed} \]

\( X_1 = \text{work experience in automotive service or repair (dummy coded into 6 levels; each level of the experience variable compared with the 0-1 year group)} \)


\( X_3 = \text{ASE test outcome (1 = 90-100%; 0 = less than 90%)} \)

The null hypothesis stated that the probability of achieving employment immediately following completion of training was the same at all levels of the predictor variables. To test \( H_0: \beta = 0 \) for all values of \( i \), the p-values associated with the computed odds ratios were examined against the .05 level of significance.

Alternatively, it was hypothesized that a significant association existed between job placement rate and one or more of the main effects; \( X_1, X_2, \) and \( X_3 \). The alternative hypothesis, \( H_a: \beta \neq 0 \) for any value of \( i \), would be retained in favor of the null if a p-value below .05 was computed. This result would indicate that the particular independent variable was an important predictor of job placement rate.

Data was analyzed to determine if a statistically significant association existed between job placement rate
and variables $X_1$, $X_2$, and $X_3$. The SAS statistical package was used to produce a logistic regression analysis of the ability to predict job placement rate from any one of the three variables: work experience, completion year and ASE test outcome.

**Analysis**

Logistic regression analysis was used to predict the two dichotomous dependent variables, ASE test outcome and job placement rate, from training program ASE certification status (Kleinbaum, 1994). Relationships between the outcome variables and technician's work experience and year of training program completion were examined as well. These variables were used to estimate the probability that a person was in one of the two ASE test outcome categories or one of the two job placement rate categories.

Logistic regression, employed in this study to determine whether a variable was important in predicting an outcome, works best when the number of subjects in each of the two categories is approximately equal. Categories to which values for the dependent variables were assigned and the associated size ($n$) of each group are noted in Table 4.

The results from a logistic regression are stated in terms of an odds ratio. This ratio compared the odds of an event for subjects in two sample groups. An odds ratio of 2.0, for example, meant that one group had two times the odds of an event as the other group. As applied to the
variables in this study, predicting job placement rate by ASE certification status with an odds ratio of 2.0 meant that the odds of immediate job placement for those with ASE training program certification status were two times the odds of immediate job placement for those without ASE certification.

Table 4

<table>
<thead>
<tr>
<th>Dependent Variable Categories (n=1,007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>ASE test outcome</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Job placement rate</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

If ASE certification were a significant predictor, it could be stated that ASE certification improves the odds of immediate job placement. If ASE certification had an odds ratio of 1.0, it could be reasoned that the odds of immediate job placement for those completing an ASE certified training program were the same as the odds for those completing a non-ASE certified program. An odds ratio of 1.0 would, therefore, have indicated that ASE certification had no effect on job placement rate.
CHAPTER IV

FINDINGS

This chapter presents the results of the statistical procedures used to analyze the data, organized around each of the four statistical hypotheses presented in Chapter III. Table(s) have been used to present the results of statistical tests and explanations given for each of the findings.

Although 2,428 completed surveys were received from technicians employed by Chrysler dealerships throughout the country, respondents who met the criteria for the study totalled 1,007. Their responses were statistically analyzed as two independent samples; one sample consisting of 343 subjects who had completed an automotive training program that was certified for ASE through NATEF, and the other sample consisting of 664 subjects whose training program was not certified by ASE/NATEF. Data from the 1,007 subjects are in Appendix F. This data file was analyzed using SAS Release 6.08 in Microsoft Windows.

The logistic regression procedure in SAS was used to analyze the categorical data collected in testing the statistical hypotheses in this study. The computer program used to analyze the data is in Appendix E.
The independent variable of primary interest was the status of training program certification, i.e. ASE vs. non-ASE. The dependent variables were ASE test outcome, as measured by the score on the ASE Automobile Technician Test, and job placement rate. Potential intervening variables that were of importance included work experience and year that training was completed. ASE test outcome, analyzed initially as a dependent variable, was also shown to be an important predictor of job placement rate. The significance of association that these variables had with the dependent variables was examined through logistic regression.

Factors Affecting ASE Test Outcome

The first research question in this study investigated the effect of ASE training program certification on automotive technician ASE test outcome. Table 5 contains results from the logistic regression analysis for ASE test outcome predicted by ASE program certification status.

The odds ratio in Table 5 indicates that individuals who completed an automotive technology training program certified by ASE were 1.939 times more likely to achieve a score on the ASE test in the 90-100% range than individuals who completed a non-ASE certified training program. A corresponding p-value of .0086 was interpreted to mean that a significant association exists between ASE program certification status and ASE test outcome.
The impact of other variates on ASE test outcome was the focus of the second research question in this study. Three variables, in addition to program ASE certification status, were examined for their importance in predicting ASE test outcome: work experience, the year training was completed by the individual and corporate sponsorship of the training program. Of these three, the number of years of work experience as a professional in automotive service and repair was the only variable shown to have had a significant association with ASE test outcome. This association was examined using the SAS logistic regression procedure to produce the results in Table 6.

The interpretation of findings for each variable in Tables 5 and 6 are as follows:

1. Those who completed ASE-certified automotive training programs were 1.939 times more likely to have an ASE test outcome of 90% or above as those who completed training not certified by ASE.
(2) A person with 1-5 years experience was almost four (3.963) times more likely to have had an ASE test outcome of 90% or higher as someone with 0-1 years experience in automotive service or repair.

Table 6
Other Predictors of ASE Test Outcome (n=1,007)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) 1-5 yr exp</td>
<td>3.963</td>
<td>7.29</td>
<td>1</td>
<td>.0069</td>
</tr>
<tr>
<td>(3) 6-10 yr exp</td>
<td>6.293</td>
<td>13.09</td>
<td>1</td>
<td>.0003</td>
</tr>
<tr>
<td>(4) 11-20 yr exp</td>
<td>8.628</td>
<td>18.28</td>
<td>1</td>
<td>.0001</td>
</tr>
<tr>
<td>(5) 21-30 yr exp</td>
<td>7.745</td>
<td>15.31</td>
<td>1</td>
<td>.0001</td>
</tr>
<tr>
<td>(6) 30+ yr exp</td>
<td>11.673</td>
<td>16.97</td>
<td>1</td>
<td>.0001</td>
</tr>
</tbody>
</table>

(3) Individuals with 6-10 years experience were 6.293 times more likely to have had an ASE test outcome in the 90-100% range as individuals with 0-1 years experience.

(4) Someone with 11-20 years experience in automotive service or repair was 8.628 times more likely to have achieved a score of 90-100% on the ASE test as someone with less than one year experience.

(5) A person with 21-30 years experience was 7.745 times more likely as someone with 0-1 year experience to have achieved an ASE test outcome of ≥90%.
Persons with 30+ years experience were 11.673 times more likely to have achieved an ASE test outcome of ≥90% as persons with less than one year of automotive service or repair experience.

Table 7

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ASE certified program</td>
<td>2.615</td>
<td>18.13</td>
<td>1</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Similar results for subjects equated on age (between 22-30 years) are displayed in Tables 7 and 8. As might logically be expected, subjects qualifying for inclusion in the 22-30 year age groups did not have more than twenty years work experience. The categories of 21-30 and 30+ years for the work experience variable, therefore, did not contain any subjects and were accordingly not included in Tables 7 and 8.

Results of the analysis for subjects equated on age (see Table 8) indicated that individuals in the 22-30 year age group with 11-20 years of professional experience in automotive service or repair were 27.185 times as likely to score in the 90-100% range on the ASE Automobile Technician Test than were technicians with less than one year of experience. For Chrysler technicians in this age group the
related p-value of .0025, compared against a .05 level of significance, indicated that a significant association existed between experience in the range of 11-20 years and ASE test scores at or above 90%.

Table 8
Other Predictors of ASE Test Outcome Score (n=387)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) 1-5 yr exp</td>
<td>10.097</td>
<td>4.77</td>
<td>1</td>
<td>.0289</td>
</tr>
<tr>
<td>(3) 6-10 yr exp</td>
<td>19.314</td>
<td>7.81</td>
<td>1</td>
<td>.0052</td>
</tr>
<tr>
<td>(4) 11-20 yr exp</td>
<td>27.185</td>
<td>9.16</td>
<td>1</td>
<td>.0025</td>
</tr>
</tbody>
</table>

Factors Affecting Job Placement Rate

Results of the logistic regression analysis for the influence of ASE program certification on job placement are in Table 9. A significant association between certification and job placement was indicated by a p-value (p=.0430) below the .05 level of significance.

Table 9
Job Placement Rate Predicted by ASE Certification (n=1,007)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ASE certified program</td>
<td>1.393</td>
<td>4.09</td>
<td>1</td>
<td>.0430</td>
</tr>
</tbody>
</table>
Results of the logistic regression analysis for important job placement predictors other than ASE program certification status are shown in Table 10. This information provides indications of variates that had a significant association with the dependent variable, as evidenced by p-values below the 0.05 level of significance that was established for the analysis.

The interpretation of findings for each variable in Tables 9 and 10 are as follows:

1. Those who completed ASE-certified training were 1.393 times more likely to find immediate job placement after finishing training as those who completed training not certified by ASE.

2. Those who achieved an ASE test outcome at or above 90% were 1.375 times as likely to have immediate job placement following training program completion as those whose ASE test score was below 90.

3. For each year later that training was completed, the individual was 1.068 times more likely to have immediate job placement. For example, subjects who completed training in 1992 were 1.068 times more likely to have immediate job placement than someone that completed training in 1991.

4. A person with 1-5 years experience was 1.149 times more likely to have immediate job placement as someone with 0-1 year of experience. Note that experience was dummy coded into six levels and that, even though this specific level
was not significant, the researcher retained the variable as a predictor because other levels of the experience variable were significant. Each level of the experience variable was compared with the 0-1 year group.

Table 10

**Other Predictors of Job Placement Rate (n=1,007)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) ASE test outcome 90-100%</td>
<td>1.375</td>
<td>5.02</td>
<td>1</td>
<td>.0251</td>
</tr>
<tr>
<td>(3) Year completed training</td>
<td>1.068</td>
<td>0.13</td>
<td>1</td>
<td>.0001</td>
</tr>
<tr>
<td>(4) 1-5 yr exp</td>
<td>1.149</td>
<td>2.52</td>
<td>1</td>
<td>.7214</td>
</tr>
<tr>
<td>(5) 6-10 yr exp</td>
<td>1.892</td>
<td>8.64</td>
<td>1</td>
<td>.1124</td>
</tr>
<tr>
<td>(6) 11-20 yr exp</td>
<td>3.587</td>
<td>12.45</td>
<td>1</td>
<td>.0033</td>
</tr>
<tr>
<td>(7) 21-30 yr exp</td>
<td>6.501</td>
<td>15.35</td>
<td>1</td>
<td>.0004</td>
</tr>
<tr>
<td>(8) 30+ yr exp</td>
<td>18.506</td>
<td>15.95</td>
<td>1</td>
<td>.0001</td>
</tr>
</tbody>
</table>

(5) Individuals with 6-10 years experience were 1.892 times more likely to have achieved immediate job placement as individuals with 0-1 year experience.

(6) Someone with 11-20 years experience was 3.587 times more likely to have been immediately placed in an automotive service/repair or related job as someone with 0-1 year of experience.
(7) A person with 21-30 years experience was 6.501 times more likely to have attained immediate job placement as someone with 0-1 year of automotive service or repair experience.

(8) Persons with 30+ years experience in automotive service or repair were 18.506 times more likely to have immediate job placement as persons with 0-1 year of automotive experience.

Results for subjects equated on age are in Table 11. The odds ratio indicates that a technician who had completed an ASE certified program was 2.615 times as likely to attain immediate employment as was a technician who had completed a training program that was not certified by ASE.

Table 11

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ASE certified program</td>
<td>2.615</td>
<td>18.13</td>
<td>1</td>
<td>.0001</td>
</tr>
</tbody>
</table>

The results for other predictors of job placement for subjects equated on age are in Table 12. The age limits on subjects in the analysis (between 22-30 years old) restricted work experience possibilities to the three categories of experience included in Table 12.
Table 12

Other Predictors of Job Placement Rate (n=387)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>Chi-square</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Year completed training</td>
<td>1.211</td>
<td>13.65</td>
<td>1</td>
<td>.0002</td>
</tr>
<tr>
<td>(3) 1-5 yr exp</td>
<td>2.448</td>
<td>2.52</td>
<td>1</td>
<td>.1275</td>
</tr>
<tr>
<td>(4) 6-10 yr exp</td>
<td>8.450</td>
<td>10.62</td>
<td>1</td>
<td>.0011</td>
</tr>
<tr>
<td>(5) 11-20 yr exp</td>
<td>17.127</td>
<td>13.17</td>
<td>1</td>
<td>.0003</td>
</tr>
</tbody>
</table>

Of significance was the indication that Chrysler technicians in the 22-30 year age group with 11-20 years of automotive service or repair experience were 17.127 times as likely to find job placement immediately upon completion of training as were Chrysler technicians in the same age group with less than one year experience. Associated with this finding was a value for p of .0003, indicating a high degree of significance when compared to the .05 α level assigned a-priori in this study.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This study was conducted to analyze the effects of training program certification on automotive technician ASE test outcome and job placement rate. The study was prompted by the need to focus training funds in ways that maximize return on investment by eliminating resource support for training-related activities that do not add value to the process. This chapter provides a synopsis of the previous chapters and summarizes the methods and procedures in general terms to establish a clear understanding of how the study was conducted.

Summary

The study examined 387 male Chrysler dealer technicians between 22 and 30 years of age. 178 of the 387 technicians comprised the experimental or treatment group as a function of completing an automotive training program certified by ASE. The remaining 209 technicians comprised the control group, having completed training that was not certified by ASE. These subjects were taken from a total of 1,007 technicians that completed training programs beyond the high school level.
The ASE Automobile Technician Test, which serves as a national automotive technician certification exam, was used as the posttest measure in the study. Job placement rate was measured by the length of time following completion of an automotive technology training program before the subject started working in automotive service/repair or related field. The status of training program certification, whether certified by ASE or not, was the independent variable in the study. The objective of the study was to analyze the effect of ASE certification on the dependent variables of ASE test outcome and job placement.

A null hypothesis was developed and tested for each of four research questions. Procedures for testing each of the hypotheses involved the application of logistic regression to produce an odds ratio and corresponding p-value. With a .05 level of significance established for the study, each of the null hypotheses were rejected. Findings indicated that the association between ASE training program certification and each of the dependent variables, ASE test outcome and job placement rate, was statistically significant.

Conclusions

Based on the findings of the study, the following conclusions were reached.

1. Findings of this study are consistent with the findings of the only other known research on the effects of ASE program certification on levels of automotive technician
ASE test outcome and job placement by Wiblin (1993). Analyses conducted in testing the four statistical hypotheses support Wiblin’s conclusion that a strong association exists between the ASE certification status of a school’s automotive training program and learner outcome measures. Student outcomes were measured in Wiblin’s study by performance on automotive sections of the Ohio Vocational Education Achievement Test.

2. Automotive training program certification involves an extensive review of the school’s facilities, resources, curriculum and operating procedures. While it is not practical to equate schools on all of the relevant characteristics thought to influence ASE test outcome and job placement, efforts to emulate the specifications for training programs defined by ASE would logically produce a better result in all technician training programs.

3. An important conclusion for the automotive service and repair industry to draw from the findings of this study is that efforts to encourage and support the certification of technician training programs provides desirable results in the areas of both ASE test outcome and job placement rate. Continuous improvement in all areas of performance has become the recognized method of operation in the design, build, service and repair of automobiles by original equipment manufacturers in business today. Organizations can no longer ignore the importance of the relationship
between relevant performance-based training and the resultant measures of business success.

4. The results of these statistical analyses support expanded interest in the area of automotive technician training measured against aggressive acceptable standards to reap the benefits of improved levels of knowledge and skills.

**Recommendations for Further Study**

1. The results of this study form the basis for a decision model to be used in directing or allocating resources toward the training and development of service technicians to meet the need for legitimate talent in the field of automobile service and repair. Continued pursuit of training program certification is an obvious recommendation. Expanding the number of schools that qualify for certification and continuously improving programs beyond the standards as they are currently defined are examples of causes worth championing in the movement toward enhanced competitive placement in the vehicle service industry.

2. A study of the impact of automotive technician proficiency on a number of efforts, both current and imagined, could prove to be a valuable extension of research on training program certification effectiveness. How the level of technician skills affects implementation of the
Clean Air Act and subsequent dependency on foreign fuel are examples of related studies.

3. Application of training program certification standards to industries outside of those examined in this study might produce some interesting and rewarding insight into the extent to which standards of program structure and performance assessment could improve results.

4. A study of the effects of program improvement at schools already certified in automotive technology might produce useful results through the realignment or reassignment of existing resources and the leveraging of available funds more effectively.

5. Investigation of the interaction of and between main effect variables such as age, mechanical aptitude, formal automotive or other mechanical training and motivation to succeed in the profession on technician output is recommended. Performance factors to be considered for use in the study include weekly flat rate hours (as an indication of productivity), monthly gross earnings (as a measure of efficiency and dedication), and frequency of repeat repairs or "shop comebacks" (metric related to quality of repair).

6. A study of the effects of geographic location and related demographic factors on job placement rate and mechanical ability outcome would provide a meaningful complement to this research. Related factors might include
socio-economic status, household income level and school district vocational education budget constraints. Results of the study could be useful in the selection of "best-in-class" technicians and in the prioritization of resources from industry and academia.

7. With the cooperation and participation of the National Institute for Automotive Service Excellence, examine the factors similar to those incorporated in this study on a national scale that includes all automobile service repair facilities. Variables to be considered for possible association include age, gender, race, socio-economic background, quality of available technical training, corporate sponsorship or involvement in training, job placement and resulting employee turnover. The purpose of the study would be to identify optimal combination(s) of characteristics and/or conditions that most efficiently produce desired performance results.
APPENDIX A

ASE PROGRAM CERTIFICATION GUIDELINES
AUTOMOBILE PROGRAM STANDARDS

STANDARD 1 - PURPOSE

THE AUTOMOBILE TECHNICIAN TRAINING PROGRAM SHOULD HAVE CLEARLY STATED PROGRAM GOALS, RELATED TO THE NEEDS OF THE STUDENTS AND EMPLOYERS SERVED.

Standard 1.1 - Employment Potential
The employment potential for automobile technicians, trained to the level for the specialty or general areas outlined in the program goals, should exist in the geographic area served by the program.

Standard 1.2 - Program Description/Goals
The written description/goals of the program should be shared with potential students and must include admission requirements, employment potential, area(s) of specialty training offered, and the cost of all tuition and fees. Technical qualifications of the faculty and the overall goal(s) of the program should also be included.

STANDARD 2 - ADMINISTRATION

PROGRAM ADMINISTRATION SHOULD ENSURE THAT INSTRUCTIONAL ACTIVITIES SUPPORT AND PROMOTE THE GOALS OF THE PROGRAM.

Standard 2.1 - Student Competency Certification
The certificate or diploma a student receives upon program completion should clearly specify the area(s) of demonstrated competency.

Standard 2.2 - Chain of Command
An organizational chart should be used to indicate the responsibilities for instruction, administration, and support services.

Standard 2.3 - Administrative Support
Positive administrative support from institutional and local governing bodies should be demonstrated. Indicators of administrative support would include: support for staff in-service training; provision of appropriate facilities; up-to-date tools, equipment, and training support materials.

Standard 2.4 - Written Policies
Written policies should be adopted by the administration and policy board for use in decision-making situations and to provide guidance in achieving the program goals. Policies regarding safety, liability, and lab/shop operation should be written and prominently displayed as well as provided to all students and instructors.
Standard 2.5 - Advisory Committee

An Advisory Committee must convene at least two times a year and be utilized to provide counsel, assistance, and information from the community served by the training program. This Committee should be broadly based and include former students, employed technicians, employers, and representatives for consumer's interests.

Standard 2.6 - Public/Community Relations

An organized plan should be used to provide the community at large information regarding the training program, its graduates, its plans, and any services provided to the community.

Standard 2.7 - Live Work

A systematic method of collecting, documenting, and disbursing live work repair receipts should be used. Instructional staff should not be required to collect payment for live work repairs.

STANDARD 3 - LEARNING RESOURCES

SUPPORT MATERIAL, CONSISTENT WITH BOTH PROGRAM GOALS AND PERFORMANCE OBJECTIVES, SHOULD BE AVAILABLE TO STAFF AND STUDENTS.

Standard 3.1 - Service Information

Service information with current manufacturers' service procedures and specification data for vehicles manufactured within the last ten (10) years should be available. This information should be accessible to students while working in the lab/shop area.

Standard 3.2 - Multimedia

Appropriate up-to-date multimedia materials such as video equipment, transparencies, etc. should be readily available and utilized in the training process.

Standard 3.3 - Instructional Development Services

The service of professional instructional development personnel should be used when available. At a minimum, equipment and supplies should be available for duplication or copying printed materials and transparencies. Instructional development personnel should conduct in-service and/or training in curriculum and media development.

Standard 3.4 - Periodicals

Current general and technical automobile magazines and newspapers should be available for student and instructor use.
Standard 3.5 - Student Materials

Necessary instructional texts or pertinent material should be available for each student to satisfy the objectives of the mode of instruction used. Basic textbooks should have copyright dates that are not over six (6) years old; specialized textbooks should have copyright dates that are not over six (6) years old.

STANDARD 4 - FINANCES

FUNDING SHOULD BE PROVIDED TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 4.1 - Program Training Cost

The enrollment in the program or program area should be sufficient to keep the per-student training costs to a realistic figure.

Standard 4.2 - Budget

An adequate annual budget should be developed, allocated, and used for the operation of the program.

Standard 4.3 - Budget Preparation

The budget should be prepared by the institutional administration in conjunction with the program faculty.

Standard 4.4 - Status Reports

Budget status reports should be made available to program staff, at least quarterly.

STANDARD 5 - STUDENT SERVICES

SYSTEMATIC PRE-ADMISSION TESTING, INTERVIEWS, COUNSELING SERVICES, PLACEMENT, AND FOLLOW-UP PROCEDURES SHOULD BE USED.

Standard 5.1 - Pretesting

A formal pretesting program should be used to assess a student's abilities in reading, mathematics, and mechanical aptitude to evaluate and assure the student a reasonable probability of success as an automobile technician. Testing procedures should be stated in program explanatory material and justification for all requirements should be available.

Standard 5.2 - Pre-admission Interviews

Prior to program admission, a student should be interviewed and approved for admission.
Standard 5.3 - Student Records
Permanent records of former students should be available, preferably in one central location, and kept confidential.

Standard 5.4 - Placement
A systematic student placement system should be used to assist program graduates to obtain employment in the automobile industry.

Standard 5.5 - Follow-up
A follow-up system should be used to determine students' employment location and for feedback regarding the efficiency, effectiveness, and appropriateness of training. The follow-up procedures should be designed to assure feedback regarding needed additions or deletions to the training curriculum, program, and tools and equipment. Follow-up of graduates employed outside of the automobile industry should indicate reasons for non-automobile employment. When applicable, this information should be used to modify the training quality and/or content.

Standard 5.6 - Legal Requirements
The training program should meet all applicable local, state and federal requirements.

STANDARD 6 - INSTRUCTION

INSTRUCTION MUST BE SYSTEMATIC AND REFLECT PROGRAM GOALS. A TASK LIST AND SPECIFIC PERFORMANCE OBJECTIVES WITH CRITERION REFERENCED MEASURES MUST BE USED.

Standard 6.1 - Program Plan
The training plan should progress in logical steps, provide for alternate sequences, where applicable, and be made available to each student.

Standard 6.2 - Student Training Plan
A training plan for each student should be used, indicating the student's training goal(s) and specific steps needed to meet that goal. Students should be given a copy of their training plan.

Standard 6.3 - Preparation Time
Adequate time should be provided for teacher preparation and program development.

Standard 6.4 - Teaching Load
The instructor/student ratio and class contact hours should allow time for interaction on a one-to-one basis.
Standard 6.5 - Curriculum

All tasks have been given a priority rating. Ninety-five percent (95%) of the tasks designated as Priority 1 (P-1) must be taught in the curriculum. Eighty percent (80%) of the tasks designated as Priority 2 (P-2) must be taught in the curriculum. Fifty percent (50%) of the tasks designated as Priority 3 (P-3) must be taught in the curriculum. Additional tasks may be included to meet the needs of local employers. All additional tasks should be approved by the Advisory Committee.

Instruction on the legal aspects and responsibilities of the automobile technician in areas such as Environmental Protection Agency regulations, safety regulation, OSHA regulations, and other appropriate requirements should be included in the curriculum. Instruction and practice in filling out work order forms, ordering parts, and basic record keeping should be a part of the training program.

Tools and equipment must be available to perform the tasks in each of the areas for which certification is requested.

Standard 6.6 - Student Progress

A record of each student's progress should be maintained through the use of a progress chart or other recording device. The record should indicate tasks required for mastery in the area and those tasks the student has mastered.

Standard 6.7 - Performance Standards

All instruction should be performance based, with an acceptable performance standard stated for each task. These standards should be shared with students and potential employers. Students should demonstrate "hands-on competency" or "mastery" of a task before the instructor verifies a student's performance.

Standard 6.8 - Safety Standards

Safety instruction should be given prior to lab/shop work and be an integral part of the training program. A safety test should be included in the training program. Students and instructors should comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment, and handling, storage, and disposal of chemicals while in the lab/shop area.

Standard 6.9 - Personal Characteristics

All training activities and instructional materials should emphasize the importance of maintaining high personal standards.
Standard 6.10 - Work Habits/Ethics
The training program should be organized in such a manner that work habits and ethical practices required on the job are an integral part of the instruction.

Standard 6.11 - Provision for Individual Differences
The training program should be structured in such a manner that students with different levels of cognitive and psychomotor skills can be accommodated.

Standard 6.12 - Related Instruction
Instruction in related mathematics, communication, and interpersonal relations should be provided and coordinated with ongoing instruction in the training program. This instruction should be provided by a qualified instructor.

Standard 6.13 - Testing
Both written and performance based tests should be used to validate student competency. Students should be encouraged to take certification tests that are publicly recognized indicators of capabilities.

Standard 6.14 - Evaluation of Instruction
Instructional procedures should be evaluated in a systematic manner. This evaluation should be through regular reviews by students and the administration. Self-evaluation of instruction should also be utilized on a systematic and regular basis. This system should include input from former students and the Advisory Committee members. Instructional procedures should show a responsiveness to the feedback from these evaluations.

Standard 6.15 - Live Work
Live work should be scheduled to benefit the student and supplement ongoing instruction on items specified in the NATEF task list. A student should have had instruction and practice on a specified repair task before live work requiring that task is assigned. Donated vehicles by the manufacturers or other sources, customer-owned vehicles, and other training vehicles may be used as the primary source of live work. Automobile training program student-owned vehicles, school buses, and other vehicles owned and operated by the governing body of the school should not be the primary source of live work vehicles. All vehicles in the lab/shop should have a completed industry-type work order attached to or on the vehicle.

Standard 6.16 - Articulation
Agreements between programs with equivalent competencies should be used to eliminate unnecessary duplication of instruction.
STANDARD 7 - EQUIPMENT

EQUIPMENT AND TOOLS USED IN THE AUTOMOBILE TECHNICIAN TRAINING PROGRAM 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.

Standard 7.1 - Safety
Equipment and tools used in the training program must have all shields, guards, and other safety devices in place, operable, and used.

Standard 7.2 - Quantity and Quality
The tools and equipment used in the training program should reflect the program goals and performance objectives. Sufficient tools and equipment should be available for the training offered. The tools and equipment should meet industry quality standards.

Standard 7.3 - Consumable Supplies
Sufficient consumable supplies should be readily available to assure continuous instruction.

Standard 7.4 - Maintenance
A preventive maintenance schedule should be used to minimize equipment down-time.

Standard 7.5 - Replacement
A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Student follow-up and Advisory Committee input should be used in this system.

Standard 7.6 - Inventory
An inventory system should be used to account for tools, equipment, parts, and supplies.

Standard 7.7 - Parts Purchasing
A systematic parts purchasing system, from work order to parts specialist to jobber, should be used. Task performance should not be unreasonably delayed due to lack of replacement parts.

Standard 7.8 - Hand Tools
Each student should have a basic hand tool set comparable to tools required for employment. The students should be encouraged to purchase a hand tool set during the period of instruction, appropriate to the automobile specialty area(s) in which they are receiving training.
STANDARD 8 - FACILITIES

THE PHYSICAL FACILITIES MUST BE ADEQUATE TO PERMIT
ACHIEVEMENT OF THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 8.1 - Training Stations
Training stations (bench and live work) should be
available in the type and number required for the
performance of tasks outlined in the program goals and
performance objectives.

Standard 8.2 - Safety
The facilities should meet all applicable safety
standards.

Standard 8.3 - Maintenance
A regular facilities maintenance program should be used
to ensure facilities are suitable when required for
instruction.

Standard 8.4 - Housekeeping
The classroom(s), lab/shop, and support area(s) should
be kept clean and orderly.

Standard 8.5 - Office Space
An area separate from the lab/shop should be available
and convenient for the instructor(s) use as an office.

Standard 8.6 - Instructional Area
A classroom convenient to, but separate from, the
lab/shop area should be available for instruction and other
non-lab/shop activities.

Standard 8.7 - Storage
Storage areas for tools, parts, supplies, and
automobiles should be sufficient to support the activities
outlined in the program goals and performance objectives.
Security should be provided to prevent pilferage and
vandalism.

Standard 8.8 - Support Facilities
Restrooms, clean-up areas, and lockers should be
provided for both male and female students and be convenient
to the instructional area.

Standard 8.9 - Ventilation
An adequate exhaust fume removal system should be in
place and operational. When appropriate, heating and
cooling systems should be used to provide sufficient comfort
for learning.
Standard 8.10 - First Aid
A first aid kit should be in place and comply with local regulations.

Standard 8.11 - Facility Evaluation
The Advisory Committee should conduct an annual evaluation of the facilities to assure adequacy to meet program goals.

STANDARD 9 - INSTRUCTIONAL STAFF

THE INSTITUTIONAL STAFF MUST HAVE TECHNICAL COMPETENCY AND MEET ALL STATE AND LOCAL REQUIREMENTS FOR CERTIFICATION.

Standard 9.1 - Technical Competency
The instructor must hold current ASE certification in the specialty area considered for certification (effective 1/1/95).

Standard 9.2 - Instructional Competency/Certification
Instructors should meet all state certifying requirements.

Standard 9.3 - Technical Updating
Faculty members should be provided technical materials required to maintain their competency. An opportunity should be provided for instructors to return to industry on a regular basis for in-service and skill upgrading.

Standard 9.4 - First Aid
The program should have a written policy, approved by the administrator of the school, on First Aid procedures.

Standard 9.5 - Substitutes
A systematic method of obtaining "substitute" instructors should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent automobile instructor.

STANDARD 10 - COOPERATIVE AGREEMENTS

WRITTEN POLICIES AND PROCEDURES SHOULD BE USED FOR COOPERATIVE AND APPRENTICESHIP TRAINING PROGRAMS.

Standard 10.1 - Standards
Student performance standards should be developed and coordinated by the supervising instructor.
Standard 10.2 - Agreements
    All agreements should be written and legally binding.

Standard 10.3 - Supervision
    A supervising automobile instructor should be assigned responsibility, authority, and time to coordinate and monitor cooperative/apprenticeship automobile programs.
APPENDIX B

VALIDITY & RELIABILITY

OF

ASE AUTOMOBILE TECHNICIAN TEST
These pages of verbatim text from ASE's validation procedures outline the process that ASE uses to ensure that their automobile technician tests measure what they purport to measure. The text is summarized by a list of 9 features incorporated in the test development procedures used jointly by ASE/ACT.

CONTENT VALIDATION OF ASE CERTIFICATION TESTS

Introduction

The measurement profession is guided by a well-defined and nationally accepted set of standards. The Standards for Educational Testing (1985) provide the accepted basis for evaluating the quality for testing practices. It emphasizes that test users should have a sound technical and professional basis for their actions. The Standards provides comprehensive and well specified rules or standards for obtaining the evidence critical to helping to ensure that tests are technically and professionally sound.

Validity is the most important consideration in test evaluation. As described in Standard 1.1, it refers to the appropriateness, meaningfulness, and usefulness of the specific inferences made from test scores. Test validation, as applied to the ASE tests, is the strategy for developing evidence to support the use of the scores for certifying purposes. Validity evidence is developed at every step of the test development process and through a comprehensive and ongoing validation research program commissioned by ASE.

Validity in Test Development

The development of tests for ASE includes a series of steps designed to ensure valid and reliable test interpretations and inferences. A job analysis is conducted to define the content domain for the specific practice being certified. The knowledge, skills, and abilities necessary for competent, safe practice are identified through an analysis of professional practice. This analysis involves input from practicing professionals, industry representatives, and technical educators. Such a study provides essential evidence of content validity by supporting the job-relatedness of the certification test. When this study has been completed, test specifications can be developed.
To allow valid inferences about the level of knowledge and skills a candidate for certification possesses, the test must reflect the knowledge and skills identified in the job analysis as necessary and important to practice. For each form of the test to provide scores that can be interpreted in the same way, each form must include items that test the same knowledge and skills in proportions that reflect the importance attributed to them in the job analysis study. A table of specifications for each ASE test is developed that specifies the definition and distribution of the test content.

The item development process begins with the training of content experts to develop technically sound test items. The training helps content experts not only to write items, but to review items written by others for accuracy, significance, and conformity to test specifications. Before an item is included in the scored portion of a test, it is pretested to evaluate its statistical characteristics. Only items whose statistical characteristics meet the test specifications are scored and contribute to certification decisions.

After a test is developed and administered, the validity of the decision to pass or fail individuals at certain score levels is the focus of attention. ASE determines passing scores using panels of subject matter experts, who evaluate and rate each item on the examination with consideration to the requirements of minimal competence on the job, and the difficulty of each item. The passing mark is a collectively defined level of mastery necessary for competent, effective practice.

Expert judgement plays an important role in validation strategies that focus on test content, critical abilities, and job-relatedness. Content matter experts identify the critical tasks conducted on the job, construct test items to measure the knowledge, skills and abilities necessary to perform the tasks competently, and participate in the evaluation of the examination for the purpose of setting a passing score.

Validity Studies

In addition to accumulating validity evidence during each step of the test development process, research studies are conducted to ensure that the test specifications remain current and reflect the continuing technological changes in the automotive industry, that the standard for passing is consistent and fair over time and across different administrations, and that no subgroup of examinees is unfairly disadvantaged.

Content validity studies with independent panels of practicing technicians and industry trainers have been
conducted to assure ongoing quality and defensibility. Item
development and review meetings are designed to ensure that
ASE items cover the topics that are material to the practice
of automotive technology, and that they measure knowledge
and skills required on the job.

Sources of ASE Content Validity

The validity of the interpretations of the ASE
examinations, when used as intended, will be primarily
related to the derivation of the content of the
examinations. The standards for Educational and
Psychological Testing (1985) confirm this approach: "For
licensure and certification, ...primary reliance must
usually be placed on content evidence that is supplemented
by evidence of the appropriateness of the construct being
measured" (p. 63). The primary source of this content
evidence is in the soundness of the test development
procedures used by ASE/ACT. Some of these features are
listed below. Additional validity studies are designed to
supplement this content validity evidence.

1. Test development begins with a professionally conducted
   job analysis using a national sample of industry
   experts.

2. This method of basing a test on a job analysis means
   that the tests are specifically designed to cover the
   competencies required on the job, as opposed to a focus
   on the content of some specific course of study or
   training session.

3. From the job analysis, the complete test specifications
   are derived that stipulate the content of every test
   form. This assures both complete content coverage in
   every form, and it allows the construction of
   equivalent forms over time.

4. A national sample of industry experts are the authors
   of the test questions. These items (test question)
   writers have been trained in item writing techniques.
   Instead of placing emphasis on theory, ASE places
   emphasis on questions that cover real knowledge that is
   required on the job. Each question is carefully
   checked by multiple experts.

5. After being received by ACT, the items are
   professionally edited to ensure clarity, freedom from
   internal clueing, etc.

6. A new form of each test is developed for each test
   date. This help assure fairness in that no one can be
   advantaged by having seen a certain test form before.

7. The forms are made equivalent through very rigid test
development procedures and through equating. Equating
provides a statistical adjustment to offset differences
in test form difficulty. The goal of this is that no examinee be disadvantaged by a test form that is a little more difficult than another.

8. Passing scores for every new test are set using a specialized procedure involving a workshop of industry experts who meet and carefully discuss and rate every question on the test. The intended meaning of the certification and the difficulty of the questions are considered when passing standards are determined.

9. After every test form is given, the statistical functioning of each item on the test is evaluated. If any final key changes are necessary, they are made before final scoring. The statistical properties of each test form are also carefully monitored.
APPENDIX C

SAMPLE ASE AUTOMOBILE
TECHNICIAN TEST QUESTIONS
The following sample questions are from the 1995 edition of The Official ASE Preparation Guide for ASE Automobile Technician Tests. They have been included here with permission from the National Institute for Automotive Service Excellence (ASE) in Herndon, Virginia.
SAMPLE QUESTIONS
ENGINE REPAIR (TEST A1)

1. Technician A says that part X shown above is used to rotate the valve spring. Technician B says that part X is used to correct installed spring height. Who is right?

(A) A only  
(B) B only  
(C) Both A and B  
(D) Neither A nor B

**Question #1 Explanation:**

Technician A's statement is wrong. Valve springs rotators are located on the top of the valve spring and usually take the place of the spring retainer.

Technician B's statement is correct. Whenever the valve's face and seat are ground, the valve will move farther up into the cylinder head port. This relocates the valve stem end farther from the top of the head, increasing the distance between the underside of the valve spring retainer and the valve spring seat. Increasing the valve spring's installed height also reduces its tension. To correct installed spring height and restore spring tension to its original spec, a shim of the proper thickness can be inserted between the cylinder head and the spring.

Therefore the answer to this question is (B).

2. A compression test shows that one cylinder is too low. A leakage test on that cylinder shows that there is too much leakage. During the test, air could be heard coming from the tail pipe. Which of these could be the cause?

(A) Broken piston rings  
(B) A bad head gasket  
(C) A bad exhaust gasket  
(D) An exhaust valve not seating
3. Technician A says that main bearing oil clearance can be checked with plastigage. Technician B says that main bearing oil clearance can be checked with a feeler gauge. Who is right?

(A) A only  
(B) B only  
(C) Both A and B  
(D) Neither A nor B

4. An engine is using too much oil. Technician A says that worn valve guides could be the cause. Technician B says that tapered cylinder walls could be the cause. Who is right?

(A) A only  
(B) B only  
(C) Both A and B  
(D) Neither A nor B

5. To raise the seat contact on the valve face shown above, the seat should be ground with a:

(A) 60° stone  
(B) 45° stone  
(C) 30° stone  
(D) 15° stone

6. A compression test has been made on an in-line 4-cylinder engine. Cylinders 2 and 3 have readings of 10 psi. Cylinder 1 has a reading of 140 psi and cylinder 4 has a reading of 145 psi. Technician A says that these readings could be caused by a blown head gasket. Technician B says that these readings could be caused by wrong valve timing. Who is right?

(A) A only  
(B) B only  
(C) Both A and B  
(D) Neither A nor B
To determine piston-to-cylinder wall clearance, the diameter of the piston shown above should be measured at:

(A) W.  (B) X.  (C) Y.  (D) Z.

The valve timing of an engine is wrong. Technician A says that this can cause high cylinder compression readings. Technician B says that this can cause a high intake manifold vacuum reading. Who is right?

(A) A only  (B) B only  (C) Both A and B  (D) Neither A nor B

Technician A says that the setup shown above can be used to check cylinder taper. Technician B says that the setup can be used to check cylinder out-of-round. Who is right?

(A) A only  (B) B only  (C) Both A and B  (D) Neither A nor B
A1 Sample Questions (continued)

10. The pressure and volume tests on a mechanical fuel pump are both below specs. Technician A says that an air leak in the fuel line between the tank and pump could be the cause. Technician B says that a plugged fuel tank pickup filter could be the cause. Who is right?

(A) A only  (C) Both A and B
(B) B only  (D) Neither A nor B

11. The exhaust manifold heat control (heat riser) valve is stuck in the open position. Technician A says that this can cause poor fuel mileage. Technician B says that this can cause the intake manifold vacuum to be lower than normal. Who is right?

(A) A only  (C) Both A and B
(B) B only  (D) Neither A nor B

12. While cranking the engine, the reading on the voltmeter in the setup shown above is below specs. Technician A says that the low reading can be caused by a bad battery. Technician B says that the low reading can be caused by a bad starter. Who is right?

(A) A only  (C) Both A and B
(B) B only  (D) Neither A nor B

Answer Key:

To: Training Center Managers

Subject: Automotive Technician Research Questionnaire

The enclosed survey supports research directed toward improving automotive technician training and certification that is being conducted by Patrick Karbon of Mopar’s Materials Operations Planning Department. This study, analyzing the effects of training program certification on technician ASE test outcome and job placement, represents partial fulfillment of the requirements for a doctoral degree at the University of North Texas.

Voluntary participation in this project by Chrysler dealership technicians will provide useful information on the topic.

To assist in this worthwhile effort, I ask that each of your instructors administer the enclosed questionnaire to all technicians at the beginning of every class they conduct following receipt of this memo. The survey should take 5-10 minutes to fill out. Surveys should be returned as they are completed via CIMS or US mail to:

Patrick J. Karbon
Mopar Parts Division
Chrysler Corporation
CIMS 423-11-11
26311 Lawrence Avenue
Center Line, MI 48015

When we reach our intended return of at least 1,000 completed surveys, you will be notified to discontinue administration of the questionnaire. Meanwhile, you are requested to reproduce the survey locally to provide needed copies.

We are counting on your help by providing the information requested from each of your technicians. Please assure technicians that responses to this study will remain anonymous and the information collected will be used only for research. Names of participants and/or dealerships will not be disclosed or placed on any mailing list(s) as a result of participation in this study.

If you wish to direct any questions or concerns to Pat Karbon’s attention, he can be reached at 810-497-0518.

Thank you for your assistance in this effort.

Enclosure: Questionnaire
AUTOMOTIVE TECHNICIAN RESEARCH QUESTIONNAIRE

Your participation in this study will help in the development of guidelines for future automotive technician training. Please respond to each of the following items by filling in the blank or by checking the box next to the most appropriate/accurate response.

1. How much experience do you have in automotive service or repair professionally?
   (1) □ 0-1 year       (2) □ 1-5 years       (3) □ 6-10 years
   (4) □ 11-20 years   (5) □ 21-30 years   (6) □ Over 30 years

2. How much experience do you have in automotive service or repair as a "hobby" prior to employment as a technician?
   (1) □ 0-1 year       (2) □ 1-5 years       (3) □ 6-10 years
   (4) □ 11-20 years   (5) □ 21-30 years   (6) □ Over 30 years

3. Did you complete a formal automotive training program beyond the high school level?
   (1) □ No              (2) □ Yes. I completed training in 19____ at:
   School Name: __________________________
   School Location (City & State): __________________________

4. Was the formal automotive training program you attended beyond the high school level sponsored or administered by one of the automobile manufacturers?
   (1) □ No
   (2) □ Yes. My training was conducted under the sponsorship of:
   (3) □ Chrysler       (4) □ Ford          (5) □ General Motors
   (6) □ Nissan         (7) □ Toyota        (8) □ Other
5. Was the formal automotive training program you completed certified by NATEF (National Automotive Technician Education Foundation)?

(1) □ No  (2) □ Yes  (3) □ Don’t know  
(4) □ Other

6. How soon after completion of your formal automotive training program beyond the high school level did you begin working for pay in automotive or a related field?

(1) □ Immediately  (2) □ Within 3 months  (3) □ 3-6 months  
(4) □ 7-12 months  (5) □ More than a year

7. Have you ever been certified in one or more areas by ASE (National Institute for Automotive Service Excellence)?

(2) □ No  (2) □ Yes

8. What is the highest score you attained in any one area of ASE certification?

(1) □ Below 70%  (2) □ 70-79%  (3) □ 80-89%  
(4) □ 90-99%  (5) □ 100%

9. What was your High School grade point average (GPA)?


10. Place a check next to the range that includes your current age:

(1) □ Under 18  (2) □ 18-21  (3) □ 22-25  
(4) □ 26-30  (5) □ 31-40  (6) □ 41-50  
(7) □ 51-60  (8) □ 61-70  (9) □ Over 70

11. Gender:

(1) □ Male  (2) □ Female

Thank you for taking the time to complete this information.
APPENDIX E

SAS COMPUTER PROGRAM
libname sd 'c:\projects\karbon';
libname library 'c:\projects\karbon';
options pagesize=52;

proc format library=library;
  value sfmt 1='Below 70%'
           2='70-79%'
           3='80-89%'
           4='90-99%'
           5='100%';

value nfmt 1='No'
           2='Yes';

value spfmt 1='No sponsor'
           2='Yes sponsor';

value pfmt 1='Immed.'
           2='0-3 mo'
           3='3-6 mo'
           4='7-12 mo'
           5='Above 12 mo';

value plfmt 1='Less than year'
           2='More than year';

data a;
  infile 'c:\projects\karbon\ascii.002';
  input id exp hob year spon natef pr score gpa age sex;
  if gpa=0 then gpa=.;
  if id=313 then natef=2;
  if id=119 then score=5;
  if id=284 then pr=1;
  if spon ge 2 then spon=2;
  if (pr lt 5 and pr ne .) then pr=1;
  if pr=5 then pr=2;
  if (year gt 50 and year le 60) then year=1;
  if (year gt 60 and year le 70) then year=2;
  if (year gt 70 and year le 80) then year=3;
  if (year gt 80 and year le 85) then year=4;
  if (year gt 85 and year le 90) then year=5;
  if (year gt 90 and year le 95) then year=6;
  if pr=1 then pr=0;
  if pr gt 1 then pr=1;
if (score=1 or score=2 or score=3) then scorr=0;
if (score=4 or score=5) then scorr=1;
if exp=2 then exp2=1; else exp2=0;
if exp=3 then exp3=1; else exp3=0;
if exp=4 then exp4=1; else exp4=0;
if exp=5 then exp5=1; else exp5=0;
if exp=6 then exp6=1; else exp6=0;
if hob=2 then hob2=1; else hob2=0;
if hob=3 then hob3=1; else hob3=0;
if hob=4 then hob4=1; else hob4=0;
if hob=5 then hob5=1; else hob5=0;
if hob=6 then hob6=1; else hob6=0;

i1=natef*scorr;
i2=natef*year;
i3=natef*spon;
i12=natef*exp2;
i13=natef*exp3;
i14=natef*exp4;
i15=natef*exp5;
i16=natef*exp6;
si2=scorr*year;
si12=scorr*exp2;
si13=scorr*exp3;
si14=scorr*exp4;
si15=scorr*exp5;
si16=scorr*exp6;
si12=spon*exp2;
si13=spon*exp3;
si14=spon*exp4;
si15=spon*exp5;
si16=spon*exp6;

format score sfmt.;
format natef nfmt.;
format spon spfmt.;
format pr pfmt.;
format prl plfmt.;
proc sort; by natef;

*********logistic regression**********;

proc logistic descending;
model scorr=natef exp2 exp3 exp4 exp5 exp6
    spon i3 / risklimits lackfit ctable pprob=(.50)
       maxiter=100;
output out=x c=c difchisq=difchisq difdev=difdev h=h
     predicted=p;

/*
proc plot data=x;
plot difchisq*p;
plot difdev*p;
plot c*p;
plot difchisq*h;
plot difdev*h;
plot c*h;
/

/*
proc sort; by difchisq;
proc print data=x;
  var id difchisq difdev c;
*/

proc logistic;
  model prr=natef scorr exp2 exp3 exp4 exp5 exp6
       year / risklimits lackfit ctable pprob=(.50)
  maxiter=100;
  output out=x c=c difchisq=difchisq difdev=difdev h=h
       predicted=p;
/*
proc plot data=x;
  plot difchisq*p;
  plot difdev*p;
  plot c*p;
  plot difchisq*h;
  plot difdev*h;
  plot c*h;
*/

***************22 to 30 year olds only***************;

data b; set a;
  if age=3 or age=4;

proc logistic data=b;
  model prr=natef scorr exp2 exp3 exp4
       year / risklimits lackfit ctable pprob=(.50)
  maxiter=100;
  output out=x c=c difchisq=difchisq difdev=difdev h=h
       predicted=p;
/*
proc plot data=x;
  plot difchisq*p;
  plot difdev*p;
  plot c*p;
  plot difchisq*h;
plot difdev*h;
plot c*h;
*/

proc logistic descending data=b;
  model scorr=natef exp2 exp3 exp4
       spon i3 / risklimits lackfit ctable pprob=(.50)
       maxiter=100;
  output out=x c=c difchisq=difchisq difdev=difdev h=h
       predicted=p;
/*
proc plot data=x;
  plot difchisq*p;
  plot difdev*p;
  plot c*p;
  plot difchisq*h;
  plot difdev*h;
  plot c*h;
footnote 'for comparison to analysis with all ages';
*/

/ *
**************natef**************;

proc freq;
  tables natef*year1 / chisq;
  tables prl*year1 / chisq;
proc freq;
  tables natef*score / chisq;
  title 'RQ #1';
proc freq;
  tables natef*(exp age spon) / chisq;
  title 'Additional Analysis';
proc ttest;
  class natef;
  var year gpa;
proc freq;
  tables natef*prl / chisq;
  title 'RQ #3';

***************score***************;

proc freq;
  tables (exp age)*score / chisq nopercent norow;
proc freq;
tables score*pr1 / chisq;

********************  job placement  ***********************;

proc freq;
  tables prl*score / chisq;

proc freq;
  tables prl*(exp age spon) / chisq;

proc ttest;
  class prl;
  var year gpa;

*********************22 to 30 year olds only**********************;

data b; set a;
  if age=3 or age=4;

proc freq;
  tables year;
  by natef;

proc freq;
  tables natef*(score exp age spon prl) / chisq;

proc ttest;
  class natef;
  var year gpa;
  */

run;
DATA FILE LAYOUT
for
AUTOMOTIVE TECHNICIAN RESEARCH QUESTIONNAIRE

The raw data listed on the following pages represents survey responses from 1,007 subjects in the research sample that completed a formal automotive training program beyond the high school level. This table describes the nature and source (survey question number) of each data element according to the data file columns numbered 1 through 26.

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<th>Possible Values</th>
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</table>

* 00 = default "YEAR"; indicates YEAR NOT PROVIDED BY RESPONDENT
** 2 = more than one corporate sponsor of respondent's auto training
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0159 5 4 65 1 1 2 3 70 6 1
0160 4 4 82 3 1 4 3 95 5 1
0161 4 2 73 1 1 5 4 83 5 1
0162 3 1 75 1 1 1 5 00 5 1
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0165 3 2 89 1 2 1 3 85 4 1
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0169 2 3 94 3 2 1 3 85 2 1
0170 2 2 91 3 2 5 3 00 3 1
0171 6 3 59 1 1 1 3 00 7 1
0172 4 3 76 1 1 2 5 88 5 1
0173 4 2 80 1 1 1 5 96 5 1
0174 4 2 83 1 2 2 4 75 5 1
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0176 2 3 90 1 2 1 3 75 3 1
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CHRYSLER TRAINING CENTER LOCATIONS

as of 12/15/94

REGIONAL TRAINING CENTERS

01. EASTERN TRAINING CENTER, Tappan, NY 10983
02. CENTRAL TRAINING CENTER, Center Line, MI 48015
03. WESTERN TRAINING CENTER, Ontario, CA 91761

ZONE TRAINING CENTERS

04. ATLANTA TRAINING CENTER, Kennesaw, GA 30144
05. BOSTON TRAINING CENTER, Mansfield, MA 02048
06. CHARLOTTE TRAINING CENTER, Charlotte, NC 28269
07. CHICAGO TRAINING CENTER, Naperville, IL 60540
08. CINCINNATI TRAINING CENTER, Cincinnati, OH 45241
09. DALLAS TRAINING CENTER, Irving, TX 75063
10. DENVER TRAINING CENTER, Englewood, CO 80112
11. HOUSTON TRAINING CENTER, Houston, TX 77073
12. KANSAS CITY TRAINING CENTER, Lenexa, KS 66215
13. MEMPHIS TRAINING CENTER, Memphis, TN 38134
14. MINNEAPOLIS TRAINING CENTER, Minneapolis, MN 55441
15. NEW ORLEANS TRAINING CENTER, Hammond, LA 70404
16. ORLANDO TRAINING CENTER, Orlando, FL 32809
17. PHILADELPHIA TRAINING CENTER, Malvern, PA 19355
18. PHOENIX TRAINING CENTER, Phoenix, AZ 85034
19. PITTSBURGH TRAINING CENTER, Warrendale, PA 15086
20. PORTLAND TRAINING CENTER, Portland, OR 97224
21. RICHMOND TRAINING CENTER, Glen Allen, VA 23060
22. ROCHESTER TRAINING CENTER, Henrietta, NY 14467
23. SAN FRANCISCO TRAINING CENTER, Livermore, CA 94550
24. ST. LOUIS TRAINING CENTER, Hazelwood, MO 63042


