THE IDENTIFICATION OF FUTURE AUTOMOTIVE TECHNICIAN COMPETENCIES BASED ON THE OPINIONS OF SELECTED INDUSTRY EXPERTS

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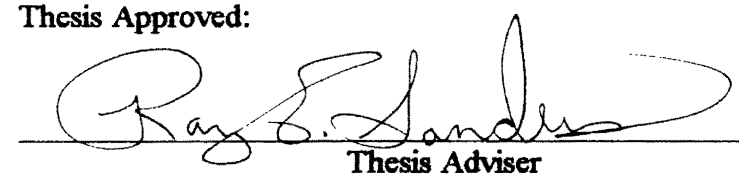

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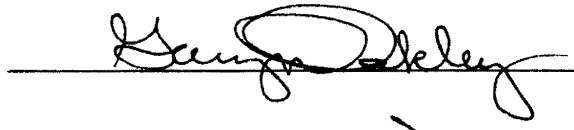

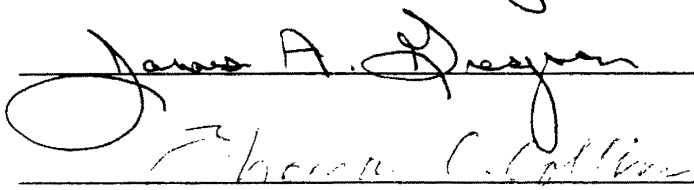

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CHAPTER I

INTRODUCTION

Many automobile owners in the United States can relate to the frustration of not having their vehicle fixed correctly at a service facility. The automobile repair industry obviously does not meet everyone's expectations. Consumer Reports (1989) found that up to 24% of the population they surveyed were not satisfied with a brake job they had done on their car. Also, of the respondents, over 25% complained they had mechanical problems with their brakes after the repair. In commenting on automotive repair, Business Week (1988) stated: "Consumers have been forced to put up with 'try-it-and-see' repairs for too long" (p. 118).

With these expressed concerns, will the repair percentage improve or worsen as technology continues to expand? Compressed Natural Gas (CNG) vehicles, electric vehicles, two stroke engines, and methanol powered vehicles are all coming within this decade. Nowell (1990) stated that he expects Los Angeles to lead the way in the use of these innovative alternative fuels, and that gasoline, like coal, will fade into obsolescence. Are present automotive technicians prepared to handle these drastic changes? What about the future automotive technician? Based on the present concern about quality repair, and the expected changes in technology, education must determine what competencies future technicians will need in order for the motoring public to be satisfied with their automobile.

Statement of the Problem

Because of the rapid change in technology, an identification of future automotive technician competencies was deemed timely. The identification of these competencies was needed by educators to properly train future students to become qualified technicians.

Purpose of the Study

The purpose of this study was to identify future competencies needed by the automotive technician employed in the automotive industry.

Research Objectives

The objectives of this research study were:

1. To compile an exhaustive list of future automotive technician competency statements based on responses from selected individuals from the automotive industry.
2. To develop a list of categorized future competency statements representative of the competency standards submitted by the respondents of the initial correspondence.
3. To involve selected individuals from the automotive industry in rating the importance of the categorized competency statements developed to describe the automotive technician.

Assumptions

The following assumptions were accepted in order to conduct this study:

1. The questionnaires were completed as an honest expression of the respondents opinions.
2. The selected individuals were knowledgeable in the future competency needs of an automotive technician.

3. The categorized competency statements agreed upon were representative of those statements originally submitted by the informed individuals.

Scope and Limitations

The researcher acknowledges the following scope and limitations of the study:

1. Implications of this study may not be applicable to some automotive technology programs due to the purposive sampling used in the Delphi process.

2. The instructor selection was limited to post-secondary institutions.

3. The participation was limited to domestic automobile manufacturers.

Definitions

The following definitions were used in this study:

Competency - "A knowledge, skill, attitude, understanding, or judgment which is required of an employee to function in his/her position" (Alsup, 1982, p. 6).

Competency statement categorization - " A general competency statement that was written to represent a group of similar competency statements submitted by respondents" (Alsup, 1982, p. 6).

Informed individual - A person who is selected to be knowledgeable in the future competency needs of an automotive technician.

Qualified technician - A technician who has been certified by Automotive Service Excellence (ASE) in his/her specialty area.

Technician - A specialist in the technical details of automotive repair and service. The term "technician" has replaced the previous term of "mechanic".

CHAPTER II

REVIEW OF LITERATURE

The review has been divided into three major areas. First, comments are made on the present automotive industry with its concern as well as insights into the future. Second, a determination of what a competency is and what the literature said the workplace expects in future competencies is reviewed. Third, present and future competencies of automotive technicians are discussed.

Automotive Industry

Automotive Service Industry

As one considers automotive repair, the number of vehicles on the road can add insight into the magnitude of the business. Morrill (1990) found that in 1960 there were 68 million registered vehicles. By 1990 that figure had jumped to 180 million, and 40 million more are expected to be registered by the year 2000. This is a large volume of automobiles, and the automotive technicians of today are expected to be familiar with them and be able to repair them. In Canada alone, the Canadian Auto Repair and Service Council (1990) commented that the number of automotive manufacturers has grown from 4 to over 30 in the last 20 years. This requires the technician to have a broad range of knowledge and skill to properly repair both new and older vehicles.

Lack of Service Satisfaction

With this large volume of varied automobiles, technicians are not succeeding in repairing vehicles to the owners satisfaction. Earlier in the introduction, it was stated that up to 24% of a surveyed population were not satisfied with brake work they had done on their car (Consumer Reports, 1989). This survey also addressed the common repair of muffler replacement. Up to 18% of the population were not satisfied, and approximately 20% said they had to return to the service facility because there still was a problem, or there was an additional problem.

It must be recognized that all problems which consumers have are not directly a result of an unqualified technician. However, this is usually a strong contributing factor. The concern at this point is: If technicians do not have the competencies needed to repair the present vehicles, what kind of repair quality will there be with the future technological changes? Automotive education must address this issue, and this study hopes to help by identifying the competencies needed of future technicians.

Changes in Technology

What type of technological changes are expected in the next 10 years? Two specific items that are prominent are: 1) electronics, and 2) alternate fuels.

Gvorki (1990) commented on the automotive electronic market in that it was expected to grow from $12.7 million in 1987 to $35 million by 1995. Sprackland (1991) added to this with a specific comment about the semi-conductor market in the automotive arena. It is expected to grow from $1.2 million in 1989 to $1.9 million by 1994. Electronic components are being added to all parts of the automobile. Some examples are: engine computer, electronic transmission, air bag, electronic suspension, digital dashes, electronic anti-lock brakes, security alarm systems, and electronic pumpless power steering. Business Week (1988) stated:

> There's probably no stopping the auto industry's rush to put more and more electronics in its cars. After all it's a technology that offers huge improvements in performance over mechanical systems. So many electronic gadgets are being added - about $300 worth per vehicle on average - that car makers are beginning to weave them into networks within the car. By the year 2000 those electronic systems could claim as much as 30% of the cost of making a new car (p. 118).

Two additional dimensions of automotive electronics that are emerging are multiplexing and fiber optics. Present and especially future technicians must be qualified to diagnose and repair electronics on automobiles. This is applying to all technicians, not just the electrical specialist. The brake, front-end, transmission, air conditioning, and tune-up technicians must all be comfortable with electronics. This is especially true with the advent of multiplexing and fiber optics. Zygmont (1989) reflected that on a fully multiplexed car, all the electronic components can run off of one wire. Multiplexing allows computers and sensors to communicate with each other through digital or binary code on one wire. Fiber optics is an advanced form of multiplexing. Wood (1992) commented that by the mid-1990's a single vehicle will have as much as 200 feet of polymeric optic fiber. Wood elaborated that fiber optic sales will grow from $12 million in 1995 to $50 million by 2000. Based on these illustrations, technicians need to be prepared for electronics.

A second major technological change in the automobile is in the use of alternative fuels. Kupfer (1989) commented on the Clean Air Act which mandates that automobile manufacturers start selling cars that run on gasoline substitutes. This mandate starts in 1995 with 500,000 units and jumps to an increase of one million units per year for 1997 and after.

Compressed Natural Gas (CNG) is a strong contender for the prominent alternative fuel (Use of CNG, 1992). Ford, Chrysler, and General Motors have already begun producing dedicated CNG vehicles for fleet use. Electric vehicles are also being developed earnestly in light of the Clean Air Act (Nowell, 1990). Additionally, methanol powered vehicles (Kupfer, 1989) have great potential with the following advantages: superior

combustion, high octane rating, 20% more horsepower, 90% less ozone (smog), and the fuel is less prone to evaporate. Compressed Natural Gas, methanol, and electric vehicles are coming and will require qualified technicians for repair work within the next 5 to 10 years.

Competencies

The large variety of automobiles on the road, lack of quality repair on present vehicles, and dramatic technological advances in the automobile have been addressed. With this in mind, automotive technology education must look ahead to the future competency needs of students. However, before proceeding on to these automotive competencies; what is a competency? This section will define and discuss the theory of competencies.

Definition

In a 1989 study of entry level competencies of hotel management trainers, Rangraj stated: "Competency suggests the mastery of basic knowledge in a given field" (p. 13). Finch and Crunkilton (1989) addressed this in a little more depth: "Competencies for vocational and technical education are those tasks, skills, attitudes, values, and appreciations that are deemed critical to success in life and/or in earning a living" (p. 242). This latter comment breaks down the definition into five different behaviors: tasks, skills, attitudes, values, and appreciations. Many times competencies are thought of only as psychomotor in the automotive area. But one must add cognitive and attitudinal (Miller, 1990). Miller broke down competencies into these three areas: "the knowledge, skills, and attitudes acquired are, in a real sense, the content of the curriculum . . . . content may be synonymous with competencies" (p. 61). Alsup (1982), also defined competency in his study on competency needs of a wood technologist: "A knowledge, skill, attitude . . .

which is required of an employee to function in his/her position" (p. 6). What kind of competencies will be needed in the future workplace: psychomotor, cognitive, attitudinal, or all three?

Future Workplace Competencies

Competency has been defined by various sources. This section will now address what research said about future competencies needed in the overall workplace. Barton and Kirsch (1990) said employers are presently demanding problem-solving, interpersonal, and employability skills and that the future workplace will have even higher requirements. The Department of Labor (1988) interviewed 134 business leaders and 34 education leaders to address what the labor force needs will be in the future, and found: 1) job requirements are changing rapidly, and 2) mathematics, reading, writing, communication, problem-solving, and teamwork will be needed. Long (1984) reviewed a report by a panel of the National Academy of Sciences in which they reported the following future needs: 1) ability to learn and adapt to a changing workplace, and 2) positive attitude and sound work habits. The Institute of Medicine (1984) found that the worker who will prosper in the future will have these core competencies: 1) command of the English language; 2) reasoning and problem-solving abilities; 3) reading, writing, and computation skills; 4) firm grounding in science and technology; 5) oral communication skills; 6) positive interpersonal relationships; and 6) constructive personal work habits and attitudes. And finally, the Center for Remediation (1992) found the future workplace needs are: 1) employees will require higher-level skills: 2) learners should connect school and real world experience; and 3) employees must value high performance and quality management.

In these findings, not many of the competencies dealt with psychomotor skills, but more with cognitive and attitudinal. Employers are expecting critical-thinkers, team-players, and good communicators now and in the future.

Automotive Technician Competencies

In the previous section, definitions of competency, and the future competencies of the general workplace were discussed. In this section, specific automotive technician competencies, both present and future will be reviewed.

Present Automotive Technician Competencies

The present competencies of an automotive service technician have been defined by the National Institute for Automotive Service Excellence (ASE). This certifying agency qualifies technicians through examination. The competencies developed by ASE have become the expected standards of industry (Alaska State Department, 1987; Center for Remediation. 1991; Doede, 1988; Duty Task List, 1991). Automotive education is also certified by a branch of ASE called the National Automotive Technicians Education Foundation (NATEF). Both ASE and NATEF acknowledge the following eight categories: 1) engine repair specialist; 2) automatic transmission/transaxle specialist; 3) manual drive train and axles specialist; 4) suspension and steering specialist; 5) brake specialist; 6) electrical systems specialist; 7) heating and air conditioning specialist; and 8) engine performance specialist. These eight areas are broken down into duties and tasks and represent the competencies expected of a technician in each respective area (Duty Task List, 1991).

Future Automotive Technician Competencies

ASE defines the competencies needed of a technician now, but what about the future? Davidow (1990) stated: there is a "scarcity of technicians who have sufficient computer-related skills to use high-tech diagnostic equipment on full feature automobiles" (p. 116). Skills will be needed in the computer area and obviously in electronics. Other

areas may include compressed natural gas, methanol, two-stroke engines, and electric-powered cars.

In addition to the above skills, cognitive and attitudinal skills will be required. Competencies may include the following skills: team, group, cooperative, participatory, problem-solving, decision-making, critical thinking, adaptability, communication, and interpersonal. Based on literature reviewed earlier in this chapter, these skills will be required of all future employees including automotive technicians.

Summary

The first part of this literature review addressed the automotive industry. The industry has a problem satisfying owners based on repair work done. With this present problem, will it worsen in the future? Advances in technology, including electronics and alternative fuels, will demand more of an automotive technician.

The second part of the literature review addressed general workplace competencies. A competency can include psychomotor, cognitive, and attitudinal skills. Future workplace skills, based on the literature will require higher-order skills.

The third part of the literature review addressed the specific competencies of an automotive technician. Present automotive technician competencies have been defined by ASE and NATEF. However, the purpose of this study is to identify future competencies of automotive technicians. Will these competencies include abilities in electronics, alternative fuels, and higher-order thinking skills?

CHAPTER III

METHODOLOGY

The purpose of this study was to identify future competencies needed by the automotive technician employed in the automotive industry. The means used to accomplish this task are described in this chapter.

The Population

The population was selected as a purposive sample. The population included: 1) three automotive industry training managers; 2) three automotive industry technician trainers; 3) six automotive technicians; 4) three automotive service managers; and 5) nine post-secondary automotive instructors. A total of 24 participants were asked to participate.

The National Training Managers of Chrysler, Ford, and General Motors were called June 16, 1993 and asked to participate. The managers were asked to recommend one instructor from their company and one service manager from their dealership network. The Chrysler manager recommended an instructor out of the Los Angeles, CA region, the Ford manager recommended an instructor from Okmulgee, OK, and the General Motors manager recommended an instructor from Oklahoma City, OK. On June 17, 1993, the three instructors were called and asked to participate. They all agreed. Service managers representing the corporations' dealerships were all recommended by the national training manager of each automotive manufacturer as well. Chrysler recommended a dealership in Detroit, MI. Ford and General Motors both recommended dealerships in Oklahoma City, OK. The service managers of each dealership were called on June 17, 1993 and asked to

participate. The service manager was also asked to volunteer two of his/her technicians to participate. The three dealerships all agreed to participate. This resulted in three national managers, three manufacturer technical instructors, three service managers and six technicians. In addition, nine automotive instructors at Oklahoma State University (OSU) - Okmulgee, a highly respected automotive technology program in Oklahoma, were asked to participate on June 16, 1993. This made up a total population of 24 participants. The industry part of the purposive sample was based on the recommendations from three national authorities in technician training. The educational part of the purposive sample was based on the fine reputation of the comprehensive automotive program at OSU - Okmulgee.

The Questionnaire

The instruments used in this study were based on the Delphi technique. The Delphi was developed by the Rand Corporation in the 1950's for use in defense. Since that time the Delphi method has been used in additional areas including education. The Delphi allows a consensus of opinions from selected experts without bringing the participants together in one location. This technique was used because of the information needed from experts and because of the future competencies requested (Linstone & Turoff, 1975). Finch and Crunkilton (1989) commented on the Delphi: "The Delphi technique focuses more directly on the future of a particular area" (p. 153). They continued: "The Delphi technique has been found to be a most useful tool in forecasting the future" (p. 154). This study utilized the "Conventional Delphi" form as described by Limstone and Turoff:

> In this situation a small monitor team designs a questionnaire which is sent to a larger respondent group. After the questionnaire is returned the monitor team summarizes the results and, based upon the results, develops a new questionnaire for the respondent group. The respondent group is usually given at least one opportunity to reevaluate its original answers based upon examination of the group response. To a degree, this form of Delphi is a combination of a polling procedure and a conference procedure which attempts

> to shift a significant portion of the effort needed for individuals to communicate from the larger respondent group to the smaller monitor team. (p.5)

Data Collection

The data collection process for this study was reviewed and approved by the Oklahoma State University Institutional Review Board on June 9, 1993. Based on this approval, the participants were initially called to request their participation as stated earlier. After this, the data collection was conducted through three separate mailings. The mailings consisted of a cover letter with an attached instrument. The first mailing asked the respondents to list the competencies an automotive technician would need in the future (See Appendix A). In the second mailing, the participants received a list of the competency statements which were analyzed and grouped on the basis of similarity. The participants were asked to rate each statement in terms of its importance. A five-point Likert scale was used. The most important position on the scale had a weight of five, and the least important position had a weight of one (See Appendix B). In the third and final mailing, the participants were asked to review the consensus ratings of the competencies, and based on the results, revise their opinion if they wished (See Appendix C).

Statistical Method

The data analysis of this study was descriptive in nature. The mean ratings for the categorized competency statements were calculated by computing the arithmetic means for responses to individual competencies. To show variability, standard deviation was calculated for each response. The formula to compute the mean is:

$$\frac{\Sigma X}{N}$$

The formula to compute standard deviation is:

where Σ = sum of
X = observation or variable
N = number
$\bar{X}$ = mean

$$\sqrt{\frac{\Sigma(X-\bar{X})^2}{N}}$$

The use of arithmetic means and standard deviations were the descriptive measures utilized. No attempt was made to make statistical inferences to a larger population, due to the subject selection not being randomized.

CHAPTER IV

RESULTS OF THE STUDY

The purpose of this study was to identify future competencies needed by the automotive technician employed in the automotive industry. The means to accomplish this purpose was the use of the Delphi technique. Twenty-four individuals were asked to participate. They were selected through a purposive sample which was described in the previous chapter. Three rounds were used in this study to collect the data. This chapter will explain the collection process for each round, and describe the analysis of the data.

Round One

The first round of this Delphi study was mailed to all 24 participants on June 23, 1993. The individuals were sent a cover letter explaining the process and an enclosed survey (See Appendix A). The survey asked for a list of the competencies that the participant felt an automotive technician of the future (5-10 years) would need to be successful. All the participants returned their surveys by July 15, 1993 except for the national training manager of Ford. The researcher did have to make several phone calls to remind the individuals of the return deadline. The Ford manager passed his survey on to a contact at the National Institute of Automotive Service Excellence (ASE) - specifically the National Automotive Technicians Education Foundation (NATEF) branch - the certifying agency for automotive technicians and automotive educational programs. The individual representing NATEF filled out the survey and returned it for the Ford manager. Each individual competency as described by the participants is shown in Table I.

Round Two

For round two, the competencies received in round one were combined based on similar responses. The 211 individual responses were combined to give a total of 53 competencies. These 53 competencies were listed on the survey used in round two. A cover letter was attached to the survey and mailed to the participants on July 31, 1993 (See Appendix B).

As stated before, 24 individuals were participating. However, since the Ford manager transferred his survey to NATEF, this changed the population. The researcher called the NATEF participant and asked her to continue in the Ford manager's place. She agreed, however, she suggested that the researcher send a copy of the second round to the Ford manager as well. The researcher did this, increasing the population by one to a total of 25 participants. The return deadline for the second round was August 20, 1993. All the surveys were returned (including the NATEF participant and the Ford manager) except for the three participants of the Chevrolet dealership. The researcher contacted the dealership four times by telephone and extended the deadline to September 10, 1993. Even with this extention, the Chevrolet dealership participants did not return their second round. This gave a response rate of 22 out of 25 or 88%.

The second round listed all 53 competencies and asked the individuals to rank them as being "very important", "quite important", "important", "slightly important", or "not important" by placing an "X" in the appropriate column (See Appendix B). The Likert scale was used and each column was assigned a weight value as follows: very important - 5, quite important - 4, important - 3, slightly important - 2, and not important - 1. These values assisted the researcher in being able to determine an average value of importance for each competency. See Table II for a list of the 53 competencies and their mean value.

TABLE I

INDIVIDUAL ITEM RESPONSES TO THE ROUND ONE INSTRUMENT

---

1. Ability to work with minimum supervision
2. Honesty and integrity
3. Understanding of basic electronics
4. Ability to get along with others in a stressful environment
5. Need understanding of basic operations of PC computer
6. Desire to do quality work
7. Dexterity
8. Ability to concentrate in a noise filled environment
9. Self motivated
10. Reading skill above average
11. Comprehension skill above average
12. Understanding of automobile computers
13. Ability to understand and operate PC type computer
14. Basic understanding of electrical theory
15. Advanced understanding of electrical theory
16. Ability to operate in high stress environment
17. Ability to operate in hazardous environment
18. Ability to communicate either effectively or forcefully
19. Tech level math skills
20. Predisposition to work with hands
21. Career commitment to being a "Mechanic"
22. Self motivation
23. Honesty and integrity
24. Communication skills
25. People skills
26. Basic electrical theory
27. Basic mechanical theory
28. 10th grade math competency
29. Hand skills
30. Highly motivated
31. Identify their strengths and continue to work and train in those areas
32. Update on new diagnostic tools and equipment; also retain the basics on diagnostic and repair skills
33. More electrical and problem solving techniques
34. Mental strength (There's more stress involved than before)
35. Physical strength (Health reasons)
36. Good driving habits
37. A better work ethic than we are seeing today
38. More computer knowledge
39. Use of online services

TABLE I (Continued)

40. More understanding of programing and how the system actually works
41. Use of integrated computer system for operation of the entire business from a terminal
42. Better communication skills: writing and speaking
43. More in-depth mathematic skills
44. Multiplexing of electrical signals, digital electronics
45. Better people skills
46. Willingness to truly diagnose a problem instead of jumping to a conclusion
47. For the technician who plans to advance: Business skills
48. A complete understanding of how and why an automotive system or component works
49. Customer satisfaction - ability in maintaining favorable relations
50. Quality of work - neatness and accuracy regardless of volume
51. Quantity of work - how rapidly an employee works; volume of work
52. Dependability
53. Cooperation and attitude - amount of interest and enthusiasm toward work
54. Safety - work methods as they affect safety of self and others
55. Attendance
56. Knowledge and versatility
57. Computer literacy
58. Electronics basics
59. Communications skills
60. Customer satisfaction oriented
61. Basic employee/employer communications
62. Analytical skills
63. Follow-up skills
64. Confidence training
65. Honesty
66. Courtesy
67. Cleanliness
68. Safety
69. Writing skills
70. Problem solving skills
71. Manual dexterity
72. Attendance, punctuality
73. Communication skills
74. Good reading skills
75. Good communication skills
76. Basic mathematical skills
77. Basic mechanical knowledge and understanding of fundamental principles
78. Computer knowledgeable
79. Basic and advanced electrical and electronics understanding
80. Desire to learn new techniques and methods

TABLE I (Continued)

81. The correct attitude - a positive one
82. Electrical knowledge
83. Mechanical ability
84. Problem solving ability
85. Reading, writing, and math at the tenth grade level minimum
86. Post-secondary training in all aspects of automotive repair
87. Greater emphasis in the area of electrical and electronics
88. Communication skills for customer and co-worker use
89. People skills
90. Motivated individual
91. Needs to enjoy chosen field
92. Needs good communication skills - verbal and non-verbal
93. Must be able to think and rationalize a solution to a problem
94. Needs good mind to hand ability
95. Math skills
96. Needs to be open-minded
97. Needs to have personal and professional goals
98. Honesty
99. Hunger for knowledge
100. Willingness to adapt to different situations
101. Critical thinking skills
102. Good common sense
103. Ability to reason
104. Electrical theory
105. Mechanical ability
106. Interest in the automotive field
107. Strong electrical understanding
108. Basic mechanical fundamental knowledge
109. Good math and reading skills
110. Computer literacy
111. Self motivated
112. Willingness to continue training as new technology is introduced
113. ASE certification - all 8 areas preference
114. Understand and/or training of applied physics
115. High school education with a good understanding of math and english
116. Twelfth grade or better physics
117. Understanding of electronic fundamentals
118. Good communication skills
119. Completed an automotive technology program (two years)
120. Needs up to date specialized training in the technicians area of expertise
121. Patience
122. Willingness to learn new products/procedures
123. Customer oriented

TABLE 1 (Continued)

124. Certification
125. Some knowledge of electronics is a must
126. Reading all updated TSB's (Technical Service Bulletins) and new information available
127. Need to know how to read electrical schematics
128. Keep up to date on latest test equipment
129. Understanding ohmmeter and digital or analog voltmeter is a must
130. Patience
131. Use of diagnostic routines
132. Remember shop manuals are a valuable tool
133. A good attitude helps and makes learning easier
134. Don't hesitate to ask another technician's opinion when having a problem
135. Learn to read vacuum schematics
136. Understanding basic EEC systems
137. Good relationship with customers
138. Specialized areas to stay on top of your job
139. It takes time and experience to get good at your job
140. How to understand computer operations
141. Experience and training on how to use reference books for each auto
142. Basic understanding of gas engines
143. Experience and training on electrical circuits
144. How to understand customer needs and complaints
145. How to understand accessory operations
146. Need to be trained and updated on new test and diagnostic equipment
147. Basic electronics
148. Ability to read schematics and understand vacuum principles
149. Good skills in math to work with micrometers and gauges
150. Good communication skills
151. Positive attitude toward public and fellow workers
152. Basic engine, transmission, and transaxle skills
153. Able to stay abreast of all changes
154. Team-work
155. Good hand coordination
156. Able to stand all day
157. Able to put up with environmental changes (snow, rain, heat)
158. Good electrical knowledge
159. Able to hustle when the work is there
160. Keep furthering education to keep up with new systems
161. Take pride in work
162. Keep customers happy
163. Ask questions when you are unfamiliar with problems
164. Learn from mistakes
165. Mechanically inclined

TABLE I (Continued)

166. Able to communicate well
167. Able to repair things, not just replace parts
168. Self motivated
169. Good attitude
170. Needs to understand computers
171. Conscientious
172. High school auto shop
173. Automotive School
174. Growth as technology changes
175. Safety conscious
176. Know how electricity works and how to diagnose problems properly
177. Understanding of how all basic things work - motors, engines, transmission, relay, solenoids
178. Able to accept help from others
179. Good learning skills
180. Good listener
181. Even-tempered.
182. Understand that when something is taking longer than you think it should, you are going to learn a lot so next time you will be able to understand and repair faster
183. Systems view
184. Good knowledge of electricity and basics
185. Good social life with friends and family
186. Enjoy what you do
187. Systems view
188. Problem solving skills
189. Understanding technical publications
190. Competence with PC for diagnostics, specifications, procedures in electronic service information delivery system
191. Rigorous attention to diagnostic routines
192. Willingness for lifelong learning/training
193. Multiplexing
194. Fewer bench overhauls, more module replacements
195. More electrical and electronic systems, fewer mechanical
196. Greatly increased knowledge/competence in exhaust emissions (HC, CO, NOx)
197. Reading
198. Writing
199. Math (basic and geometry)
200. Listening
201. Speaking
202. Quality orientation
203. Customer orientation
204. Reasoning/problem solving
205. Must like learning

TABLE I (Continued)

206. Willing to accept change
207. Respect for the environment
208. Ability to understand electrical/mechanical systems and relationships
209. Understanding of what computers can/cannot do
210. Must enjoy or respect the role of a technician
211. Must like cars

TABLE II

LIST OF THE COMBINED 53 COMPETENCIES, THEIR MEAN VALUE AND THEIR STANDARD DEVIATION

Item	Mean	Standard Deviation
1. Personal computer skills	3.32	0.945
2. Electrical circuits/diagnosis knowledge	4.82	0.501
3. Testing and diagnostic equipment knowledge	4.59	0.666
4. Automotive computer system knowledge	4.59	0.590
5. Multiplexing knowledge	3.86	0.990
6. More electrical knowledge/less mechanical	3.27	1.202
7. Proper use of reference materials (service manuals and technical service bulletins)	4.77	0.429
8. How to follow diagnostic routines	4.64	0.581
9. How to read schematics	4.73	0.550
10. Practical experience	4.05	0.899
11. Business skills	2.95	1.133
12. Attended high school auto shop	3.32	1.041
13. Attended a 2 year college auto program	4.18	0.907
14. High school physics	2.91	1.192
15. Writing/reading skills	4.18	1.500
16. Math skills (Algebra, geometry, trigonometry)	3.68	0.839
17. Speaking/communication skills	4.18	0.853
18. Exhaust emissions (HC, CO, NOx) Knowledge	3.77	1.110
19. Gas engine knowledge	4.00	1.272
20. Automobile accessory knowledge	3.64	1.002
21. Micrometer/gauge knowledge	3.82	1.140
22. Transmission/transaxle knowledge	3.86	0.889
23. Have personal and professional goals	4.45	0.671
24. Dependable	4.77	0.528
25. High self-esteem	4.50	0.673
26. Honesty/integrity/good work ethic	4.73	0.456
27. Likes cars	3.91	1.065
28. Self-motivated	4.64	0.581
29. Career commitment to being a mechanic	3.91	1.109
30. Need to be certified/licensed - ASE	4.32	1.086
31. Cleanliness	4.23	0.813
32. Quality conscious	4.86	0.351
33. Persistent - don't give up	4.64	0.658
34. Good social life with family and friends	3.77	0.869
35. Safety conscious	4.64	0.581

TABLE II (Continued)

Item	Mean	Standard Deviation
36. Problem solving/reasoning/critical thinking skills	4.73	0.550
37. Aggressive	3.23	1.232
38. Positive Attitude	4.50	0.512
39. Patience	4.55	0.596
40. Ability to learn new things	4.73	0.456
41. Learn from mistakes	4.64	0.581
42. Don't be afraid to ask for help	4.50	0.598
43. Get along with others/teamwork	4.45	0.671
44. Ability to concentrate in a noise-filled environment	4.14	0.941
45. Respect for the environment	4.27	0.767
46. Concerned for customer's needs and complaints	4.54	1.143
47. Systems view	3.73	0.935
48. Diagnose individual system, not the whole	3.45	1.405
49. Fewer bench overhaul - more module replacement	3.00	1.069
50. Repair - not just replace - components	3.86	0.990
51. Be specialized	3.27	1.518
52. Good hand coordination/manual dexterity	4.00	1.272
53. Fast worker/high volume of work	3.32	1.086

The top value given by the participants was "quality conscious" with a mean value of 4.86. This was followed by "electrical circuits/diagnosis knowledge" with a value of 4.82, and "proper use of reference materials (service manuals and technical service bulletins)" and "dependable", both with an average value of 4.77. The competencies that averaged with the lowest values were "high school physics" with a value of 2.91, "business skills" with a value of 2.95, and "fewer bench overhaul - more modular replacement" with a value of 3.00. The top 15 competencies are listed on Table III.

Round Three

Round three of the study was mailed on September 14, 1993. It was mailed to the 22 of the 25 remaining participants. A cover letter explaining the last round was enclosed with the survey (See Appendix C). The third round survey consisted of the 53 competencies and the mean value for each item. The participants were asked to look at the consensus for each competency and decide if they agreed with the group consensus. If the individual agreed, then no further action was required on their part and the survey did not need to be returned. If the participant disagreed, then he/she was asked to signify this by placing an "X" in the appropriate column of importance. As of the return deadline for the third round, no surveys were returned. Based on the lack of response, the researcher assumed there was no disagreement with the overall group consensus.

Analysis of Findings

As stated earlier in this chapter, the mean value for each competency was calculated. The top four competencies were mentioned, as well as the bottom three. The mean values for each competency can be seen in Table II. The standard deviation for each item was calculated to show variability. The standard deviation for each competency can be seen in Table II. The standard deviation varied from 0.351 to 1.518 for the 53

TABLE III

TOP 15 COMPETENCIES BASED ON MEAN VALUE

Item	Mean	Standard Deviation
1. Quality Conscious	4.86	0.351
2. Electrical Circuits / Diagnosis Knowledge	4.82	0.501
3. Proper use of Reference Materials (Service Manuals and Technical Service Bulletins)	4.77	0.429
4. Dependable	4.77	0.528
5. How to Read Schematics	4.73	0.550
6. Honesty / Integrity / Good Work Ethic	4.73	0.456
7. Problem Solving / Reasoning / Critical Thinking Skills	4.73	0.550
8. Ability to Learn New Things	4.73	0.456
9. How to Follow Diagnostic Routines	4.64	0.581
10. Self - Motivated	4.64	0.581
11. Persistent - Don't Give Up	4.64	0.658
12. Safety Conscious	4.64	0.581
13. Learn from Mistakes	4.64	0.581
14. Testing and Diagnostic Equipment Knowledge	4.59	0.666
15. Automotive Computer System Knowledge	4.59	0.590

items. The item that showed the least deviation of 0.351 was "quality conscious" which, interestingly enough was the highest item in the mean score with a value of 4.86. The second competency as far as deviation was "proper use of reference materials (service manuals and technical service bulletins)" with a value of 0.429. This competency was third in the mean scores with a value of 4.77. The third best standard deviation score of 0.455 was shared by "honesty/integrity/good work ethic" (which had a mean score of 4.73) and "ability to learn new things" which also had a mean value of 4.73. The fourth in line in standard deviation was "electrical circuits/diagnosis knowledge" at 0.501. This item also had a very high mean value of 4.82. In summary, it seems the individuals who participated agreed surprisingly well with one another as the top five standard deviation values were also in the top five mean scores for each competency.

In Table IV, the bottom 15 competencies based on mean value can be seen. The lowest value of 2.91 was given to "business skills", followed by "high school physics" at 2.95, "fewer bench overhaul - more module replacement" at 3.00, "aggressive" at 3.23 and "more electrical knowledge/less mechanical" at 3.27. Of the bottom five competencies, four also had the most standard deviation. Of the bottom 15 competencies based on mean value, nine also were in the list of 15 competencies with the most standard deviation.

TABLE IV

BOTTOM 15 COMPETENCIES BASED ON MEAN VALUE

Item	Mean	Standard Deviation
1. Business Skills	2.91	1.133
2. High School Physics	2.95	1.192
3. Fewer Bench Overhaul/More Module Replacement	3.00	1.069
4. Aggressive	3.23	1.232
5. More Electrical Knowledge/Less Mechanical	3.27	1.202
6. Be Specialized	3.27	1.518
7. Fast Worker/High Volume of Work	3.32	1.086
8. Attended High School Auto Shop	3.32	1.041
9. Diagnose Individual System - Not the Whole	3.45	1.405
10. Automobile Accessory Knowledge	3.64	1.002
11. Math Skills (Algebra, Geometry, Trigonometry)	3.68	0.839
12. Systems View	3.73	0.935
13. Exhaust Emissions (HC, CO, NOx) Knowledge	3.77	1.110
14. Good Social Life With Family and Friends	3.77	0.869
15. Micrometer/Gauge Knowledge	3.82	1.140

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to identify future competencies needed by the automotive technician employed in the automotive industry. The Delphi technique was used to collect the data for the study because of the Delphi's success in predicting aspects of future competencies. Three rounds were used. In the first round the participants were asked to list the competencies they thought a technician of the future (5-10 years) would need. The 211 individual responses were grouped on the basis of similarity and this resulted in a list of 53 competencies. These 53 competencies were listed in the round two instrument. In this second instrument, the participants were asked to rate each competency based on importance. A Likert scale was used. It included: "very important" with a value of five, "quite important" with a value of four, "important" with a value of three, "slightly important" with a value of two, and "not important" with a value of one. With the return of the round two instrument, the mean value of each competency was calculated. This mean value was used in the third round. The round three instrument showed all 53 competencies including the mean value for each established from the responses in round two. The participants were mailed round three and asked to revise the mean values of the group consensus if they disagreed. If they disagreed with the consensus on an item or on multiple items, they were asked to identify that and return the third instrument. If they did not disagree, then the third instrument did not need to be returned. Once this data was

collected, the researcher added to the analysis by computing the standard deviation for each competency to show variability.

The population consisted of a purposive sample. The national training managers of Chrysler, Ford, and General Motors were contacted by telephone and asked to participate. They were also asked to recommend a training instructor from their company and a dealership to participate. This resulted in three national training managers, three corporate training instructors, three dealership service managers, and six dealership service technicians (two technicians from each of the three dealerships). The researcher also contacted the Automotive Technology department at Oklahoma State University (OSU) - Okmulgee and asked the nine instructors there to participate. This gave a total of 24 participants. In round one, the national manager of Ford asked a person at the National Automotive Technicians Education Foundation (NATEF) to assist him - this increased the population to 25. In round one, all the participants responded - resulting in a 100% return rate. In round two, 22 of 25 instruments were returned resulting in an 88% return rate. In round three, no surveys were returned indicating no disagreement in the consensus by the participants.

Conclusions

To determine consensus among the participants, both the mean and standard deviation were calculated for each of the 53 competencies. The top competencies based on mean value were: "quality conscious" - 4.86, "electrical circuits/diagnosis knowledge" - 4.82. "proper use of reference materials (service manuals and technical service bulletins)" - 4.77, "dependability" - 4.77, "honesty/integrity/good work ethic" - 4.73, "how to read schematics" - 4.73 and "problem solving/reasoning/critical thinking skills" - 4.73. These competencies followed the literature specifically in the area of higher order and affective skills - "ability to learn new things", "quality", and "good work ethic". These data agreed

with the literature. Based on this, it can be concluded that the most important competencies needed by a technician in the automotive field are related to attitudinal or affective constructs, as 9 of the 15 top competencies were related to work attitudes, including the cognitive skill of problem solving/critical thinking. The remaining 6 of the top 15 competencies related to troubleshooting, reading schematics, testing, and diagnosis which are all problem solving skills. The automobile technician of the future must be able to critically think and troubleshoot, as well as possess a good work ethic. In addition to attitudinal and problem solving skills, these data emphasized the technician's ability to understand and work with electronics. This also agreed with the literature as the literature spoke of multiplexing and the use of fiber optics. Six of the top 15 competencies related to electronics and showed the participants' opinion of importance in this area. These results have strong implications for automotive education and how workers are prepared.

In addition to the data collected by calculating the mean, standard deviation was computed to delineate variability. The following competencies showed the least amount of deviation: "quality conscious" - 0.351, "proper use of reference materials (service manuals and technical service bulletins)" - 0.429, "honesty/integrity/good work ethic" - 0.456, "ability to learn new things" - 0.456 and "electrical circuits/diagnosis knowledge" - 0.501. It is noted that the five competencies with the least deviation were also in the top five of the mean values. These descriptive statistics show that the participants strongly agreed with each other and that affective skills and electronics are mandatory competencies of a future automotive technician.

Recommendations

It is recommended that persons involved in the education of future automotive technicians be familiar with the results of this study. In order to improve the education of future technicians, the researcher recommends that:

1. Automotive educators implement techniques to improve student's higher order abilities, such as: ability to learn new things, problem solving/critical thinking, and reasoning skills.

2. Automotive educators implement techniques to improve students' work attitude and work ethic, such as: honesty, dependability, quality consciousness, and self - motivation.

3. Automotive educators implement techniques to improve the student's ability to understand and diagnose electronic systems.

4. Automotive educators implement techniques to improve the student's ability to read and use reference materials.

The researcher also recommends the following areas for further research:

1. Researchers should consider the process of selecting authorities in the specific study area by having them recommend participants in a purposive sample.

2. Further study should be conducted on specific techniques of implementing teaching strategies to improve student's higher order skills, affective skills, and electronic skills.

3. Further study should be conducted to determine if there was a significant difference of opinion in responses between the industry participants and the educational participants.

4. Further study should be conducted on identifying future competencies of an automotive technologist.

Implications

Based on the conclusions and recommendations, automotive educators and their administrators must consider the implications of this study. First, educators must determine ways to incorporate development of affective skills into the curriculum. Students must be

given opportunities to develop the skills of: 1) dependability, 2) honesty, 3) self-motivation, 4) safety consciousness, and 5) quality consciousness. Approaches such as problematics, group discussion, guest speakers, and role playing can be used to accomplish this goal.

Second, educators and administrators must consider the implication of the drastic change in technology - specifically in electronics. Educators need to start early in their curriculum teaching the basics of electricity and electronics. Once the basics have been learned, the students should be given many laboratory experiences to learn diagnosis and testing with the use of digital volt/ohmmeters and other testers. These experiences will help prepare the future automotive technician for the changing electronics in automobiles. Obviously, these implications need to be considered if educators hope to properly prepare technicians for the future.

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APPENDIXES

APPENDIX A

ROUND ONE COVER LETTER AND INSTRUMENT

607 Sharp Circle
Perkins, OK 74059
June 23, 1993

Charles D. Groves
Ford Motor Company
Fairlane Office Center #2, Suite #414
#4 Parklane Blvd
Dearborn, MI 48126

Dear Mr. Groves:

Based on our phone conversation of June 15, 1993, I want to thank you for your commitment to participate in this study. I am enclosing the first round of the Delphi study to identify future competencies needed by an automotive technician employed in the automotive industry. Automotive technology is changing drastically. Every year new skills are required of automobile technicians to be successful, and automotive education must train technicians for the challenges of the future. The results of this study will form the basis for my Master's thesis in Occupational and Adult Education at Oklahoma State University.

You are one of a group of twenty-four professionals selected to participate in this study. As a participant in the study, you will be asked to:

(1) Respond to the attached questionnaire.
(2) Evaluate on two separate occasions the information gathered on the questionnaire from all twenty-four participants.

All information will be treated confidentially. Please use the self-addressed, stamped envelope for returning the survey. Please return the enclosed survey by July 7, 1993. Your time, consideration, and participation are very much appreciated. If you have any questions please call me at (405) 547-2352.

Sincerely,

Robert L. Frisbee

Robert L. Frisbee

Enclosure

cc: Dr. Ray Sanders, Thesis Advisor
Occupational and Adult Education
Oklahoma State University

COMPETENCIES NEEDED BY AUTOMOTIVE TECHNICIANS
IN THE FUTURE

Part I

PURPOSE OF THE STUDY: This study is designed to identify future competencies needed by the automotive technicians employed in the automotive industry.

DIRECTIONS: This is the first round of the three round survey. In this round, please list the primary competencies (including hands-on abilities, knowledge, and attitudes) you think best describe what the automotive technician needs to possess for successful employment in the future. In this application, future refers to within the next 10 years. Do not feel obligated to come up with 15 competencies. Only list as many as you wish. If you have more than 15, please continue on the back of this page.

I again thank you for your time and participation. The second round should be mailed to you within three to four weeks. The two remaining rounds will require less of your time than this first round. If you have any questions please call me at (405) 547-2352. Thank you. --Robert L. Frisbee

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APPENDIX B

ROUND TWO COVER LETTER AND INSTRUMENT

607 Sharp Circle
Perkins, OK 74059
July 31, 1993

John D. Mack
Service Technology Group
General Motors Corporation
30501 Van Dyke
Box 9008
Warren, MI 48098-9008

Dear Mr. Mack:

First, let me thank you for your response to round one of the Delphi study regarding future competencies of an automobile technician. Your input was vital, and I am glad you will continue to help refine the data by completing the second round questionnaire.

I have listed for your review all of the competencies I received in the first round. All like responses have been combined. I am now asking you to rate each competency based on its importance. Through this process, I hope to determine a consensus of opinion among the professionals participating in the study.

Please complete the attached instrument and return it by August 20, 1993 in the self-addressed, stamped envelope. Again, thank you for your time and participation. If you have any questions, feel free to call me at (405) 547-2352.

Sincerely,

Robert L. Frisbee

Robert L. Frisbee

Enclosure

cc: Dr. Ray Sanders, Thesis Advisor
Occupational and Adult Education
Oklahoma State University

COMPETENCIES NEEDED BY AUTOMOTIVE TECHNICIANS IN THE FUTURE

PART II

DIRECTIONS: This is round two of the three round process. Each item in this questionnaire was selected as an important competency by one or more experts involved in this study. Please rate each item (by placing a "X" in the appropriate column) based on the extent of your agreement with the importance of the competency.

	very important	quite important	important	slightly important	not important
1. PERSONAL COMPUTER SKILLS					
2. ELECTRICAL CIRCUITS / DIAGNOSIS KNOWLEDGE					
3. TESTING AND DIAGNOSTIC EQUIPMENT KNOWLEDGE					
4. AUTOMOTIVE COMPUTER SYSTEM KNOWLEDGE					
5. *MULTIPLEXING KNOWLEDGE*					
6. MORE ELECTRICAL KNOWLEDGE / LESS MECHANICAL					
7. PROPER USE OF REFERENCE MATERIALS (SERVICE MANUALS AND TECHNICAL SERVICE BULLETINS)					
8. HOW TO FOLLOW DIAGNOSTIC ROUTINES					
9. HOW TO READ SCHEMATICS					
10. PRACTICAL EXPERIENCE					
11. BUSINESS SKILLS					
12. ATTENDED HIGH SCHOOL AUTO SHOP					
13. ATTENDED A 2 YEAR COLLEGE AUTO PROGRAM					
14. HIGH SCHOOL PHYSICS					
15. WRITING / READING SKILLS					
16. MATH SKILLS (ALGEBRA, GEOMETRY, TRIGONOMETRY)					
17. SPEAKING / COMMUNICATION SKILLS					
18. EXHAUST EMISSIONS (HC, CO, NOX) KNOWLEDGE					
19. GAS ENGINE KNOWLEDGE					
20. AUTOMOBILE ACCESSORY KNOWLEDGE					
21. MICROMETER / GAUGE KNOWLEDGE					
22. TRANSMISSION / TRANSAXLE KNOWLEDGE					
23. HAVE PERSONAL AND PROFESSIONAL GOALS					
24. DEPENDABLE					
25. HIGH SELF-ESTEEM					
26. HONESTY / INTEGRITY / GOOD WORK ETHIC					
27. LIKES CARS					
28. SELF-MOTIVATED					
29. CAREER COMMITMENT TO BEING A MECHANIC					
30. NEED TO BE CERTIFIED / LICENSED--ASE					
31. CLEANLINESS					
32. QUALITY CONSCIOUS					
33. PERSISTENT-DONT GIVE UP					
34. GOOD SOCIAL LIFE WITH FAMILY AND FRIENDS					
35. SAFETY CONSCIOUS					

	very important	quite important	important	slightly important	not important
36. PROBLEM SOLVING / REASONING / CRITICAL THINKING SKILLS	/	/	/	/	/
37. AGGRESSIVE	/	/	/	/	/
38. POSITIVE ATTITUDE	/	/	/	/	/
39. PATIENCE	/	/	/	/	/
40. ABILITY TO LEARN NEW THINGS	/	/	/	/	/
41. LEARN FROM MISTAKES	/	/	/	/	/
42. DONT BE AFRAID TO ASK FOR HELP	/	/	/	/	/
43. GET ALONG WITH OTHERS / TEAMWORK	/	/	/	/	/
44. ABILITY TO CONCENTRATE IN A NOISE FILLED ENVIRONMENT	/	/	/	/	/
45. RESPECT FOR THE ENVIRONMENT	/	/	/	/	/
46. CONCERNED WITH CUSTOMER'S NEEDS AND COMPLAINTS	/	/	/	/	/
47. SYSTEMS VIEW	/	/	/	/	/
48. DIAGNOSE INDIVIDUAL SYSTEM, NOT THE WHOLE	/	/	/	/	/
49. FEWER BENCH OVERHAUL--MORE MODULE REPLACEMENT	/	/	/	/	/
50. REPAIR--NOT JUST REPLACE COMPONENTS	/	/	/	/	/
51. BE SPECIALIZED	/	/	/	/	/
52. GOOD HAND COORDINATION / MANUAL DEXTERITY	/	/	/	/	/
53. FAST WORKER / HIGH VOLUME OF WORK	/	/	/	/	/

APPENDIX C

ROUND THREE COVER LETTER AND INSTRUMENT

610 W. Kansas
Pittsburg, KS 66762
September 14, 1993

Mr. Ron Watkins
Chrysler Corporation
26001 Lawrence Ave.
Centerline, MI 48015

Dear Mr. Watkins:

The Delphi study on future competencies of an automobile technician is nearly completed, and your help has made it all possible. For that, I sincerely thank you. Knowing you are very busy makes me all the more appreciative of the time you have given for this study.

The third round of this study represents the consensus of opinion on the fifty-three competencies. As the last step of this process, please review the attached form. If you agree with the consensus of importance of the items, then your participation is finished. If, however your opinion differs, revise the rating to your preference. If you make revisions or additional remarks, please return the form in the self-addressed, stamped envelope by September 28, 1993.

Again, thank you for your time, effort, and participation in this study. Hopefully, this data will be used to improve the education of automotive technicians of the future. If you have any questions, please call me at (316) 235-4380.

Sincerely,

Robert L. Frisbee

Robert L. Frisbee

Enclosure

cc: Dr. Ray Sanders, Thesis Advisor
Occupational and Adult Education
Oklahoma State University

COMPETENCIES NEEDED BY AUTOMOTIVE TECHNICIANS IN THE FUTURE
PART III

DIRECTIONS: This is the third and final round. A number is given for each competency. This number represents the average of all participant's agreement of importance for each of the competencies. The most important position on the scale has a weight of five, where the least important position has a weight of one. If you agree with the group concensus on the importance of each competency, then no further action is required. If you disagree, please place a "X" in the column of importance that you feel is more appropriate for the competency, and return the survey in the self-addressed, stamped envelope--Thank You.

	very important	quite important	important	slightly important	not important
1. PERSONAL COMPUTER SKILLS		3.32			
2. ELECTRICAL CIRCUITS / DIAGNOSIS KNOWLEDGE	4.82				
3. TESTING AND DIAGNOSTIC EQUIPMENT KNOWLEDGE	4.59				
4. AUTOMOTIVE COMPUTER SYSTEM KNOWLEDGE	4.59				
5. MULTIPLEXING KNOWLEDGE		3.86			
6. MORE ELECTRICAL KNOWLEDGE / LESS MECHANICAL		3.27			
7. PROPER USE OF REFERENCE MATERIALS (SERVICE MANUALS AND TECHNICAL SERVICE BULLETINS)	4.77				
8. HOW TO FOLLOW DIAGNOSTIC ROUTINES	4.64				
9. HOW TO READ SCHEMATICS	4.73				
10. PRACTICAL EXPERIENCE	4.05				
11. BUSINESS SKILLS			2.95		
12. ATTENDED HIGH SCHOOL AUTO SHOP		3.32			
13. ATTENDED A 2 YEAR COLLEGE AUTO PROGRAM	4.18				
14. HIGH SCHOOL PHYSICS			2.91		
15. WRITING / READING SKILLS	4.18				
16. MATH SKILLS (ALGEBRA, GEOMETRY, TRIGONOMETRY)		3.68			
17. SPEAKING / COMMUNICATION SKILLS	4.18				
18. EXHAUST EMISSIONS (HC, CO, NOX) KNOWLEDGE		3.77			
19. GAS ENGINE KNOWLEDGE	4.00				
20. AUTOMOBILE ACCESSORY KNOWLEDGE		3.64			
21. MICROMETER / GAUGE KNOWLEDGE		3.82			
22. TRANSMISSION / TRANSAXLE KNOWLEDGE		3.86			
23. HAVE PERSONAL AND PROFESSIONAL GOALS	4.45				
24. DEPENDABLE	4.77				
25. HIGH SELF-ESTEEM	4.50				
26. HONESTY / INTEGRITY / GOOD WORK ETHIC	4.73				
27. LIKES CARS		3.91			
28. SELF-MOTIVATED	4.64				
29. CAREER COMMITMENT TO BEING A MECHANIC		3.91			
30. NEED TO BE CERTIFIED / LICENSED--ASE	4.32				
31. CLEANLINESS	4.23				
32. QUALITY CONSCIOUS	4.86				
33. PERSISTENT-DONT GIVE UP	4.64				
34. GOOD SOCIAL LIFE WITH FAMILY AND FRIENDS		3.77			
35. SAFETY CONSCIOUS	4.64				

	very important	quite important	important	slightly important	not important
36. PROBLEM SOLVING / REASONING / CRITICAL THINKING SKILLS	4.73				
37. AGGRESSIVE		3.23			
38. POSITIVE ATTITUDE	4.50				
39. PATIENCE	4.55				
40. ABILITY TO LEARN NEW THINGS	4.73				
41. LEARN FROM MISTAKES	4.64				
42. DONT BE AFRAID TO ASK FOR HELP	4.50				
43. GET ALONG WITH OTHERS / TEAMWORK	4.45				
44. ABILITY TO CONCENTRATE IN A NOISE FILLED ENVIRONMENT	4.14				
45. RESPECT FOR THE ENVIRONMENT	4.27				
46. CONCERNED WITH CUSTOMER'S NEEDS AND COMPLAINTS	4.54				
47. SYSTEMS VIEW		3.73			
48. DIAGNOSE INDIVIDUAL SYSTEM, NOT THE WHOLE		3.45			
49. FEWER BENCH OVERHAUL--MORE MODULE REPLACEMENT		3.00			
50. REPAIR--NOT JUST REPLACE COMPONENTS		3.86			
51. BE SPECIALIZED		3.27			
52. GOOD HAND COORDINATION / MANUAL DEXTERITY	4.00				
53. FAST WORKER / HIGH VOLUME OF WORK		3.32			

VITA

Robert Lee Frisbee

Candidate for the Degree of

Master of Science

Thesis: THE IDENTIFICATION OF FUTURE AUTOMOTIVE TECHNICIAN COMPETENCIES BASED ON THE OPINIONS OF SELECTED INDUSTRY EXPERTS

Major Field: Occupational and Adult Education

Biographical:

Personal Data: Born in Hutchinson, Kansas, February 28, 1963, the son of Robert E. and Luella O. Frisbee. Married to Kristi Russell April 26, 1986.

Education: Graduated from Sterling High School, Sterling, Kansas in May, 1981; received Bachelor of Science in Automotive Technology from Pittsburg State University in Pittsburg, Kansas, May 1985; completed requirements for the Master of Science degree at Oklahoma State University in December, 1993.

Professional Experience: District Manager for Chrysler Corporation in Anaheim, California from June 1985 to March 1988; Technical Training Instructor for Chrysler Corporation in Ontario, California, from March 1988 to July 1992; Automotive Instructor at Pittsburg State University, Pittsburg, Kansas from August 1993 to Present.

Professional Organizations: Member of American Vocational Association, Phi Kappa Phi, National Institute of Automotive Service Excellence.

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 06-08-93 **IRB#:** ED-93-101

Proposal Title: THE IDENTIFICATION OF FUTURE AUTOMOTIVE TECHNICIAN COMPETENICES BASED ON THE OPINIONS OF SELECTED INDUSTRY EXPERTS

Principal Investigator(s): Ray Sanders, Robert Frisbee

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature: Marcia K. Tilley Date: June 9, 1993

Chair of Institutional Review Board