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ABSTRACT

California automotive technician programs were surveyed regarding their awareness of the impact that mandates of the Clean Air Act would have on their automotive technology programs. A questionnaire was sent to 100 California community colleges with an automotive technology program; 49 usable questionnaires were returned. A possible byproduct of the study was to provoke the thought process of automotive department personnel into initiating new curricula that included electric vehicle technology. Survey results indicated that most college administrators were not aware of the fact that a Clean Air Act mandate existed. Those who were aware had no plans to offer an electric vehicle program in their college. In fact, the majority of administrators had no plans to offer an electric vehicle program, but many did concede to including electric vehicle technology in a limited fashion in selected auto technology classes. To develop a successful electric vehicle program, the colleges indicated they would need 17-22 students enrolled in the program. A chi-square comparison indicated that most college administrators would consider it a benefit to include electric vehicle technology in their automotive programs, yet most were not going to initiate a program. (Appendixes include the cover letter and questionnaire, and the percentage of scores for all survey questions. Contains 12 references. (YLB)

A STUDY OF THE AWARENESS LEVEL OF ELECTRIC VEHICLE TECHNOLOGY IN CALIFORNIA COMMUNITY COLLEGE AUTOMOTIVE CURRICULUMS

by

James Keyzer

A thesis

submitted in partial fulfillment

of the requirements for the degree of

Masters of Science in Occupational Education

in the School of Education

Ferris State University

Spring 1995

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Chapter I: The Problem

1. Introduction and Background of the Problem

In the past several years, many great advances have been made in the development of the electric vehicle. Many of these recent developments have been initiated because of the Clean Air Act of 1977.(See Clean Air Act) This act mandates specific requirements of vehicles which are to be sold in California by the year 1998. Auto manufacturers from around the world are very much aware of the requirements set forth in this act. They all have very much at risk if they do not conform to the upcoming standards. According to J. Henry(11-91, pp 1&50), many more states are considering following suit in adopting the Clean Air Act standards set forth in California. This possibility is rapidly enhancing the development of electric vehicle technology. In almost all of today's automobile manufacturing corporations, top priority is being directed toward electric vehicle development in order to conform with this act.(It's a Global Issue)

The educational system is not considering the development of electric vehicles as being a top priority in redirecting their automotive technology curriculums. High schools, community colleges, and universities should all be in the process of

adjusting their curriculums to address the electric vehicle technology of the future. The educational system automotive programs should all be teaching the basics of electric vehicle technology to insure that there are qualified technicians to perform repairs on these vehicles when they are produced. The educational system must switch to a more proactive approach to new technology rather than a reactive approach.

2. Statement of the Problem Situation

Many colleges are not properly addressing the fact that electric vehicles will be on our nation's highways in mass quantities in a very short period of time.

Our educational system must act immediately to adequately train mechanics to service electric vehicles. The level of awareness of the educational system must increase dramatically in the field of electric vehicle technology.

3. The Purpose of the Study

The purpose of this study is to determine the level of awareness of California automotive technician programs regarding the impact the mandates of the Clean Air Act will have on their automotive technology programs.

A questionnaire was sent out to all community colleges in California which have an automotive technology program. A byproduct

of this questionnaire may help provoke the thought process of automotive department personnel into initiating new curriculums which include electric vehicle technology.

The researcher will compile the information from the questionnaire to determine if California automotive technology curriculums are in need of some major overhauling in the very near future.

4. Rationale and Theoretical Framework

Electric vehicles will soon be a part of everyday living, especially for people living in the state of California. With a mandate already in place, educational systems must direct their thoughts to the future. If two percent of all vehicles sold in California (approximately 34,500 according to J. Henry)are electric vehicles, which mechanics will have the knowledge or expertise to properly and safely repair them? With this thought in mind, action must be taken immediately to train future mechanics who will work on electric vehicles. The year 1998 is rapidly approaching and currently there are few qualified mechanics out in the field who are able to work out the bugs often associated with the introduction of new technology. Much research has been done to bring electric vehicle development as far as it is today.

The education system must do their part to promote public

knowledge and interest in electric vehicle technology.

5. **Research Questions with respect to California's postsecondary automotive programs**

A. To what extent do faculty know the implications the Clean Air Act will have on their college automotive technology program?

B. What initiatives have been made in the automotive program curriculum to include electric vehicle technology?

C. To what extent do faculty know of national electric vehicle program certification standards?

D. What curriculum change procedures are currently in place that would facilitate in implementation of the electric vehicle program?

E. What components are necessary to develop a successful electric vehicle technology program?

6. **Definition of Terms.**

The following terms are defined to clarify their use in the context of the study:

C.A.R.B. - California Air Resource Board

Curriculum - a set of courses constituting an area of specialization

Clean Air Act - legislation enacted in the state of California

which mandates auto manufacturers to produce zero-emission vehicles.

Electric Vehicle - vehicles powered by an electric motor.

E.P.A. - Environmental Protection Agency

E.V. - Electric Vehicle

I.C.E. Vehicle - Internal Combustion Engine Vehicle

Program Certification - a set of criteria an educational program must comply with.

A.S.E. Certification - American Society of Automotive Engineers compliance standards.

7. **Scope and Delimitations of the Study.**

The data for this study was collected during the winter of 1995. Questionnaires were sent to all community colleges in the State of California which presently have an automotive technology program.

Since the state of California has been the pioneer state in mandating a solution to their air pollution problem, this research is being directed to the educational systems based in California.

National criteria must be initiated in the development of electric vehicle repair programs. Programs should be able to pass requirements set forth by national criteria guidelines. Ideally, programs can strive to attain the status of being a nationally

certified electric vehicle repair program.

The results of the questionnaire sent out are limited to the current conditions involving electric vehicle technology. Electric vehicle technology can be a very political issue. Large corporations, such as the big three automakers, play an enormous role in the development of new technology such as that of the electric vehicle. In fact, the majority of the United States Congress has just changed from Democratic control to Republican control. This change alone could impact the future of the electric vehicle.

The big three automakers have consistently opposed the 1998 California Clean Air Act mandate. So far, the Environmental Protection Agency (E.P.A.) in California has held firm in its position to implement the Clean Air Act rules. The big three automakers also realize that if they do not conform to the Clean Air Act rules, the foreign automobile manufacturers will immediately step up their production level of electric vehicles.

8. **Assumptions.**

The following assumptions were made with respect to this study:

A. That the Clean Air Act will not be repealed before it is implemented.

B. That battery technology will continue to improve to the point where electric vehicles will have comparable driving range before requiring recharging to the range of conventional vehicles before needing refueling.

Chapter II: Review of Related Literature

1. Organization of the Present Chapter

This chapter examines the current awareness levels of electric vehicle technology in California Community College automotive curriculums. The future of electric vehicles rests upon how well our current automotive education programs can adapt to include electric vehicle technology.

California is a forerunner in the development of new technology because many high technology corporations in California are trying to replace former lucrative United States Department of Defense contracts to that of innovative automotive technology.

2. Historical Background

Electric vehicle technology had interested inventors and investors as early as the turn of the century. Both inventors and investors realized that finding the most effective technology to propel automobiles would revolutionize the transportation industry.

Several advantages of electric vehicles were apparent from the very beginning. These advantages included such features as being:

silent, free from odor, simple in construction and gearing, and capable of having a considerable range of speed. (Olmsted, 1993)

The market acceptance of electric vehicles was initially widespread and numerous manufacturers offered vehicles of every size and description from touring cars to fleets of trucks. (Olmsted,1993) However, operational constraints of electric vehicles contributed to the early decline in their use. These constraints included the recharging technology and the short range of the vehicles. A focused attempt was made to address this difficulty. Serious efforts to create a new and marketable electric vehicle occurred in the 60's, 70's, and 80's. (Olmsted,1993) However, the limits of technology and the cost never allowed electric vehicle development to again reach competitive levels.

The situation has changed dramatically in the 1990's because of regulatory and technological innovations. Much of the attention on electric vehicles has resulted from the introduction of a pivotal new requirement which mandates the introduction of zero-emission vehicles in the near future in California. This requirement will influence the emergence of electric vehicles in the market place. (Olmsted, 1993)

Progress toward the development of electric vehicle technology has not taken the form of a single revolutionary breakthrough.

Rather, a series of incremental improvements have occurred which, when combined, have created the feasibility of successful applications.

Mass production of components and automobiles to meet the projected regulatory and market demand for electric vehicles is anticipated.

Numerous questions concerning efforts to educate mechanics in the field of electric vehicle technology have also surfaced. Electric vehicle technology curriculums are being developed by the United States Department of Energy and by York Technical College of South Carolina to address the upcoming need for electric vehicle technicians. (Electric Vehicle Competency Profile, February,1992)

3. **Literature Related to the Research Problem**

Literature related to the current awareness level of California Community Colleges involving electric vehicle technology is extremely limited in a best case scenario. Most literature involves speculation as to what will transpire in the upcoming years before the California Clean Air Act mandate is enacted in 1998.

Most research to date has been that performed by associates working under the direction of Dr. Robert Kosak of York Technical College located in Rock Hill, South Carolina. York Technical

College does recognize the future needs of our society as it pertains to electric vehicle technology.

An electric vehicle technology curriculum has been developed by York Technical College, however, it has yet to be tested in a real classroom environment.

An electric vehicle discussion list based out of San Jose State University on the Internet has been an excellent source of up-to-date events happening in the electric vehicle industry.

Most other forms of literature pertaining to electric vehicles is presented in the form of brochures. These brochures are also very scarce.

Literature about the technology, including the up-to-date changes occurring in the electric vehicle industry, is very limited.

The education system of California is just coming to grips with the fact that its administrators must act soon to help out future high technology mechanics. Literature pertaining precisely to this issue is extremely limited if not non-existent.

That is precisely the reason why this research project was initiated.

Chapter III: Methodology

1. Description of Research Methodology.

This research study utilizes descriptive research methodology. Research methodology was used because of the current status in the development of electric vehicles.

This research is intended to provide valuable data to the automotive repair program directors or administrators of the California Community College system. This research data should increase the level of awareness pertaining to what type of curriculum adjustments must be implemented to produce qualified technicians to repair electric vehicles.

2. Pilot Studies.

The pilot study questionnaires will be tested via three community colleges located in California. Each college will be from a different size category. Two weeks will be allowed for results of the questionnaire to be returned.

3. Selection of Subjects.

For this research study, all community colleges of California which institute an automotive technician training program were surveyed. The research study focused on the state of California because this state is becoming the pioneer state in the development

of electric vehicles via the mandate of the Clean Air Act.

California's demographic qualities also played an important role in the subject (or in this case, state) selection.

A list of all the California Community Colleges which have an auto technology program were generously supplied by the Chancellor's Office of California Community Colleges located in Sacramento, California. This list also recorded the programs available at each community college.

The research questionnaire was sent to all of the 74 community colleges with auto technology programs and two community colleges with energy technology programs. The questionnaire was directed to the automotive or energy technology program directors. The list did not include the names of the current program directors, however, it did include the mailing address of each community college.

4. **Instrumentation**

The instrument utilized for this research study consisted of a questionnaire format. The questionnaire population was asked to respond to 40 questions pertaining to the development of electric vehicles.

A copy of the survey instrument is contained in Appendix A. This questionnaire was reviewed by three experts: One expert was knowledgeable in content, Dr. Ed Cory, Professor at Ferris State

University. The second expert was knowledgeable in the field of research, Dr. Katherine Manley, Professor at Ferris State University. The third expert was knowledgeable in the field of research data entry, Helen Bacon of Ferris State University.

The questionnaire was designed to elicit the following data:

1) General College Information
2) Curriculum Content Information
3) College Personnel Information
4) College Views Pertaining to Program Enhancement
5) Demographic Information
6) Population Characteristics

5. **Field Procedures**

A questionnaire was sent to 76 community colleges in California with specific instruction listed on the envelope that it was to be forwarded to the automotive technology program director.

Automotive program characteristics along with demographic characteristics were divided appropriately to emphasize each subject area.

Information derived from the data on the questionnaire resulted in the creation of many charts and graphs to visually illustrate the results of the research study.

6. **Data Collection and Recording**

The questionnaire was sent out on December 15, 1994 via the United States Postal Service. Each questionnaire packet included a cover letter, a pre-addressed, postage paid return envelope, and the questionnaire itself.

The outside of each questionnaire packet was directed to the attention of the automotive or energy technology program director.

On March 15, 1995 approximately three months after the initial mailing, a follow-up questionnaire was mailed to each community college that did not respond to the initial questionnaire.

Most of the colleges responded within one month after the follow-up questionnaire was sent, eliminating the need for additional follow-up questionnaires to be sent out.

The final results were as follows:

Status	Number	Percent
Questionnaires Mailed	76	100
Questionnaires Returned Completed	49	64
Questionnaires Returned Usable	49	64

The percentage of questionnaires returned was lower than desirable, however, the questionnaires returned were of sufficient number to perform the statistical analysis.

Chapter IV: Research Findings

1. Introduction

This study assesses the level of awareness of California automotive technician programs for the national certification requirement for electric vehicle repair. The survey instrument and cover letter are included in Appendix A.

Appendix B contains the percentages of scores for all of the survey questions. A sample of the Appendix B format is shown below in Figure #1. This appendix displays the overall percentages, the percentages of those colleges which are discussing an electric vehicle program or presently have a limited number of classes pertaining to electric vehicles, and the colleges which already have a program in place.

			overall n=49	discussing or have program n=21	have a program n=3
1		What is the student population of you community college?			
	a	below 500	0.00%	0.00%	0.00%
	b	501 to 1500	8.20%	0.00%	0.00%
	c	1501 to 3000	4.10%	0.00%	0.00%
	d	3001 and above	87.80%	100.00%	100.00%

Figure #1

2. Analysis Procedure Used

In this study, two types of analysis were performed, one was a frequencies analysis and the other was a chi-square analysis.

The frequencies analysis was used for individual survey questions as they compared to schools which were discussing an electric vehicle program and those which had already had an electric vehicle program.

The chi-square analysis was performed to compare information from two questions on the survey.

3. Demographic Findings

Many factors may influence advances in electric vehicle technology. The survey included many questions pertaining to demographic data which could affect the community college auto technology programs.

Question #1 shows that most (87.8%) of California Community Colleges are very large, having a student population of over 3000. See Figure #2.

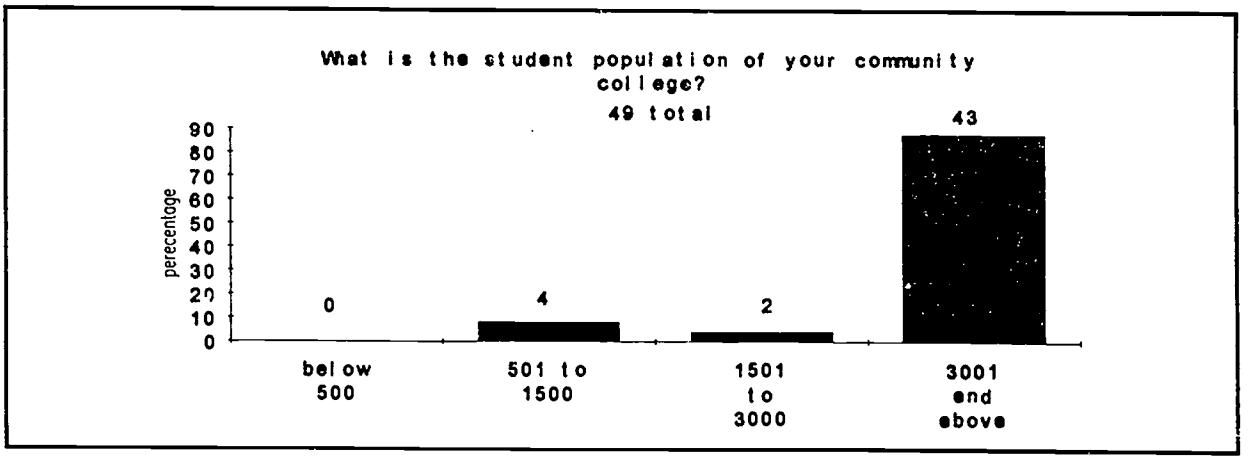


Figure #2

The average age of the majority (59.2%) of auto technology students was between 23 and 27 years of age. See Figure #3.

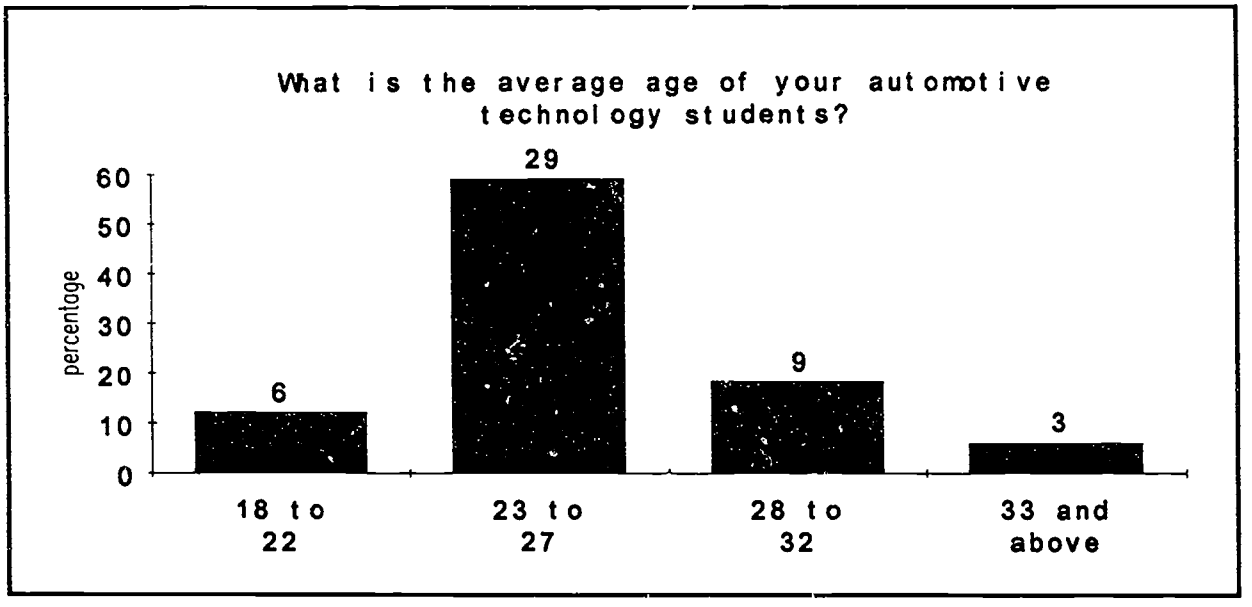
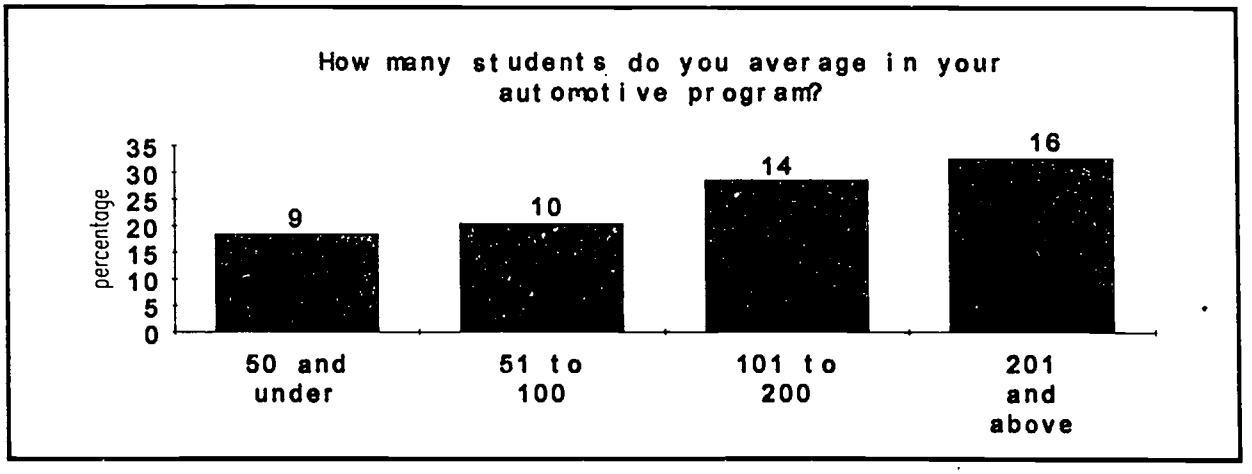


Figure #3

The number of students in automotive programs varied quite substantially, however, programs having 200 or more students still ranked the highest with 32.7%. See Figure #4 below.



Question #4 asked if any auto technology students presently drove an electric vehicle and there was not one person in all of the auto technology programs. See Figure #5

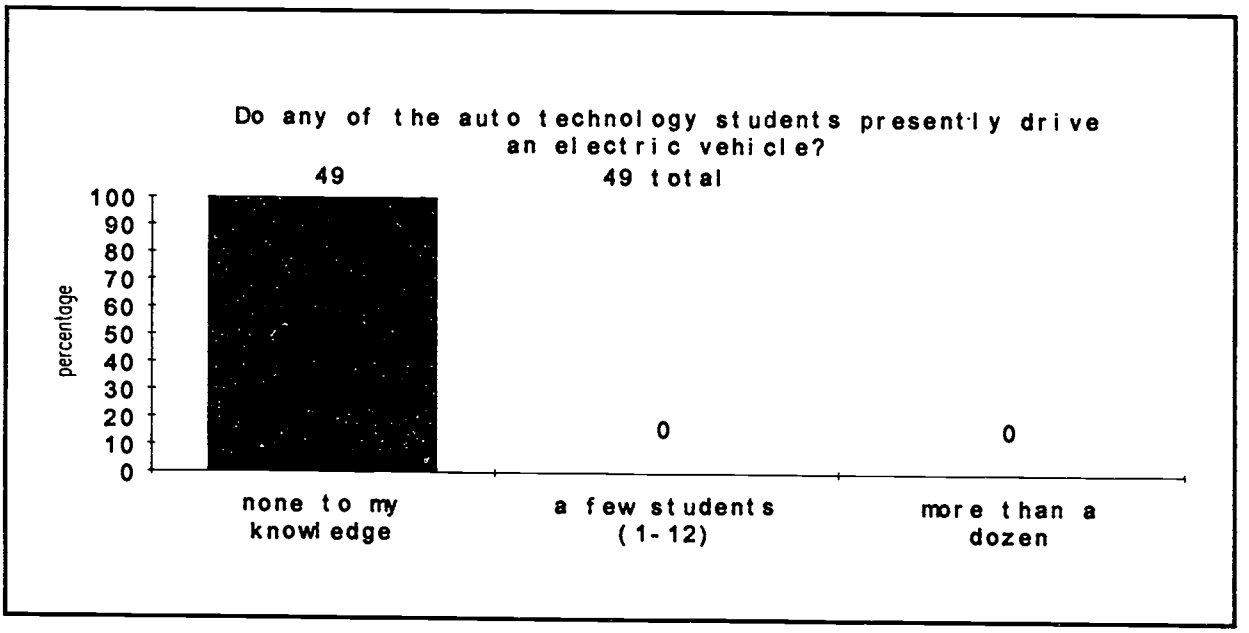


Figure #5

Question #21 asked a similar question to question #4, however, question #21 addressed the question of how many college personnel presently drive an electric vehicle. The majority also said 0. (83.7%). In some colleges, there were personnel driving electric vehicles, however, there were not very many of them. See figure #6

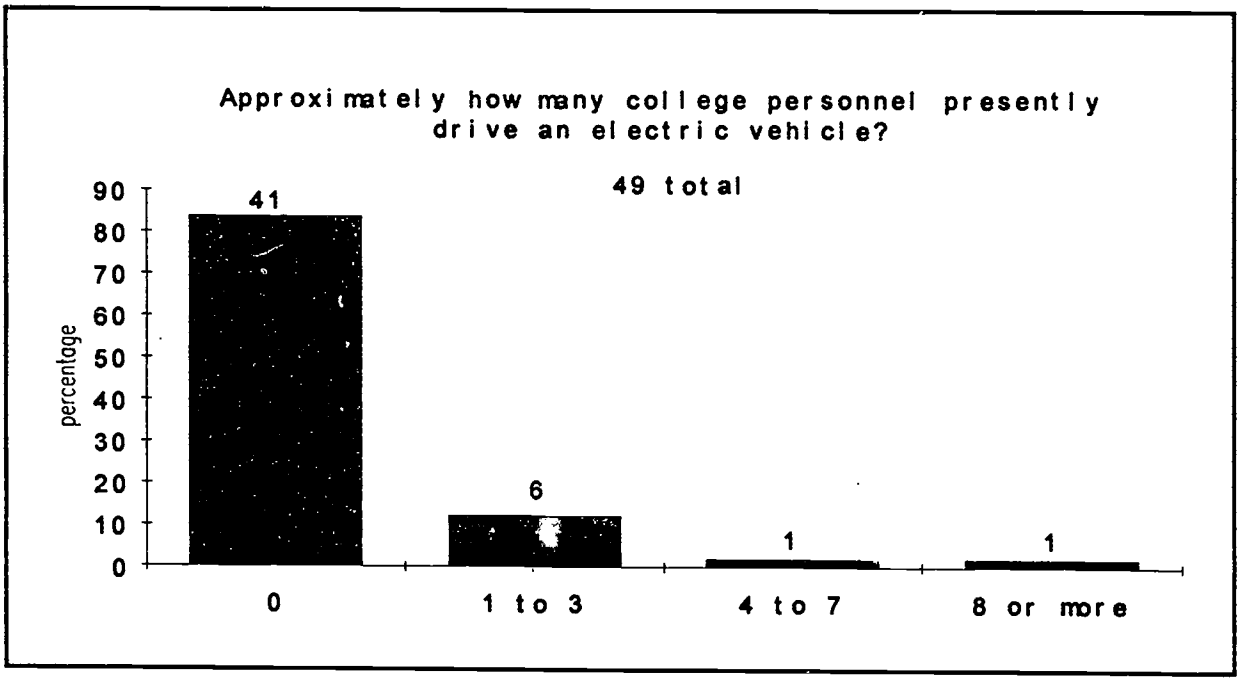


Figure #6

Question #9 indicated that very few women are interested in automotive technology. Most programs (63.3%) had one to five women enrolled in their automotive program.See figure #7.

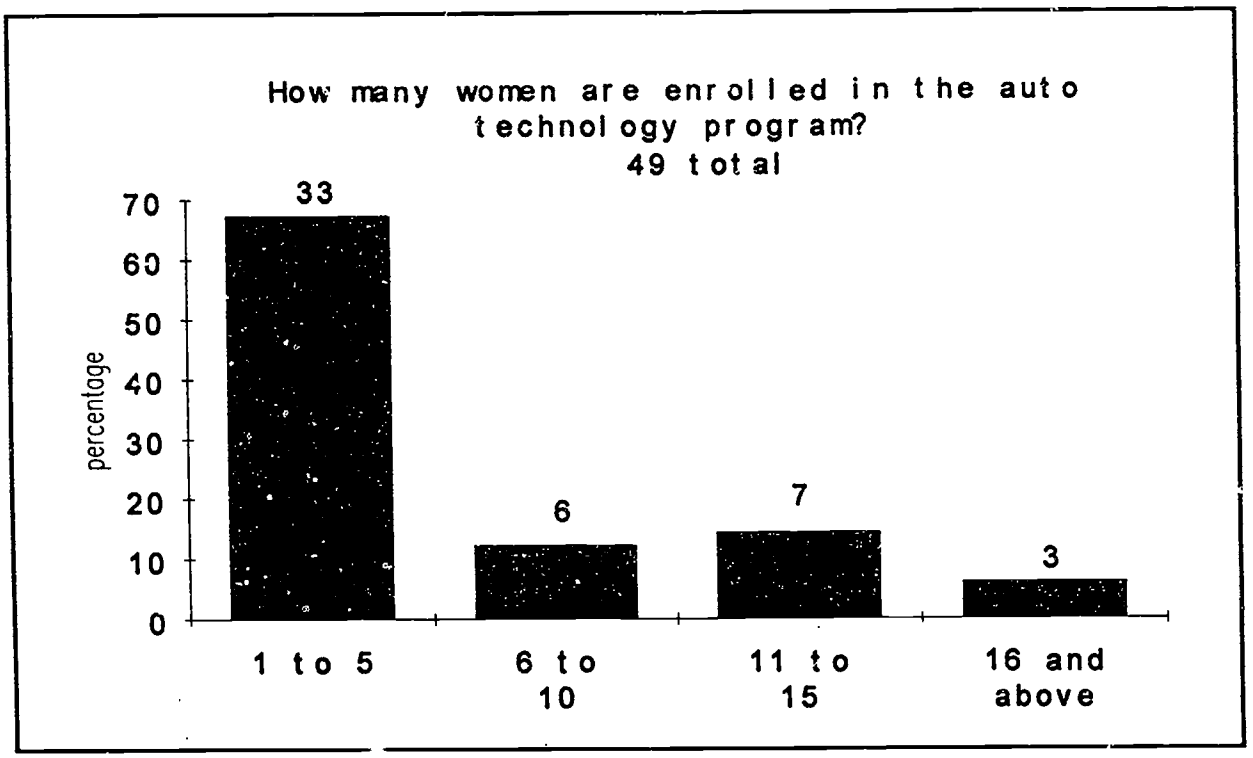


Figure #7

It is quite common for many of the automotive technology students to drop out of the program before graduating. (54.2% below 70%). This may be due to the high demand for automobile mechanics in the field. See figure #8.

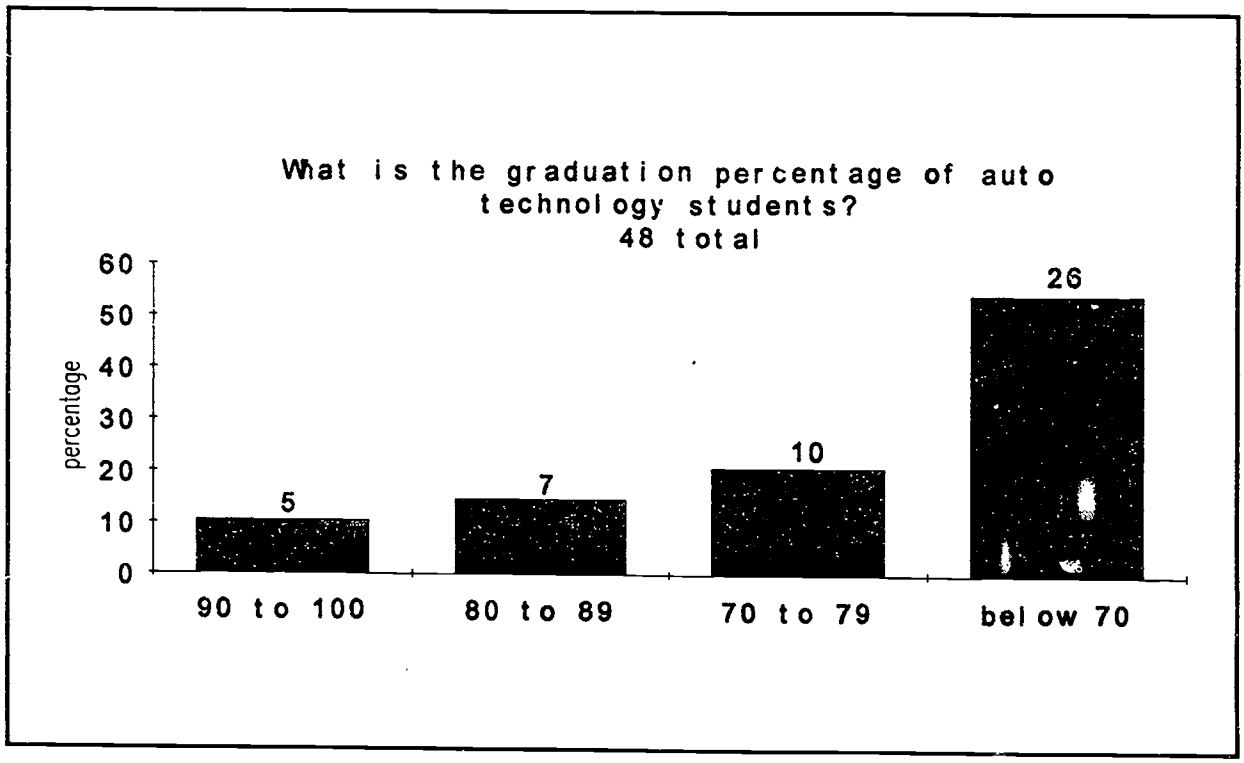


Figure #8

Because of the fact that many students drop out of the automotive technology programs before graduating, the placement percentage is also not very high. See figure #9

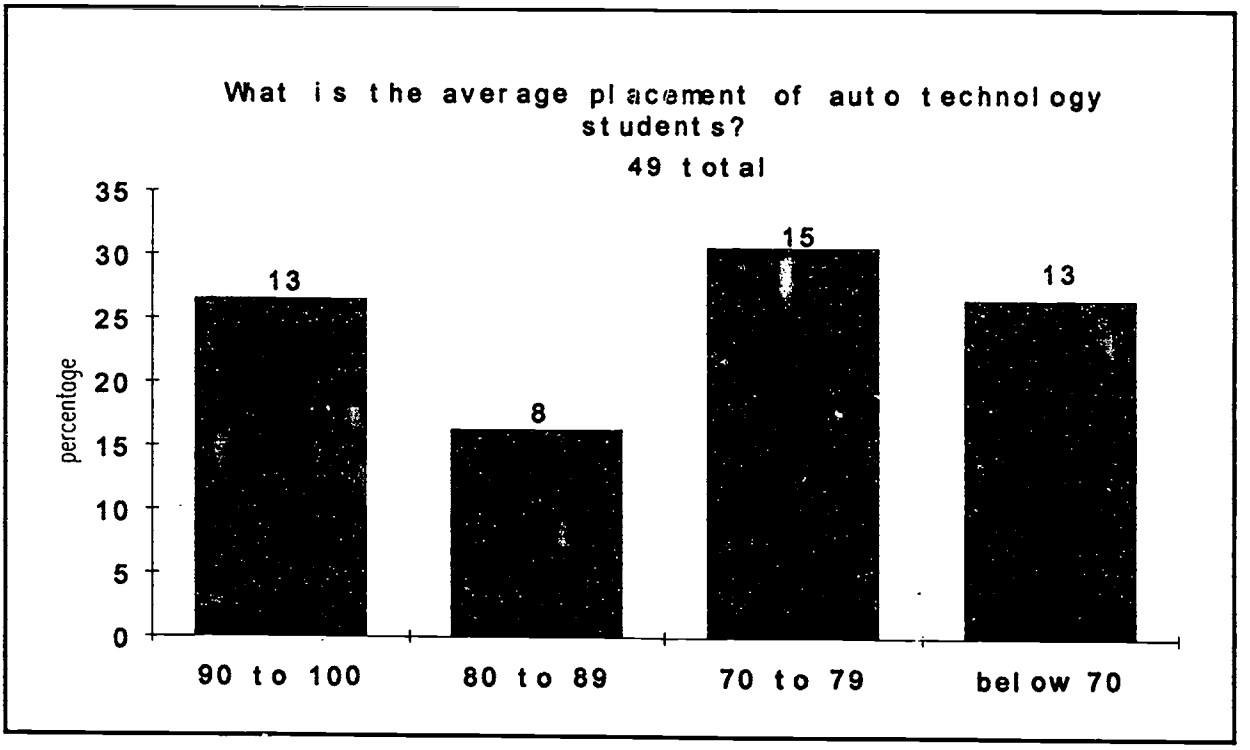


Figure #9

4. Analysis of Research Question A:

To what extent do faculty know the implications the Clean Air Act will have on their college automotive technology program?

Question #11 of the questionnaire addresses this topic and points out the fact that 40.8% of college administration is only somewhat aware of the mandates listed in Clean Air Act concerning electric vehicles. 34.7% of the college administration was not aware of any implications the Clean Air Act may have on an automotive technology program. See Figure #10

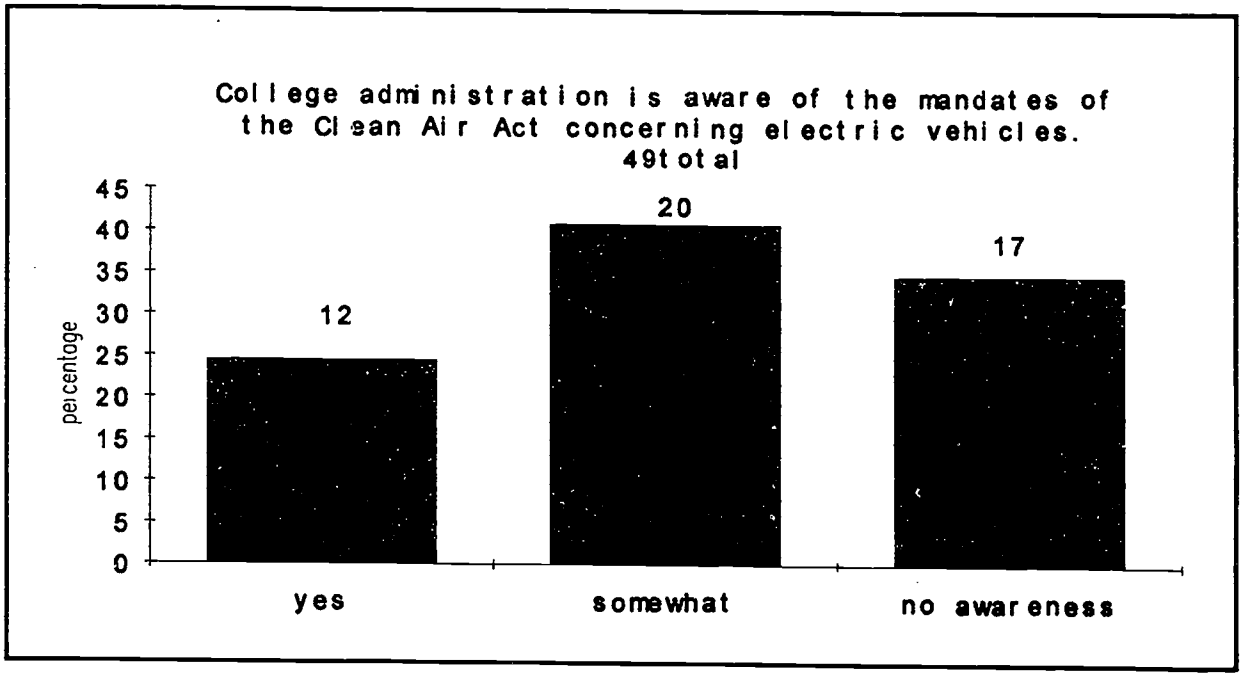


Figure #10

More statistical information concerning research question A was introduced in survey questionnaire #16. An amazing 55.1% of automotive technology programs have no plans to offer an electric vehicle program to accommodate the Clean Air Act mandate. Only 6.1% have a program already in place. Another 38.8% are in the process of implementing a program or are discussing the development of an electric vehicle program. See Figure #11.

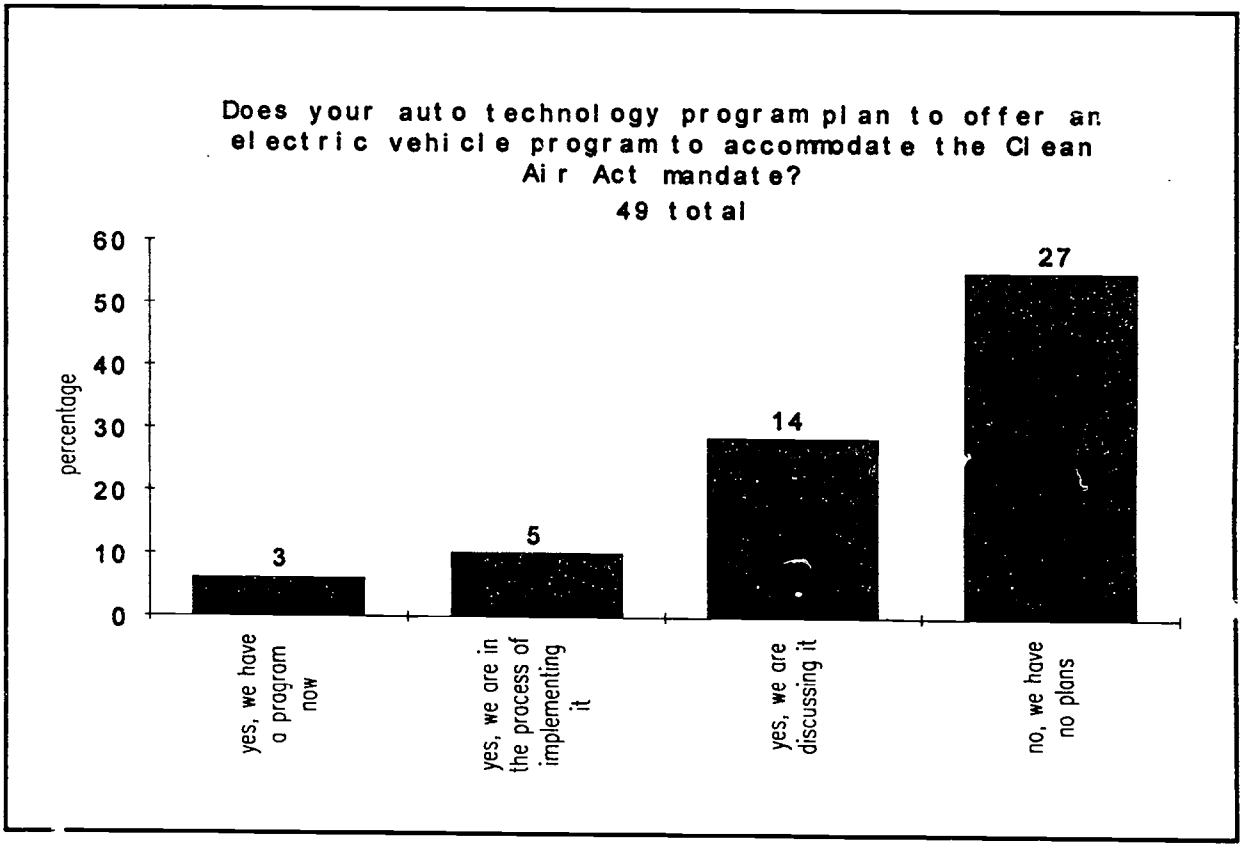


Figure #11

5. Analysis of Research Question B.

What initiatives have been made in the automotive program curriculum to include electric vehicle technology?

Question #6 of the survey questionnaire indicates that 57.10% of all the community colleges had no plans at the present time to expand their automotive technology programs to include electric vehicle technology. 6.1% already had a program in place with the remaining colleges discussing including a program (8.2%) or had plans in the making(28.6%). See Figure #12

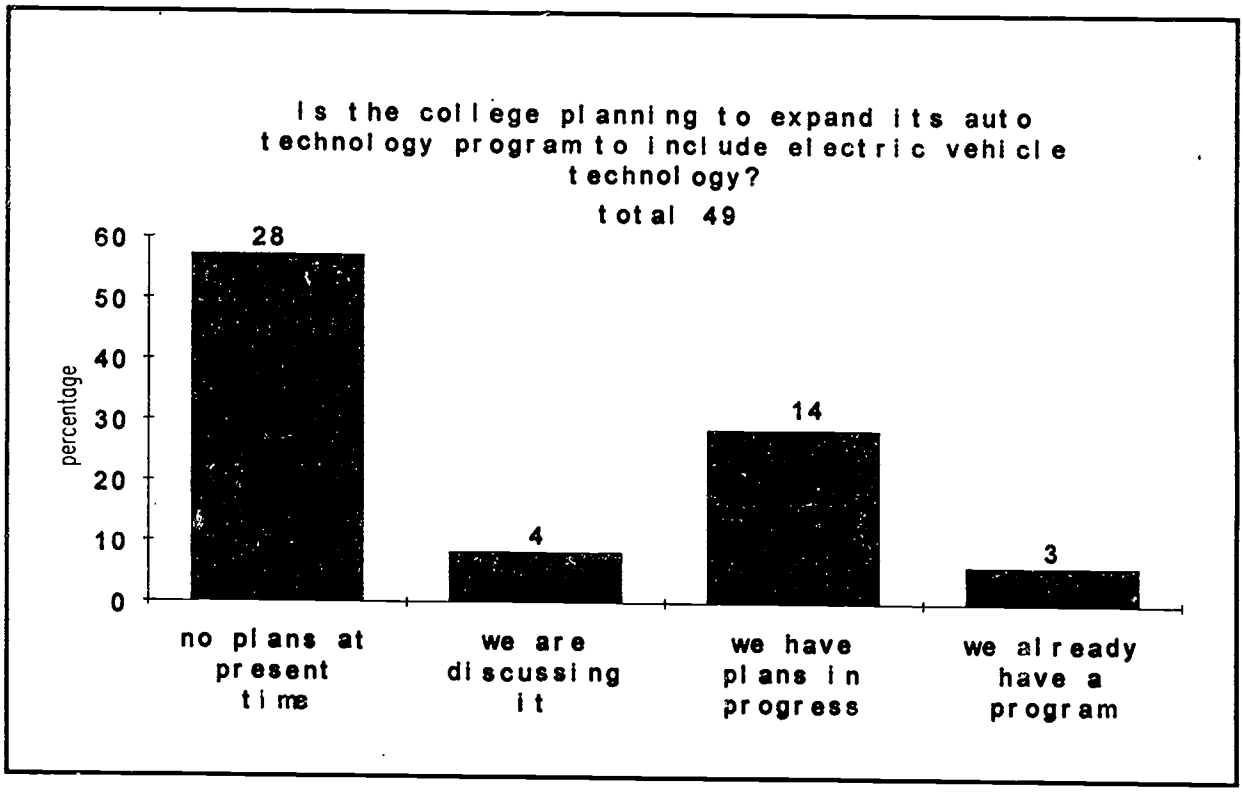


Figure #12

In order to keep pace with new technology, automotive shops must readily acquire new diagnostic equipment. It appeared in the survey results that 34.7% of the colleges are keeping pace with technology in the purchase of new equipment. 42.9% are somewhat keeping their equipment updated. 22.4% have outdated equipment or no new equipment at all. See Figure #13

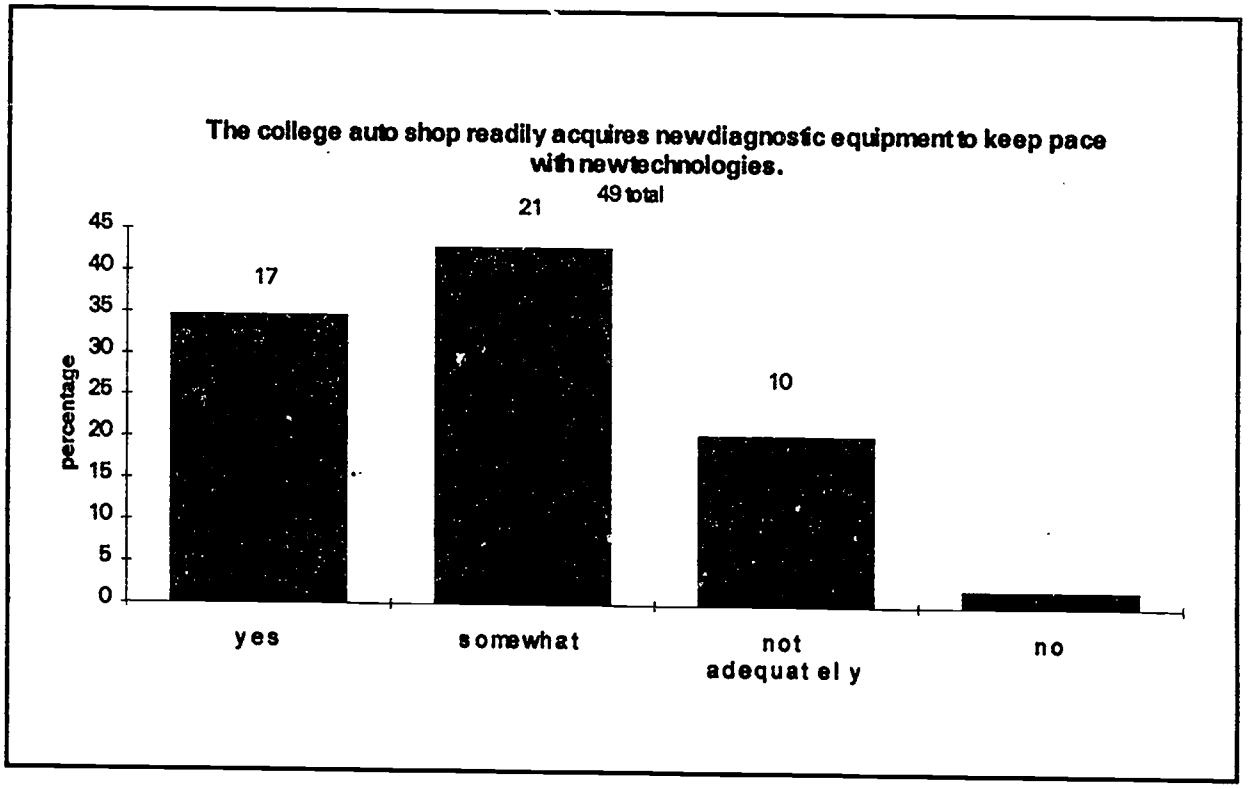


Figure #13

Some colleges already have taken initiatives which would help facilitate the implementation of an electric vehicle technology program. Other colleges were already teaching electric vehicle technology but in a limited fashion. Question #15 addresses this issue by asking," How many components of your automotive technology curriculum would facilitate implementing an electric vehicle program?" The results indicate that the majority of colleges (54.5%) have between 1 to 3 components already in place. The remaining percentages can be seen in figure #14.

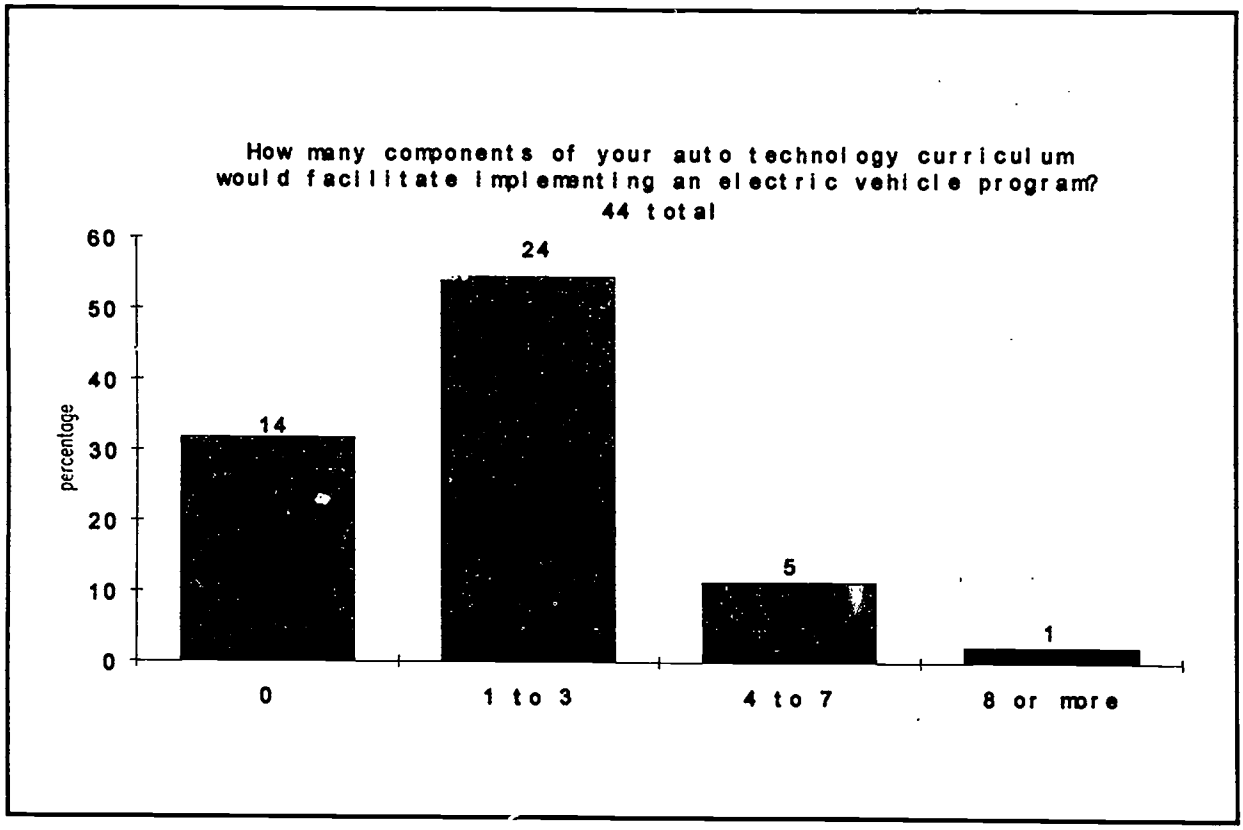


Figure #14

6. Analysis of Research Question C.

To what extent do faculty know of national electric vehicle program certification standards?

Electric vehicle program certification standards are presently being developed by the United States Federal government.Many college faculty are unaware of these developments concerning electric vehicle technology programs. In fact, 36.7% of all survey respondents indicated that they were unaware of this fact. 38.8% said that they had limited knowledge of this fact while 24.5% were aware of the program certification standards which are being developed. See Figure #15.

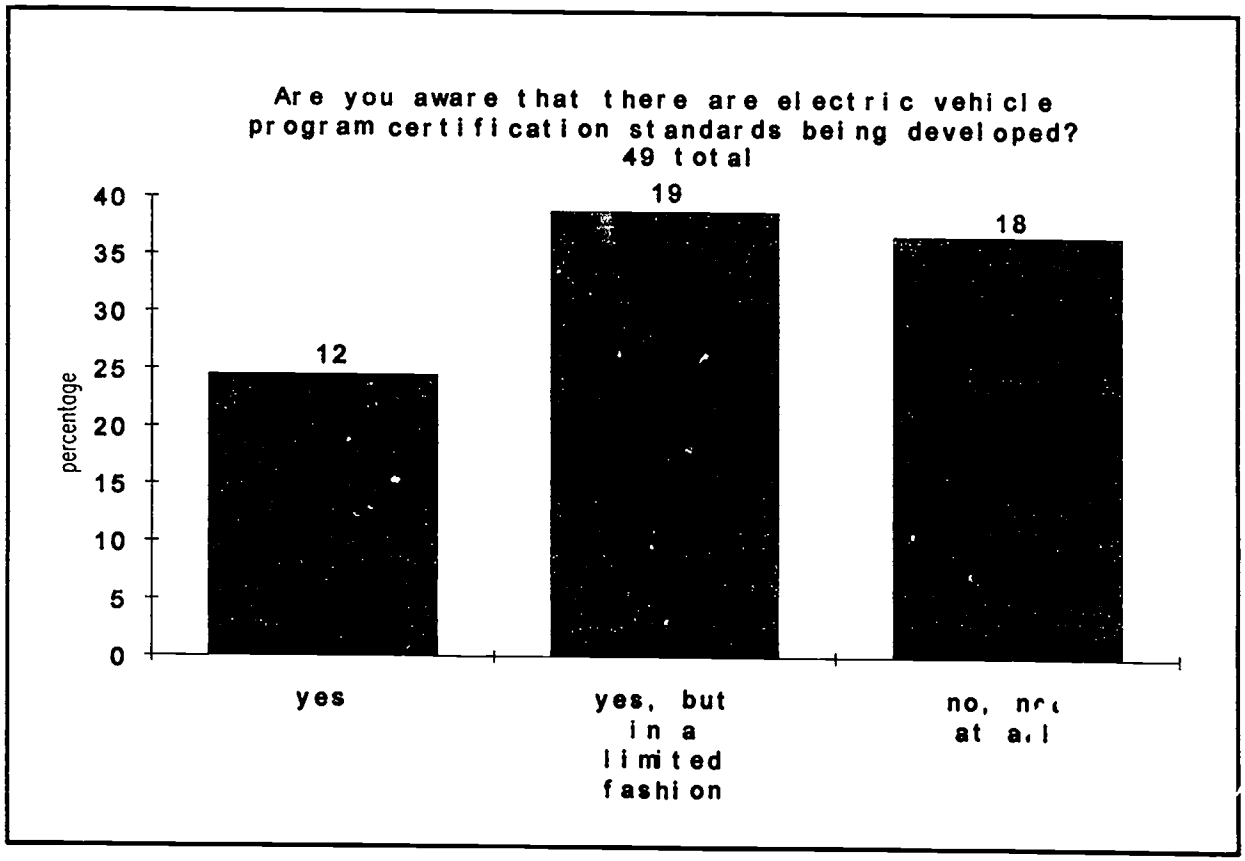


Figure #15

7. **Analysis of Research Question D.**

What curriculum change procedures are currently in place that would facilitate in implementation of the electric vehicle program?

Altering a curriculum to implement a new program is seldom a simple task. Survey question #13 indicates that the majority of the colleges (55.1%) agreed that the process of altering a curriculum is only somewhat simple.

Most of the colleges (83.7%) employed a well-defined curriculum to meet the demands of their automotive program.

Question #14 indicated that many of the colleges altered their automotive technology curriculum in the past five years to meet the demands of new technological developments. See Figure #16.

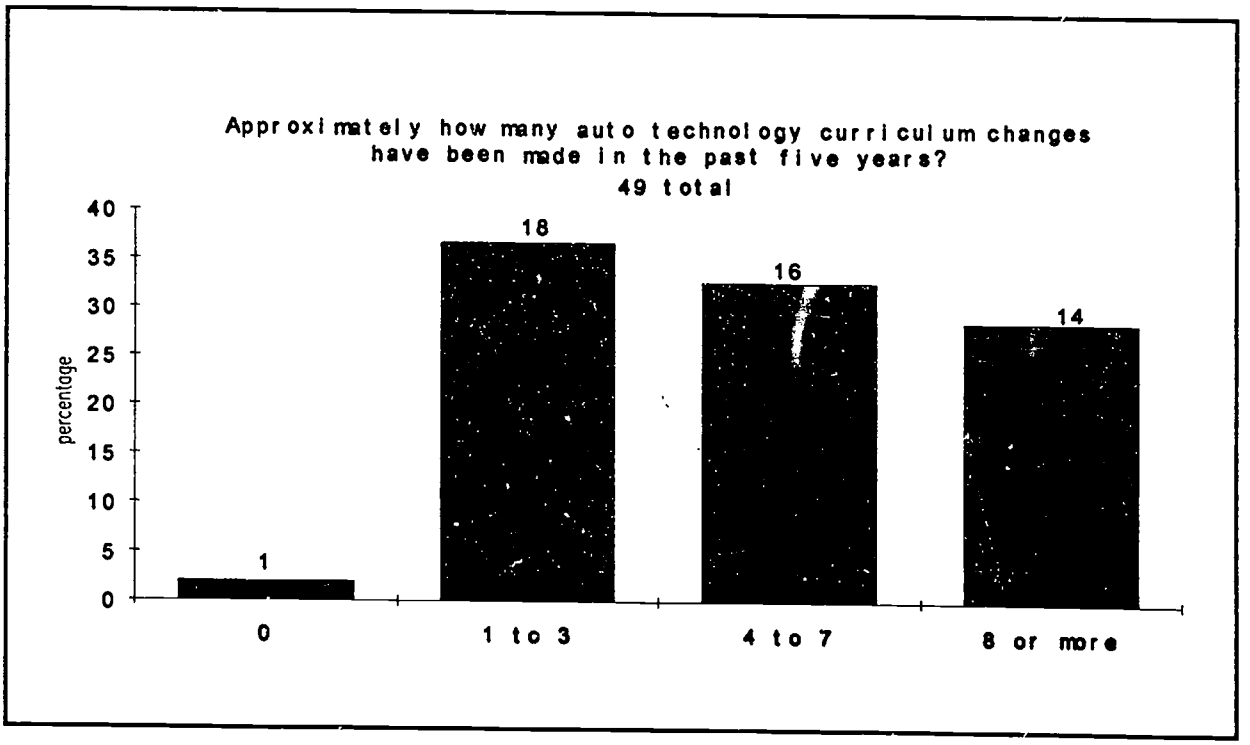


Figure #16

Most colleges explore many different avenues before making any curriculum adjustments. 87.8% of the colleges made curriculum change decisions based on input from advisory committees, local businesses, and from other instructors.

The average time frame it would take to implement a new electric vehicle program varied significantly. This can be depicted in figure #17. See Figure #17.

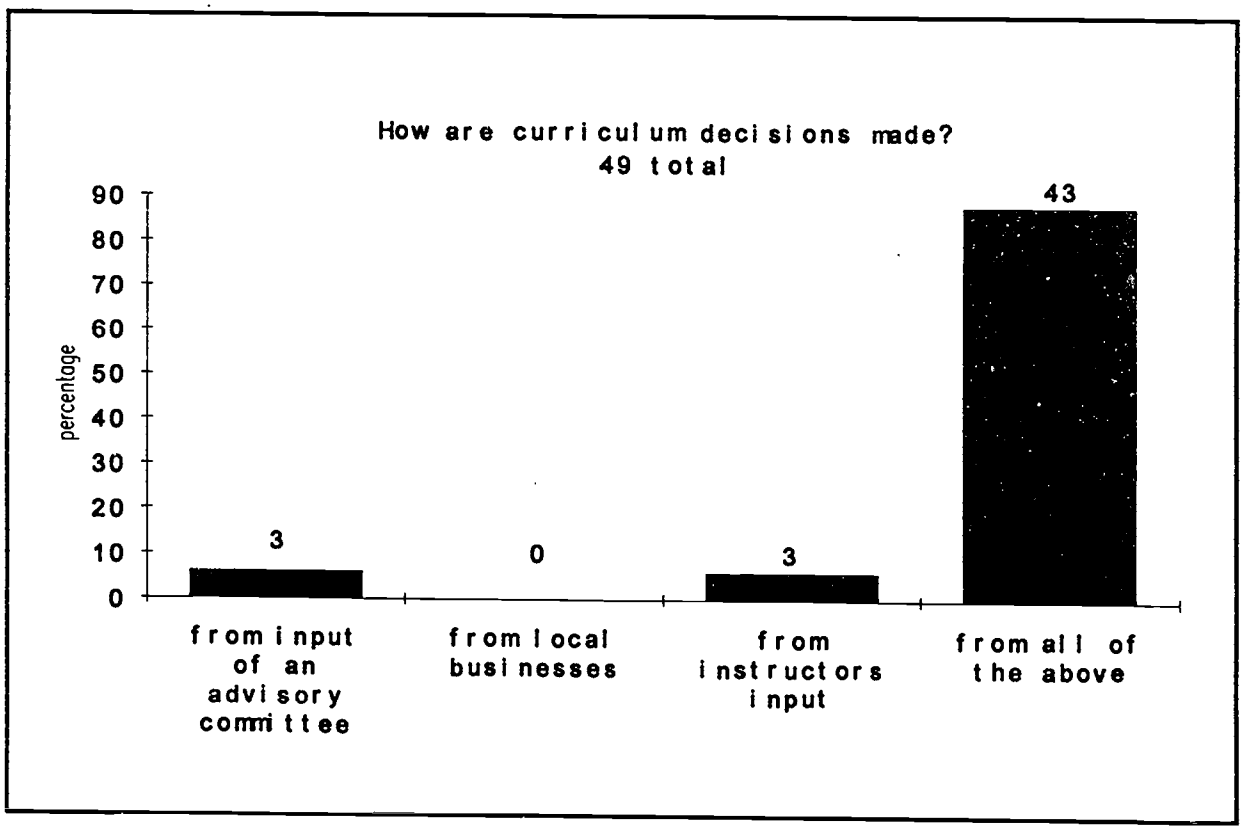


Figure #17

8. Analysis of Research Question E.

What components are necessary to develop a successful electric vehicle technology program?

To develop a successful electric vehicle program, most colleges indicated that they would require 17 to 22 students (55.1%) to be financially successful. 32.7% indicated that they would require 23 or more students. See Figure #18.

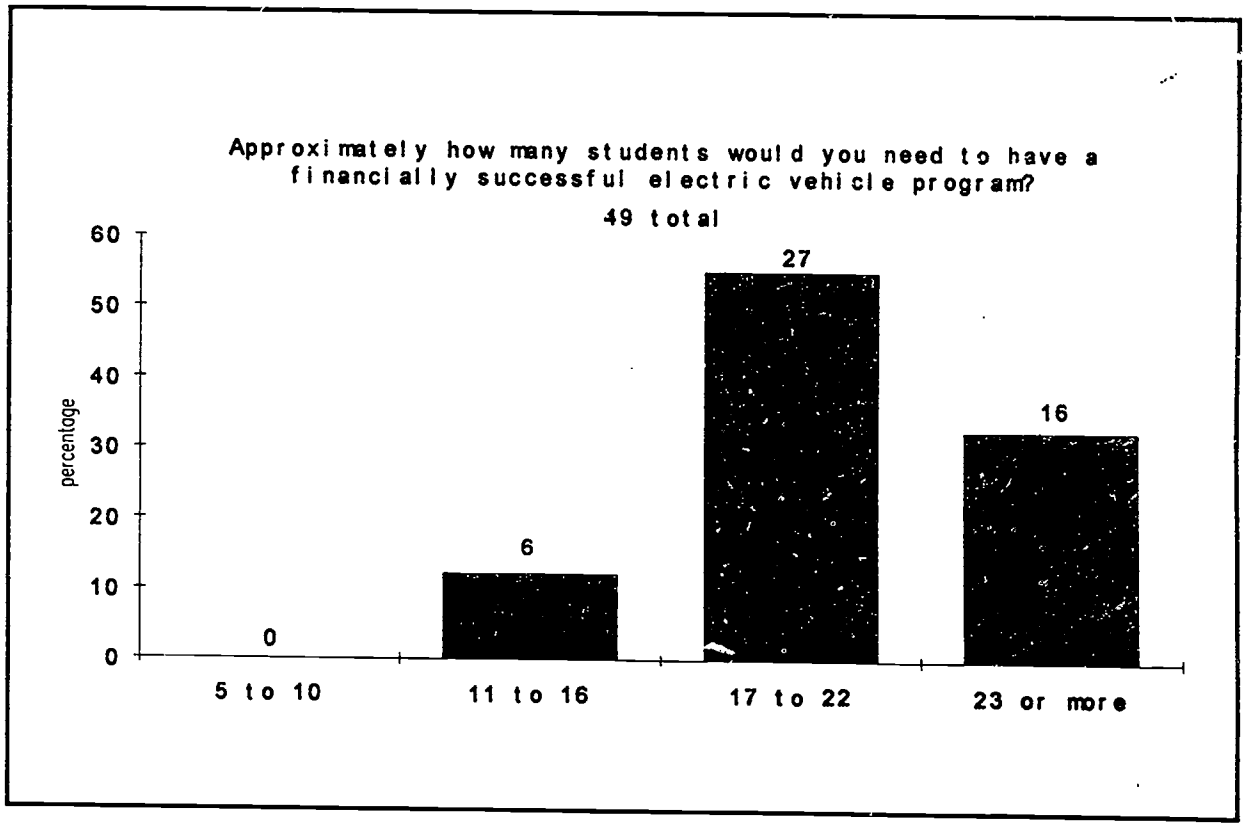


Figure #18

Successful electric vehicle programs depend on effective recruitment personnel to draw students to the program. 63.3% of the colleges did not employ a recruitment person to perform this task.

A very discouraging fact was brought to light in survey question #31. It pointed out that 61.2% of the colleges surveyed had no inquiries about electric vehicle technology. This may be a direct result of not having a recruitment person.

9. **Additional statistical information concerning electric vehicle technology.**

A. Faculty Information

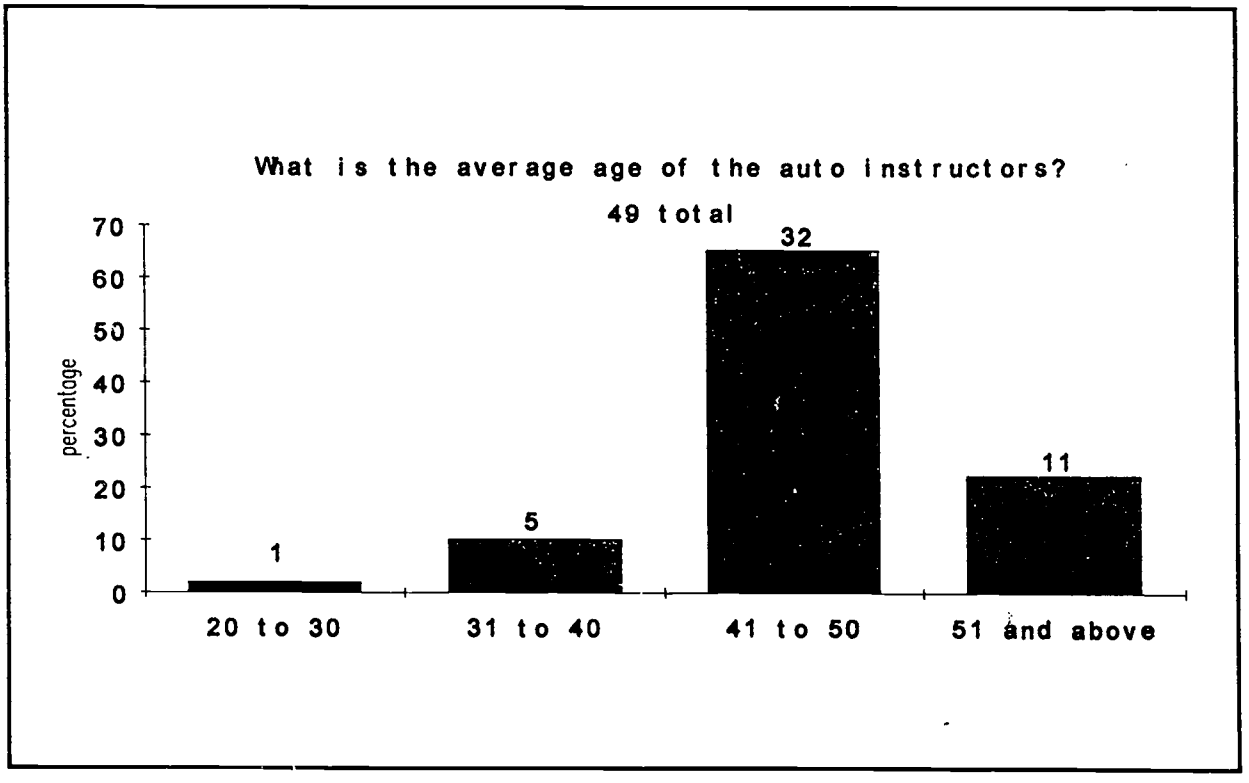


Figure #19

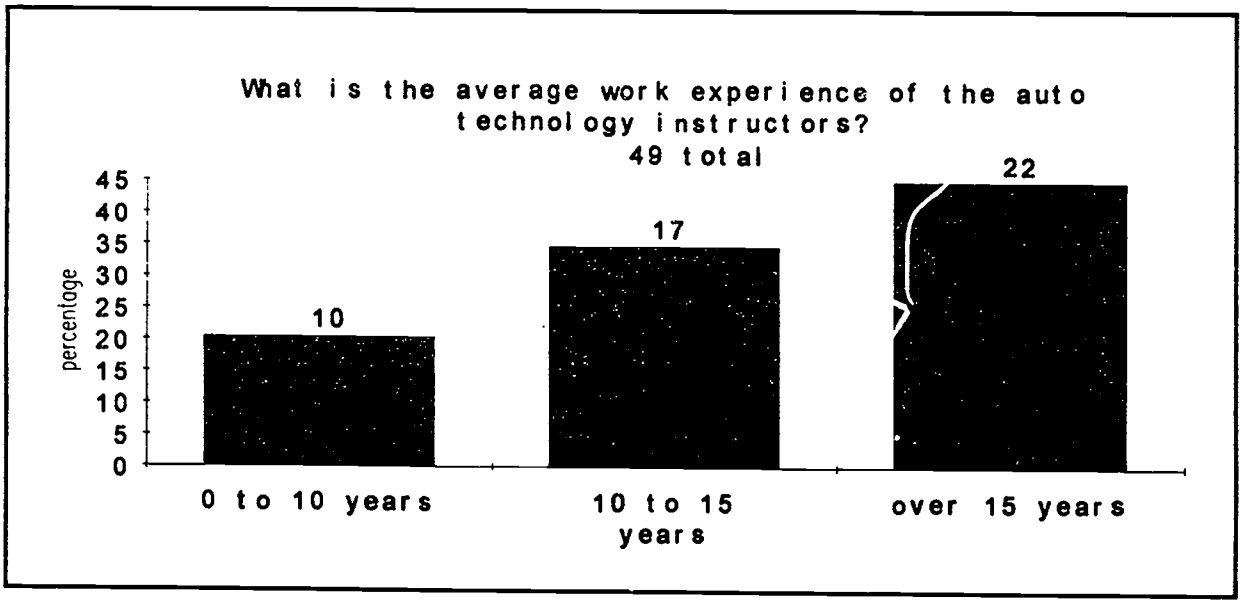


Figure #20

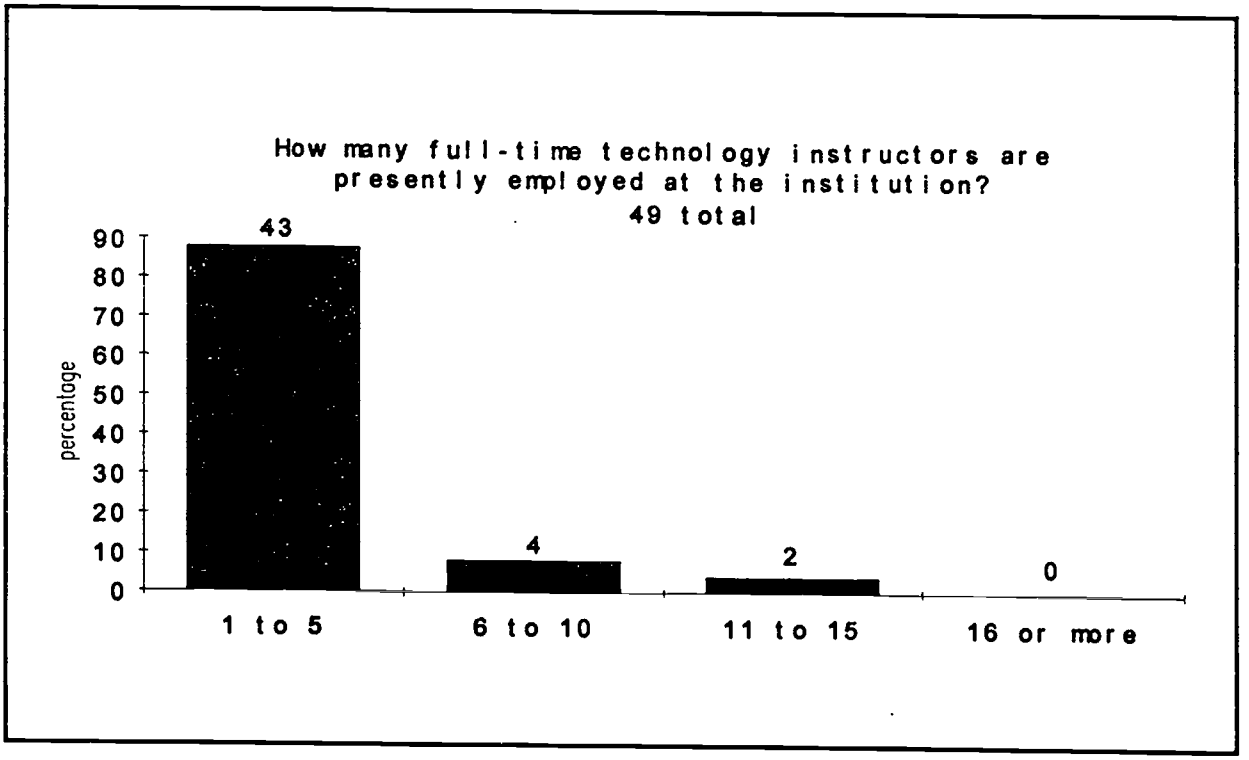


Figure #21

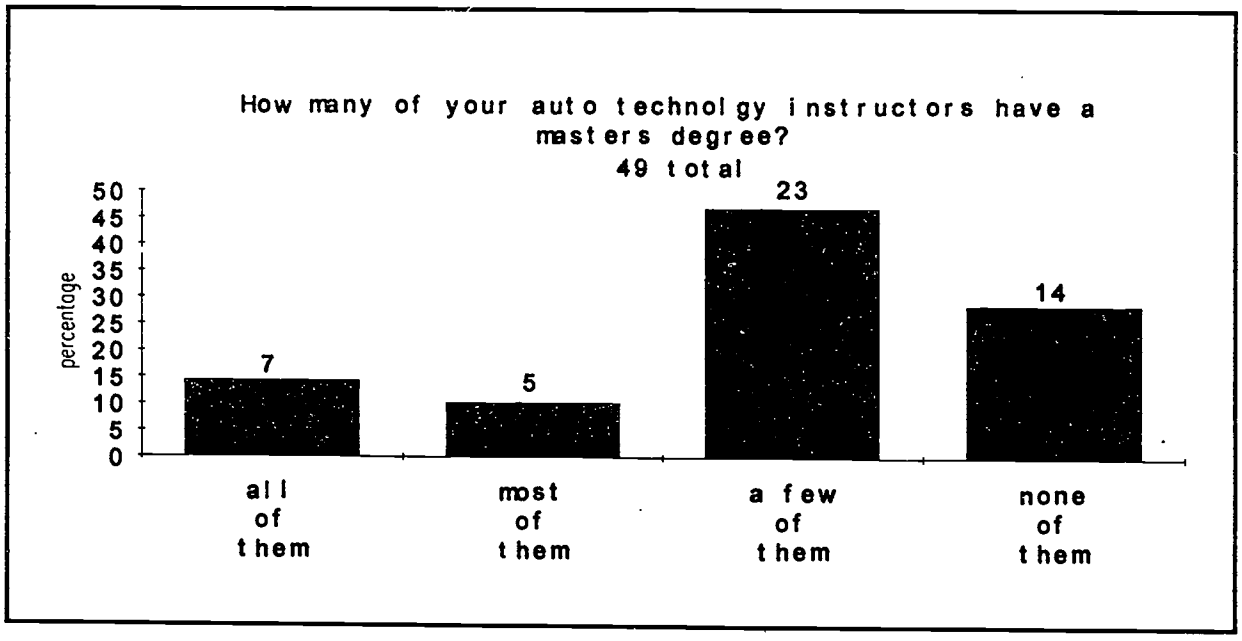


Figure #22

B. Community Information

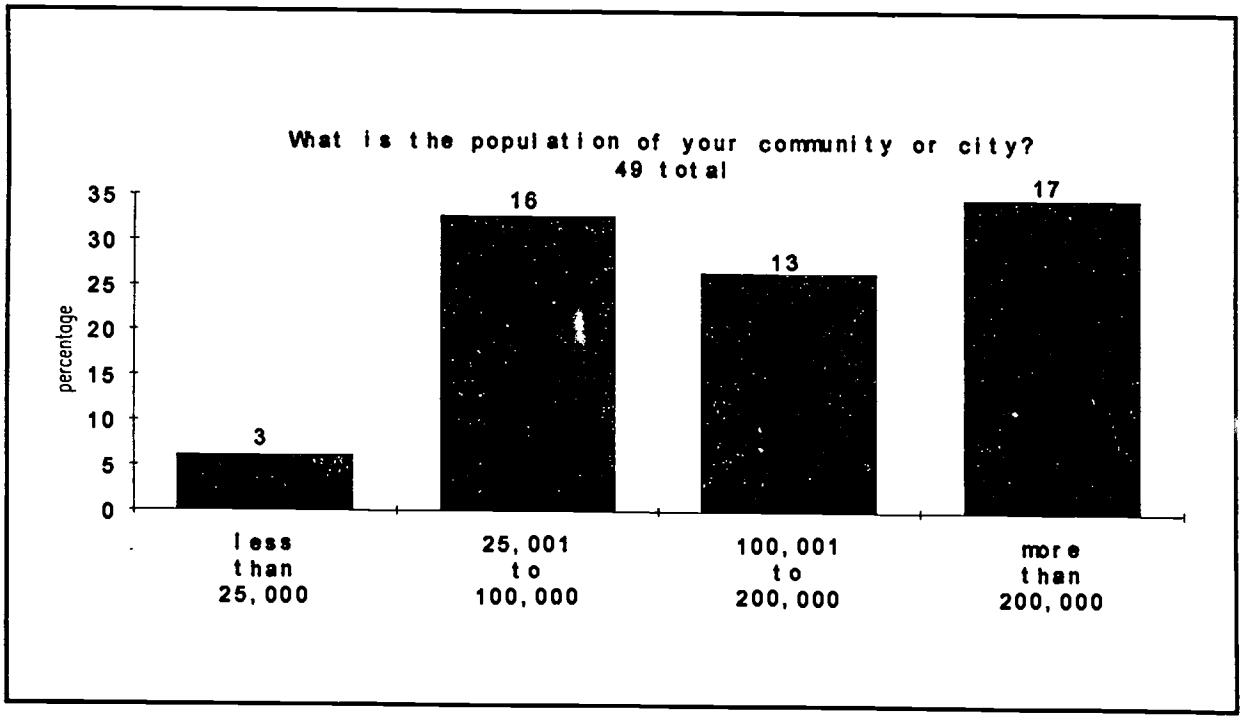


Figure #23

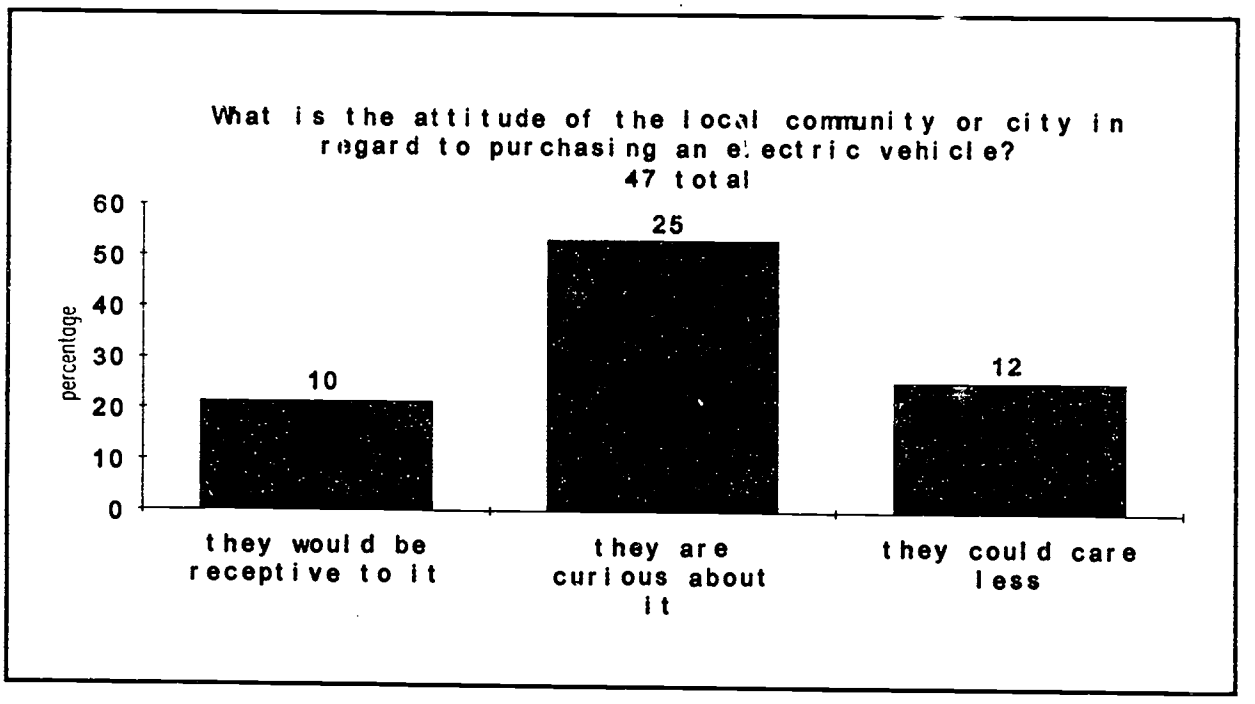


Figure #24

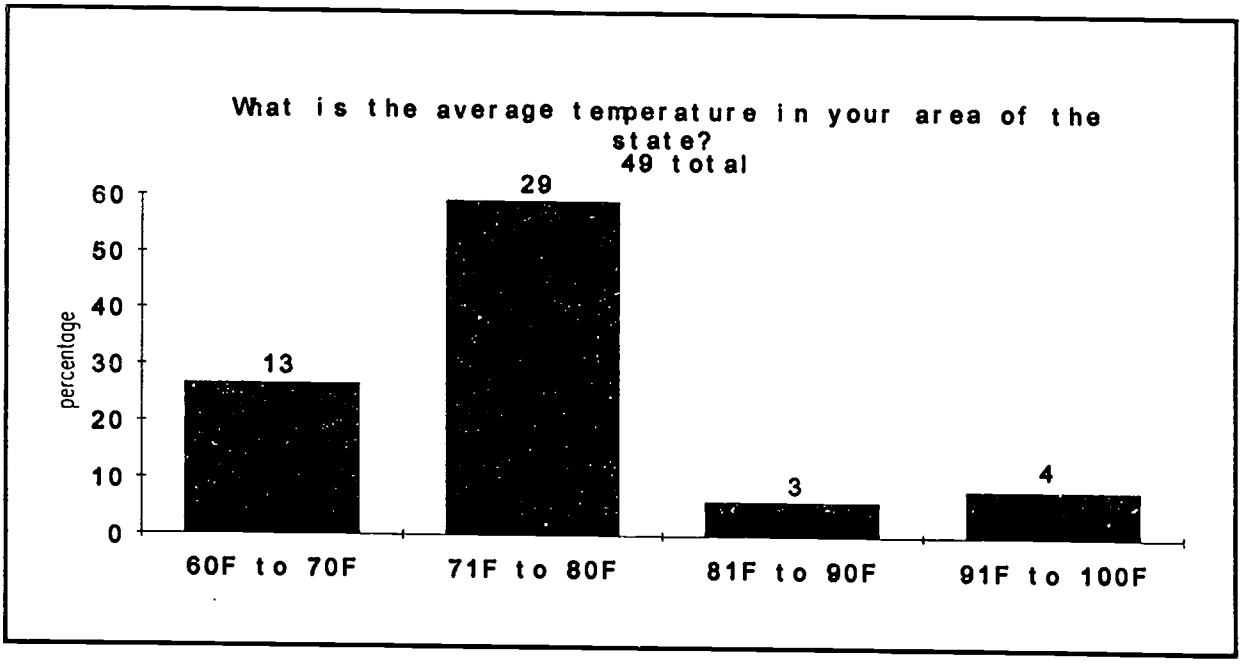


Figure #25

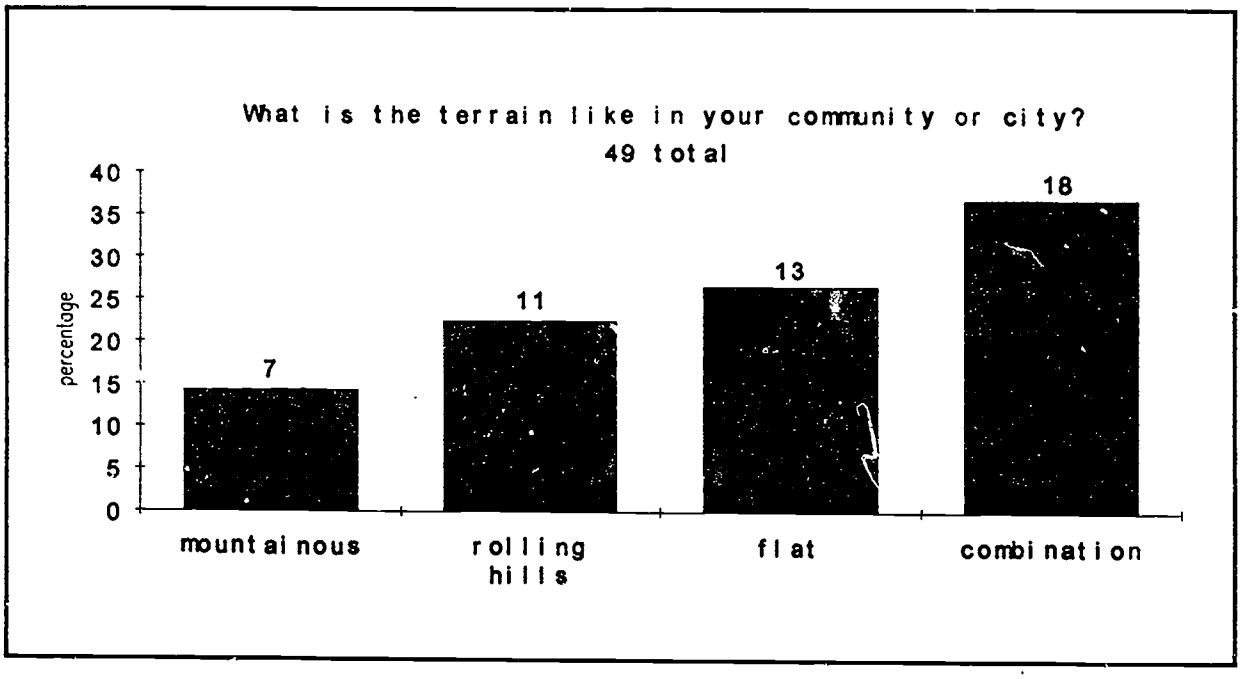


Figure #26

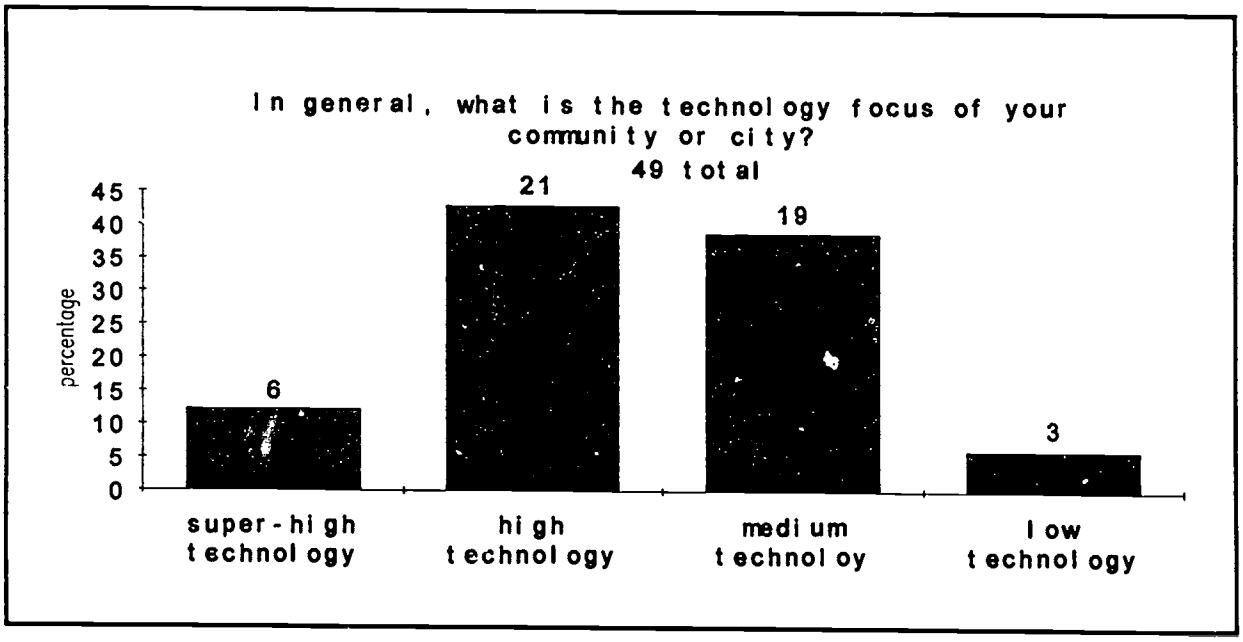


Figure #27

C. Financial Information

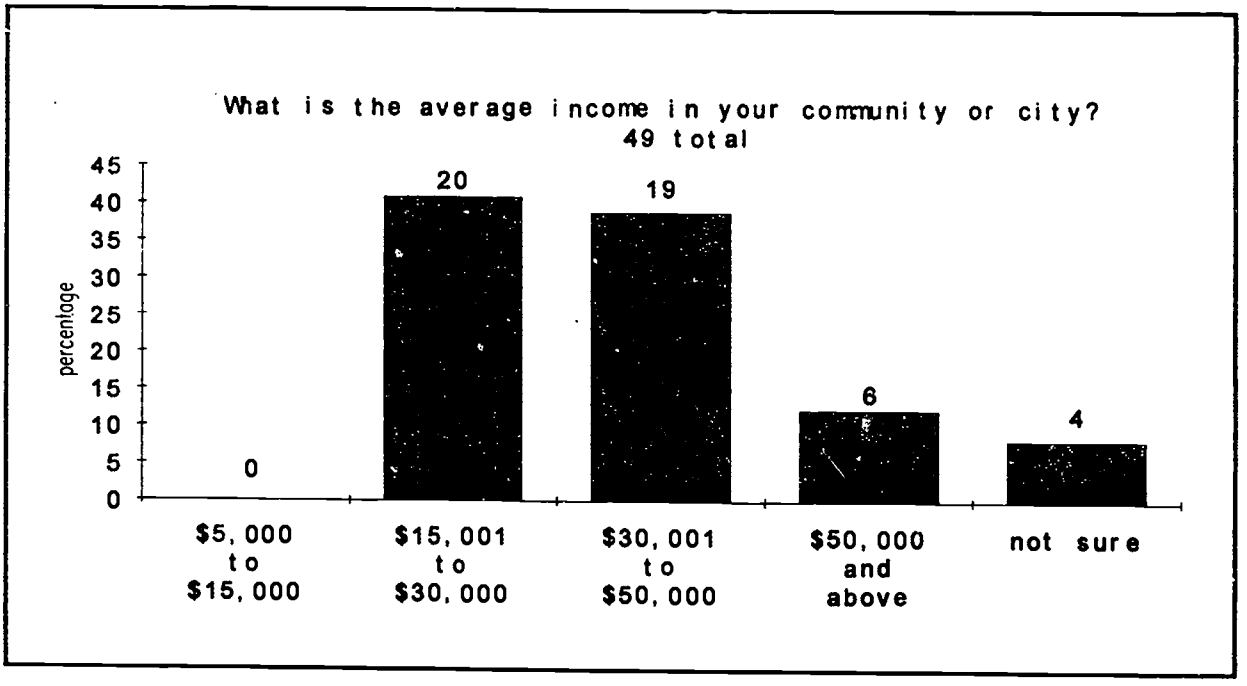
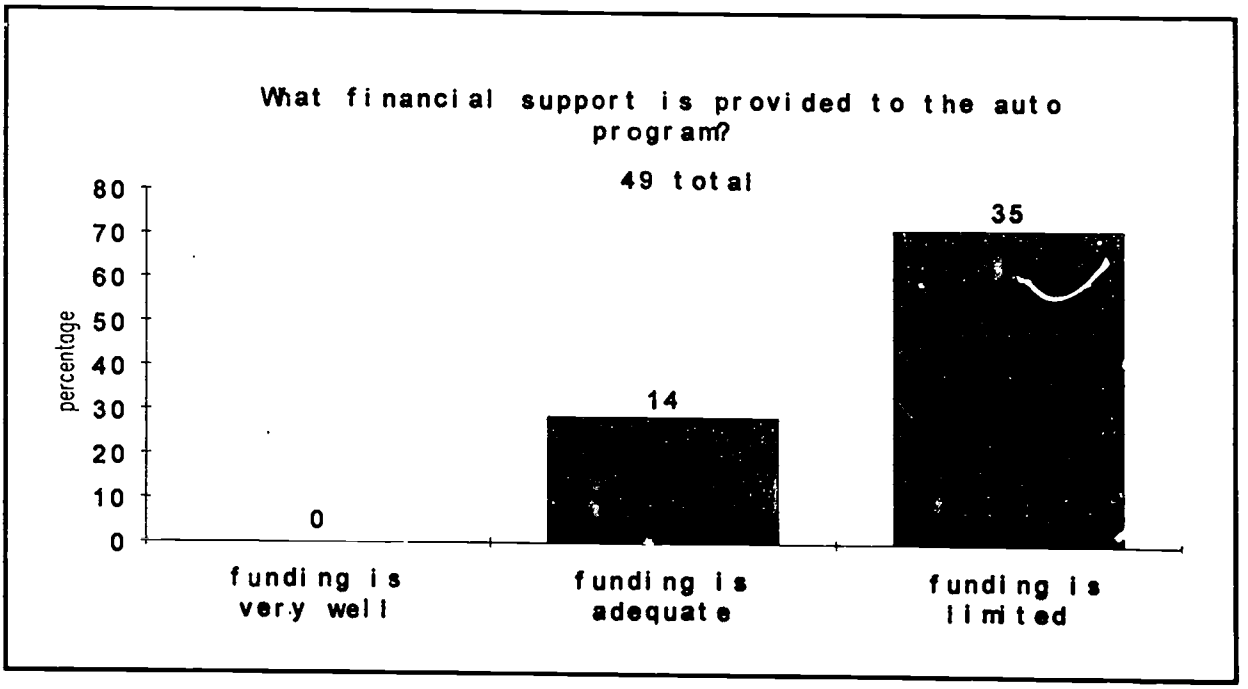


Figure #28 (above)

Figure #29 (below)



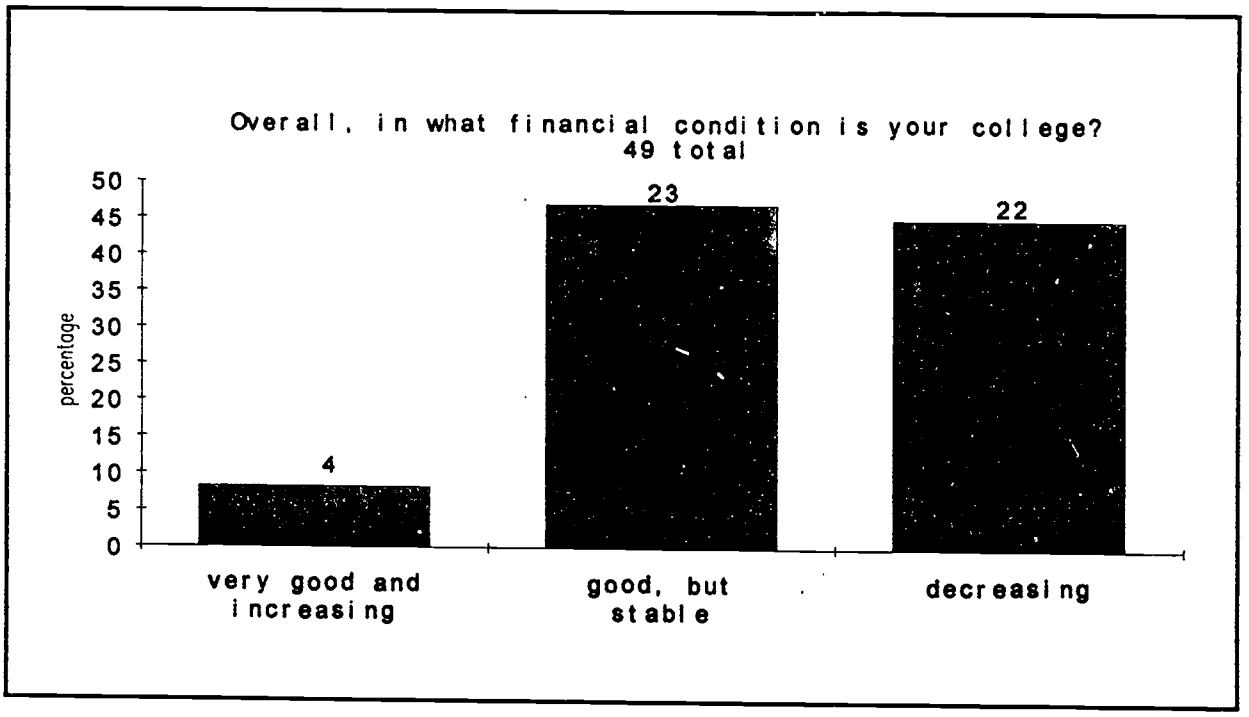
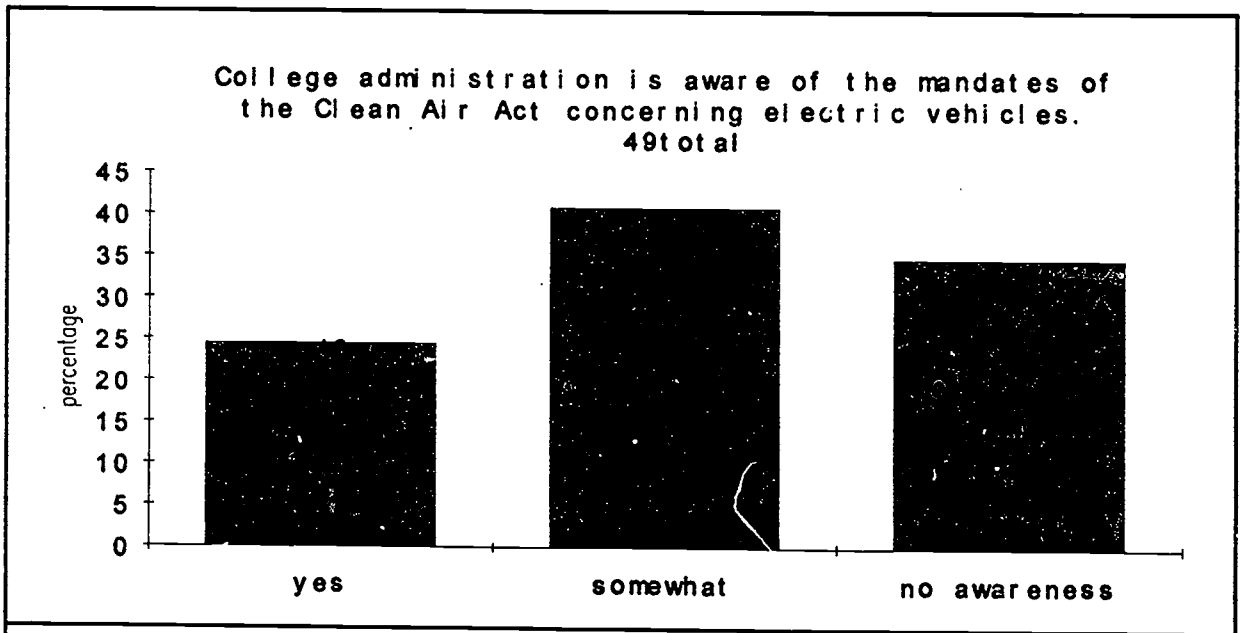


Figure #30

10. Chi-Square Analysis

The Chi-square analysis between survey questions #11 and #16 had a significant difference of .02043. Statistics in this comparison indicated that 64.5% of the California community college administrators were aware of, or at least, somewhat aware of the mandates of the Clean Air Act and yet 55.1% of college administrators had no plans to include electric vehicle technology in their auto technology program. See Figure #31.


College administration is aware of the mandates of the Clean Air Act concerning electric vehicles.
49total
percentage
45
40
35
30
25
20
15
10
5
0
yes
somewhat
no awareness

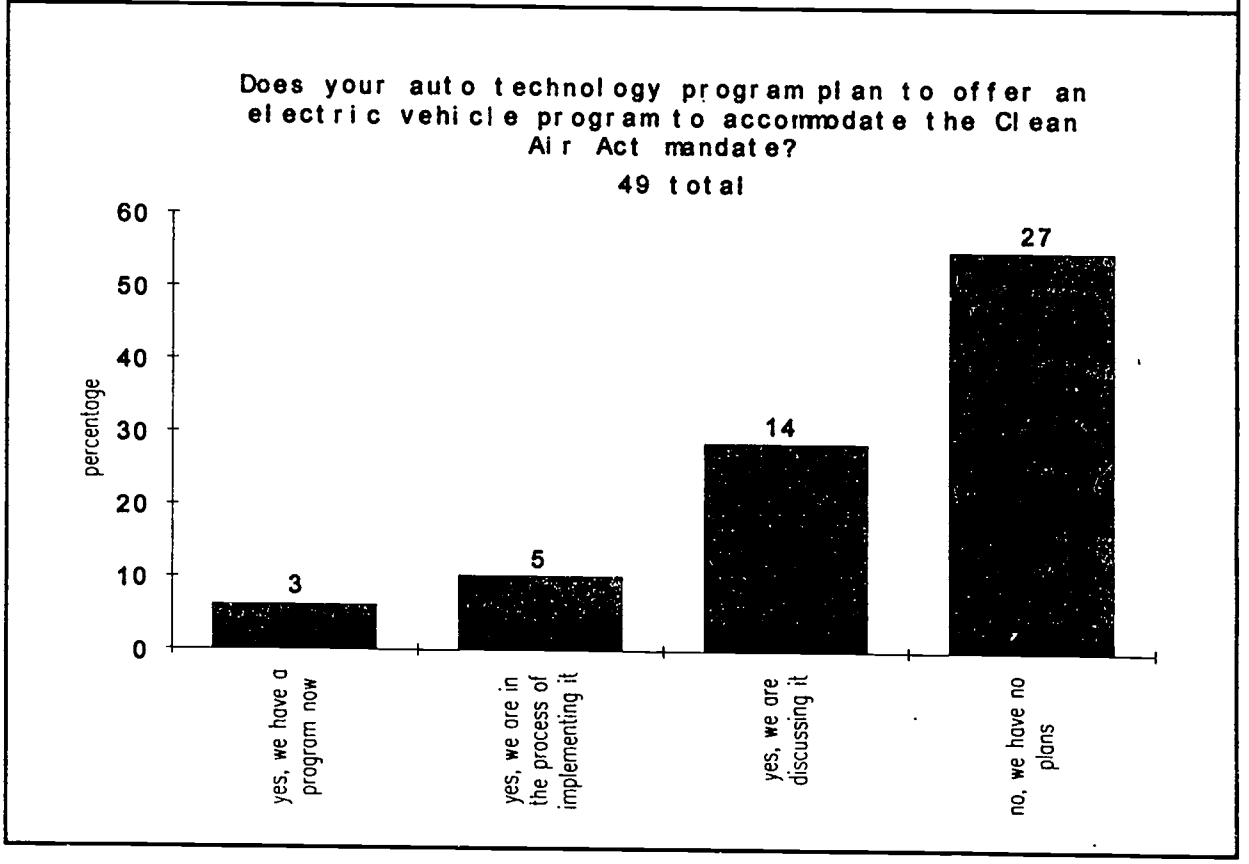

Does your auto technology program plan to offer an electric vehicle program to accommodate the Clean Air Act mandate?
49 total
percentage
60
50
40
30
20
10
0
3
5
14
27
yes, we have a program now
yes, we are in the process of implementing it
yes, we are discussing it
no, we have no plans

Figure #31

Another interesting comparison was performed between survey questions #6 and #28. The significant difference between these indices was .04284. The comparison indicated that 76.6% of the faculty would consider it a benefit to include electric vehicle technology in their auto technology program, however, 57.4% of the faculty had no plans at the present time to expand its auto technology program to include electric vehicle technology. See Figure #32.

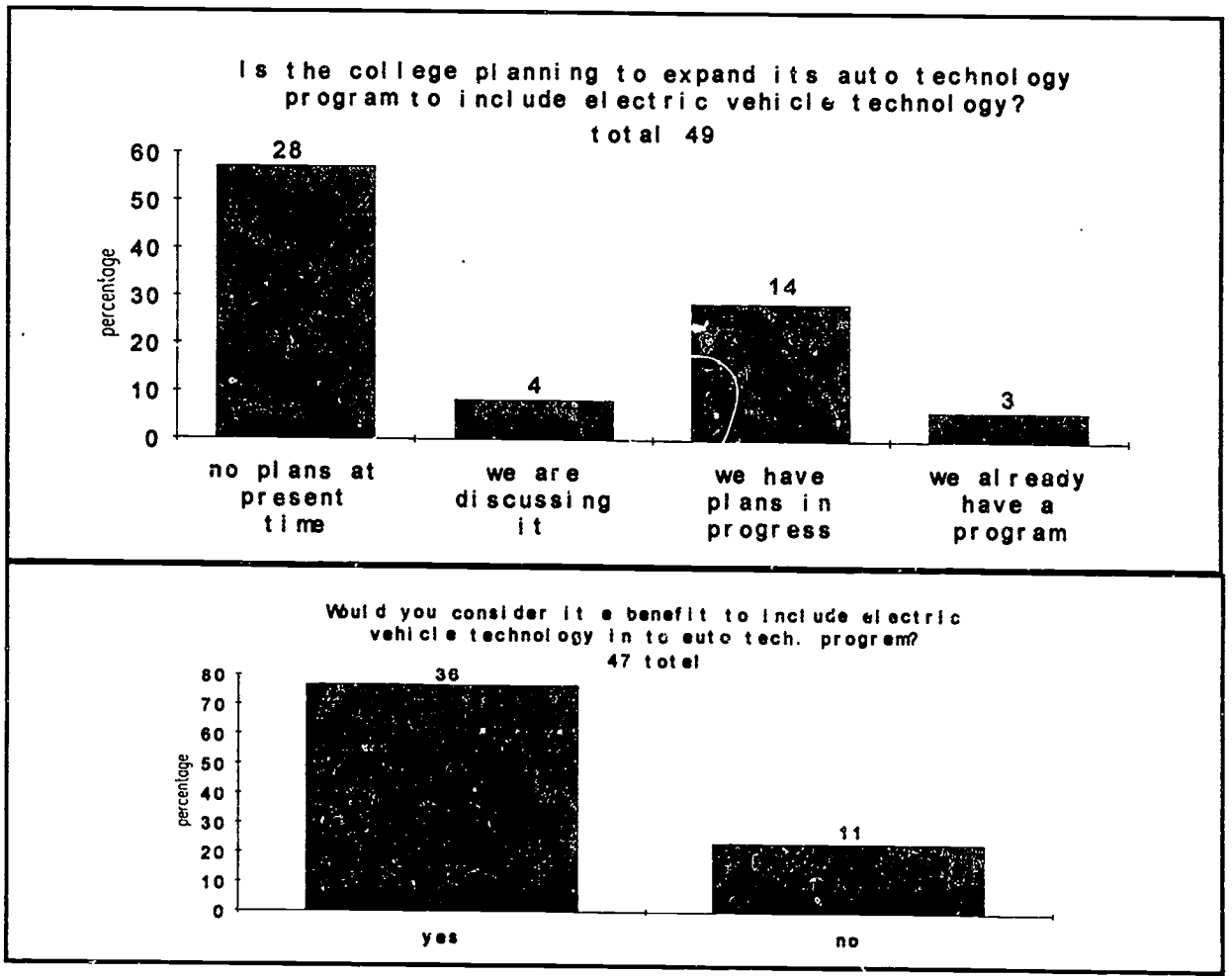


Figure #32

A third chi-square analysis was performed between survey questions #6 and #15. This comparison had a significant difference of .00203. It indicated that 56.8% of the colleges had no plans to include electric vehicle technology in their auto technology program, however, 70.2% of the colleges already had at least 1 or more components already in place that would facilitate the implementation of an electric vehicle program. See Figure #33.

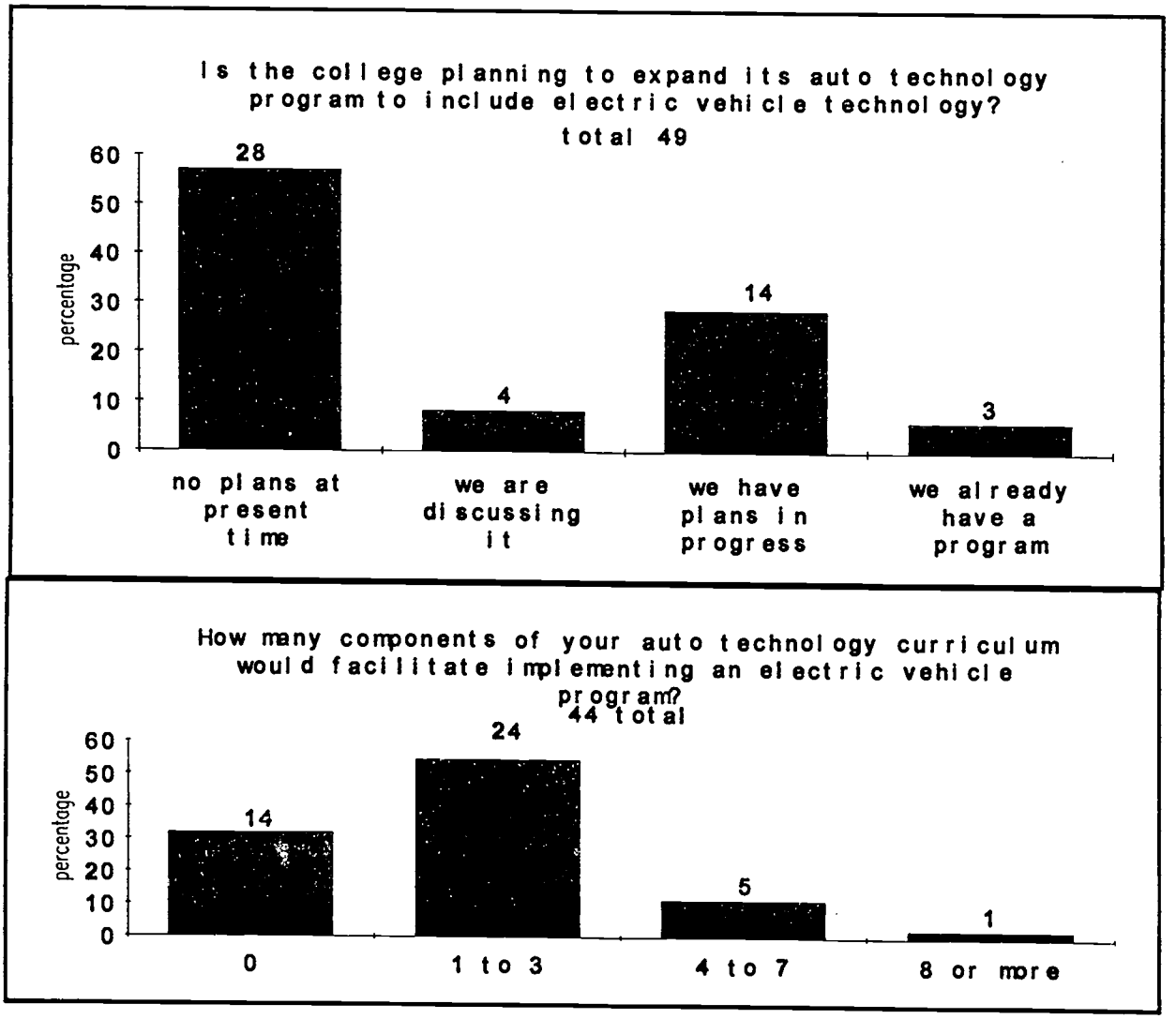


Figure #33

Chapter V: Summary and Discussion

1. Introduction

Many community colleges in California are not addressing the fact that electric vehicles will be on their state's highways in mass quantities in a very short period of time.

This study assesses the awareness level of electric vehicle technology in California community college automotive curriculums.

2. Listing of the Main Findings

A. Demographic Findings

1) Most of the community colleges in California are very large. 87.8% of the colleges have a student population of over 3000 students.

2) The majority (59.2%) of students were between 23 and 27 years of age.

3) The number of students in automotive technology programs varied quite substantially, however, programs having 200 or more students still ranked the highest with 32.7%.

4) No auto technology students and only 8 faculty presently drive an electric vehicle.

B. Data Concerning the Clean Air Act

1) 40.8% of college administration is somewhat aware of the mandates listed in the Clean Air Act and 34.7% of college administration was not at all aware of the mandates of the Clean Air Act.

2) 55.1% of automotive technology programs have no plans to offer an electric vehicle program to accommodate the Clean Air Act mandate.

C. Data concerning initiatives to include electric vehicle technology.

1) 57.1% of all the community colleges had no plan at the present time to expand their auto technology program to include electric vehicle technology.

2) Many (54.5%) of the colleges surveyed have taken some kind of initiative which will help facilitate an electric vehicle technology program.

3) 34.7% of the colleges are keeping pace with technology by purchasing new equipment for their auto technology program.

D. Awareness of certification standards

1) Electric vehicle program certification standards are presently being developed by the United States Federal Government. 36.7% of all survey respondents indicated that they were unaware of this fact. 38.8% had limited knowledge of this fact while 24.5% were aware that program certification standards are being developed.

E. Data concerning curriculum changes

1) Almost all (48 of 49) of the colleges surveyed made at least one curriculum change in the past five years.

2) 87.8% of colleges made curriculum change decisions based on input from a variety of sources.

F. Components of a successful electric vehicle program.

1) Most colleges indicated that they would require between 17 and 22 students for an electric vehicle program to be successful.

2) 63.3% of the colleges did not employ a recruitment person which correlated to the 61.2% of colleges which had no inquiries about an electric vehicle program from

interested students.

G. Chi-square findings

1) 64.5% of the California Community College administrators were aware of, or at least, somewhat aware of the mandates of the Clean Air Act and yet 55.1% of college administrators had no plans to include electric vehicle technology in their auto technology program.

2) 76.6% of the faculty would consider it a benefit to include electric vehicle technology in their auto technology program, however, 57.4% of the faculty have no plans at the present time to expand its automotive technology program to include electric vehicle technology.

3) 56.8% of the colleges had no plans to include electric vehicle technology in their auto technology program, however, 70.2% of the colleges already had at least one or more components in place that would facilitate the implementation of an electric vehicle program.

3. Conclusions Based on Main Findings

Most community colleges surveyed had a very large student population. The automotive technology programs were also quite large with most of the programs averaging more than 200 students. The average age of the students was between 23 and 27 years of age.

The survey results indicated that no students were presently driving an electric vehicle, while only eight faculty members drove an electric vehicle.

The Clean Air Act mandates will impact the California Community College

automotive technology programs, yet, most of the college administrators were not even aware of the fact that a Clean Air Act mandate even existed. The college administrators who were aware of the Clean Air Act mandate had no plans to offer an electric vehicle program in their college.

The majority of college administrators had no plans to offer an electric vehicle program, but, many did concede to include electric vehicle technology in a limited fashion in selected auto technology classes.

The United States Government is developing national certification standards for electric vehicle programs, yet, the majority of college faculty were aware of this fact.

Changing a curriculum is not always an easy task but is possible because most colleges had at least one curriculum change in the past five years. When making curriculum changes, college administrators utilized input from a variety of sources.

To develop a successful electric vehicle program, the colleges indicated that they would need between 17 and 22 students enrolled in the program. To get students enrolled in new programs such as an electric vehicle program, the college should employ a recruitment person. This would be very helpful because at the time of this survey , the colleges surveyed had very few student inquiries about the existence of an electric vehicle program.

A chi-square comparison indicated that most college administrators would consider it a benefit to include electric vehicle technology in their automotive programs yet, most were not going to initiate a program.

4. Theoretical Interpretations

The mandates of the Clean Air Act are rapidly approaching. College administrators must act immediately to include electric vehicle technology in their auto technology programs. If programs for electric vehicle technology are not developed and implemented in a timely fashion, there will be a great dissatisfaction among new electric vehicle buyers when they need service performed on their electric vehicle and there are no qualified technicians to perform the repairs. This fact alone could stagnate the future evolution of the electric vehicle.

5. Recommendations

It is strongly recommended that the California community college administrators act quick and efficiently to include electric vehicle technology in their automotive technology program.

Once they have an electric vehicle technology program in place, they must actively market the program to make it successful.

It would be of best interest to the colleges if they utilized the electric vehicle program guidelines set forth by the United States Government.

APPENDIX A

COVER LETTER AND QUESTIONNAIRE

College of Alameda

555 Atlantic Avenue

Alameda, CA 94501-2109

Dear Auto Technology Program Director: December 10, 1994

The state of California is a forerunner in new technology. Education of technological advances should always be considered top priority when making curriculum adjustments. New technology in colleges, such as the one you are at, must incorporate technological advances to insure quality and successful technical programs are maintained. In a position such as yours, I am sure that you are well aware of this fact. I would like to see auto technology education stay abreast of new developments, consequently, I have chosen to focus my graduate studies from Ferris State University to electric vehicle technology.

Since your college is located in California and you will, more than likely, be subjected to the future repairing of electric vehicles, I would like to request a few minutes of your valuable time to fill out the enclosed questionnaire.

Since you are in the educational system, I am sure that you realize the importance of questionnaires. Please use your expert judgement in answering these questions.

The field of vocational education is growing at an extremely rapid pace. Professionals, such as you and your staff, must be commended for dedicating your lives to this very important field. I hope to carry on this tradition by passing knowledge on to future generations.

Enclosed you will find a self-addressed, postage-paid envelope to return the questionnaire to my home address. Thank-you for the courtesy of your assistance.

Very sincerely yours,

James E. Keyzer

James E. Keyzer

QUESTIONNAIRE

Instructions: Please place an X on the line following the letter which best describes your answer to the question.
Note: Questions are located on both sides of page.

COLLEGE INFORMATION:

1) What is the student population of your community college?
a)___ below 500
b)___ 501 to 1500
c)___ 1501 to 3000
d)___ 3001 and above

2) What is the average age of your automotive technology students?
a)___ 18 to 22
b)___ 23 to 27
c)___ 28 to 32
d)___ 33 and above

3) How many students do you average in your automotive program?
a)___ 50 and under
b)___ 51 to 100
c)___ 101 to 200
d)___ 201 and above

4) Do any of the auto technology students presently drive an electric vehicle?
a)___ none to my knowledge
b)___ a few students (1-12)
c)___ more than a dozen

5) My college actively promotes its automotive program.
a)___ strongly disagree
b)___ disagree
c)___ neither agree nor disagree
d)___ agree
e)___ strongly agree

6) Is the college planning to expand its automotive technology program to include electric vehicle technology?
a)___ no plans at present time
b)___ we are discussing it
c)___ we have plans in process
d)___ we already have a program

7) What is the graduation percentage of auto technology students?
a)___ 90% to 100%
b)___ 80% to 89%
c)___ 70% to 79%
d)___ below 70%

8) What is the average placement percentage of auto technology graduates?
a)___ 90% to 100%
b)___ 80% to 89%
c)___ 70% to 79%
d)___ below 70%

9) How many women are enrolled in the auto technology program?
a)___ 1 to 5
b)___ 6 to 10
c)___ 11 to 15
d)___ 16 and above

10) The college automotive shop readily acquires new diagnostic equipment to keep pace with new technologies?
a)___ yes
b)___ somewhat
c)___ not adequately
d)___ no

11) College administration is aware of the mandates of the Clean Air Act concerning electric vehicles?
a)___ yes
b)___ somewhat
c)___ no awareness

CURRICULUM:

12) Does your auto technology program have a well-defined curriculum?
a)___ yes, each course is clearly defined
b)___ somewhat, instructors have latitude to modify course content
c)___ no, each instructor defines the curriculum for his/her courses

13) In your college, the process of altering a curriculum to meet new technological advancements is simple.
a)___ yes
b)___ somewhat
c)___ no

14) Approximately how many major automotive technology curriculum changes have been made in the past 5 years to compensate for advancements in technology?
a)___ 0
b)___ 1 to 3
c)___ 4 to 7
d)___ 8 or more

15) How many components of your present auto technology curriculum are in place that would facilitate the implementation of an electric vehicle program?
a)___ 0
b)___ 1 to 3
c)___ 4 to 7
d)___ 8 or more

16) Does your auto technology program plan to offer an electric vehicle technology program to accommodate the Clean Air Act mandate?
a)___ yes, we have a program now
b)___ yes, we are in the process of implementing it
c)___ yes, we are discussing it
d)___ no, we have no plans

17) If you were to include electric vehicle technology in your program, how long would it take to implement this change in your present curriculum?
a)___ 0 to 6 months
b)___ 7 to 12 months
c)___ 13 to 24 months
d)___ more than 24 months

18) How are curriculum decisions made?
a)___ from input of an advisory committee
b)___ from local businesses
c)___ from instructors input
d)___ from all of the above

19) Is electric vehicle technology presently being taught?
a)___ yes
b)___ yes, but in a limited fashion
c)___ no, not at all

20) Are you aware that there are electric vehicle program certification standards being developed?
a)___ yes
b)___ yes, but in a limited fashion
c)___ not at all

CHARACTERISTICS OF COLLEGE PERSONNEL:

21) Approximately how many college personnel presently drive an electric vehicle?
a)___ 0
b)___ 1 to 3
c)___ 4 to 7
d)___ 8 or more

22) What financial support is provided to the auto program?
a)___ funding is very well
b)___ funding is adequate
c)___ funding is limited

23) What is the average age of the auto technology instructors?
a)___ 20 to 30
b)___ 31 to 40
c)___ 41 to 50
d)___ 51 and above

24) What is the average work experience of the auto technology instructors?
a)___ 0 to 10 years
b)___ 10 to 15 years
c)___ over 15 years

25) How many full-time auto technology instructors are presently employed at the institution?
a)___ 1 to 5
b)___ 6 to 10
c)___ 11 to 15
d)___ 16 or more

26) How many of your auto technology instructors have a masters degree?
a)___ all of them
b)___ most of them
c)___ a few of them
d)___ none of them

27) What percentage of your auto technology instructors are ASE certified?
a)___ 100%
b)___ 80% to 99%
c)___ 60% to 79%
d)___ below 60%

COLLEGE VIEWS PERTAINING TO PROGRAM ENHANCEMENT:

28) Would you consider it a benefit to include electric vehicle technology in your auto technology program?
a)___ yes
b)___ no

29) Over the past 5 years, enrollment in the auto technology program has...
a)___ increased significantly
b)___ increased marginally
c)___ stayed the same
d)___ decreased

30) Does your college employ a recruitment person?
a)___ yes
b)___ no

31) Approximately how many inquiries have you received from perspective students regarding electric vehicle technology?
a)___ 0
b)___ 1 to 5
c)___ 6 to 15
d)___ 16 or more

32) Approximately how many students would you need to have enrolled in an electric vehicle technology program for it to be financially successful?
a)___ 5 to 10
b)___ 11 to 16
c)___ 17 to 22
d)___ 23 or more

33) Overall, in what financial condition is your college?
a)___ very good and increasing
b)___ good, but stable
c)___ decreasing

DEMOGRAPHIC INFORMATION:

34) What is the average temperature in your area of the state?
a)___ 60F to 70F
b)___ 71F to 80F
c)___ 81F to 90F
d)___ 91F to 100F

35) What is the population of your community or city?
a)___ less than 25,000
b)___ 25,001 to 100,000
c)___ 100,001 to 200,000
d)___ more that 200,000

36) What is the terrain like in your community or city?
a)___ mountainous
b)___ rolling hills
c)___ flat
d)___ combination

37) In general, what is the technology focus of your community or city?
a)___ super-high technology
b)___ high technology
c)___ medium technology
d)___ low technology

38) How would you rate a normal family's electric utility bill?
a)___ much higher than normal
b)___ higher than normal
c)___ normal
d)___ lower than normal
e)___ don't know

POPULATION CHARACTERISTICS:

39) In general, what is the attitude of the local community or city in regard to purchasing an electric vehicle?
a)___ they would be receptive to it
b)___ they are curious about it
c)___ they could care less

40) What is the average income in your community or city?

a)___ $5,000 to 15,000
b)___ $15,001 to 30,000
c)___ $30,001 to 50,000
d)___ $50,000 and above
e)___ not sure

APPENDIX B
PERCENTAGE OF SCORES FOR ALL SURVEY QUESTIONS

			overall n=49	discussing or have program n=21	have a program n=3
1		What is the student population of you community college?			
	a	below 500	0.00%	0.00%	0.00%
	b	501 to 1500	8.20%	0.00%	0.00%
	c	1501 to 3000	4.10%	0.00%	0.00%
	d	3001 and above	87.80%	100.00%	100.00%

			overall n=47	discussing or have program n=21	have a program n=3
2		What is the average age of your automotive technology students?			
	a	18 to 22	12.20%	14.30%	0.00%
	b	23 to 27	59.20%	61.90%	33.30%
	c	28 to 32	18.40%	19.00%	33.30%
	d	33 and above	6.10%	4.80%	33.30%

			overall n=49	discussing or have program n=21	have a program n=3
3		How many students do you average in your automotive program?			
	a	50 and under	18.40%	4.80%	0.00%
	b	51 to 100	20.40%	28.60%	66.70%
	c	101 to 200	28.60%	28.60%	0.00%
	d	201 and above	32.70%	38.10%	33.30%

			overall n=49	discussing or have program n=21	have a program n=3
4		Do any of the auto tech. students presently drive an elec. vehicle?			
	a	none to my knowledge	100.00%	100.00%	100.00%
	b	a few students (1-12)	0.00%	0.00%	0.00%
	c	more than a dozen	0.00%	0.00%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
5		My college actively promotes its automotive program.			
	a	strongly disagree	12.20%	9.50%	33.30%
	b	disagree	4.10%	4.80%	
	c	neither	30.60%	19.00%	33.30%
	d	agree	42.90%	61.90%	33.30%
	e	strongly agree	10.20%	4.80%	

			overall n=49	discussing or have program n=21	have a program n=3
6		Is the college planning to expand its auto tech. program to include E.V. technology?			
	a	no plans at present time	57.10%	0.00%	
	b	we are discussing it	8.20%	19.00%	
	c	we have plans in process	28.60%	66.70%	
	d	we already have a program	6.10%	14.30%	100.00%

			overall n=49	discussing or have program n=20	have a program n=3
7		What is the graduation percentage of auto technology students?			
	a	90% to 100%	10.40%	20.00%	33.30%
	b	80% to 89%	14.60%	10.00%	0.00%
	c	70% to 79%	20.80%	15.00%	33.30%
	d	below 70%	54.20%	55.00%	33.30%

			overall n=49	discussing or have program n=21	have a program n=3
8		What is the avg. placement percentage of auto tech. students?			
	a	90% to 100%	26.50%	28.60%	33.30%
	b	80 % to 89%	16.30%	9.50%	0.00%
	c	70% to 79%	30.60%	33.30%	0.00%
	d	below 70%	26.50%	28.60%	66.70%

			overall n=49	discussing or have program n=21	have a program n=3
9		How many women are enrolled in the auto technology program?			
	a	1 to 5	67.30%	38.10%	0.00%
	b	6 to 10	12.20%	19.00%	0.00%
	c	11 to 15	14.30%	28.60%	33.30%
	d	16 and above	6.10%	14.30%	66.70%

			overall n=49	discussing or have program n=21	have a program n=3
10		The college auto shop readily acquires new diagnostic equip. to keep pace with new technologies.			
	a	yes	34.70%	38.10%	0.00%
	b	somewhat	42.90%	38.10%	33.30%
	c	not adequately	20.40%	23.80%	66.70%
	d	no	2.00%	0.00%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
11		College administration is aware of the mandates of the Clean Air Act concerning EV's.			
	a	yes	24.50%	38.10%	33.30%
	b	somewhat	40.80%	52.40%	66.70%
	c	no awareness	34.70%	9.50%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
12		Does your auto tech. program have a well-defined curriculum?			
	a	yes, each course is clearly defined	83.70%	81.00%	66.70%
	b	somewhat, instructors have latitude to modify course content	16.30%	19.00%	33.30%
	c	no, each instructor defines the curriculum for his/her courses	0.00%	0.00%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
13		In your college, the process of altering a curr. to meet new technological advancements is simple.			
	a	yes	28.60%	33.30%	0.00%
	b	somewhat	55.10%	47.60%	66.70%
	c	no	16.30%	19.00%	33.30%

			overall n=49	discussing or have program n=21	have a program n=3
14		Approximately how many auto tech. curr. changes have been made in the past 5 years?			
	a	0	2.00%	0.00%	0.00%
	b	1 to 3	36.70%	28.60%	66.70%
	c	4 to 7	32.70%	33.30%	0.00%
	d	8 or more	28.60%	38.10%	33.30%

			overall n=49	discussing or have program n=19	have a program n=2
15		How many components of your auto tech. curr. would facilitate implemeting an E.V. program?			
	a	0	31.80%	15.80%	0.00%
	b	1 to 3	54.50%	63.20%	50.00%
	c	4 to 7	11.40%	15.80%	0.00%
	d	8 or more	2.30%	5.30%	50.00%

			overall n=49	discussing or have program n=21	have a program n=3
16		Does your auto tech. pgm. plan to offer an E.V. pgm. to accommodate the Clean Air Act Mandate?			
	a	yes, we have a program now	6.10%	9.50%	66.70%
	b	yes, we are in the process of implementing it	10.20%	23.80%	33.30%
	c	yes, we are discussing it	28.60%	61.90%	0.00%
	d	no, we have no plans	55.10%	4.80%	0.00%

			overall n=49	discussing or have program n=20	have a program n=2
17		How long would it take to implement an E.V. program in your present curriculum?			
	a	0 to 6 months	34.00%	40.00%	100.00%
	b	7 to 12 months	38.30%	45.00%	0.00%
	c	13 to 24 months	19.10%	10.00%	0.00%
	d	more than 24 months	8.50%	5.00%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
18		How are curriculum decisions made?			
	a	from input of an advisory committee	6.10%	0.00%	0.00%
	b	from local businesses	0.00%	0.00%	0.00%
	c	from instructors input	6.10%	0.00%	0.00%
	d	from all of the above	87.80%	100.00%	100.00%

			overall n=49	discussing or have program n=21	have a program n=3
19		Is electric vehicle technology presently being taught?			
	a	yes	4.10%	9.50%	66.70%
	b	yes, but in a limited fashion	26.50%	47.60%	33.30%
	c	no, not at all	69.40%	42.90%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
20		Are you aware that there are E.V. program certification standards being developed?			
	a	yes	24.50%	19.00%	33.30%
	b	yes, but in a limited fashion	38.80%	47.60%	33.30%
	c	not at all	36.70%	33.30%	33.30%

		overall n=49	discussing or have program n=21	have a program n=3
21	Approximately how many college personnel presently drive an electric vehicle?			
a	0	83.70%	71.40%	66.70%
b	1 to 3	12.20%	23.80%	33.30%
c	4 to 7	2.00%	0.00%	0.00%
d	8 or more	2.00%	4.80%	0.00%

		overall n=49	discussing or have program n=21	have a program n=3
22	What financial support is provided to the auto program?			
a	funding is very well	0.00%	0.00%	0.00%
b	funding is adequate	28.60%	28.60%	33.30%
c	funding is limited	71.40%	71.40%	66.70%

		overall n=49	discussing or have program n=21	have a program n=3
23	What is the average age of the auto technology instructors?			
a	20 to 30	2.00%	0.00%	0.00%
b	31 to 40	10.20%	4.80%	0.00%
c	41 to 50	65.30%	81%	100.00%
d	51 and above	22.40%	14.30%	0.00%

		overall n=49	discussing or have program n=21	have a program n=3
24	What is the average work experience of the auto technology instructors?			
a	0 to 10 years	20.40%	14.30%	0.00%
b	10 to 15 years	34.70%	28.60%	66.70%
c	over 15 years	44.90%	57.10%	33.30%

		overall n=49	discussing or have program n=21	have a program n=3
25	How many full-time auto technology instructors are presently employed at the institution?			
a	1 to 5	87.80%	85.70%	66.70%
b	6 to 10	8.20%	14.30%	33.30%
c	11 to 15	4.10%	0.00%	0.00%
d	16 or more	0.00%	0.00%	0.00%

		overall n=49	discussing or have program n=21	have a program n=3
26	How many of your auto technology instructors have a masters degree?			
a	all of them	14.30%	9.50%	0.00%
b	most of them	10.20%	4.80%	0.00%
c	a few of them	46.90%	47.60%	33.30%
d	none of them	28.60%	38.10%	66.70%

		overall n=49	discussing or have program n=21	have a program n=3
27	What percentage of your auto technology instructors are ASE certified?			
a	100%	75.50%	90.50%	100.00%
b	80% to 99%	14.30%	4.80%	0.00%
c	60% to 79%	2.00%	0.00%	0.00%
d	below 60%	8.20%	4.80%	0.00%

		overall n=47	discussing or have program n=20	have a program n=3
28	Would you consider it a benefit to include E.V. technology in to auto tech. program?			
a	yes	76.60%	95.00%	100.00%
b	no	23.40%	5.00%	0.00%

			overall n=49	discussing or have program n=20	have a program n=3
29		Over the past 5 years, enrollment in the auto technology program has...			
	a	increased significantly	33.30%	40.00%	0.00%
	b	increased marginally	35.40%	30.00%	66.70%
	c	stayed the same	27.10%	30.00%	33.30%
	d	decreased	4.20%	0.00%	0.00%

			overall n=48	discussing or have program n=21	have a program n=3
30		Does your college employ a recruitment person?			
	a	yes	36.70%	42.90%	33.30%
	b	no	63.30%	57.10%	66.70%

			overall n=49	discussing or have program n=21	have a program n=3
31		Approx. how many inquiries have you received from perspective students regarding E.V. tech.?			
	a	0	61.20%	33.30%	0.00%
	b	1 to 5	32.70%	57.10%	100.00%
	c	6 to 15	6.10%	9.50%	0.00%
	d	16 or more	0.00%	0.00%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
32		Approx. how many students would you need to have a financially successful E.V. program?			
	a	5 to 10	0.00%	0.00%	0.00%
	b	11 to 16	12.20%	19.00%	0.00%
	c	17 to 22	55.10%	42.90%	66.70%
	d	23 or more	32.70%	38.10%	33.30%

			overall n=49	discussing or have program n=21	have a program n=3
33		Overall, in what financial condition is your college?			
	a	very good and increasing	8.20%	14.30%	0.00%
	b	good, but stable	46.90%	52.40%	33.30%
	c	decreasing	44.90%	33.30%	66.70%

			overall n=49	discussing or have program n=21	have a program n=3
34		What is the average temperature in your area of the state?			
	a	60F to 70F	26.50%	19.00%	33.30%
	b	71F to 80F	59.20%	76.20%	66.70%
	c	81F to 90F	6.10%	0.00%	0.00%
	d	91F to 100F	8.20%	4.80%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
35		What is the population of your community or city?			
	a	less that 25,000	6.10%	0.00%	0.00%
	b	25,001 to 100,000	32.70%	33.30%	33.30%
	c	100,001 to 200,000	26.50%	28.60%	33.30%
	d	more than 200,000	34.70%	38.10%	33.30%

			overall n=49	discussing or have program n=21	have a program n=3
36		What is the terrain like in your community or city?			
	a	mountainous	14.30%	4.80%	33.30%
	b	rolling hills	22.40%	23.80%	33.30%
	c	flat	26.50%	28.60%	33.30%
	d	combination	36.70%	42.90%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
37		In general, what is the technology focus of your community or city?			
	a	super-high technology	12.20%	4.80%	0.00%
	b	high technology	42.90%	57.10%	33.30%
	c	medium technology	38.80%	33.30%	66.70%
	d	low technology	6.10%	4.80%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
38		How would you rate a normal family's electric bill?			
	a	much higher than normal	6.10%	42.90%	0.00%
	b	higher than normal	30.60%	52.40%	33.30%
	c	normal	49.00%	0.00%	66.70%
	d	lower than normal	6.10%	0.00%	0.00%
	e	don't know	8.20%	4.80%	0.00%

			overall n=47	discussing or have program n=21	have a program n=3
39		What is the attitude of the local community or city in regard to purchasing an E.V.?			
	a	they would be receptive to it	21.30%	19.00%	33.30%
	b	they are curious about it	53.20%	66.70%	66.70%
	c	they could care less	25.50%	14.30%	0.00%

			overall n=49	discussing or have program n=21	have a program n=3
40		What is the average income in your community or city?			
	a	$5,000 to $15,000	0.00%	0.00%	0.00%
	b	$15,001 to $30,000	40.80%	42.90%	33.30%
	c	$30,001 to $50,000	38.80%	33.30%	66.70%
	d	$50,000 and above	12.20%	14.30%	0.00%
	e	not sure	8.20%	9.50%	0.00%

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