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Gender Inequality in Technology Education

Kurt M. Konsela

GENDER INEQUALITY IN TECHNOLOGY EDUCATION

by

Kurt M. Konsela

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Chairperson

Dean
School of Graduate Studies

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This study looks at the gender inequality in technology education. The problem is examined first by looking at careers involving technology and why the majority of people in these fields are male. After examining technical careers, colleges with degrees in technology are examined to find if females are in low numbers here. Finally, high schools around the Twin Cities metropolitan area are examined to see how many females enroll in technology education classes.

PROBLEM:

There is a lack of females enrolling in Technology Education.

FINDINGS:

Two hundred female students responded to a survey about technology education in their high school, and 63 (31.5%) of the participants had taken at least one class. There were 17 (9%) participants that had taken multiple technology education classes at the high school. The participants were asked in the survey if more females would be interested in taking technology education classes if the high school would offer an all female technology education class. 74 participants said that more females would take an all female education class. The class that would be most beneficial to have an all female class format is a class in general automobile care.

CONCLUSIONS:

There were several conclusions which were drawn as a result of the review of literature and the survey results. The responses indicated that 100% of participants that had taken a technology education class at the high school enjoyed the experience. Secondly, students who had taken a technology education class did so because they were interested in the subject. Thirdly, the survey indicated a large number of females are interested in pursuing a career in a technical field. There were 411 responses from the participants who thought it would be interesting to pursue some kind of a career in a technical field. Finally, the survey indicated that 74 (37%) of the participants believe that more females would register for technology education class if it was an all female class. Two classes offered at the Buffalo High School were selected by the

participants that they believe would do well in an all female class format. The classes are Introduction to Drafting and Introduction to Woods.

May 2005
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Approved by Research Committee:

Balsy Kasi Chairperson

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INTRODUCTION

Gender Gaps in Careers

Gender equity continues to be a problem from technology education classroom to technical careers. According to the National Science Foundation Report (NSFR) (1994), in 1990, Women constituted 52% of the U.S. population and 46% of the labor force in all occupations, but only 22% in the science and technology related fields including Industrial Technology. The report showed women's numbers in technology fields are not increasing proportionally with the population in the United States. According to Brown (2001), "the percentage of women working in the field of information technology today is drastically lower than the percentage of total women in the actual work force, and this statistic continues to drop" (p. 1).

These numbers have caused problems inside the work place. According to Hanmer (1996), "women are 1/2 the world's people; they do 2/3 the world's work; they earn 1/10 the world's income; they own 1/100 of the world's property" (p. 11). Technology careers certainly has gained its own respect in the workplace ranging from computer programming to aviation but the number of women in these fields are far below the number of men. Women are still doing the cheap manual labor; they are working harder than the average man and getting paid less (Brown, 2001).

Women Enrolled in College

The state of Minnesota has 46 two and 4-year colleges. Women have increased their numbers in these colleges. In 1999, the graduating class of liberal arts baccalaureates was 57% women and 43% men. This is up from 43% women in 1970 and less than 24% women in 1950. In schools across the United States, which concentrate on technology careers, men still vastly outnumber the women. More men are hired in professions that offer higher starting salaries than those entered as liberal arts graduates (Howard, 1999).

Carnegie Mellon University cited its male/female ratios in engineering, see Figure 1.1, which is often associated with technology majors. Carnegie Mellon University posts these numbers in an effort to prepare females in advance for a high number of male students in their classes. The belief at Carnegie Mellon University is that with advanced warning dealing with these differences is easier. According to the State of Minnesota (2001), the state of Minnesota had 46 technical schools in 2001. The technical schools with the largest female percentages are the schools with traditional female dominated programs such as nursing, liberal arts, and health services.

Women have reduced gender gaps in liberal arts colleges and in some technical schools. They still have a long way to go at equalizing the ratios in male dominated fields such as computer programming, engineering, and other highly technical fields (Erbe, 1999).

Type of Engineering	Female % of Class	Male % of class
Chemical	35%	65%
Civil	23%	77%
Electrical & Computer	7%	93%
Mechanical	8%	92%
Materials Science	6%	94%

Source: (Erbe, 1999)

Figure 1.1

Carnegie Mellon University's Male/Female Percentages in Engineering Programs

Females in Technology Education

Females in public schools have the opportunity to be introduced to technology education in Minnesota. Middle schools across Minnesota offer a seventh or eighth grade technology education classes. Student experiences vary from program to program. Some students are introduced to the traditional wood and metal shops; others are introduced to new labs with computer graphics and Computer Numerically Controlled (CNC) machines in them.

In Minnesota high schools, technology education classes are usually electives. Students are starting to plan what they are going to do after 4 years of high school. Students have a limited amount of electives that they can register for and still stay on pace to graduate. One example, the Buffalo High School is on a block schedule which means a student has to fill 64 singletons in their high school career. After all the

required classes are filled a student is left to fill 33 singletons in their schedules. Most males and females pick traditional paths to follow. Data from the State of Minnesota Carl Perkins surveys show 72,137 females and 98,473 males took Career and Technical classes. The highest percentages for females were in the areas of Arts and Communication (64%), Health Services (82%) and Human Resources (72%). Traditionally, these areas are high in female numbers.

Central Minnesota Data

Classroom numbers from the Wright Technical Center, located in Buffalo Minnesota, support the national statistics. Wright Technical Center is a consortium of high schools located throughout Wright County that teach Vocational Education classes. In the 1999-2000 school year, female enrollment accounted for only 33% of the total school population. One of the classes, with the highest female enrollment, was a class on maternity, possibly skewing the numbers. In 2002, at Buffalo High School, a suburban school of the Twin Cities, the percentage of females in Technology classes was 13% (Buffalo High School, 2002).

Contribution of women and their perspectives are needed in technology fields. A woman's influence on products that women use the majority of the time, like compact cars, curling irons or sewing machines might have looked different if a women's point of view was there in the early stages of development (Richardson, 2000). To get females interested in technology careers, technology education classes need to have females in them to develop their interest in technical careers. As long as the percentage of females in technology education classes remains where they are

now, society will always be lacking a female's perspective in the world's environment.

Statement of Problem

There is a lack of females enrolling in Technology Education.

Statement of the Purposes

1. Provide information for suburban technology education teachers regarding female percentages in technology education classes.
2. Provide data for technology education curriculum writers to write female friendly technology curriculum that will help increase enrollment percentages for females in technology education classes.
3. Contribute to the increase in females in technology education classes in suburban Minnesota schools.

Research Questions

1. To what extent are females enrolling in Technology Education classes?
2. What are the key factors that contribute to low female enrollment in high school Technology Education elective classes?
3. What can be done to increase female participation in technology education classes?

Statement of the Need

Female ratios are significantly lower in technology education classes than other elective classes offered in high schools. At the Buffalo High School females account for 13% of the technology education classroom population. In Art it is 55%, Physical Education 22% (9th and 10th graders must take at least one physical education class), Family and Consumer Science 64% and Business Education 42%. Technology Education programs are missing a large number of school-aged females to share its knowledge about a subject that offers many opportunities for a career (Buffalo High School, 2003).

Corporations are not blinded by the absence of females in technical fields. Ford has pledged 2.5 million dollars to support female involvement in technical programs. According to Smith College (2001):

> "Ford Motor Company has made this commitment to Smith as a model for bringing women and minorities into the engineering field and into the workforce," said Jacques Nasser, Ford CEO and president. "We know that diversity of genders, races, nationalities and beliefs is a great competitive advantage. We can't get to where we want to go without women as leaders." (p. 2)

Women are half the world's population. In the Technology Education classroom women only represent about 13-20% of the classroom population. The world of technology is losing great minds to other fields of work and in the process it is losing a female's point of view. According to Dr. Kathy Richardson (2001), researcher at Compaq Computers:

> I really like technology, but most of it is designed by men, and I think that they bring their perspective of the world into it. There's a lot of technology that, if it were designed somewhat differently, would be really neat. In my

> personal life, I make things that I truly want and that fit me in a very personal way, such as meals, or furniture in my house. As a technologist, I've always built things for somebody else who I didn't really care about. (p. 1)

Old stereotypes must change. A woman's influence on a new product, women as technology education instructors and women as leading engineers are all necessary in the world today.

Assumptions

1. The information from the Children, Family, and Learning Center of Minnesota for the determination and evaluation of Gender Equality is accurate in their reports.
2. The information collected from the surveys in the Methodology will be from a broad base of female students.

Delimitations

1. Male/Female ratio numbers will be selected from four suburban schools of the Twin Cities, which have similar technology education programs and school enrollment size.
2. Colleges and schools with traditional Technology Education programs are only being compared in this study.
3. Only technical careers with sufficient information available are being compared.

Procedures

The following procedures will be used to complete the study:

1. Identification of the problem and purpose.
2. A review of literature will be completed to identify Gender Equality in suburban schools in Minnesota specifically around the Twin Cities. The research facilities utilized include Inter Library Loan and St. Cloud State Library.
3. Female high school students will be randomly selected and asked to respond to a survey.
4. A survey instrument will be developed and reviewed by the thesis committee.
5. Data from the survey will be entered into a Database so data can be analyzed for similarities and differences.
6. Information found from the surveys will be put into tables and figures and explained.
7. Recommendations and conclusions will be expressed in the final chapter of this study.

Terminology

For the purpose of this study, the following definitions were used:

Delimitations: According to Best and Kahn (1998), "Are the boundaries of the study" (p. 38).

Gender Gap: For this thesis, it will refer to the difference between male and female statistics.

Technology Education: According to the International Technology Education Association (ITEA) (1995), Curriculum that "is problem-based learning utilizing math, science and technology principles" (p. 1).

Suburb: According to Webster's II Dictionary (1984), " Residential area or community outlying a city" (p. 1156).

Suburban: According to Webster's II Dictionary (1984), "Located or living in a suburb" (p. 1156).

Stereotype: According to Valian (1998), "A term which tends to connote an inaccurate and negative view of a social group" (p. 104).

Technical Career: A career that utilizing math, science, and technology principles to solve problems in industry.

Twin Cities: According to Gousha (1996), "The cities Minneapolis and St. Paul, Minnesota."

Summary

The purpose of this chapter has been to provide an overview of the problem to be investigated. This chapter included an introduction to the study, the statement of the problem, the statement of the purpose, the statement of the need and the statements of the assumptions and limitations. The chapter also contained the statement of terminology that will be used throughout the study.

Chapter II

REVIEW OF LITERATURE

Introduction

Women enrolled in technology education classes have been low or non-existent throughout history. These low enrollment numbers correspond to the low numbers of women entering technical fields of study and careers. The information found here helps support the fact that women are not registering for Technology Education classes and technical fields of study. The information also supports that women are under represented in fields of technological employment.

Barriers for Women

Women choosing careers in technology not only have a long hard fight in front of them; they have history against them. According to Kasi (August 2000):

> Throughout most of its history, science and technology in the U.S. has been principally the domain of men. A few women made some progress early in the 20th century in entering technical fields. But the Great Depression, World War II and the G.I. Bill, and the general tenor of the culture during the subsequent years produced barriers to women and relatively few women were able to surmount these barriers. (p. 3)

It is not just past historical events that have slowed or stopped women from entering fields of technology. Congress, in 1999, was trying to eliminate a 25-year-old program aimed at promoting females' education in elementary and high schools. Under

the Women's Educational Equity Act, the federal government provides teaching materials, projects, and programs to schools to eliminate gender bias. The government has also permitted states and localities to use federal money for programs encouraging girls to pursue careers and advanced degrees in math, science, engineering, and technology (Eilperin, 1999).

There are still more circumstances that hinder women from becoming involved in technical careers. Women have to fight through stereotypes in technical careers. Women interested in computers and computer career opportunities are labeled as geeks. Women are then less likely to pursue interests because of this labeling (Zehr, 1998). Another stereotype is one that is found in schools across the country. This stereotype is that males and females alike feel that technology education classes are "guy" classes. Females perceive technology education classrooms as dirty, hence unfeminine. Technology Education classrooms are usually located in remote parts of the building away from the core classes; where sexist, dehumanizing comments from male students occur, and technology education classes are in sorts a dumping ground for academically challenged students (Wonacott, 2002).

Women and Technical Careers

The percentage of women working in the field of information technology, in 2004, is drastically lower than the percentage of women in the work force, and this statistic continues to drop. Females are not taking advantage of the opportunities that await them in careers involving information technology. Young women must dispel nervousness when considering a career in information systems (Brown, 2001).

Information technology is a fast-growing field with a need for skilled workers, but at present, women hold only 20% of the jobs (Gibson, 2002). In the United States women make up 50% of the Internet users, 38% of users in Japan, and 37% in China. Although women are an increasing proportion of Internet and Information Technology (IT) users, they are underrepresented among designers, leaders, and managers in the IT world. Female representation in mid-to upper level IT-related jobs is still quite low. Only 9% of engineers, 28.5% of computer programmers, and 26.9% of systems analysts in the U.S. are women. Only among data entry workers do women make up the majority at 85% (Taggart & O'Gara, 2000).

Many companies that use technology in some phase of production, assembly, or manufacturing want more female input. Ann Bynum, manager, external research, applications research lab, Intel Corporation, Portland, Oregon says that, "Women bring a special perspective to engineering and designing products because they look holistically at people's needs. And technology must be created for people—not just as an interesting solution to a problem" (Wheeler, 2000). According to Wheeler (2000):

> Intel's support of women is evident in a myriad of ways–from hosting a Women In Technology 2000 conference for women's history month, to initiatives that focus on career options for women in the field of technology, to a committee created specifically for women in science and engineering. (p. 1)

Beyond the Women in Technology conference, Intel has created the Intel Foundation, which funds undergraduate scholarships for women. Recruiters for Intel frequently attend engineering conferences and talk to women about the company (Wheeler, 2000).

Intel is interested in hiring women for the following reasons, according to Wheeler (2000):

> And in order to design technology aimed at women, companies such as Intel recognize the value of having women on the team–on both the technology, design, and marketing sides–understanding intuitively the particular needs of women.

Ford Motor Company has also made a commitment to start new innovative ways to bring women into engineering by generously pledging $2.5 million in support of the Picker Engineering Program. The donation will be used to help support academic programs, outreach, recruitment and scholarships to female engineering students (Smith College, 2001).

Mullins gives one explanation why women's numbers in these careers are low. According to Mullins (2001),

> There are few women in technology fields, compared to others, because girls aren't encouraged to take math and science courses in school. But girls should be encouraged because there is a shortage of highly-skilled technicians of any gender in the field. (p. 1)

Women that have made the leap into the technical fields of work have had support. According to Gibson (2002):

> In addition to the desire for a challenging career, many women said support from men–fathers, husbands, teachers, friends or male co-workers–influenced their decision to enter the IT field. Almost two-thirds of the women surveyed cited encouragement by male figures in their lives as a major factor in their career selection. (p. 1)

The natural rebellious attitude of a teenage child may also indicate why child do not follow in their parents' footsteps. A Junior Achievement poll of 1,000 teens between ages of 13 and 18 shows that 78% of teens say they are not interested in

following in their parents' career paths, up from 76% last year. Comparing genders, 82.5% of females were not interested, while 76.1% of males were not interested. However, teenagers do rely on helping adults to provide them with career guidance. Teenagers list teachers/counselors as their number one source for career information.

A woman's father's occupation may lead her to a technical career. Of the women surveyed with technical careers, 27% have a father that holds a career in science, math, or engineering, a proportion that far exceeds the number of people engaged in these jobs nationally, which is about 5%. Other persuaders include high school teachers and college professors, including male mentors, also proved to be highly influential in women's choices to pursue information technology careers (Gibson, 2002). Women with fathers who have a technical degree follow in their fathers footsteps more frequently than the average teenager. According to a survey published by the USA TODAY newspaper, see Figure 2.1, teenagers want to pursue a career of their father's 11% of the time, and their mother's career only 4%.

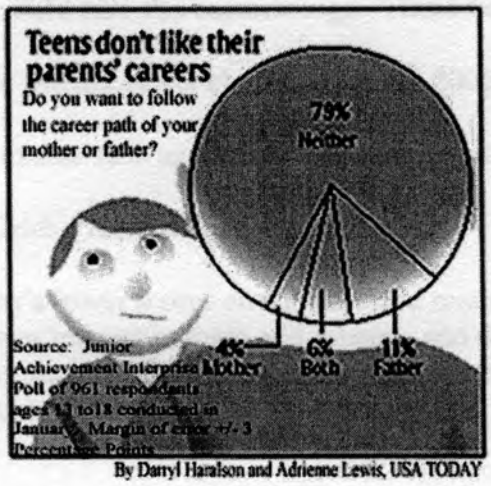


Figure 2.1

USA TODAY Snapshot

Female Graduates with Degrees in Technology

Across the United States, more females are going to liberal arts colleges and earning degrees more than ever before. Across the nation the average female population on campus is 55.8%. The Department of Education projects that by 2008 women will outnumber men 9.2 million to 6.9 million in undergraduate and graduate programs. In one particular school, Hastings College, the female ratio has ranged from 52% to 54%, amounting to between 44 and 90 more women on campus than men. This is typical for small liberal arts colleges around the country (Oltmans, 1999).

However, fewer females are entering the field of computer science. In 1985, women received 36% of the computer science Bachelor's degrees to only 28% in 1995 (Lanius). Throughout the United States, men dominate courses in traditionally male trades like electrical engineering and plumbing while women make up about 97% of the

students in such fields as child care and cosmetology. These fields of study that females are pursuing are often low-paying career choices (Collins, 2002).

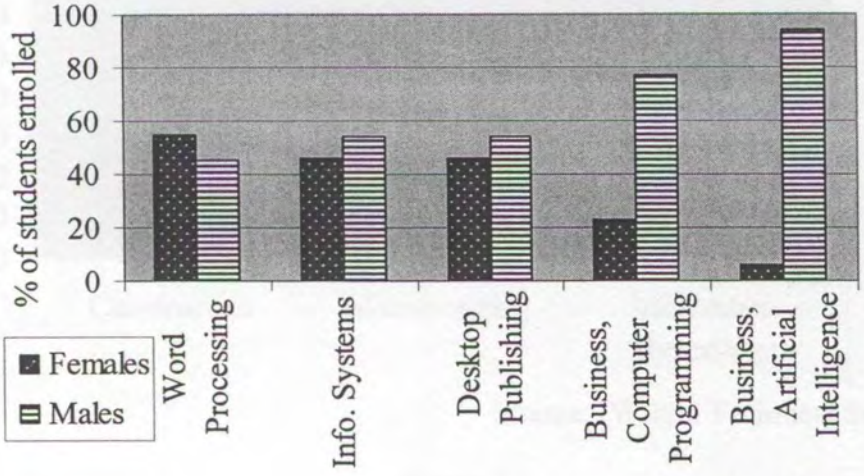
College entrance exams such as the SAT test may have influenced females from enrolling in technology fields. According to Valian (1999):

> Because of women's lower scores on standardized mathematical tests like the SAT, their lower interest in math and science, and their inaccurate judgments of their mathematical abilities, few women become engineers and natural scientists.

Females Enrolled in Technology Education

With everything that is new in Technology Education, females still lack equal representation in Technology Education classes. Technology Education classes that have been traditionally strong with females such as visual technology are still there but as new technologies emerge, females are not registering for these new classes. Some of these new classes would be bio-technology and Computer Aided Drafting (CAD) courses. Females are registering for some Technology Education classes. As Figure 2.2 shows, female ratios are above or close to one to one with males in the areas of Word Processing, Information Systems, and Desktop Publishing. In Montana in 1980, females accounted for half of enrollment in only one high school technical education course–51% of Graphics Arts students were female. Female enrollment was less than 10% in all other high school technical education courses. Similarly, in the state of Virginia in 1995, only one high school technical education course, Communications Technology, had about 50% female enrollment. In the 32 remaining high school

technical education courses, female enrollment was less than 15% in 27 courses and less than 10% in 17 courses (Wonacott, 2002).

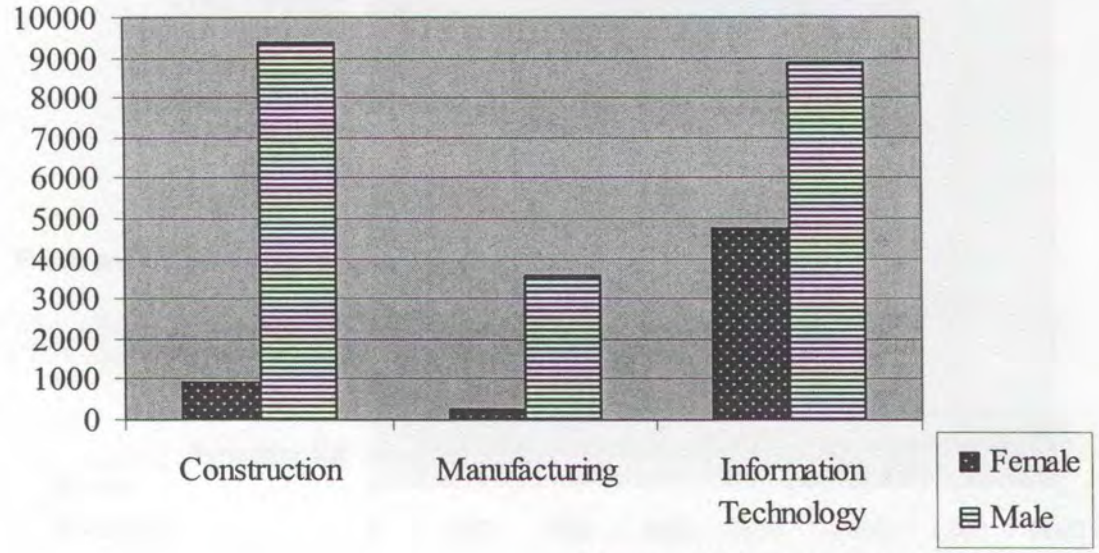


Source: (Savvy, 2000)

Figure 2.2.

U.S. Student Enrollment in Technology Classes by Gender

In the state of Minnesota females enrolling in Technology Education related fields follow the same percentages from Figure 2.2. From the Carl Perkins Annual Report–TECH PREP 2002-2003, see Figure 2.3, the number of females enrolling in Technology Education fields follows the national averages.

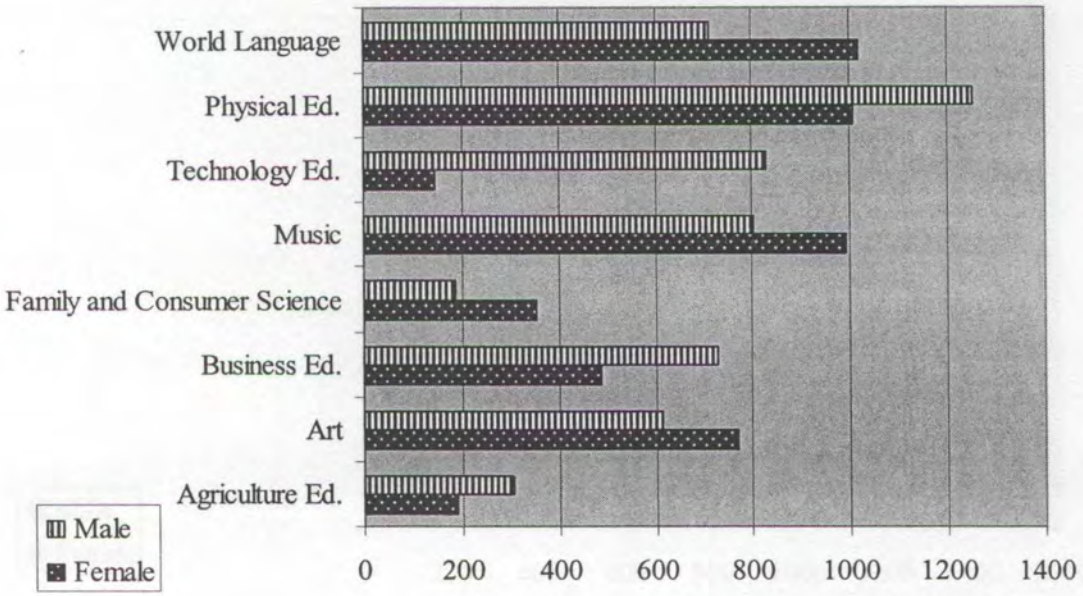


Source: (Wright Technical School, 2004)

Figure 2.3

Carl Perkins Annual Report–TECH PREP 2002-2003

Many Technology Education classes at the Buffalo High School in Minnesota share these ratio and percentage numbers. At the Buffalo High School, the overall male to female ratio for their classes in the 2002-2003 school year was more than 5 to 1. In Energy, Power, and Transportation class the number of males was 146 to 1 female. The most evenly balanced class, Visual Technology, does have a ratio that is close to 1 to 1. The total numbers for that particular class was 115 males to 110 females (Buffalo High School, 2003). Other than Technology Education classes, see Figure 2.4, elective class ratios were much more in balance for the 2002-03 school year.

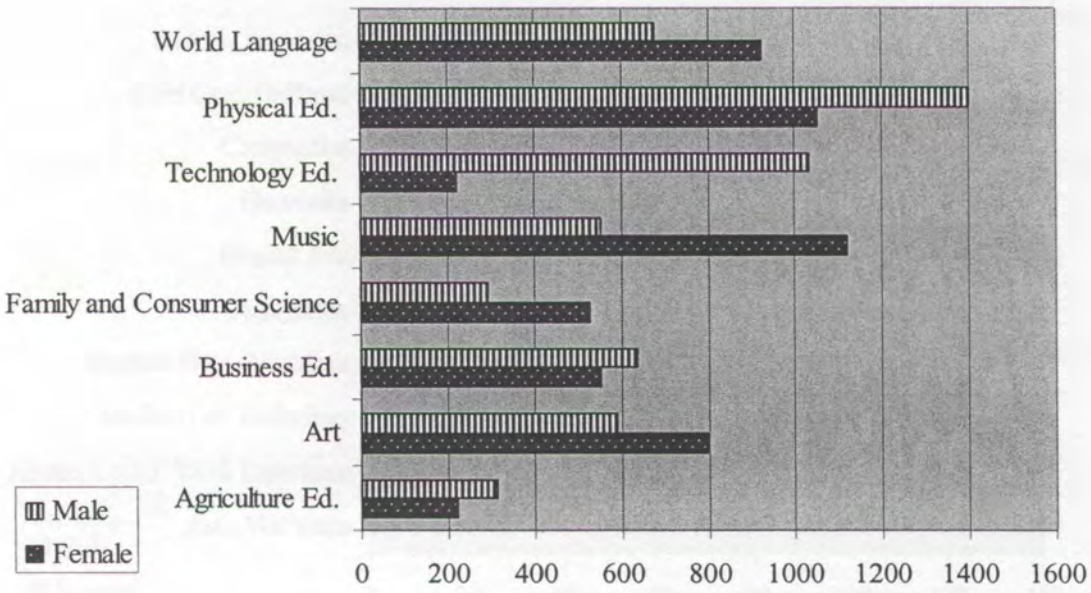


Source: (Buffalo High School, 2003)

Figure 2.4

2002-03 Class Ratio

Comparing the numbers of the 2002-03 and 2003-04 school years indicate that it was not a one-year problem. Figure 2.5 indicates that when comparing the ratios for all the electives, ratios are very similar from year to year.

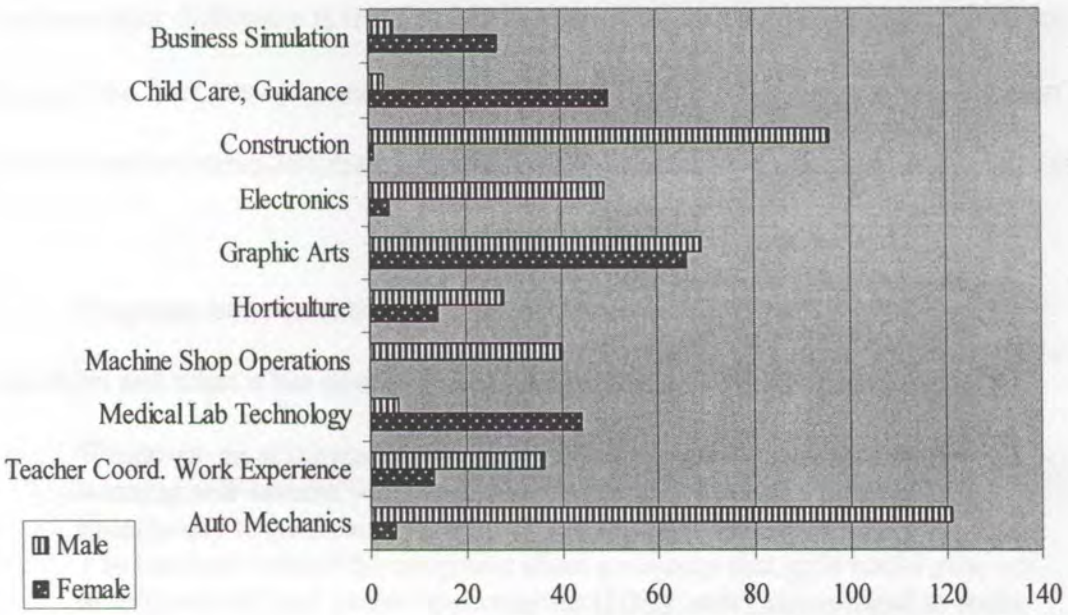


Source: (Buffalo High School, 2003)

Figure 2.5

2003-04 Class Ratio

At the Wright Technical School in Buffalo Minnesota students follow the traditional path of courses. Males take classes that were traditionally dominated by males and females take traditionally taken female classes. As noted in Figure 2.6, the class Graphic Arts has a male/female ratio close to 1 to 1.



Source: (Wright Technical School, 2002)

Figure 2.6

WTC 2000-01 Class Ratio

Two other schools have indicated similar ratios as above. The first is St. Michael/Albertville High School, which also located in 10 miles East of Buffalo in Wright County, has roughly the same male/female ratio as the other schools shown above. St. Michael/Albertville's male/female ratio for the 2003-04 school year was 654 males to 72 females which calculated into a 9 to 1 ratio. St. Michael/Albertville projected class enrollment for Technology Education in the 2004-05 school year was 681 males to 60 females that calculated into a ratio of 11 to 1 ratio.

The second school is Spring Lake Park High School. Spring Lake Park is a school that is currently in the same conference, North Suburban Conference, as Buffalo. In general, Spring Lake Park and Buffalo have about the same size student population.

The one major difference is that Buffalo has four Technology Education teachers and Spring Lake Park has only one. Spring Lake Park's 2003-04 Technology Education student numbers were 284 males and 53 females, calculated into male/female ratio of 5 to 1.

Programs have been started to help educate females about Technology Education and what it has to offer. According to Zehr (1998):

> Windows–an acronym for "women inventing notable database online winning self-esteem"–is one of several computer courses tailored specifically to girls that are popping up in public schools across the country. The teachers behind the programs share a concern that girls could miss out on educational and career opportunities if they aren't encouraged to study computers. (p. 1)

Another opportunity for females is a summer institute that teaches teachers C++ programming language and instructs high school teachers on how to make girls feel comfortable in computer science classes (Zehr, 1998).

Several schools around the Twin Cities metropolitan area have or are considering all female technology classes. One school that is considering this is White Bear Lake. White Bear Lake High School Technology Education staff is considering a proposal for the 2005-06 school year. The class would be an all female manufacturing class. Two schools that currently offer an all female class are Woodbury and Mahtomedi High Schools. Woodbury offers an all female automobile class. The class is designed to teach females about changing a spare tire, removing the battery, checking the anti-freeze, changing fuses and light bulbs, checking brakes, changing the oil, and rotating the tires. The instructor has been happy with the success and claims the popularity of the class is still growing. For the 2004-05 school year, there are three

sections with a total of 115 females (H. Kaupang, personal communication, January 18, 2005).

Mahtomedi offers a Wood Technology I for Girls Only class. The class teaches safety in the areas of hand tools and powered machines. Females build a piece of selected furniture during class time. This is a pilot program that started 6 years ago. The program has two objectives. The first objective is to educate females about technology education. The second objective is to see if females will enroll in more than one technology education class throughout their high school career. The program was established after surveying students, parents and community leaders about the shortage of females enrolling in technology education classes at Mahtomedi High School. All involved were in support of this type of program. The state of Minnesota has expressed some concerns of reverse discrimination but has not taken any action to discontinue the program (M. Lefeber, personal communication, January 27, 2005).

A survey sent to all female members of the International Technology Education Association (ITEA) in 1994 had several ideas as to how to increase female involvement in technology education classes. The ideas are as follows: have more electives available, focus girls on their strong points, curriculum development with removal of gender biases, have segregated classes, and more female teachers (Flowers, 1994).

Analyzing the Data

The data being analyzed for review will be collected by a survey instrument. The information from the survey will be analyzed looking for frequencies and chi-squared tests. According to Peck, Olsen, Devore (2001):

To analyze the data from a single population a statistician may use chi-squared tests for univariate categorical data. Univariate categorical data is most conveniently summarized in a one-way frequency table. Suppose, for example, that each item returned to a department store is classified according to disposition–cash refund, credit to charge account, merchandise exchange, or return refused. Records of 100 randomly selected returns are examined and each disposition recorded. The first few observations might be

Cash refund	Return refused
Exchange	Cash refund
Exchange	Credit to account

Counting the number of observations of each type might then result in the following one-way table:

	Dispostion				
	Cash	**Credit**	**Exchange**	**Refused**	
Frequency	34	18	31	17	(p. 600)

Summary

Women have taken great strides in the past decades in education, but they still have ways to go in high school elective classes such as technology education. Women have also increased their enrollments in liberal colleges throughout the United States but still lack enrollment numbers in majors dealing with technology. Finally, women are not equally represented in technical careers such as engineers. The time has come to find out why females are not pursuing these career opportunities in greater numbers.

Chapter III

METHODOLOGY

Introduction

This chapter provides information on the methodology of this research. This includes a restatement of the problem statement, a restatement of the research questions, the methods which were used to identify experts, develop and implement the survey instrument, selection of the participants of the survey, analyze and interpret the data.

Statement of the Problem

There is a lack of females enrolling in Technology Education.

Research Questions

1. To what extent are females enrolling in Technology Education classes?
2. What are the key factors that contribute to low female enrollment in high school Technology Education elective classes?
3. What can be done to increase female participation in technology education classes?

Sample Population

The population was a random selection of 50 females each from the freshman, sophomore, junior, and senior classes from the Buffalo High School. Surveying 50 females from each grade represents about 12% of the school population or approximately 23% the female population in school. This gave 200 sets of results from the surveys.

Sample Selection

A research randomizer was used to select the female students. The randomizer allowed the user to enter how many sets, the number in each set, and the range for each set. The randomizer being used, Research Randomizer, can be found at http://www.randomizer.org/form.htm.

Demographics

Survey included a demographic section. The demographics produced important results. The data from the demographic section was collected and analyzed. See Appendix C. The demographic section was refined based on the suggestions of the thesis panel.

Validation and Pilot Test

The survey along with its demographic section was reviewed for face validity and suitability by a review panel, consisting of three members of the faculty of St.

Cloud State University. They are Dr. Kurt Helgeson, Dr. Jeanne Anderson, and Dr. Balsy Kasi (committee chair). This examination was used to identify any potential problems with the content, instructions, or structure of the instrument that might cause problems. A pilot test was done with the teachers that are going to administer the survey to their students. Comments came back positive about the survey.

Survey Procedures

Teachers in the high school that teach single grade levels were asked to allow their students to participate in the study. Twenty teachers were given a set of 10 random numbers. These random numbers did correspond to a number in the teacher's grade book which represented a student. The teacher was asked to give the student a survey to fill out as long as the student was female. If the corresponding number was not a female the teacher was directed to move up one student at a time until a female was reached to take the survey.

Survey Instrument

The survey instrument included a letter of introduction (see Appendix A) and an explanation of the research. Selected females were asked to fill out a survey (see Appendix B) that identifies reasons as to why they do or do not take Technology Education classes.

Survey Implementation

The survey was administered to students in January 2005. Randomly selected students were given time at the end of their block to complete their survey forms. Students selected to complete the survey were given a pencil as a token of appreciation. The pencil had the caption "Tech Ed Tech Ed Tech Ed Tech It Out" stamped on it.

Data Collection

The results from the survey were entered into a database such as MINITAB. The database made it easier for the data to be sorted by different factors such as race, G.P.A. and guardian careers.

Data Analysis

Once all the information was entered, the data was analyzed for similarities between students. This allowed some data to be disregarded while other data was further reviewed for similarities in responses. Finding these similarities was the first step to finding the answers as to why female students do not take Technology Education classes.

Chapter Summary

This chapter identified the steps that were completed for this study. The steps included restatement of the problem, restatement of the research questions, sample

population, sample selection, demographics, validation and pilot test, survey procedures, survey instrument, survey implementation, data collection, and analysis of the data.

Chapter IV

ANALYSIS OF DATA

Introduction

This chapter is an analysis of the data collected from the survey instrument. Included is the demographic information of the participants, the survey framework, and a discussion of the survey data.

Demographic Information

There were 199 students who participated in the study. The participants were from four grade levels: 1) Freshmen (9^{th} grade), 2) Sophomores (10^{th} grade), 3) Juniors (11^{th} grade), 4) Seniors (12^{th} grade). The demographics and data analyzed were from those 199 participants. The participants were grouped and analyzed by current grade, their race, cumulative G.P.A. (Grade Point Average), career plans, male guardian career choice, and female guardian career choice. The following figures show the results from the demographic section of the survey. Figure 4.1 shows the number of students per grade that participated in the survey.

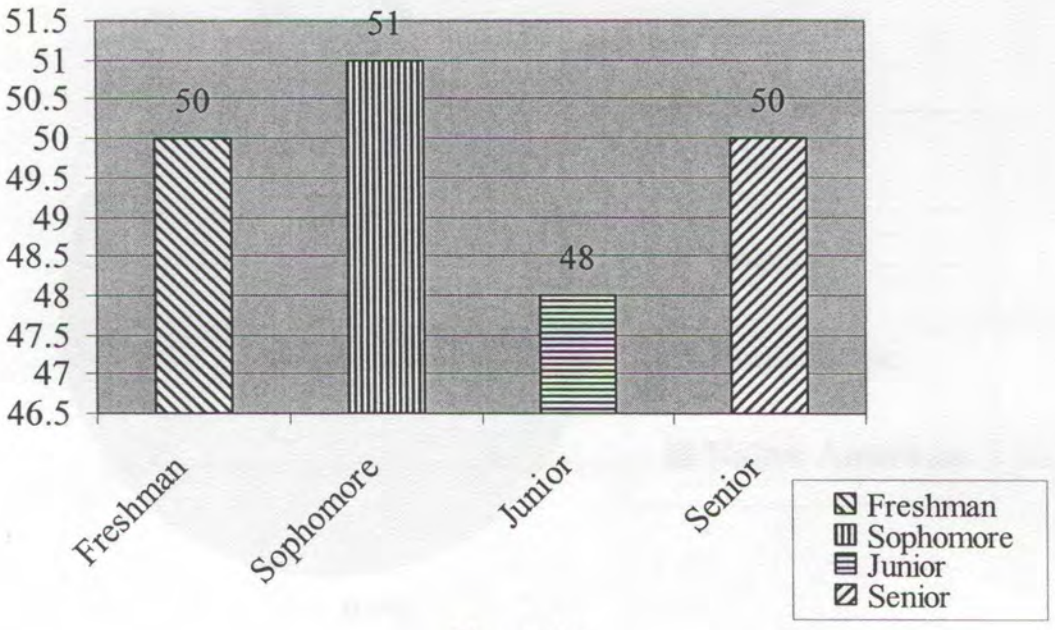


Figure 4.1

Current Grade

Figure 4.2 shows the number of each race that participated in the survey. Finding out the number of students of each race that took technology education classes may lead to new ways of promoting technology education in the schools. Also, this will show if more minority students are taking technology education classes proportionally than white students.

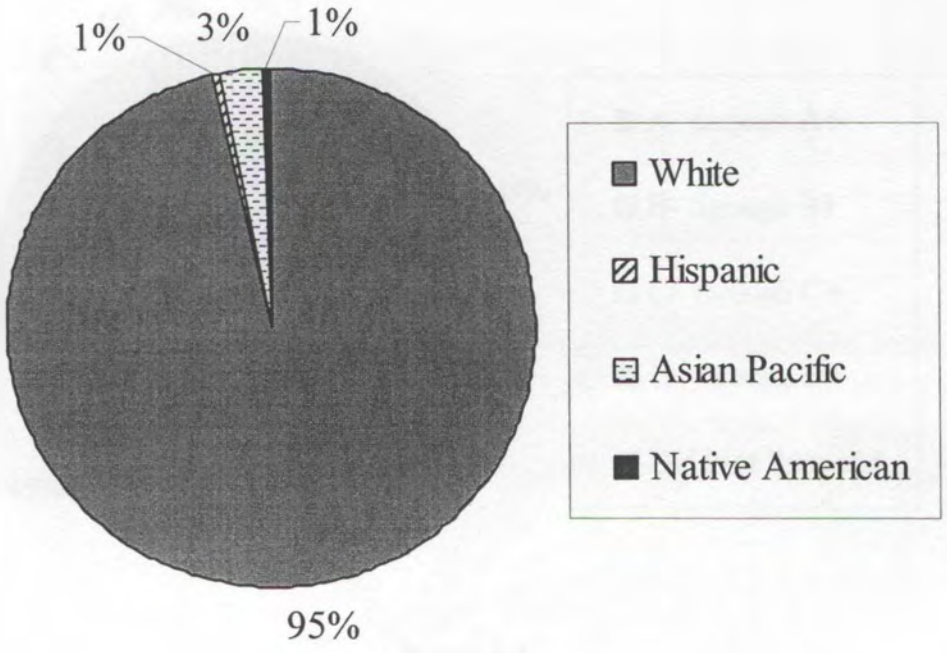


Figure 4.2

Race

Figure 4.3 shows the number of participates in each of the letter Grade Point Averages (G.P.A.). This question in the demographic section is looking to see if more students from a certain G.P.A. range are taking technology education classes.

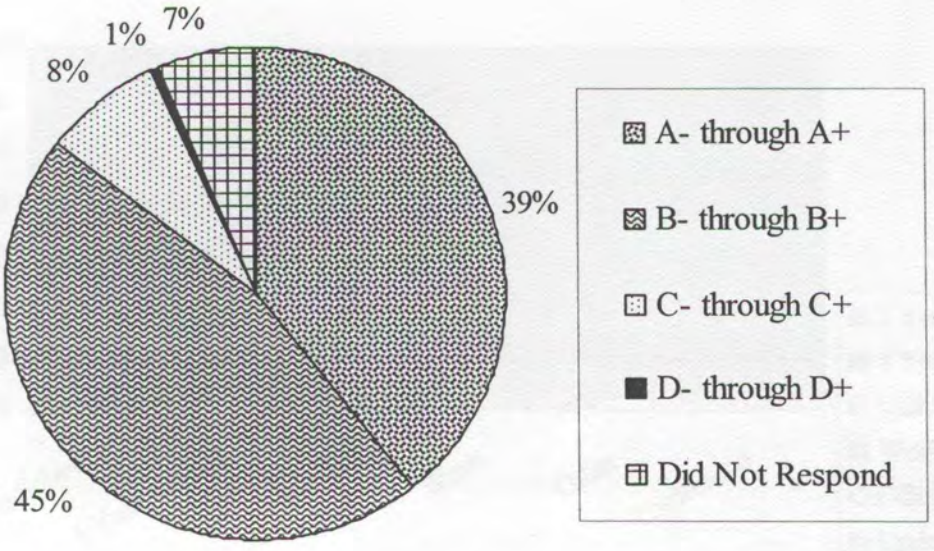


Figure 4.3

G.P.A.

Figure 4.4 shows the anticipated future plans of the participants. The data shows that more students who are thinking about going to a 4-year school after high school take technology education classes than all other categories combined.

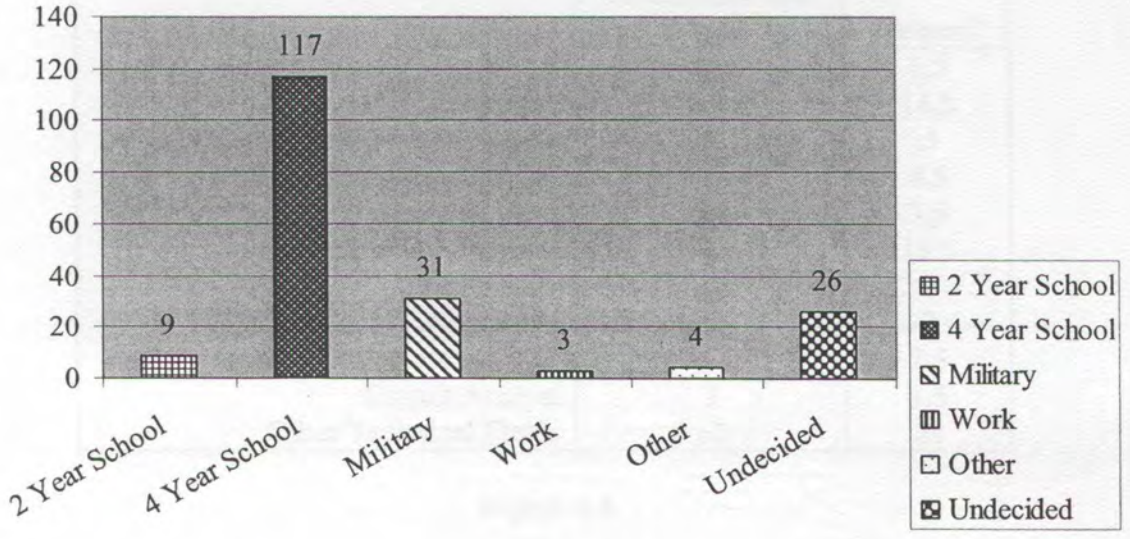


Figure 4.4

Future Plans

Figure 4.5 shows the number of participants which have a male guardian that has a career in one of the given technical areas. This data could be used to see if children follow in their male guardian career paths.

Male Guardian Career Choice	Participants that responded Yes	Percent
Architect	3	1.5
Engineer	29	14.5
Communications Specialists	1	.5
Technology Education Teacher	3	1.5
Project Manager	15	7.5
Construction Laborer	39	19.5
Researcher	0	0
New Product Development	6	3
Photographer	5	2.5
Circuit Analyst	3	1.5
Other Technical Fields	62	31

Figure 4.5

Male Guardian Career

Figure 4.6 shows the number of participants which have a female guardian that has a career in one of the given technical areas. This data could be used to see if children follow in their female guardian career paths.

Female Guardian Career Choices	Participants that responded Yes	Percent
Architect	0	0
Engineer	3	1.5
Communications Specialists	4	2
Technology Education Teacher	0	0
Project Manager	5	2.5
Construction Laborer	2	1
Researcher	2	1
New Product Development	2	1
Photographer	3	1.5
Circuit Analyst	2	1
Other Technical Fields	29	14.5

Figure 4.6

Female Guardian Career

Survey Framework

The survey instrument consisted of three intermixed sections. Participants were first asked to answer a yes/no question. Then they were asked to check all responses that applied to them or to rank choices from a given list of responses. Ranked responses were given a value of one (being the highest) to nine (being the lowest).

Survey Data

The following information summarizes the participants' responses into the three sections of the survey instrument. The frequency and percentage are listed for each question in the following tables.

Question 1 from the survey asked if the participant had ever taken a Technology Education class at the high school. From the 199 responses, 63 (31.5%)

of the participants had taken at least one class. There were 17 (9%) participants that had taken multiple technology education classes at the high school. Participants were asked to check which technology education classes they had taken. Figure 4.7 shows the breakdown of individual classes and how many participants took each. The participants took a total of 86 classes.

Classes taken by survey participants	Number of Participants	Percent
Introduction to Drafting	10	11.6
Advanced Drafting	5	5.8
Introduction to Woods	11	12.8
Woods II	2	2.3
Wood III/College in the Schools	0	0
Goals 2000	5	5.8
Visual Technology	44	51.1
Energy and Power	6	7.0
Research and Development	1	1.1
Electricity/Electronics	2	2.3
Automobile Engineering	0	0

Figure 4.7

Technology Education Classes Taken

Question 2 asked participants who have not taken a technology education class at the high school, if any of the given set of classes looked interesting. Figure 4.8 provides the number of participants that find the set of technology education classes interesting enough to possibly take. Participants were able to select more than one class they found of interest.

Classes of Interest to Participants	Total Number
Introduction to Drafting	38
Advanced Drafting	20
Introduction to Woods	56
Woods II	29
Wood III/College in the Schools	15
Goals 2000	27
Visual Technology	74
Energy and Power	16
Research and Development	18
Electricity/Electronics	17
Automobile Engineering	31

Figure 4.8

Classes of Interest

Question 3 was directed to those who took a technology education class at the high school to find out if they enjoyed the experience. All 63 participants, who took a technology education class, responded yes. Question 4 asked the participants what made the experience the most enjoyable. To determine what made the experience enjoyable, participants were asked to rank a given set of responses. Figure 4.9 shows what participants ranked as their first and second reasons as to what made their technology education experience enjoyable. Reason number one which made their experience enjoyable was a new experience in the classroom. The second and third choices that made the participant's experience enjoyable were the instructors and the class curriculum.

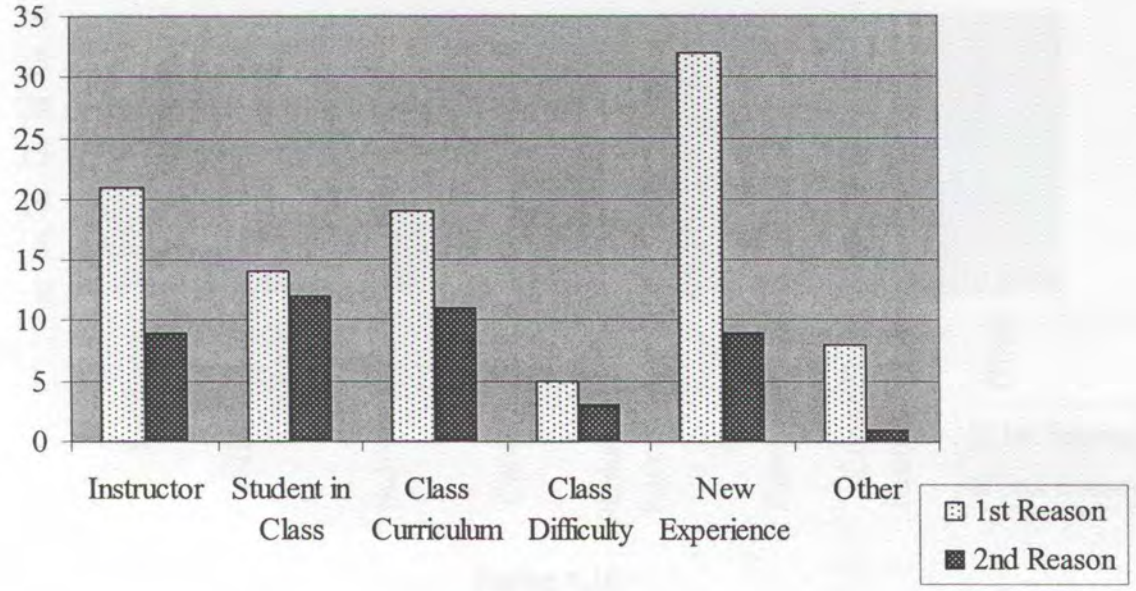


Figure 4.9

What Made Class Enjoyable

Question 5 was directed at those participants who did not enjoy the experience, to determine why their experience was not enjoyable. Referring back from question 3, all the participants had answered they enjoyed their experience; therefore there was not sufficient data to be included.

Question 6 asked the participants that had taken a technology education class at the high school why they did? Again, from a list of responses, participants were asked to rank their responses, with one given to the most significant reason why they took a class and eight given to the least significant reason. Figure 4.10 shows the first and second reason why participants took a technology education class.

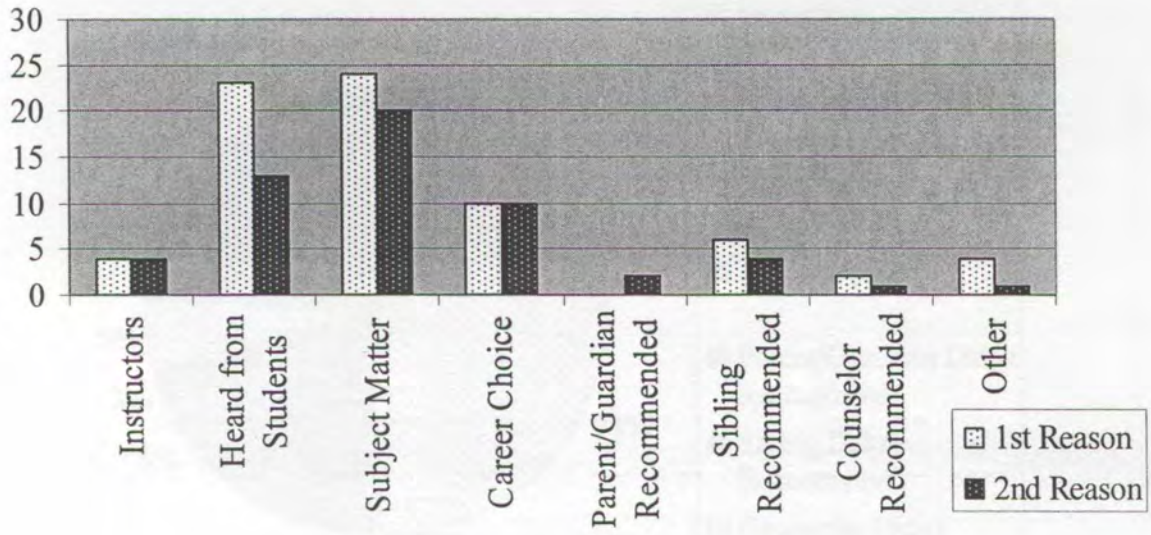


Figure 4.10

Why Take a Technology Education Class

Question 7 asked the participants that had not taken a technology education class at the high school why they did not? Again, from a list of responses, participants were asked to rank their responses, with one being the most significant reason they have not taken a technology education class and eight being the least significant reason. Figure 4.11 shows the list the participants could choice from and the percentages for each response.

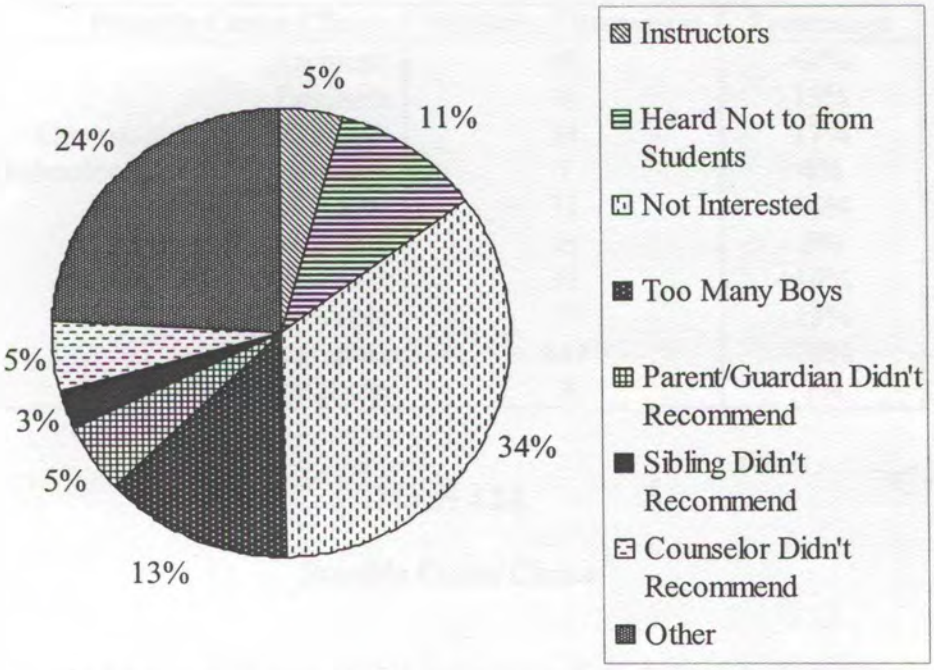


Figure 4.11

Why Not Take a Technology Education Class

Question 8 asked participants to check all of the career choices that they may have an interest in pursuing in the future. Figure 4.12 shows the list of career choices and the number of participants that checked each as possible career option. Participants were allowed to choose as many as they were interested in.

Possible Career Choice	Number of Responses	Percentage
Architect	88	44%
Engineer	26	13%
Communications Specialist	34	17%
Technology Education Teacher	7	4%
Project Manager	31	16%
Construction Laborer	15	8%
Researcher	31	16%
New Product Developer	29	15%
Photographer	147	74%
Circuit Analyzer	3	1%

Figure 4.12

Possible Career Choice

Figure 4.13 was then looked at to see how many selections each participant made. The most selections that one participant made was seven. There were a number of participants that selected no possible career choices. Figure 4.13 shows the number of selections each participant chose.

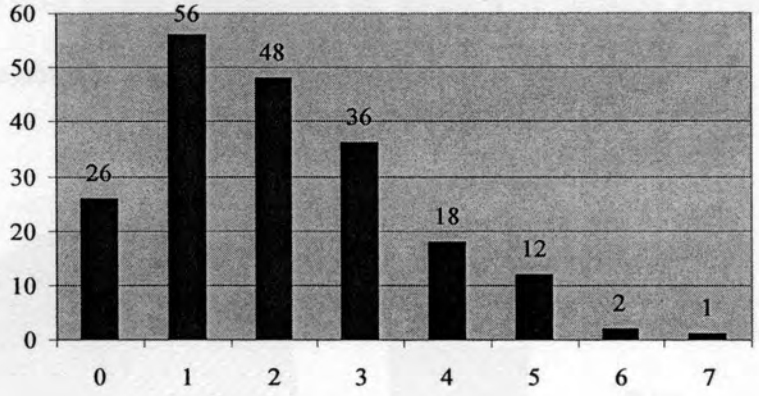


Figure 4.13

Number of Career Choices

Question 9 asked participants if females would be interested in taking technology education classes if the high school would offer an all female technology education class. Figure 4.14 shows the results of question 9.

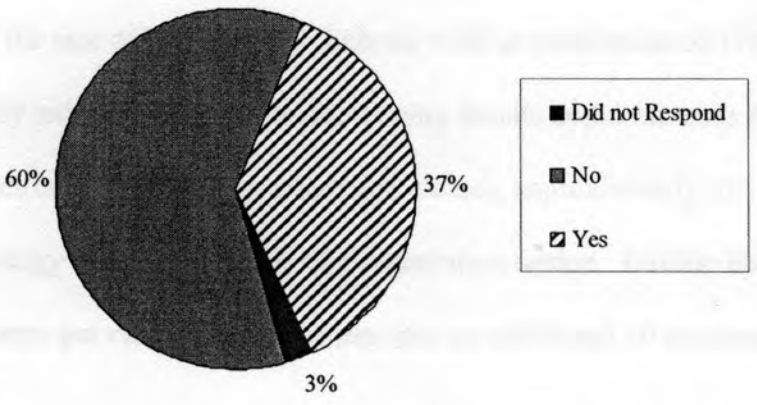


Figure 4.14

Higher Enrollment in an All Female Technology Education Class

Figure 4.15 further breaks down the results from question 9 by participants that have and have not taken a technology education class at the high school.

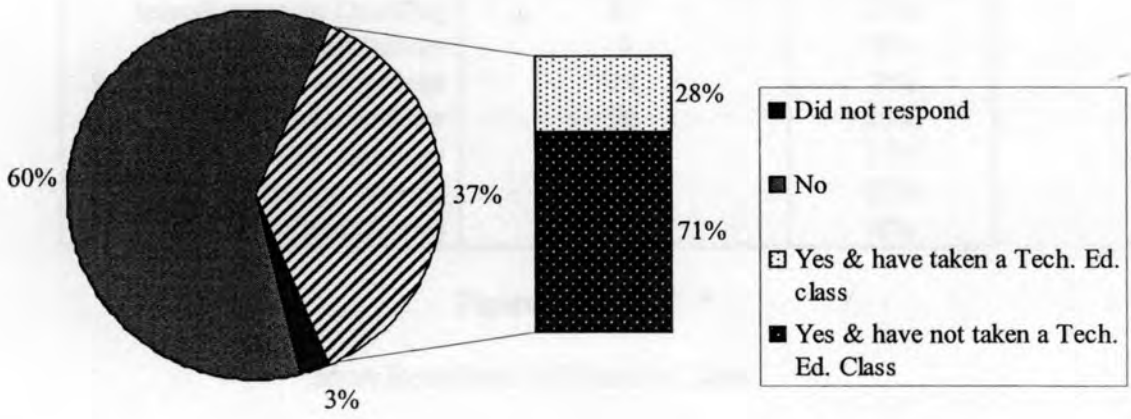


Figure 4.15

Question 9 Separated by Responses

A school the size of Buffalo High School, with an enrollment of 1700 students and approximately half the school population being female could increase the yearly number of females taking technology education classes, approximately 323, by adding all female technology education classes as a registration option. Buffalo High School averages 30 students per class. This translates into an additional 10 sections (classes) per year.

Question 10 asked the participants to check which type of technology education class would be most beneficial to have in an all female classroom setting.

Figure 4.16 shows the list of classes that participants could choice from. Participants were allowed to check more than one class.

Class Type	Number of Responses	Percentage
Introduction to Drafting	21	11%
Energy and Power	9	5%
Research and Development	14	7%
General Car Care	50	25%
Visual Technology	30	15%
Introduction to Woods	42	21%
Electricity/Electronics	15	8%

Figure 4.16

Most Beneficial All Female Class

Question 11 asked the participants to respond to the idea of an all female technology education class. The eight most common responses from the participants are listed in Figure 4.17. In addition to the most common responses, Figure 4.17 shows the number of times a participant listed it as their reason why an all female technology education class is a good or bad idea.

	Number of Responses
Females are not interested in technology education classes at the high school	25
Classes are more fun with males in them	16
Males can help females work on their projects	18
Diversity in the classroom is important	29
No room in my schedule to take a technology education	3
Females should have an option to take either a regular class or all female class	2
Should have an all female class; females often feel intimidated by male students	7

Figure 4.17

Responses for an All Female Class

Question 12 asked the participant who influences their interests the most. Figure 4.18 shows the list the participants could choose from. Participants were asked to rank the choices with one being the most persuasive person and nine being the least persuasive.

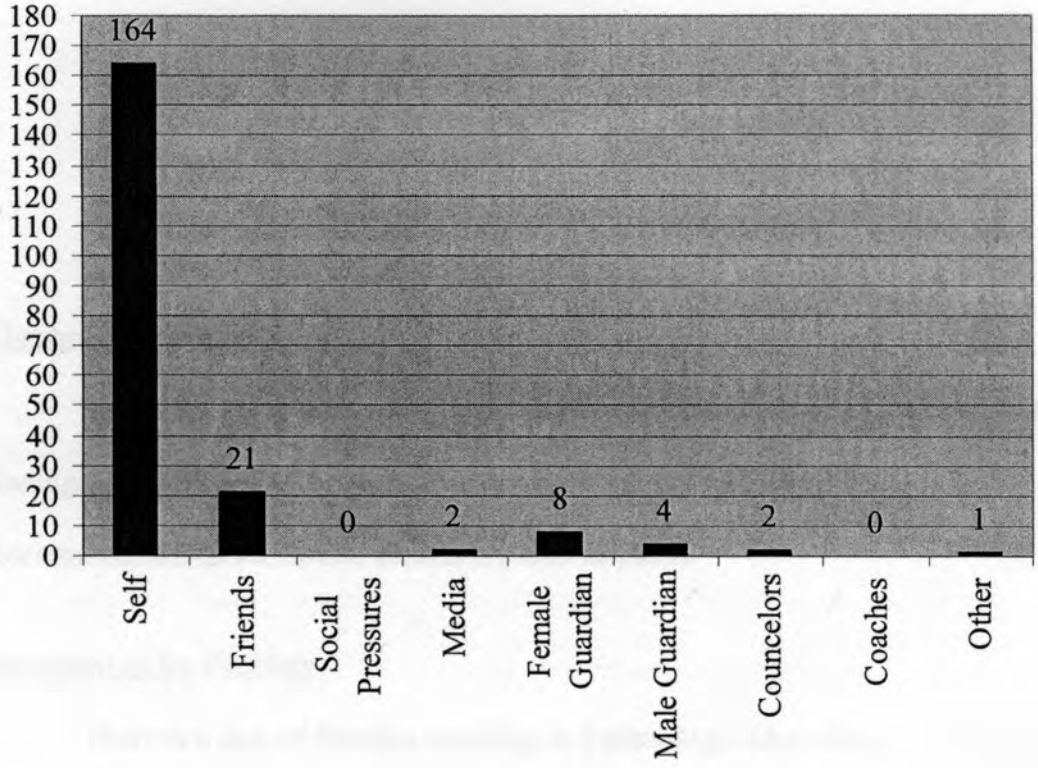


Figure 4.18

Influences on Participants

Chapter Summary

This chapter was an analysis of the data collected by the survey instrument. Included was demographic information about the participants, the survey framework, and a discussion of the survey data.

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMEDATIONS

Chapter Introduction

This chapter includes a restatement of the problem and purpose of the study, findings of the study, and conclusions based on the survey instrument. Recommendations for further studies are also included.

Statement of the Problem

There is a lack of females enrolling in Technology Education.

Statement of the Purpose

1. Provide information for suburban technology education teachers regarding female percentages in technology education classes.
2. Provide data for technology education curriculum writers to write female friendly technology curriculum that will help increase enrollment percentages for females in technology education classes.
3. Contribute to the increase in females in technology education classes in suburban Minnesota schools.

Research Questions

1. To what extent are females enrolling in Technology Education classes?
2. What are the key factors that contribute to low female enrollment in high school Technology Education elective classes?
3. What can be done to increase female participation in technology education classes?

Summary

The review of literature provided data and information that show low number of females enrolling in technology education classes. The business community, colleges, and high school classes associated with technology all have low female involvement. This review of literature was to provide the reader with information on past and current literature about low female involvement in technology.

The survey instrument was administered to 200 randomly selected females at the Buffalo High School. This translates into 23% of the female student population or 12% of the school population. The 200 surveys were handed out to 50 females per grade level. Teachers of a single grade level were given a list of random numbers. These random numbers were to reflect the teacher's grade book in which the teacher used to select their students to take the survey. If a random number represented a male student the teacher was instructed to move up one number within their grade book until a female student was located in the grade book to complete the survey. The survey participants were grouped and analyzed by grade level, race, and if they had taken a technology education class at the high school.

The survey data indicated that 63 participants had taken a technology education class at the high school. The survey data also indicated that more juniors and seniors had taken a technology education class compared to the freshman and sophomores. The data indicated that three minority female students had taken a technology education at the high school. In addition, the survey data indicated that a 38% of the participants favored the introduction of an all female technology education class.

Analyzing the information found in the review of literature and the data from the surveys revealed several points of interest to this study. The review of literature indicates a low number of females in technical fields of employment. Only 9% of engineers, 28.5% of computer programmers, and 26.9% of systems analysts in the U.S. are women (Taggart & O'Gara, 2000). The data collected from the survey for this study indicates something different. The 200 participants who took the survey had indicated 411 times, they would be interested in some kind of career involved with technology. The participants had a list of 10 broad technical career choices to choose from. This indicates that each participant chose on average of two careers. One of the career choices was an engineer, which 26 (13%) of the participants chose as a possible career choice. Referring to Figure 4.12 in Chapter IV, the figure identifies the number of times the participants selected a technical career as a possible career choice. The survey does show that the females in this study do have a higher interest in becoming an engineer, 13%, more than the current number of female engineers, 9%, in the United States today.

The results from the survey differ from the findings in the review of literature regarding college. From the review of literature, across the United States, more females are going to liberal arts colleges and earning degrees more than ever before. Across the nation the average female population on campus is 55.8%. The Department of Education projects that by 2008 women will outnumber men, 9.2 million to 6.9 million in undergraduate and graduate programs. The survey indicated that 69% of the participants plan on attending a 4-year school. This beats the national average by 13.2%. However, the survey can not indicate if more females plan on entering fields of technology in college.

The number of participants that took a technology education class was 63 of 200 participants or 31.5%. The class with the highest number of females enrolled is Visual Technology with 44 of the 63 participants enrolled. A class such as Visual Technology follows the national and state average of high female enrollment with a much lesser equality throughout the rest of the technology education program.

Research Questions

Research question 1: To what extent are females enrolling in technology education classes? Females across the United States are enrolling in some technology education classes. The traditional classes with high female enrollment are word processing, informational systems, desktop publishing, communications, and photography. But as new technology education classes emerge, such as bio-technology and CAD (computer aided drafting), females are not registering. Classes that have been male dominated are not gaining interest from females either. Of the

200 participants which took the survey, 63 participants did take at least one technology education class. However, in further review of these 63 participants, 44 took Visual Technology, a heavily female dominated course.

Research question 2: What are the key factors that contribute to low female enrollment in high school technology education elective classes? Several factors are listed here. Remarks from the survey found a certain percentage of females are just not interested in taking a technology education class. I believe this to be true. Just as in sports or other school related activities there will always be a percentage of students who do not want to participate. To go along with this, females completing the survey were to rank who persuades their actions the most. An overwhelming majority of the responses were themselves. Females did list friends and female guardians second and third respectively. Again, participants feel no real pressure from friends or guardians when it comes to registering for classes at school. The last factor keeping female enrollment low in technology education is a tradition of male dominated classrooms. The survey indicated that 38% of the participants believe that an all female technology education class would increase the number of females enrolled in technology education.

Research question 3: What can be done to increase female participation in technology education classes? Awareness about technology education and the benefits it provides may help increase female participation in technology education classes. The participants from the survey indicated 411 responses from a list of careers involving technology that they found interesting enough to think it would

make a good career choice. With this kind of response for technology career choices, then technology education programs must make female students aware how technology education classes aid in these technology careers. A career day orientated around technology education could be introduced to the students. Speakers about related careers could be brought in to talk about the advantages of their careers. Pamphlets could be handed out to students before registration explaining technology education classes to take if interested in a given technology field. As indicated in research question two, parents are an influence in their child's future and class selection. So, parents need to be educated about what technology education is now in 2005, and get rid of the stigma that technology education classes are just shop classes. Parents need to see the importance of technology education for their own children and the benefits that can come out of learning technology education.

Conclusions

There were several conclusions which were drawn as a result of the review of literature and the survey instrument. The responses indicated that 100% of participants that had taken a technology education class at the high school enjoyed the experience. As indicated by Figure 4.9 on page 39, participants listed the instructor, class curriculum, and the new experience as reasons the class was enjoyable. Secondly, students who had taken a technology education class did so because they were interested in the subject. But more importantly as Figure 4.10, on page 40, indicates students considered advice from other students to try these classes. Thirdly, the survey indicated 80% of the participants are interested in pursuing a career in a

technical field. There were a total of 411 responses from the participants who thought it would be interesting to pursue a career in one or more of the technical fields listed from Figure 4.12 on page 42. Fourthly, the survey indicated that 74 (37%) of the participants believe that more females would register for technology education class if it was an all female class. Two classes offered at the Buffalo High School were selected by the participants that they believe would do well in an all female class format. The classes are Introduction to Drafting and Introduction to Woods Technology. The class the participants selected that would most benefit from an all female class format is a class in general automobile care. Finally, the survey indicated that the participants are influenced most in their lives by themselves. Figure 4.18, on page 47, shows that over 75% of the participants follow their own hearts by making their own decisions when selecting classes for registration.

Recommendations

There are four recommendations based on this study. The recommendations are:

1. A similar survey given to a group of females at a high school where an established all female class exists. A study done in this setting may result in different responses to the question if more females would or do take technology education classes in an all female classroom.
2. High schools without an all female technology education class should persuade or influence the school's superintendent, school board, and school

principal to allow an all female technology education class to be put in the school's registration booklet.

3. Before registration, an informational meeting should be held for students to see and hear the career choices they have related to technology education classes at the high school.
4. Before registration, send pamphlets home to parents informing them about possible career choices in technical fields and which technology education classes would be beneficial for their daughter to take.

Conclusion

This chapter included a restatement of the problem and purpose of the study, findings of the study, and conclusions based on the survey instrument. Recommendations for further studies were also included in the chapter.

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APPENDIXES

APPENDIX A

Survey Letter of Intent

To Whom It May Concern:

You are 1 of 50 randomly chosen female students in your grade that is being asked to complete a survey about technology education at the high school.

This survey will be collecting information as to why female students do or do not enroll in technology education classes at the Buffalo High School. Your involvement in the study is very important to its success. The survey will be administered during this class at your teacher's convenience.

I assure you that all findings from the survey will remain confidential. Your responses will not be shared with other research projects or other areas of interest.

After the surveys are completed, the information in the surveys will be entered into a database. Once all the information is entered, the data can than be analyzed for similarities between individual responders.

In advance, your cooperation is greatly appreciated. As a token of my appreciation please keep the pencil that accompanies the survey.

Thankfully,

Mr. Konsela, Technology Education Teacher, Buffalo High School

APPENDIX B

Survey: Questions for Females Concerning Technology Education

Survey: Questions for Females Concerning Technology Education

Hello, my name is Mr. Konsela, I'm a Technology Education teacher here at the high school. I'm conducting a survey about females electing to take or not take Technology Education classes. I need your help. Did you know that at our high school only one female for every six males take a Technology Education class? I want to find out why and what I can do to change this unequal ratio. With your help, by taking this survey, I can take the first steps in fixing this ratio.

1. Have you ever taken a Technology Education class at the high school?

_____1 YES _____2 NO

If YES, check **all** that apply

_____ Intro. To Drafting

_____ Advanced Drafting

_____ Intro. To Woods

_____ Woods II

_____ Woods III/College in the Schools

_____ Goals 2000

_____ Visual Technology

_____ Energy and Power

_____ Research and Development

_____ Electricity/Electronics

_____ Automobiles

2. If you checked NO, check **all** that look interesting to you

_____ Intro. To Drafting

_____ Advanced Drafting

_____ Intro. To Woods

_____ Woods II

_____ Woods III/College in the Schools

_____ Goals 2000

_____ Visual Technology

_____ Energy and Power

_____ Research and Development

_____ Electricity/Electronics

_____ Automobiles

3. If you have taken a Technology Education class at the high school did you enjoy the experience?

_____1 YES _____2 NO

4. If YES, what made the experience enjoyable?
Please rank 1 through 6. One being your strongest choice and six being your weakest.

_____ Instructor

_____ Students in class

_____ Class Curriculum

_____ Class Difficulty

_____ New Experience

_____ Other: Please explain: _____

5. If NO, what **DIDN'T** make the experience enjoyable?
   Please rank 1 through 6. One being your strongest choice and six being your weakest.

_____ Instructor

_____ Students in class

_____ Class Curriculum

_____ Class Difficulty

_____ New Experience

_____ Other: Please explain: _____

6. If you have taken a Technology Education class at the high school, why did you?
   Please rank 1 through 7. One being your strongest choice and seven being your weakest.

_____ Instructors

_____ Heard from other students, it's a good class to take

_____ Interested in the subject

_____ Possible career choice

_____ Parents/Guardians said you should take a Technology Education class

_____ Counselors recommended you taking a Technology Education class

_____ Other: Please explain: _____

7. If you haven't taken a Technology Education class, why not?

   Please rank 1 through 7. One being your strongest choice and seven being your weakest.

_____ Instructors

_____ Heard from other students not to take these classes

_____ Not interested

_____ Too many boys take them

_____ Parents/Guardians said you should **NOT** take a Technology Education class

_____ Counselors recommended you should **NOT** take a Technology Education class

_____ Other: Please explain: _____

8. There are many career choices that are related to many Technology Education courses. Please check **all** career choices that look interesting to you.

_____ Architect

_____ Engineer

_____ Communications Specialist

_____ Technology Education teacher

_____ Project Manager

_____ Construction Laborer

_____ Researcher

_____ New Product Development

_____ Photographer

_____ Circuit Analyst

9. Would more females be interested in registering for an all-female Technology Education class, "No Boys Allowed?"

_____1 YES _____2 NO

10. If Yes, what content area would be most beneficial for this type of class?

_____1 Intro. To Drafting _____5 Visual Technology

_____2 Energy and Power _____6 Intro. To Woods

_____3 Research and Development _____7 Electricity/Electronics

_____4 Car Care

_____8 Other: Please explain: _____

11. If No, why not?

Please explain.

12. What persuades your interests the most?

Please rank 1 through 9. One being your strongest choice and nine the weakest.

_____1 Yourself

_____2 Friends

_____3 Social Pressures

_____4 Media

_____5 Female Guardian (Mom)

_____6 Male Guardian (Dad)

_____7 Counselors

_____8 Coaches

_____ 9 Other: Please explain: _____

APPENDIX C

Demographics

Demographics: Please check all the following

1. Your current grade

_____1 Freshman

_____2 Sophomore

_____3 Junior

_____4 Senior

2. Your Race

_____1 White, non-Hispanic

_____2 Hispanic

_____3 African-American

_____4 Asian-Pacific Islander

_____5 Native American

_____6 Other: _____

3. Your approximate letter G.P.A.

_____1 A- through A+

_____2 B- through B+

_____3 C- through C+

_____4 D- through D+

4. What are your College/Career Plans

_____1 2 year school

_____2 4 year school

_____3 Military

_____4 Work

_____5 Other: Please explain: _____

5. Please check all that apply. Do you have a Male parent/guardian that works in any of these related fields of work.

_____1 Architect

_____2 Engineer

_____3 Communications Specialist

_____4 Technology Education teacher

_____5 Project Manager

_____6 Construction Laborer

_____7 Researcher

_____8 New Product Development

_____9 Photographer

_____10 Circuit Analyst

_____11 Other technical field: Please explain:_____

6. Please check all that apply. Do you have a Female parent/guardian that works in any of these related fields of work.

_____1 Architect

_____2 Engineer

_____3 Communications Specialist

_____4 Technology Education teacher

_____5 Project Manager

_____6 Construction Laborer

_____7 Researcher

_____8 New Product Development

_____9 Photographer

_____10 Circuit Analyst

_____11 Other technical field: Please explain:_____