

**Author:**        **Kitzmann, David A.**

**Title:**        *Identifying the Factors for Low Female Enrollment in Technology  
Education Courses*

The accompanying research report is submitted to the **University of Wisconsin-Stout, Graduate School** in partial completion of the requirements for the

**Graduate Degree/ Major:**    **MS Degree: Career and Technical Education**

**Research Advisor:**    **Sylvia Tiala, Associate Professor Teaching, Learning and  
Leadership**

**Submission Term/Year:**    **Summer 2017**

**Number of Pages:**    **64**

**Style Manual Used:** **American Psychological Association, 6<sup>th</sup> edition**

- I have adhered to the Graduate School Research Guide and have proofread my work.  
 I understand that this research report must be officially approved by the Graduate School.  
**Additionally, by signing and submitting this form, I (the author(s) or copyright owner) grant the University of Wisconsin-Stout the non-exclusive right to reproduce, translate, and/or distribute this submission (including abstract) worldwide in print and electronic format and in any medium, including but not limited to audio or video. If my research includes proprietary information, an agreement has been made between myself, the company, and the University to submit a thesis that meets course-specific learning outcomes and CAN be published. There will be no exceptions to this permission.**  
 I attest that the research report is my original work (that any copyrightable materials have been used with the permission of the original authors), and as such, it is automatically protected by the laws, rules, and regulations of the U.S. Copyright Office.  
 My research advisor has approved the content and quality of this paper.

**STUDENT:**

**NAME:** David A. Kitzmann

**DATE:**8-20-2017

**ADVISOR:** (Committee Chair if MS Plan A or EdS Thesis or Field Project/Problem):

**NAME:**

**DATE:**

**This section for MS Plan A Thesis or EdS Thesis/Field Project papers only**

**Committee members (other than your advisor who is listed in the section above)**

1. CMTE MEMBER'S NAME:

**DATE:**

2. CMTE MEMBER'S NAME:

**DATE:**

3. CMTE MEMBER'S NAME:

**DATE:**

**This section to be completed by the Graduate School**

This final research report has been approved by the Graduate School.

Director, Office of Graduate Studies:

**DATE:**

**Kitzmann, David, A. *Identifying the Factors for Low Female Enrollment in Technology Education Courses***

**Abstract**

Career and Technical Education (CTE) and Technology Education (TE) courses have much to offer young people. It provides them an opportunity to determine and develop their interests and skills and learn about career options. Females benefit from these courses as well as males.

For decades, TE courses have been male dominated, with much lower female enrollment rates across the nation. Low female enrollment is a national problem. Numerous research studies have been conducted.

Minnetonka schools are recognized as a top-ranking school in Minnesota and nationally acclaimed. It is also considered an affluent community. This raised the questions of what factors lead to low female enrollment in TE and CTE courses at Minnetonka and what role the affluence factor might have in CTE courses enrollment.

Through this research, literature review and study, it was determined that negative female perceptions of CTE and TE exist in Minnetonka. Key areas and potential solutions have been identified. It is hoped that this research will add to the knowledge and understanding of this problem.

### **Acknowledgments**

I would like to thank Mr. Tim Alexander, the Minnetonka Director of Human Services who encouraged me to consider finishing my Master's degree, which was first attempted in 1996, but fell along the wayside during overwhelming life experiences. His assurance that a Master's degree is valued in the Minnetonka school district, put this dream in motion.

I would like to thank Dr. Deanna Schultz for taking time to hear my situation, then tirelessly working in putting together a workable plan, staying ahead of this plan with coordinating efforts to bring it to fruition, believing in me, guiding me and encouraging me all along the way to completion.

I would like to thank Dr. Sylvia Tiala for accepting my request to advise me on my research paper, then guiding and encouraging me through the seemingly endless process of getting it right and completing this paper.

I would like to thank Justin Sullivan for his help with the multiple statistical analysis tests run as I narrowed my focus to exactly what I needed for this research project and for his patience in respectfully reviewing and guiding my understandings of statistical analysis for this paper at the Stout Planning, Assessment, Research & Quality (PARQ).

Finally, I would also like to thank my three daughters, who's being, leads me to champion causes for females in CTE and TE, and for waiting by patiently through the summer of 2017 as I was missing for the most part to them, while pursuing this goal.

**Table of Contents**

Abstract .....2

List of Tables .....6

Chapter I: Introduction.....7

    Statement of the Problem.....9

    Purpose of the Study .....10

    Assumptions of the Study .....10

    Definition of Terms.....10

    Limitations of the Study.....13

    Methodology .....14

Chapter II: Literature Review .....15

    Female Perceptions of CTE and TE.....16

    Self-Concept and Efficacy .....17

    Who is Most Influential in Enrollment Decisions .....18

    Demographics .....18

    Initiatives.....19

Chapter III: Methodology .....22

    Subject Selection and Description .....22

    Instrumentation .....22

    Data Collection Procedures.....24

    Data Analysis .....25

    Limitations .....25

    Summary.....26

Chapter IV: Results.....	28
Demographic Information.....	28
Question 1: What are the Factors that Lead to Low Female Enrollment in TE Courses at Minnetonka High School? .....	30
Question 2: Does the Community Demographics Play a Role in Student Enrollment in TE Courses? .....	36
Community Demographics .....	40
Summary.....	42
Chapter V: Discussion, Conclusion and Recommendation .....	44
Discussion.....	45
Conclusions.....	52
Recommendations.....	53
References.....	55
Appendix A: TE Department Survey Questions.....	60
Appendix B: TE Targeted Survey Group Questions .....	62

### List of Tables

Table 1: Demographic Information of Respondents in TE Department Survey .....	29
Table 2: Technology Education (TE) Course Experience .....	29
Table 3: Efficacy; Comparing Females and Males in Their Perceived Success in TE Courses.....	31
Table 4: Attitude; Comparing Females and Males on Taking Another TE Course.....	32
Table 5: Interests; Comparing Females to Males on Whether the Courses Met Their Interests ...	33
Table 6: Support; Comparing Females and Males on Course Support for Their Career Goals ....	34
Table 7: Comparing Female and Male Career Goals.....	36
Table 8: Most Influential on Career Choices .....	38
Table 9: Prompted to Take Another TE Course .....	39
Table 10: Female vs. Male Barriers .....	40
Table 11: Highest Level of Education Achieved in Respondent's Household .....	41
Table 12: Parents Occupations in the Respondent's Households .....	42

## **Chapter I: Introduction**

Career and Technical Education (CTE), is linked closely with Technology Education (TE) and Vocational Education (VE). These programs have gone through many changes as they have evolved over the years.

Technology Education (TE): is a program of study of technology designed for all students to provide an understanding of what technology is, and how it effects our world past, present and future. Typical courses taught fall into clusters of engineering, communications, construction, manufacturing, power & energy and transportation. Vocational Education (VE): is a program of study that offers a sequence of courses for preparing a student with specialized training for jobs in industry. Its roots can be traced back to apprenticeships in Europe and colonial America. Typical fields included are: agriculture, business, construction, industry, manufacturing and transportation. VE is still in existence, but is evolving into CTE: a more comprehensive program that specializes in skilled trades, applied sciences, technology and career preparation offering both academic and career oriented courses with an emphasis on students being college and career ready upon graduation. CTE is an umbrella term that may include traditional courses from TE and VE as well as including courses from Family and Consumer Science, (FACS), Business & Marketing (B/M) Agriculture Education, and Health Occupations.

Science, Technology, Engineering and Math, (STEM) is a program that combines the academics of science and math, typically seen as general education courses, with the application of technology and the problem – solving procedures of engineering to view the world, solve problems and meet human needs. Courses may include applied math, science, technology and engineering.

Regardless of what these programs are called, they have much to offer young people. They provides students an opportunity to experience career paths into different fields and areas of study to determine whether they enjoy them and have natural abilities or the potential for developing skills in these fields (Stipanovic, 2010). This in turn, helps students make more informed decisions about their future work, many of which may be in high paying and in demand careers. This helps young people find their place and become contributing members in our society (Carnevale, Rose, & Hanson, 2012). CTE also offers academic, occupational and technical skills employers want and need by providing the link between the labor market and the needs of young people. All students should have this opportunity (Stone, 2014).

Unfortunately, all students do not take advantage of these opportunities. Female students are not utilizing these courses to their benefit to the same degree as their male counterparts. This study, conducted in the Minnetonka, Minnesota school district, will look at one area of CTE, Technology Education, to explore several factors contributing to this trend. Although Minnetonka high school enrollment data shows an almost even split between female and male students, TE classrooms do not reflect this percentage. Male enrollment at Minnetonka high school in TE courses averages 39% over the last ten years, while female enrollment in TE courses averages only 6% over the same period (Minnetonka public schools, 2017). This is not specific to Minnetonka. Across the nation, female enrollment in TE courses have historically been below that of the males, (Tiffany-Iskander, Gore, Furse, & Bergerson, 2013).

Research and discussions into why this is the case has gone on for years. A review of literature identifies many possible reasons or causes. Female perceptions of TE and the demographics of the community are two of the areas this study will focus on.

Several categories were prominently identified that fall under perceptions and include: gender stereotypes, who TE is designed to serve and self-concept/efficacy. There seems to be strong perceptions toward gender stereotypes in what types of careers a female should have. The perception that TE is designed for males, and for those who cannot pursue the college for all pathway. Self-concept and efficacy also play a role in feeding into these perceptions.

Additionally, there are many influences that affect student choice and determine which courses students enroll in. Parents, peers, counselors, teachers/coaches are a few of the key influencers who play a substantial role and whose advice students may use to form their own perceptions of TE. These perceptions may all play an important factor in low female enrollment in TE courses.

Each school district is unique in many ways, its' location, student base, community involvement and various enterprises in the area. Minnetonka schools are in the heart of an affluent suburb, west of Minneapolis, Minnesota. Minnetonka is considered a white-collar community with higher than normal incomes and education levels. It is hypothesized that these demographics may also play a role in female enrollment in TE courses.

There have been numerous programs and concepts attempted with the goal of bringing more females into the TE field, many with good results. These attempts will be reviewed in chapter 2.

### **Statement of the Problem**

Minnetonka school enrollment data indicates that female enrollment in TE courses in Minnetonka high school is much lower than TE enrollment of males. Looking at national data, it is evident that female enrollment in TE is an important national issue and one deserving further research. Ideally, the first step in resolving the gender inequity in TE programs would be to

identify the major factors leading to low female enrollment in TE courses in Minnetonka high school. It is hypothesized that perceptions of TE and the demographics of this community may be important factors to research. It is hoped that this research will add to the discussion of the issue of improving gender equity in TE in the future.

### **Purpose of the Study**

The purpose of this study is to identify the female perceptions of TE at Minnetonka high school as well as identifying how the demographics of a community may impact enrollment of females in TE courses.

### **Assumptions of the Study**

Four assumptions have been made during this study.

1. That students would base their responses on their own opinions.
2. That students will answer honestly.
3. Responses to the questions and surveys accurately reflect the entire student population
4. That instructor behavior and attitudes do not impact female enrollment.

### **Definition of Terms**

The following terms and definitions were used in this study.

**Articulated college credit programs.** Programs designed to allow students an opportunity to earn vocational and community college credit in high school (Minnesota Community and Technical College Program, 2017).

**Career and technical education (CTE).** A secondary and postsecondary educational program that prepares students in technical, job-specific, academic and employability skills in one of sixteen career clusters with an emphasis on students being college and career ready upon graduation (Association for Career and Technical Education, 2017).

**Career clusters.** A grouping of occupations and broad industries based on commonalities (Minnesota State Careerwise Education, 2017 a).

**Career pathways.** Career pathways are small groups of occupations within a career cluster. Occupations within a pathway share common skills, knowledge, and interests. (Minnesota State Careerwise Education, 2017 b).

**Carl D. Perkins vocational and technical education act (Perkins Act).** A principal source of federal funding to states for the improvement of secondary and postsecondary CTE programs across the nation. The purpose of the Act is to develop more fully the academic, career, and technical skills of secondary and postsecondary students who elect to enroll in career and technical education programs (U.S. Department of Education, 2017 a).

**Gender equity.** Providing equal accommodations and opportunities for both female and male students in the same way and at the same time (National Collegiate Athletic Association, 2017).

**IEEE Women in Engineering (WIE).** One of the largest international professional organizations dedicated to promoting women engineers and scientists and inspiring girls around the world to follow their academic interests to a career in engineering (IEEE a, 2017).

**Inspiring girls now in technology evolution (IGNITE).** A program that exposes girls to the many opportunities in technology careers, dispelling stereotypes and networking them with professional role models through job shadows, internships and mentors (Ignite, 2017).

**Institute of Electrical and Electric Engineers (IEEE).** an association dedicated to advancing innovation and technological excellence for the benefit of humanity, is the world's largest technical professional society (IEEE b, 2017).

**Investors in CTE.** Students taking three or more CTE course in any career cluster during high school (U. S. Department of Education, 2013).

**Post-secondary education opportunities (PSEO).** Programs that allow 10th-, 11th- and 12th-grade students to earn college credit while still in high school, through enrollment in and successful completion of college-level courses (Minnesota Department of Education, 2017).

**Program of study (POS).** An academic and career plan developed by your school to help move you towards a college and career path (Homeland Security, 2017).

**Project Lead the Way (PLTW).** Provides transformative learning experiences for K-12 students and teachers across the U.S. by creating an engaging, hands-on classroom environment and empowering students to develop in-demand knowledge and skills they need to thrive and providing teachers with the training, resources, and support they need to engage students in real-world learning (PLTW, 2017).

**Science, technology, engineering and math (STEM).** A program that combines the academics of applied science, math, technology and engineering to view the world, solve problems and meet human needs (U. S. Department of Education b, 2017).

**Title IX of 1972.** A federal statute that protects people from discrimination based on sex in education or activities that receive federal financial assistance (U. S. Department of Education c, 2017).

**Technology.** Human's use of knowledge, tools and materials to innovate and make products that extend our capabilities and meet our wants and needs (Purdue University-Polytechnic University, 2016).

**Technology education (TE).** A program of study of technology designed for all students to provide an understanding of what technology is, and how it effects our world past, present and

future. Typical courses taught fall into the clusters of engineering, communications, construction, manufacturing, power & energy and transportation (Dugger, 2013).

**Vocational education (VE).** A program of study that offers a sequence of courses for preparing a student for specialized training for jobs in industry. Typical fields included are: agriculture, business, marketing/distribution, health, trade and industry and communications (Weingarten, 2015).

### **Limitations of the Study**

The following limitations should be considered;

1. The survey will be limited to one school district so results cannot be generalized.
2. The survey will be conducted in several different schools and classrooms within the Minnetonka district and provide by different instructors. Inconsistencies may result.
3. A convenience sample is being selected. Those who choose to voluntarily respond to the survey and who return signed consent forms or aren't opted-out by their parents will participate.
4. This study may have a lower number of responses and participants due to the informed consent protocols.
5. This study will be conducted in the last days of the school year in the 2016-2017 when many students may be checked out, pre-occupied with thoughts of summer, no school and freedom. It may not be taken as seriously as it could be, had it been conducted in the fall of the school year when participants are more engaged.
6. Due to the time of year this survey will occur and consent protocols, it may not recruit a sufficient number of survey and targeted focus group participants.

7. Due to the request to participate in the survey to teachers being sent out in a weekly newsletter that may or may not be read, teacher participation in recruiting volunteers may be low.

8. The survey questions were constructed by the researcher. Validity and reliability of the measures has not been determined and need to be validated and refined after running the survey the first time.

### **Methodology**

Information will be gathered using a survey created in Google docs. High school students, grades 9-12, ages 15-18 will be invited to respond by returning a student/parental consent form to acquire the code to the survey. Middle school students, grades 6-8, ages 12-14 will be invited to respond after an opt-out email is sent to their parents. The survey will be voluntary at all levels.

Additionally, volunteers will be-recruited to participate in a targeted survey group of 5-10 members each to gather additional information. It is hoped to have three groups consisting of females with TE experience, females without TE experience and a mixed group of females with and without TE experience.

## Chapter II: Literature Review

There are many possible reasons identified and offered as to why females do not enroll in Career and Technical Education (CTE) and the Technology Education (TE) related aspects of CTE courses at the same rate as males. Gender stereotyping, who CTE and TE are designed for, and efficacy play an important role in the perception of CTE and TE programs. Data gathered from the accountability requirements of the Carl D. Perkins IV Act in 2006 reports student participation and completion of non-traditional CTE courses. The results show female enrollment in non-traditional areas to be 35% (National Alliance for Partnerships in Equity, 2006). Non-traditional fields including: agriculture, precision manufacturing/production, engineering, construction/repair and automotive have female enrollment rates ranging from 9% to 25% (Eardley & Manvell, 2003). The number of female student investors, taking three or more CTE courses in any career cluster during high school has dropped from 43% in 1982 to 32% in 2004. It is suggested this may be, in part, the results of increased academic requirements for students to earn their diploma brought on by the high school reforms of the National Commission on Excellence in Education in 1983 (U. S. Department of Education a, 2013).

Female enrollment in TE courses, part of a CTE program, in Minnetonka high school is lower than the national statistics reported by the Perkins IV accountability reports. Minnetonka enrollment data gathered from the last ten years' enrollment records shows that typically only 5% -7% of the female student population enroll in TE courses at Minnetonka high school.

Ensuring that females have the same opportunities as their male counterparts should be of great importance. Understanding the reasons for low female enrollment is a key element to reversing this trend and increasing female enrollment, ensuring more students benefit from TE courses.

## **Female Perceptions of CTE and TE**

In past decades, Vocational Education (VE), a predecessor of CTE programs, offered sequence of courses for preparing a student for specialized training for jobs in industry. This perhaps creates a strong prevalent perception that these programs are designed to train males for industry and manufacturing jobs that are typically performed by males. In 1995, it was reported that these perceptions were already well formed,

Males were more likely than females to be vocational concentrators and specialists, while females were more likely to be in the college preparatory track. Additionally, males were more likely to concentrate in agriculture, trade and industry, and technical and communications, while females were significantly more likely to concentrate in business, health, and occupational home economics (Levesque et al. 1995. pp.12).

These strong VE stereotypes and gender typing of jobs were passed down to the modern TE programs and are still apparent in female enrollment data today. This overriding perception that TE courses are “guy” classes, along with fears of the perceptions of the climate, and feeling of acceptance in the male dominated classroom/field continue to be factors (Riegle-Crumb & Moore, 2013). A similar study includes gender-typing of careers and gender role socialization, which includes non-verbal messages perceived from the social environment as factors to be considered. This may include parental influence regarding the level of importance of enrolling in a TE course based on limited, and possibly outdated perceptions of what TE is and how it can help their child (Ji, Lapan, & Tate 2004).

There continues to be a stigma of TE as being an academic dumping ground and for those students not going on to a four-year college. In a study of student attitudes toward TE, both TE and non-TE students rated highly that TE was designed for students going to work after high

school, but were split by a 30% margin that TE was designed for students going to college, with TE students rating this category much higher than non-TE students. Both groups also indicated equally that they felt it was for those students who struggle academically and a both identified TE as being designed to serve those students who have discipline problems, but to a lesser degree than those struggling academically (Gaunt & Palmer, 2005). TE's hands on learning approach creates opportunities which help students who struggle academically to be successful, so it is perhaps not surprising that students make this connection.

The TE labs are typically filled with equipment and materials and due to the activity based learning are noisier and dirtier than regular education classrooms. As a result, they are often segregated from the regular education areas of the school which may make feel like more of a place for "guys" and not perceived as a place for a woman (Kidwai, 2011).

### **Self-Concept and Efficacy**

The perception that TE courses are for females and they can be successful in them is an important factor. However, there is a low number of female TE instructors who serve as models of modern career gendering in the field and play a role in female enrollment (Wonacott, 2002). Watching a female role model succeed at and enjoy STEM and engineering activities may be more likely to change children's stereotypes than having success in these activities themselves (Master, Cheryan, Moscatelli, & Meltzhoff, 2017).

A recent study showed that boys and girls as young as six years old had already developed a strong gender stereotype view that boys are naturally better than girls at robotics, engineering, science, technology and math (STEM) activities. This creates stereotype threat that tends to keep females from trying because of the expectation of doing poorly. The study went on

to show that when given early positive experiences in these fields, female efficacy and interest increased to the same level as the males (Master, et al. 2017).

### **Who is Most Influential in Enrollment Decisions**

Gaunt and Palmer (2005) also studied who most influences student choice in their decision to take a TE course, Peers were most influential at more than 70%, followed by parents at 55%, high school counselors at 49% and teachers at 29%. It is important to note that parents influence may be based on their experiences in these programs from many years ago and may not reflect a true understanding of current practices and goals (Rose, 2014).

Another avenue to look at is disparities in guidance/counseling practices. An informed guidance counselor can direct students into TE courses, or away from them quite easily. It is imperative that guidance counselors are up to date on current TE goals and practices, beyond merely knowing which classes are offered. Counselors need ongoing training to ensure female students receive the full range of options available to them and female students are not simply tracked into women dominated fields (Toglia, 2013). Although federal laws mandate gender equity in all aspects of education in Title IX of the Education Amendments Act of 1972 and the Perkins IV Act of 1984, girls and women continue to be underrepresented in TE and STEM programs and the gender divide has barely narrowed. When females are excluded, even by their own choice, they are not receiving equal access to learning about highly paid, in demand technical occupations (Toglia, 2013). Students, female and male, benefit from these courses, unfortunately only a fraction of females enroll in TE courses.

### **Demographics**

It is hypothesized that the demographics of the Minnetonka community may play an important role in female enrollment in the Minnetonka school district. According to the U. S.

Census bureau, (2016), Minnetonka is in a western suburb of Minneapolis, Minnesota, where over 90% of residents are white, with 56.8% having a Bachelor's degree or higher. The average household income is \$78,589. Minnetonka schools enrolls over 10,000 students with currently over 3500 students in the high school alone. 91% of graduates are college bound and it is highly touted that students average 26.7% on ACT tests (Minnetonka public schools, 2017).

**Respondent demographics.** Technology Education enrollment data from Minnetonka high school over the past 10 years, indicates that an average of 6% of the female students have enrolled in TE courses during this time. Compared to national enrollment data of 9% to 25%. (Eardley & Manvell, 2003), female enrollment in TE courses in Minnetonka high school is low.

**Community demographics.** Minnetonka is an affluent western suburb of Minneapolis, Minnesota, where Fifty-eight percent of students reported households having a Bachelor's degree or higher and fifty-three percent reporting high level income occupations. These demographics may impact students' choices to enroll in CTE/TE courses as parents, who advise their children, may have little exposure to the courses or career paths they offer.

## **Initiatives**

Fifteen years ago, Science, Technology, Engineering and Math (STEM), a program that combines the academics of applied science, math, technology and engineering to view the world, solve problems and meet human needs, emerged and was introduced nationally. Five years later Ohio schools began work with the National Alliance for Partnership in Equity, (NAPE) and became the first in merging STEM and equity becoming known as Ohio STEM Equity and more currently as the STEM Equity Pipeline. It exists for four reasons: women earn 33% more in STEM-focused jobs than in other jobs, jobs go unfilled because there are not enough men to fill them, it provides more innovation by providing new lenses and perspectives and it creates

opportunities for all regardless of race, gender or ethnicity. It attempts to change the micro-messages young people hear about gender and cultural norms. It targets children as young as seven during summer camps, fourth graders during career fairs and seventh and eighth graders at step into your future career days. This causes change in how girls perceive themselves and how they will fit into the world in their future, giving them power and choice. As of 2015, roughly 150 teachers and administrators were involved in the program (Huston, 2015).

Recent attempts have been made to create girls' only Technology education classes resulting in increased participation. St Anthony Village high school, in St Paul, MN, currently runs a Women in Engineering course that is for girls only. Students elected to design and build wooden cribs, tables and board games for Isuroon, a local nonprofit for Somali women. It took three years and recruitment at lunches to achieve enough enrollment to run the class. Prior to this, the instructor reported typically having only one or two girls on his rosters. The instructor noted that the class of twenty girls were more successful in completing the projects than his typical boy students. He plans to offer it again next year. The class is supported by administration to get more women in engineering (Dupuy, 2016). It is important to note that Title IX of 1972 makes it illegal to offer gender segregated classes. No child left behind revived the single sex concept in public schools. However, federal regulations in 2006 excluded vocational education from the policy change (Peckham, 2009). It should also be noted that activities that divide children by gender may reinforce and increase the stereotypes identified in their study (Master, et al. 2017).

In Seattle, a program called: Inspiring Girls Now in Technology Evolution (IGNITE) is a program that works by exposing girls to the many opportunities in technology careers, dispelling stereotypes and networking them with professional role models through job shadows, internships

and mentors. After six years of IGNITE, Seattle reports that half of their technology classes are filled with girls. The program won the Programs and Practices That Work award: Preparing Students for Non-Traditional Careers Award (Peckham 2007). The determination of what effect this has on female enrollment is not known now and would need to be determined through further study.

Perspectives are changing. The rate this occurs at could be improved by increasing public awareness through local and national media linking to student achievement, workforce development and job creation. Parents and guidance counselors need to be educated about the goals and practices of modern CTE/TE programs so their advice to their children and students on which courses to enroll in isn't from their high school experiences 20 years ago (Kidwai, 2011).

Further fueling gender inequities including disparities in guidance/counseling practices, inequities in the number of female CTE/TE instructors as well as career gendering in the field certainly play a role in female enrollment (Wonacott, 2002).

### **Chapter III: Methodology**

Technology's impact on the world we live in is profound and is changing at an increasing rate. It is imperative to have a better understanding of technology that can be gained through TE courses. This study is intended to determine factors that lead to low enrollments in TE courses of females. This chapter will address this population and the research subjects, instrumentation, data, collection process and analysis procedures.

#### **Subject Selection and Description**

The research subjects will be female and male students enrolled in the Minnetonka school district who volunteer to participate. The students will be between the ages of 12 and 18 in grades 6-12. Students will be invited to participate in the survey during the spring semester term.

Additionally, targeted survey groups of female volunteers, with and without TE experience will be recruited to provide additional thoughts on whether the classrooms are welcoming, or not and to offer suggestions for improvements.

#### **Instrumentation**

Two surveys will be used to collect data for this research project. For the TE department survey, the researcher prepared a Google sheets survey instrument to gather information consisting of 16 questions. The survey will be administered to female students in the high school and all TE students in the spring semester TE courses. These questions were prepared using multiple choice questions to gather categorical data, open ended questions to gather descriptive data and Likert Scale questions to gather continuous data pertaining to the specific elements discovered in the literature review which identified female perceptions of TE as a broad category, but with closer inspection, the following themes arose: attitude towards TE courses; the climate, and feeling of acceptance in the male dominated classroom/field (Riegler-Crumb &

Moore, 2013), prompted question # 6; How likely are you to take another TE course? Interest; a place for “guys” and not perceived as a place for a woman (Kidwai, 2011), prompted question # 7; Rate how TE courses meet your career interests. Efficacy; with gender-typing of careers and gender role socialization (Ji, Lapan, & Tate 2004), prompted question # 4; Rate how successful you felt you were in the TE course and question # 15; What are the barriers to achieving your career goal? Female stereotypes, but when given early positive experiences in these fields, female efficacy and interest increased to the same level as the males (Master et al. 2017), prompted question # 5; What prompted you to take a TE course. Career goals were also an important area to study; TE is often considered an academic dumping ground and for those students not going on to a four-year college (Gaunt & Palmer, 2005), and females typically on the college track and more likely to concentrate in business, health, and occupational home economics (Levesque et al. 1995), prompted question # 12; What are your career goals?

Influences were also identified as an important subject to research; parental influence based on limited, and possibly outdated perceptions of what TE is and how it can help their child (Ji, Lapan, & Tate 2004), and parent’s experiences in these programs from many years ago that may not reflect a true understanding of current practices and goals (Rose, 2014). Prompted questions # 13; Who or what helped you learn about your career options? And question # 14; Who or what has the greatest influence on your career choices. See Appendix A for a breakdown of the questions, type and information sought.

For the TE targeted survey group, the researcher prepared a Google sheets survey consisting of 17 questions. Both multiple choice for categorical data and open-ended questions for descriptive data were included. The survey will be administered to females who volunteer to

be further involved in this study. See Appendix B for a breakdown of the questions, type and information sought.

### **Data Collection Procedures**

Data will be collected through a survey administered in the spring semester of 2016-2017 school year. The intent of the survey is to determine perceptions of TE and to determine if the demographics of the community play a role in female enrollment in the high school TE courses. The survey will be voluntary and designed in a way so as not to discourage or intimidate the participating subjects. Examples include asking students to identify their parent's highest level of education and occupation as a respectful way of determining household income, as opposed to asking them to provide their household income.

Mass email to teacher groups is prohibited at Minnetonka. A request will be sent to the Principal who, when approved, will forward the request to his administrative assistant for inclusion in the weekly staff bulletin. The request will be to recruit teachers to administer this researcher's survey. When a teacher agrees to administer the survey, they will be given a survey packet in their mailbox. The packet will contain a brief description of the purpose of the survey and that it is voluntary, a script to read to their students explaining the purpose of the study and that it is voluntary, a survey consent form for parents and students to provide their permission indicated by their signature on the form and a slip of paper with a link to the survey that students would receive only after returning the signed parent/student permission form. The subjects will be asked to complete the survey at their convenience on their iPads, (not logged in) to ensure anonymous responses.

Due to a short lead time to include middle school participation, each of the middle school TE instructors will be contacted via email to participate in the project. They will send opt-out

emails to the parents of their students developed from script provided by the researcher. They will administer the survey as part of their end of the semester activities. Students whose parents email to say “no” to permitting their child from participating will be allowed to surf the internet on their iPads while the rest of the students completes the survey on their iPads.

### **Data Analysis**

The results of the survey will be analyzed using a t-test to make comparisons between all female and male respondents in the Minnetonka school district as categorical independent variables and efficacy, attitude, interests and supports as continuous dependent variables.

For community demographics, the survey data results will be tallied to determine highest education level and occupation levels in the household to identify levels of affluence.

### **Limitations**

The following limitations should be considered:

1. The survey will be limited to one school district so results cannot be generalized.
2. The survey will be conducted in several different schools and classrooms within the Minnetonka district and provide by different instructors. Inconsistencies may result.
3. A convenience sample is being selected. Those who choose to voluntarily respond to the survey and who return signed consent forms or aren't opted-out by their parents will participate. It will not be the entire student population.
4. This study may have a lower number of responses and participants due to the consent form protocols.
5. This study will be conducted in the last days of the school year in the 2016-2017 when many students may be checked out, pre-occupied with thoughts of summer, no school and

freedom. It may not be taken as seriously as it could be, had it been conducted in the fall of the school year when participants are more engaged.

6. Due to the time of year this survey will occur and consent protocols, it may not recruit a sufficient number of survey and focus group participants.

7. Due to the request to participate in the survey to teachers being sent out in a weekly newsletter that may or may not be read, teacher participation in recruiting volunteers may be low.

8. The survey questions were constructed by the researcher. Validity and reliability of the measures has not been determined and need to be validated and refined after running the survey the first time.

### **Summary**

The purpose of this research will be to identify perceptions of TE programs at Minnetonka schools and the effect that demographics may play on enrollment choices. The subjects will be female and male, with an age range of 12-18, and a mix of students with and without experience in TE.

Data will be collected using a survey that the researcher designed, to best answer questions for Minnetonka school district. A limitation may be that the survey needs to be validated and refined after running the survey the first time. This instrument will follow research survey protocols with clear instructions and consent protocols approved by the University of Wisconsin – Stout's Institutional Research board. Both the TE department survey and the targeted group survey will be created in Google sheets. The TE department survey will use a combination of multiple choice, open end questions and Likert Scale questions, while the TE targeted survey group survey will use only multiple choice and open-ended questions. The

survey will be administered in the spring semester of 2016-2017 school year and will be completely voluntary and designed in a way so as not to discourage or intimidate the participating subjects. Recruitment of volunteers will differ between the high school and middle school. In the high school, recruitment of participants will be done through teachers who volunteer to help. In the middle school, participants will be all TE students in spring semester who haven't been opted-out by their parents.

The results of the survey will be analyzed using a t-test to make comparisons between female and male participants and their perceptions as measured in several categories.

## Chapter IV: Results

This study identified factors leading to low female enrollment in TE courses in Minnetonka high school and attempted to determine if the community's demographics play a role in students' TE enrollment decisions. Students were asked to complete a survey asking them about their perceptions of TE courses with questions that addressed: their interests, their efficacy, career goals, who or what helped them learn about and was most influential in their decisions. They were also asked to identify their gender, age, parents level of education and parent occupation levels as a respectful method of determining affluence levels and to identify if demographics may play a role. The research questions addressed in this research study were:

1. What are the factors leading to low female enrollment in TE courses at Minnetonka high school?

2. What role does the community's demographics play in female student enrollment?

### Demographic Information

In the high school, the survey was given to all female students who volunteered and had completed the consent form properly, (53 students, or 16.3%). It was also given to all the middle school students, female and male, who were currently enrolled in TE courses in the spring semester of 2016/2017 and who hadn't been opted-out by their parents, (273 students, or 83.7%). Research subjects surveyed total were 326 with 162, or 49.7% reporting female and 143, or 43.8% reporting male as their gender. 21, or 6.4% reported no answer, prefer not to say or other as their gender. The students were all between the ages of 12 and 18 in grades 6-12. See Table 1.

Additionally, a targeted survey group of five female students, four with TE experience and one without TE experience volunteered to provide additional thoughts on whether the TE classrooms were welcoming and provide suggestions for improvement.

Table 1

*Demographic Information of Respondents in TE Department Survey*

Response	Frequency	Percentage
Middle School-Grades 6-8	273	83.7%
High School-Grades 9-12	53	16.3%
Female	162	49.7%
Male	143	43.8%
Prefer not to say/other-gender	21	6.4%

n = 326 total respondents

Respondents were asked if they have had experience in taking a TE course. 304 participants or 93.3% responded they had. 16 participants or 3.4% responded they had not. Six participants or 1.8% preferred not to answer. See Table 2.

Table 2

*Technology Education (TE) Course Experience*

Response	Frequency	Percentage
TE experience	304	93%
No TE experience	16	4.9%
Prefer not to say	6	1.8%

n = 326 total respondents

This study focused on two research questions. The first question focuses on factors leading to low female enrollment at Minnetonka High School. The second question examined the role the community demographics may play in female student enrollment in TE courses. An analysis of these two questions follows.

## **Question 1: What are the Factors that Lead to Low Female Enrollment in TE Courses at Minnetonka High School?**

A review of literature identified several themes, or factors around the general heading of perceptions. These factors include: efficacy, interest, attitude, support and career goals. Surveys were created to examine these factors and the results were analyzed.

**Perceptions of TE.** To determine perceptions of the participant's TE experiences, the participants were asked to respond to survey questions using a Likert Scale of 1-7, with 1 being low and 7 being high in four separate categories: efficacy, attitude, interest and support. The resulting data was analyzed using a t-test. Gender was used as the categorical independent variable and Likert scale responses to the following questions were used as continuous the dependent variables

1. efficacy: how successful students felt they had been in the course?
2. attitude: how likely students were to take another course?
3. interest: do Minnetonka courses meet students' interests?
4. support: do the TE course support students' career choices?

For the t-test, the level of significance was set at .05. For these t-tests, only respondents who indicated female or male for gender were analyzed. This resulted in a total sample size of 293, and did not include respondents who did not answer, selected prefer not to answer, or other.

**Efficacy.** To determine efficacy toward TE courses, students were asked to respond to how successful they felt they had been in their TE course on a Likert scale of 1-7. The equal variance not assumed t-test indicated a significance level of .131 (2-tailed), ( $t=3.99$ ), females ( $M=5.242$ ,  $SD=1.209$ ), and males ( $M=5.795$ ,  $SD = 1.131$ ). The results show that females

responded with lower self-efficacy/success ratings than did male students but not at statistically significant difference between the two groups. See Table 3.

Table 3

*Efficacy; Comparing Females and Males in Their Perceived Success in TE Courses*

Gender	N	Mean	Std. Deviation	Std. Error Mean
Female	161	5.242	1.209	.098
Male	132	5.795	1.131	.098
				p. = .131

n =293

Feedback from the targeted survey group contributed that, “it is perceived that many females don’t get exposed to the same TE activities as males and are not starting on the same level as males”. An additional thought indicated, “females seeing the many different machines and equipment they are unfamiliar with, makes it feel like one should already know what they are doing before taking the class, or perhaps this isn’t the class for them”.

**Attitude.** To determine attitude toward TE courses, respondents were asked to indicate how likely they were to take another TE course based on their experiences. A Likert scale of 1 – 7 was used in the survey. The equal variance not assumed t-test reported a significance level of  $p = .90$  (2-tailed), ( $t=6.39$ ), females ( $M=3.766$ ,  $SD=1.913$ ), and males ( $M=5.128$ ,  $SD = 1.716$ ). The results that females are less likely to take another TE course than their male counterparts, but it was not a statistically significant difference. See Table 4.

Table 4

*Attitude; Comparing Females and Males on Taking Another TE Course*

Gender	N	Mean	Std. Deviation	Std. Error Mean
Female	161	3.766	1.913	.152
Male	132	5.128	1.716	.149

n =293

p = .090

The targeted survey group's contribution regarding TE courses was that "It isn't so much about how the lab/classroom looks, as it is about how it feels." "Sexist jokes and being made fun of for not knowing or when you ask for help. That's the issue." The group also mentioned that they "don't want special treatment, only to be treated as an equal" Additionally, "the large machines, yellow safety tape, close together large equipment, feels claustrophobic, intimidating, feels like a trap, ventilation tubes on the ceiling, dark colors of equipment all created a dark ominous feeling." There were also concerns about being accepted, "The work tables could easily become filled with cliques of students making it hard to fit in." Suggestions from the targeted survey group included "assigning seats to avoid the cliques and groups of possibly unwelcoming classmates, continue to clean, organize and paint using white and variation of whites or pastels spectrum colors to brighten the space".

**Interest.** To determine interests, respondents were asked to indicate how well Minnetonka courses met their interest using a Likert scale of 1 – 7. The equal variances t-test indicated a significance level of  $p = .022$ , (2-tailed), ( $t=4.68$ ), females ( $M=4.553$ ,  $SD=1.643$ ), and males ( $M=5.401$ ,  $SD = 1.413$ ). Females reported that the courses at Minnetonka met their interests at a lower level than did males at a statistically significant level as shown in Table 5.

Table 5

*Interests; Comparing Females to Males on Whether the Courses Met Their Interests*

Gender	N	Mean	Std. Deviation	Std. Error Mean
Female	161	4.553	1.413	.123
Male	132	5.401	1.643	.129
				p < .000

n =293

The targeted survey groups questions were concentrated on TE courses and provided an opportunity to focus on the TE offerings. The insights the group provided were that they preferred for TE courses to be like the other courses in the high school; an equal mix of both females and males where both are treated equally and with respect. They also have an expectation level of the classrooms to be clean and organized as well as they can be, but seemed to understand that in an activity based class, it is a little more difficult to maintain this.

**Support.** To determine the level that TE courses support their career choices, respondents were asked to indicate how well the TE course supported their career choices using a Likert Scale of 1 to 7, with 1 being not likely and 7 being very likely. The equal variance not assumed t - test showed a significance level of  $p = .586$  (2-tailed), ( $t=5.19$ ), females ( $M=3.925$ ,  $SD=1.701$ ), and males ( $M=4.954$ ,  $SD = 1.675$ ). Females indicate that TE courses don't support their career choices at a slightly lower level than their male counterparts. It should be noted that both male and female responses were similar ( $p = .586$ ) with means for both groups hovering around 4 to 5 on a Likert scale of 1 to 7. There was not at a statistically significant difference between males and females. See Table 6.

Table 6

*Support; Comparing Females and Males on Course Support for Their Career Goals*

Gender	N	Mean	Std. Deviation	Std. Error Mean
Female	161	3.925	1.701	.134
Male	132	4.954	1.675	.146
				p = .586

n =293

The targeted survey group contributed that they did see value in the TE classes in that it, “helped them determine what they wanted to do, as well as what they didn’t want to do.” They identified that a spark of interest in one area, could lead to a solid interest in one of the TE concentration areas with “Interest in TE came from STEM, middle school TE and robotics which increased their interest in attempting other different TE course,” and “I found out I am interested in engineering.”

**Career goals.** Survey respondents were asked to identify what careers or job goals they were considering in an open-ended question to gather descriptive responses. Responses were grouped into similar categories and tallied. Engineering was the most common response for total responses with fifty-six, or 19.1 % choosing this field with (female = 26 or 16 %; male = 30 or 22.7 %). The next highest category was health and medical field receiving fifty-four, or 18.4% of the responses with (female = 43, or 26.7 %; males = 11, or 8.3). The next highest category was unsure with forty-two, or 14.3 % responses with (female = 15 or 9.3%; male = 27 or 20.4 %). Sports and entertainment was next highest with twenty-eight, or 9.6 % responses with (female = 9 or 5.6 %; male = 19 or 14.4 %), with males twice as likely to select this field as females. Education was the next highest category with eighteen, or 6 % of the responses with (female = 17 or 10.6 %; male = 1 or .76%). Communications also received eighteen, or 6.1% responses with (female = 15 or 9.3 %; male = 3 or 2.3 %). Business reported sixteen, or 5.5%

responses with (female = 16, or 5.5 % and male = 6, or 4.5 %). No answer received fourteen, or 4.8 % responses with (female = 7, or 4.3% and males = 7, or 5.3 %). Careers in computers received thirteen, or 4.4% with (female = 0 or 0 %; males = 13 or 9.8 %). The legal field with thirteen, or 4.4%, with (females = 11, or 6.8 %; males = 2, or 1.5 %). Trades indicated nine, or 3.1 % with (females = 3, or 1.9 %; males = 6, or 4.5 %). When looking at the data, medical, education and communications received higher selections from females than from males while engineering and sports/entertainment were the highest categories for males indicating students are continuing to pursue traditional careers roles. When looking at female career choices, Project Lead the Way (PLTW) was brought in to Minnetonka to transition from TE to CTE five years ago and offers engineering education. With female enrollment increasing in these courses, perhaps the bio-medical strand, available in PLTW might better align with female interests. Communications was another area of higher interest for females than males. Five years ago, the photography classes (a part of communications) were moved to the art department. Graphic arts and graphic design are still a part of our communications offering. For complete results see Table 7.

Table 7

*Comparing Female and Male Career Goals*

Response	Total	Total	Female	Female	Male	Male
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
Engineering	56	19.1%	26	16.1 %	30	22.7 %
Computers	13	4.4 %	0	0 %	13	9.8 %
Medical	54	18.4 %	43	26.7%	11	8.3 %
Education	18	6 %	17	10.6 %	1	.76 %
Military	4	1.4 %	0	0 %	4	3.0 %
Communications	18	6.1 %	15	9.3 %	3	2.3 %
Legal	13	4.4 %	11	6.8 %	2	1.5 %
Financial	4	1.4 %	2	1.2 %	2	1.5 %
Business	16	5.5 %	10	6.2 %	6	4.5 %
Trades	9	3.1 %	3	1.9 %	6	4.5 %
Sports/Ent	28	9.6 %	9	5.6 %	19	14.4 %
Sales	4	1.4 %	3	1.8 %	1	.76 %
No answer	14	4.8 %	7	4.3 %	7	5.3 %
Unsure	42	14.3 %	15	9.3 %	27	20.4 %
Total n =293			n = 161		n = 132	

**Question 2: Does the Community Demographics Play a Role in Student Enrollment in TE Courses?**

Survey questions were created to gather data on the demographics of the participants family in the Minnetonka community which included: parent's highest education level achieved,

parent's occupations and possible influences on the participants of the study. The results were analyzed and show that a substantial majority of high school students come from households with a high education level and high paying occupation levels and that parents have the greatest impact on the participants course and career choices.

**Influences.** Participants were asked to identify who or what had the most influence on their career choices in an open-ended question. The responses were grouped into the following categories:

Family: which includes parents, siblings and extended family which received the highest response with 108, (36.9 %) responding with (female = 59 or 36.6 %; males 49 or 37.1 %). The next highest category was no response which included no response, prefer not to say or didn't know with sixty-one, (20.8 %) responding with (female = 28, or 17.4%; males = 33, or 25 %). This was followed by no one: which included no one helped me or none, with thirty-eight, or 12.9 % with (females = 21, or 13 %; males = 17, or 12.9 %). School: which included Counselors, teachers, coaches, peers, courses they've taken, recruiters, open houses with forty-five, or 15.3 % responses with (females = 32, or 19.9 %; males = 13, or 9.8 %) responses. Personal experience: which included personal interests, police explorers, travel and personal experiences had forty, (15 %) responses with (females = 25 or 15.5 %; males = 19, or 16.7 %). This indicates that family has the highest influence on career choices, (female = 59 or 36.6 %; males 49 or 37.1 %), a close percentage margin between females and males. The high number of no one and no answer indicates a need for help for students in determining their career choices. See Table 8.

Table 8

*Most Influential on Career Choices*

Response	Total	Total	Female	Female	Male	Male
	Freq.	pct.	Freq.	Pct.	Freq.	Pct.
Family	108	36.9 %	59	36.6 %	49	37.1 %
School	45	15.3 %	32	19.9%	13	9.8 %
Personal exp.	41	14 %	21	13 %	20	15.1 %
No one	38	12.9 %	21	13 %	17	12.9 %
No response	61	20.8 %	28	17.4 %	33	25 %
Total n = 293			n = 161		n = 132	

**Prompted to take a TE course.** Data from the survey was analyzed by comparing females to males to identify differences between the two groups on what prompted them to take a TE course (see Table 9). This resulted in a survey sample total of 293 with 161 female responses and 132 male responses. It was a required course was reported as the highest category with, (female = 140, or 86.8% and male with 91, or 68.9%). A clear majority of respondents were from the middle school where Technology Education courses are required. Personal interest was the next highest response selected with, (female = 7, or 4.3% and male = 37, or 28%), with males five times more likely to choose this response. Parent suggested taking the course with, (female = 2, or 1.2% and male 3, or 2.3%). A friend suggested taking the course with, (female = 3, or 1.9% and male 1, or .7%). Preferring not to answer or other with, (female = 9, or 5.6% and males = 0 or 0%). See Table 9.

Table 9

*Prompted to Take Another TE Course*

Response	Total	Total	Female	Female	Male	Male
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
Required	231	78.8%	140	86.9%	91	68.9%
Personal interest	44	15%	7	4.3%	37	28%
Parent suggested	5	1.7%	2	1.2%	3	2.3%
Friend suggested	4	1.4%	3	1.9%	1	.7%
No response	9	3.1%	9	5.6%	0	0%
Total n =293			Female n = 161		Male n = 132	

**Barriers.** Participants were asked to identify what they felt were the biggest barriers to achieving their careers goals in an open-ended question to gather descriptive responses. The responses were grouped-into six categories and are shown in Table 10. The highest category included no answer, none, prefer not to say and don't know with (female = 75 or 46.6% and male = 56 or 42.4%). The second highest category of personal reasons included: negative character traits such as lack of effort/motivation, laziness, indecisiveness and procrastination with equal responses from female and male (female = 32 or 19.9% and male = 32 or 24.2%). The next highest category of education: which included GPA, learning what they need to know and getting into a good college, the career they want doesn't pay enough to pursue with (female = 30 or 18.6% and male = 22 or 16.7%). The next highest category was financial including: not enough money, college preferred is too expensive, student loans/debt, with (female = 7 or 4.3% and male = 13 or 9.8%). Gender discrimination: which includes being female, being overlooked for a male worker, systematic oppression of women in the workplace and society with (female =

10 or 3.4% and male = 0 or 0%). The “no barriers” category received (female = 7 or 4.3% and male = 9 or 6.8%). See Table 10 below for full results.

Table 10

*Female vs. Male Barriers.*

Response	Total	Total	Female	Female	Male	Male
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
No answer	131	45.7%	75	46.6%	56	42.4%
Personal	64	21.8%	32	19.9%	32	24.2%
Education	52	17.7%	30	18.6%	22	16.7%
Financial	20	6.8%	7	4.3%	13	9.8%
Gender discrim.	10	3.4%	10	6.2%	0	0%
No barriers	16	5.5%	7	4.3%	9	6.8%
Total n =293		Female n = 161		Male n = 132		

### Community Demographics

Minnetonka is considered an affluent suburb west of Minneapolis, Minnesota.

**Parents highest education level.** Respondents were asked to indicate the highest level of education their parents had achieved in their household. The largest category reporting their parents had an MS/PhD degree or higher with 117, or 39.9% responses with (female = 68, 42.2%; male = 49, or 37.1 %). The next highest category was not sure with 106, or 36.2% responses with (female = 56, or 34.8%; males = 50, or 37.9%). A BS/BA was reported third highest with 49, or 16.7% responses with (female = 25, or 15.5%; male = 24, or 18.2%). Only fifteen, (5.2%) reported an AS or lower with (female = 9, or 5.6%; male = 6, or 4.5%). Six, (2%) chose not to respond. See Table 11.

Table 11

*Highest Level of Education Achieved in Respondent's Household*

Response	Total	Total	Female	Female	Male	Male
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
MS/PhD or higher	117	39.9 %	68	42.2 %	49	37.1 %
BS/BA	49	16.7 %	25	15.5 %	24	18.2 %
AS or lower	15	5.2 %	9	5.6 %	6	4.5 %
Not sure	106	36.2 %	56	34.8 %	50	37.9 %
No answer	6	2 %	3	1.9 %	3	2.3 %
Total n = 293		Female n = 161		Male n = 132		

**Parent's Occupations.** Respondents were asked to indicate their parents' occupations as a respectful method of gauging the income level of their household. Responses were researched and categorized by high pay, \$100k and up; middle pay, \$50-100k; modest pay, \$50k and below, no response, prefer not to respond/other (see Table 12). High pay received the highest responses with 136, or 46 % total responses with (female = 85 or 52.8 %; male = 51, or 38.6 %). The next highest reported by ninety-nine, (33.8%) indicated a middle range. Eighteen respondents, or 6.1%, indicated pay levels in the modest range. Forty, (13.7%) did not answer or selected prefer not to answer. See Table 12.

Table 12

*Parents Occupations in the Respondent's Households*

Response	Total	Total	Female	Female	Male	Male
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
High > \$100k	136	46.4 %	85	52.8 %	51	38.6 %
Mid = \$50-100k	99	33.8 %	59	36.6 %	40	30.5 %
Modest < \$50k	18	6.1 %	7	4.3 %	11	4.3 %
No answer	40	13.7 %	10	6.2 %	30	6.2%
n = 293			n = 161		n = 132	

**Summary**

Quantitative data from the t-tests showed a difference between females and males responses in each category with females responded in the efficacy category with lower self-efficacy/success ratings than did male students but not at a statistically significant difference. In the attitude category, females are less likely to take another TE course than their male counterparts, but it was not a statistically significant difference. In the meets interest category, females reported that the courses at Minnetonka met their interests at a lower level than did males at a statistically significant level. In the supports goals category, Females indicate that TE courses don't support their career choices at a slightly lower level than their male counterparts. It should be noted that both male and female responses were similar ( $p = .586$ ) with means for both groups hovering around 4 to 5 on a Likert scale of 1 to 7 as shown in Table 6. This was not at a statistically significant difference between males and females.

Data on demographics were compiled that identifies that for both females and males, Minnetonka as an affluent community with parents who have a high level of education of

MS/PhD or higher (39.9%) with (females = 68, 42.2%; male = 49, or 37.1 %).and occupation level income of \$100k or higher (46.4%) with (female = 85 or 52.8 %; male = 51, or 38.6 %) and who have a high level of influence on the participants career choices with family as the top bracket, (36.5%) with (female = 58 or 36 %; males 49 or 37.1 %).

## **Chapter V: Discussion, Conclusion and Recommendation**

The purpose of this study was two-fold. First it was to determine what factors lead to low female enrollment at Minnetonka high school? Second, to determine if demographics of the community play a role in female student enrollment?

A review of literature identified several themes, or factors around the general heading of perceptions. These factors include: efficacy, interest, attitude, support and career goals. This information was used to inform the research in this study. Surveys were created to address these factors. The survey's data analysis substantiated the literature review findings that these factors are an important part of the general theme regarding female perception of TE courses. The results were analyzed and indicate that females responded at rates lower than males in every category. The research gathered qualitative as well as quantitative data. The results show consistency with the literature review, and differences in responses between female and male perceptions.

This study showed that when attempting to learn why female's students aren't enrolling in TE courses, it is important to gather information from those females who are choosing not to enroll. Recruitment for this survey was done by asking teachers to assist in the recruitment process. All TE teachers participated. Very few teachers outside of the TE department chose to become involved. This resulted in only 16, (4.9%) non-TE experience female respondents, with the remaining 304, (93%) female respondents having TE experience and 6, (1.85) preferring not to answer.

Another observation of this study is the predominant middle school responses of 273, (83%), (where TE is a required course) compared to 53, (16.3%) from high school respondents where TE courses are an elective. Although gathering information from students with TE

experience is valuable and provides insight into student's perceptions of TE who have taken a TE course, it is perhaps of more value for this research to gather information from students who have not taken a TE course. This would help better answer the question of what are their reasons for not taking a TE course.

The time of year this study was performed may be a limitation. This study was conducted at the end of the school year when interest and engagement levels are typically lower. The number of no answers to many of the questions may be an indication of this low engagement. Answers by every participant to every question ensures a better set of data. Conducting this survey at a time of the school year when students are fresh and more engaged in school would be more likely to provide better results.

## **Discussion**

Discussion will be addressed around the two questions in this study.

**Question 1: What are the factors that lead to low female enrollment in TE courses at Minnetonka high school?** VE is a program that has successfully been utilized for decades to guide and train people into careers where there are needs and can be used to make our society better; in times of war and social unrest. These careers have been predominantly male oriented in the past. This perception has become engrained in our society and shows up in female enrollment in these types of courses at an often much lower rate as males. VE is evolving into CTE, and TE, (associated with these programs) has inherited this perspective and must work hard to change it to include all, regardless of race, gender or ethnicity.

Research determined that female enrollment in TE courses at Minnetonka is lower than normal through data gathered from the accountability requirements of the Carl D. Perkins IV Act in 2006, and reports female enrollment in non-traditional areas to be 35% (National Alliance for

Partnerships in Equity, 2006). And, non-traditional fields including: agriculture, precision manufacturing/production, engineering, construction/repair and automotive have female enrollment rates ranging from 9% to 25%. (Eardley & Manvell, 2003). Minnetonka enrollment data gathered from the last ten years' enrollment records shows a lower enrollment rate where typically only 5-7% of the female student population enroll in TE or CTE courses at Minnetonka high school (Minnetonka Public Schools 2017).

Regarding career goals, the literature review identified that females were more likely to be in the college preparatory track, and more likely to concentrate in business, health, and occupational home economics (Levesque et al. 1995). In this study, career choices followed this pattern. Females chose the medical field at a higher rate than males with (female = 43, or 26.7 %; males = 11, or 8.3), and similarly in the education field with (female = 17 or 10.6 %; male = 1 or .76%). In the engineering field, a lower number of females selecting it than males, (female = 26 or 16 %; male = 30 or 22.7 %). Important to note is that the Minnetonka TE program brought in the Project Lead the Way (PLTW) programs as a method of transitioning from TE to a CTE program five ago. This appears to be catching on, gaining in popularity and is of interest to both females and males alike. Perhaps it may be a best first step to draw more females into the TE program. These courses concentrate on the design process and problem-solving. Perhaps incorporating design challenges, such as splints, artificial limbs and other types of medical devices that relate to the medical field might draw more interest from females.

Perhaps this indicates that gender roles and career perceptions are beginning to change in some areas. A roadmap to help in this area has been laid out by the Perkins Act and adopted by the Minnesota Department of Education, (MNDOE) that begins with the interest inventory tests to identify student's areas of high interest, followed by exposure to the career clusters to identify

areas of careers that align with these high interests and an opportunity to research educational requirements and income levels for these careers. It continues with career pathways showing connections to post-secondary options, including articulations with post-secondary schools, advanced placement and post-secondary educational opportunities, (PSEO). Additionally, programs of study should be incorporated that identify which TE courses and other courses should be taken during high school to better align and prepare the student for successfully achieving their career goals. Although recommended and required by the Perkins Act, this has not been incorporated and administered at a consistent rate necessary to make the substantial difference it could make. Minnetonka's pending TE curriculum review will address this. Additionally, the high number of responses listed as unsure or no answer, (19.1% total responses) is concerning. This substantiates the need for focused education on career options that the Perkins Act requirements call for and would help alleviate any disconnects between career goals and the role TE courses can play that help students achieve their goals.

Looking at perceived barriers, ten of the females (6.2%) identified gender discrimination issues in an open-ended question regarding what barriers they perceived to attaining their career goals. This indicates that gender discrimination was on the minds of at least these females without any kind of prompter to list it. The targeted survey group also brought up a perception that females have less exposure to the machines and equipment related to TE courses at an earlier age than males do, making them wonder if this is the class for them and if they are starting at the same place as males, or are they starting behind.

Highlighting a participant's response to barriers, that created interest on this researcher's part was one where the career goal was perceived as not providing an income worth pursuing. The surveys were anonymous, but looking at the other answers provided, it was determined she

was a female in middle school with an AS degree as the highest education level obtained in her household, a parent who is a hairdresser and family as the biggest influence on career choices. Her career interest is in Interior design. How she made the determination that it would not be a lucrative career is unclear.

Additionally, it was noted that the results of the group, (131 or 45.7%) did not answer with (female = 75 or 46.6% and male = 56, or 42.4%). This indicates career option education is lacking. If focused career options education was part of every TE course, students would be more aware of all their opportunities and potential barriers. It would also help students interested and passionate about fields such as interior designer and others to become aware of the facts and be able to use them in making and arguing their career choices based on facts and data and what they want to do, and not on the perceptions of someone else. This raises the questions of whether students are willing to give up their dream job where they will be happy to please their parents and pursue a high paying career? This is an area for further research.

Female attitudes toward TE course is worth discussing. This was an area where females reported less likely to take another TE course than males but not at statistically significant levels. There was much input from the targeted survey group regarding this. It was recommended that the “instructor be welcoming and inclusive to all, saying things like ‘Hey guys’ excludes girls”, “by welcoming females into the class, and encouraging female students who enjoy the class to tell their friends and encourage them to sign up for the class”. This will ultimately get “an even mix of male to female student ratios” that was preferred by this group. It was also brought up that the “work tables could potentially segregating students if allowed to choose their seats and suggestions of assigning seats early would help alleviate this.” Suggestions for a continuous process of improvement be incorporated to ensure this happens, that include the instructor

“working to organize student participation in cleaning and organizing the workspace, and keeping equipment clean and painted with brighter colors”.

The main theme of the targeted survey group’s responses was “having a non-threatening, well-lit, bright, open, clean, organized and inviting workplace as being important to all students”. And regarding attitudes were that it wasn’t so much about how the lab/classroom looked, as it was about how it felt; if it was welcoming, and could they expect to be treated fairly and equally in the classroom”. The importance of this cannot be overstated.

Multiple causes may be to blame; possible hostility towards females in these courses, both verbal and non-verbal, parental and counselor influences, both of which may be outdated, lack of female TE instructors and female role models, which may have an influence on female attitudes and perceptions of TE and how females can fit into this world of technology to name a few. This study did not survey parents, counselors and teachers to identify results in this area, but concentrated on students. The results were lower female ratings in efficacy, attitude, interest and support for their goals. In courses meeting their interest category, it was a statistically significant difference with females feeling courses less met their career goals than did males.

Looking at why this may be, this study identifies that many of these female negative perceptions still exist. Identified in this study, feelings of intimidation and hostility towards females in TE courses with comments such as “made to feel stupid because we don’t know or ask about something.” “Sexist jokes and comments.” “an intimidating environment with warning signs, yellow tape, large dark colored-ominous machines, (that they are unfamiliar with and don’t know how to use, but perceive males do from earlier experience), overhead vents, groupings at work tables that appear to be filled with cliques of people who know each other from previous classes and may be unwelcoming to someone new to the group”.

The thought that this may be a “guys” class, was mentioned more than once in the literature review. A take away from this study is that it appears that Minnetonka females don’t necessarily adhere to this and “are willing to try something new and different from usual, if it catches their interests, and if they are treated respectfully and as equals”. Also, if females “can make a connection to their career goals and see the course as something that will help them achieve their career goals, they will go deeper into other courses in TE areas”. Many of which that do align with female career goals; engineering, communications and possibly medical, if the bio-medical PLTW strand were to be brought in, or medical oriented design challenges were added to existing PLTW courses.

While 36% of all students identified family as the leading influence on their career choice, 15% of all students indicated personal interests as what prompted them to take a TE course. This indicates that in middle and high school, students are beginning to make choices more independently based on their own perceptions. This is where the focused career options education could stand out, possibly making a TE course, the course to take for finding out what career options might best fit your interests.

The author of this study, believes that the literature review and data from this study indicate that negative female perceptions of TE courses still exist, as evidenced by the consistent low enrollment of females in TE courses, the low ratings in each of the identified categories in this study, the input from participants in this study, along with the scores of research and writings on female enrollment in TE over the last decades.

Female role models and exposure to technology careers, beginning as early as 7 years old and consistently in 4<sup>th</sup> and again in 8<sup>th</sup> grade) as is the case with the STEM equity movement, would go a long way to changing this perception. If females are in a course they feel aligns with

their career goals, their efficacy, interest in, feeling supported in their career choices and attitude toward TE courses will report at higher rates and more equivalently to males. Gender roles and socialization are influenced by parents and other adult figures as they guide children and students in their early years. The literature review indicated that parents, teachers and counselors have an important influence on student's career and course choices. Although this study did not survey parents, teachers and counselors to determine this, students identified family as the most influential (36.5%) and school (14.6%) as the next most influential. Changing these perceptions may be a formidable task.

**Question 2: Does the community demographics play a role in student enrollment in TE courses?** Data on demographics was compiled that show that Minnetonka is an affluent community with parents who have high education levels of MS/PhD or higher (39.9%) and BS/BA degrees (16.7%) and occupation level income of \$100k or higher (46.4%) and mid-range of \$50-100k, (33.8%) and who have a high level of influence on the respondent's career choices with family as the top bracket, (36.5%). While this study could ascertain affluence in the community, it was unable to determine if there is a positive or negative correlation between this and female enrollment, or to what level this might exist with any level of confidence.

This survey concentrated on student perceptions. Teachers, Parents, counselors and other adults in student's lives were not surveyed in this study. In looking at the female perceptions of TE and enrollment choices, it is apparent that involving this group, is necessary to determine their views on gender roles, socialization and perceptions of TE, (which may be outdated as this field is ever evolving at faster rates.) and to identify the cultural norms and differences in opinions between the affluent and other levels of households might be able to answer this question further.

## Conclusions

Female enrollment in Minnetonka TE courses is lower than national averages and that of their male counterparts. Creating and offering relevant course offerings and activities that align with female interests such as design challenges and problem-solving activities that are related to the medical field, (a high interest area for females) and that better align with female career choices, ensuring students make the connections to their career choices, ensuring females are welcomed and treated equally in TE courses will go a long way toward increasing female TE enrollment through word of mouth, bringing in new students and an increase in continued female enrollment in other TE courses.

Gender roles and socialization have been, and continue to be very strong influencers. These perceptions may be changing, but the rate this occurs is slow. The rate of this change could be increased through the inclusion of a focused career option training and guidance in and through every TE course. Of equal importance is informing counselors and parents about TE to keep them up to date on what TE is, and what it offers through career fairs, open houses and promoting TE at every opportunity through presentations to the school board, news of accomplishments provided to the local media to help change the perceptions of TE.

It is imperative to take this proactive course of action in promoting the TE program. The need for career options training in Minnetonka is evident and aligns with recommendations of the Perkins Act that should be followed consistently to provide this in TE courses. This will help students better understand their career options, determine a solid career choice that aligns to their interests and would reduce the no goal, unsure of goal responses this survey received. Learning how various courses align with their career goals and supports them in achieving them, would increase levels of positive responses to interest, efficacy, support and attitude toward TE. This in

turn would begin shifting the gender roles perceptions, driven from the student side to the parent and adult side, thus creating more career options for females as well as interest and efficacy in pursuit of their goals at a faster rate.

### **Recommendations**

For future studies, it is recommended that studies include participation of all female students to gather input from the non-TE input. This study was weighted heavily toward females with TE experience and when attempting to find out why females aren't enrolling in TE courses, it is very important to hear from the young women who are not enrolling to find out why they aren't enrolling.

This study was conducted at the end of the school year when students are beginning to check out for the summer and the level of engagement is at a low as other things take priority over the things associated with school and taking voluntary surveys. In future research studies, it is recommended they be conducted in the beginning of the school year or soon thereafter, when students are more engaged. This will most likely provide greater participation and more thoughtful responses.

The findings of this study point to negative female perceptions of TE, gender roles and socialization. To better understand these elements, future research studies should include parents, coaches, counselors and other adults who have a high influence on children to determine and better understand their views on gender roles, socialization and perceptions of TE, (which may be outdated) and to identify the cultural norms and differences in opinions between the affluent and other levels of households. This study focused only on the student's perceptions and did not include these.

It is also recommended to look further at student career choices to determine if they are made based on their own interests and passions or the result of other influences, and to look further into female TE instructors and role models as the literature review indicated strong results when these are in place.

## References

- Association for Career and Technical Education. (2017, August 20). *What is CTE?* Retrieved from: [https://www.acteonline.org/cte/#.WYP\\_nOmQyUk](https://www.acteonline.org/cte/#.WYP_nOmQyUk)
- Carnevale, A., Rose, S., & Hanson, A. (2012). *Certificates: Gateway to gainful employment and college degrees*. Washington, DC: Georgetown University Center on Education and the Workforce.
- Dupuy, B. (2016, December 21). Girls-only engineering class builds for a cause. *Star Tribune*. Retrieved from: <http://www.startribune.com/girls-only-engineering-class-gives-back-to-somali-women/407691006>
- Dugger, W. E. Jr. (2013). *The progression of technology education in the U.S.A.* Retrieved from: <https://www.iteea.org/File.aspx?id=47099&v=662e0da9&source=generalSearch>
- Eardley, E., & Manvell, J. (2006). Legal remedies for girls' under-representation in nontraditional career and technical education. *International Journal of Manpower*, 27(4), 396-416.
- Fox Valley Technical College. (2017, August 20). *What is a career pathway?* Retrieved from <https://wicareerpathways.org>
- Gaunt, D., & Palmer, L. (2005). Positive student attitudes toward CTE. *Techniques*, 80(8), 44-47.
- Homeland Security. (2017, August 20). *What is a program of study?* Retrieved from <https://studyinthestates.dhs.gov/2015/10/what-is-a-program-of-study>
- Huston, P. (2015). Girls behind the stem equity movement. *Techniques*. 90(3),15-18
- Ignite (2017, August 20). *Inspiring girls now in technology evolution*. Retrieved from <http://www.igniteworldwide.org>.

- IEEE. (2017 a, August 20). *Women in engineering*. Retrieved from [https://www.ieee.org/membership\\_services/membership/women/index.html](https://www.ieee.org/membership_services/membership/women/index.html)
- IEEE. (2017 b, August 20). *Meaning of IEEE*. Retrieved from [https://www.ieee.org/about/ieee\\_history.html](https://www.ieee.org/about/ieee_history.html)
- Ji, P. Y., Lapan, R. T., & Tate, K. (2004). Vocational interests and career efficacy expectations in relation to occupational sex-typing beliefs for eighth grade students. *Journal of Career Development, 31*(2), 143-154.
- Kidwai, S. (2011). Changing the image of CTE. *Techniques, 86*(4), 16-19.
- Levesque, K., National Center for Education Statistics, N.C.E.S, Nces, & Institute of Education Sciences. (1995). *Vocational education in the United States: The early 1990s / Karen Levesque ... [and others]*. Retrieved from <https://eric.ed.gov/?q=vocational+education+in+the+united+states%3a+the+early+1990%27s&ft=on&id=ED388841>
- Master, A., Cheryan, S., Moscatelli, A., & Meltzoff, A. (2017). Programming experience promotes higher STEM motivation among first grade girls. *Journal of Experimental Child Psychology, 160*, 92-106.
- Minnesota Department of Education. (2017, August 20). *Postsecondary enrollment options*. Retrieved from <http://education.state.mn.us/MDE/fam/dual/pseo>.
- Minnesota State Careerwise Education. (2017 a, August 20). *About Career Clusters*. Retrieved from <https://www.careerwise.mnscu.edu/careers/aboutclusters.html>.
- Minnesota State Careerwise Education. (2017 b, August 20). *Career pathways*. Retrieved from <https://www.careerwise.mnscu.edu/careers/pathways.html>

- Minnesota Community and Technical College Program. (2017, August 20). Retrieved from <https://ctecreditmn.com/articulated-college-credit.php>.
- Minnetonka Public Schools. (2017, August 20). *Minnetonka school web page*. Retrieved from <http://www.minnetonkaschools.org/>.
- National Collegiate Athletic Association. (2017, August 20). *Women gender equity and title IX*. Retrieved from <http://www.ncaa.org/about/resources/inclusion/women-gender-equity-and-title-ix>
- National Alliance for Partnerships in Equity. (2006). *Guide for program improvement for Perkins IV: Nontraditional CTE participation and completion*. Retrieved from <https://www.napequity.org/nape-content/uploads/Guide-for-Program-Improvement-Perkins-IV.pdf>
- Peckam, S. (2007). Seattle schools win nontraditional CTE students award. *Tech Directions*, 67(5), 8.
- Peckham, S. (2009) *Technically speaking*. *Tech Directions*, 72(7), 4.
- PLTW. (2017, August 20). *Inspiring, engaging and empowering k-12 students*. Retrieved from <https://www.pltw.org>.
- Purdue University-Polytechnic University. (2016, August 20). *What is technology?* Retrieved from <https://polytechnic.purdue.edu/departments/technology-leadership->.
- Riegle-Crumb, C., & Moore, C. (2013). Examining gender inequality in a high school engineering course. *American Journal of Engineering Education*, 4(1), 45-65.
- Rose, M. (2014). Not your father's shop class. *American Educator*, 38(3), 12-17.
- Stipanovic, N. (2010). Providing comprehensive career guidance services through a career pathways framework. *Techniques*, 85(7), 32-36.

- Stone, J. R. (2014, Fall). More than one way: The case for high quality CTE. *American Educator*, 4-11.
- Tiffany-Iskander, E., Gore, P. Furse, C., & Bergerson, A. (2013). Gender differences in engineering-related fields ACT 30-year data analysis identified trends and suggested avenue to reverse trends. *Journal of Career Assessment*, 21(4), 599-613.
- Toglia, T. (2013). Gender equity issues in CTE and STEM education: Economic and social implications. *Techdirections*, 72(7),14-17.
- U. S. Census Bureau. (2016). *U. S. census report*. Retrieved from <https://www.census.gov/quickfacts/fact/table/minnetonkacityminnesota/PST045216>
- U. S. Department of Education. (2013). *National Assessment of Career and Technical Education (Interim report)*. Washington, DC: Author.
- U. S. Department of Education. (2017 a, August 20). *Carl D. Perkins career and technical education act of 2006*. Retrieved from <https://www2.ed.gov/policy/sectech/leg/perkins/index.html>.
- U. S. Department of Education. (2017 b, August 20). *Science, technology engineering and math: education for global leadership*. Retrieved from <https://www.ed.gov/STEM>.
- U. S. Department of Education. (2017 c, August 20). *Title IX and sex discrimination*. Retrieved from [https://www2.ed.gov/about/offices/list/ocr/docs/tix\\_dis.html](https://www2.ed.gov/about/offices/list/ocr/docs/tix_dis.html)
- Weingarten, R. (2015, February 16). *Vocational education is out; Career and technical education is in*. Retrieved from <https://www.edsurge.com/news/2015-02-16-vocational-education-is-out-career-and-technical-education-is-in>.

Wonacott, M. E. (2002). *Equity in career and technical education* (Report No. 20). ERIC Clearinghouse on Adult, Career, and Vocational Education, Center on Education and Training for Employment, College of Education, the Ohio State University. Retrieved from <http://www.calpro-online.org/eric/docs/mr00035.pdf>

### Appendix A: TE Department Survey Questions

Question	Type of question	Information sought
1. What is your gender?	M/C	Demographic
2. What school level are you in?	M/C	Demographic
3. Do you have TE experience?	M/C	Demographic
4. Rate how successful you felt you were in the course?	Likert Scale	Efficacy
5. What prompted you to take the course?	M/C	Influence
6. Rate how likely you are to take another TE course.	Likert Scale	Interest
7. Rate how Minnetonka's current course offerings meet your needs.	Likert Scale	Interest
8. Rate how Minnetonka's TE program offering supports your career goals.	Likert Scale	Interest
9. What courses would you like to see offered in the TE program?	Open-ended	Interests
	M/C	Demographic

---

10. What is the highest level of education achieved in your household?	Open-ended	Demographic
11. What are your parent's occupations?	Open-ended	Interests
12. What are the career/jobs goals you are considering?		
Goals	Open-ended	Influence
13. Who or what helped you learn about your career goals options?	Open-ended	Influence
14. Who or what had the greatest influence on your career choices?	Open-ended	Efficacy
15. What are the barriers to achieving your career goals?	Open-ended	Interests
16. Where in the future do you plan to work?		

---

### Appendix B: TE Targeted Survey Group Questions

Question	Type of question	Information sought
1. Looking at the photo of the woodworking room, what do you find welcoming?	Open-ended	Perception
2. Looking at the photo of the woodworking room, what do you find un-welcoming?	Open-ended	Perception
3. Looking at the photo of the woodworking room, what would you suggest doing to make it more female welcoming?	Open-ended	Perception
4. Looking at the photo of the metals room, what do you find welcoming?	Open-ended	Perception
5. Looking at the photo of the metals room, what do you find un-welcoming?	Open-ended	Perception
6. Looking at the photo of the metals room, what would you suggest doing to make it more female welcoming?	Open-ended	Perception
7. Looking at the photo of the graphics room, what do you find welcoming?		

---

8. Looking at the photo of the graphics room, what do you find unwelcoming?	Open-ended	Perception
9. Looking at the photo of the graphics room, what would you suggest doing to make it more female welcoming?	Open-ended	Perception
10. Looking at the photo of the engineering room, what do you find welcoming?	Open-ended	Perception
11. Looking at the photo of the engineering room, what do you find un-welcoming?	Open-ended	Perception
12. Looking at the photo of the engineering room, what would you suggest doing to make it more female welcoming?	Open-ended	Perception
13. If you have taken a TE course, how did it help you determine your future goal?		
14. If you have taken a TE course, would you recommend it to a friend?	Open-ended	Interests

---

---

15. What additional course content would you like to see offered in the TE department?	M/C	Perception
16. If a “girls’ only TE course were offered, would you be interested in signing up?	Open-ended	Interests
17. As a female looking at the class make up in TE courses, what is your ratio of male to female preference?	M/C	Interests
	M/C	Interests

---