

## Abstract

LEE, JENNIFER ANNE. Gender Equity Issues in Technology Education: A Qualitative Approach to Uncovering the Barriers. (Under the direction of Dr. Theodore Branoff.)

This study was conducted in order to discover existing barriers that discourage females from enrolling in technology education (TED) classes in high school and college and to offer suggestions on ways to overcome those barriers. A pilot study was conducted in 2005 at an International Technology Educator's Association (ITEA) National Conference to help inform the researcher on the best way to collect data for the study. Participants for the pilot study included female technology education students from several major universities around the country. The pilot study was conducted in order to inform the researcher on the best data collection methods for the current study. As a result of the pilot study, qualitative research methods were utilized for the current study including a demographic survey, focus groups, small group interviews, and document analysis. The subjects for the current study were male and female students attending a major university who were enrolled in technology education courses, as well as a group of females who were not technology education majors. Three groups were interviewed for the study: one group was composed of females majoring in technology education; a second group was made up of females enrolled in an introductory graphic communications class who were not technology education majors; and the final group was a group of male technology education majors. Data analysis revealed possible explanations for and solutions to low female enrollment in technology education and technology-related fields, which could influence the way technology education and STEM classes are taught in the future.

Gender Equity Issues in Technology Education:  
A Qualitative Approach to  
Uncovering the Barriers

by  
Jennifer A. Lee

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APPROVED BY:

---

Dr. Theodore J. Branoff  
Chair of Advisory Committee

---

Dr. William J. Haynie  
Technology Education Program

---

Dr. Alice Scales  
Graphic Communications Program

---

Dr. Catherine Warren  
Women's and Gender Studies

## Dedication

This study is dedicated to the courageous women who have broken and continue to break down the barriers in historically male-dominated areas in order to pursue their dreams. I honor their perseverance, dedication, and willingness to create a path for other women to follow. I especially dedicate this study to the female participants, all of whom diligently continue to make positive changes in their professions. I also dedicate this dissertation to the women who contributed to what technology education is today, including but not limited to Lois Coffey Mossman, Mary Margaret Scoby, Jane Smink, Clara Stilmar, Sara Patrick, Alice Krackowizer and Margaret Wells, Jane Welling and Charlotte Calkins, and Theresa C. Gunther. Although their contributions to our field are largely forgotten and rarely mentioned, the efforts of these women greatly advanced the creation of initial industrial arts philosophy and curriculum; and, therefore, to what technology education is today.

## Biography

Jennifer Anne Lee was born on October 25, 1964 at Morón Air Force Base in Seville, Spain to Lieutenant Colonel Robert Edward (Ret. USAF) and Mary Anne Lee. After graduating from Hendersonville High School, Hendersonville, North Carolina in 1982, Jennifer completed two years as a social work major at Western Carolina University (WCU) in Cullowhee, North Carolina. Following two years at WCU, Jennifer transferred to the University of North Carolina at Asheville, (UNCA) where she completed her Bachelor of Arts degree in Theater in 1989.

After designing and building scenery and properties for eight years at professional theaters around the country, including the Alliance Theatre Company in Atlanta, Georgia and The Seattle Repertory Theatre in Seattle, Washington, Jennifer returned to UNCA to pursue an elementary education licensure. After receiving her K-6 teaching licensure, Jennifer taught fourth and fifth grade and elementary drama for seven years in several North Carolina public schools. Jennifer left teaching to pursue a master's degree in Technology Education (TED) at North Carolina State University (NCSU), in Raleigh, North Carolina.

Jennifer received her Master's of Education in Technology Education in 2004 and, with some encouragement from Dr. William J. Haynie, continued in the program to pursue a doctorate. While pursuing her doctoral degree, Jennifer served as a departmental teaching assistant and taught TED 115: Woods Processing Technology and TED 110: Materials and Processes Technology. In 2006, Jenny won the Outstanding Teaching Assistant Award for the NCSU Technology Education Department. She is a member of

Epsilon Pi Tau (EPT), the Technology Education Honor Society, and served as the club's president during the 2004-2005 school year. She won the EPT leadership award in 2006. She is a member of the International Technology Educator's Association (ITEA) as well as the Southeast Technology Educator's Conference (STEC). Her research interests include the issue of low female participation in technology education and other STEM fields, creativity and social capital and the work of Dr. Richard Florida, and brain research focused on cognitive processing and sleep.

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## CHAPTER 1: INTRODUCTION TO THE STUDY

“Just so long as there is one woman who is denied any right that man claims for himself, there is no free man; that no man can be a superior, true American, so long as one woman is denied her birthright of life, liberty, and the pursuit of happiness.”

– Elbert Hubbard, 1927, Father of the Arts and Crafts Movement

### Background of the Problem

#### *Universal Effects of Low Female Enrollment in Technology Education and STEM*

The issue of low female enrollment in the areas of science, technology education, engineering, and mathematics (STEM) affects education, industry, and global and economic leadership of the United States (National Science Board, 2006). In the United States, there is a growing difference between supply and demand of qualified workers for technology and STEM-related fields (Bybee & Starkweather, 2006; Damschen, Rosenfeld, & Wentworth, 2007; Gordon, 2007; InterAcademy Council, 2006; Jackson, 2004; Kirkegaard, 2007; National Commission on Mathematics and Science Teaching, 2000; Wyer, Murphy-Medley, Damschen, Rosenfeld, & Wentworth, 2007).

With the rising number of foreign graduates in the STEM fields returning to their countries of origin, and the decreasing number of United States graduates in these areas, the nation could possibly lose its position as the global and economic leader of the world (Committee on Prospering in the Global Economy, 2005; Kirkegaard, 2007; NSB, 2006). Moreover, the attacks of September 11, 2001 have caused the United States government

to be exceptionally aware of and concerned about terrorist threats to national defense and the need for technical workers to support national defense (NSB, 2006; National Science Foundation, 2007). With the threat of terrorism, the competition for global and economic leadership, and one-quarter of the current STEM workers retiring by the end of this decade, the need for recruiting women into technology education and the other STEM fields becomes crucial (Jackson, 2004).

#### *Technology Education and Science Interest among Female Students*

Existing research reveals that students of both genders are initially attracted to and enjoy science classes (Arambula-Greenfield, 1997; Truluck & Courtenay, 1999).

Although this fascination with the sciences typically continues through the elementary school level, by the time they begin middle school, male and female students' interest and disposition toward STEM-related classes begins to change (Jones, Howe, & Rua, 2000). Males become more interested in science and technology classes while females become attracted to other types of courses (Jones, Mullis, Raizen, Weiss, & Weston, 1992).

In North Carolina, there is a large presence of female students in middle school technology education classes; however, by high school, the number of females in technology education classes drops to less than half the total number of students enrolled in high school technology education classes (North Carolina Department of Public Instruction, 2005; Tom Shown, personal communication, 2006). By the time female students begin to make college and career choices, few of them select majors in technology education and the other STEM areas (Bybee & Starkweather, 2006; Jackson, 2004). Female students losing interest in technology education and other STEM areas,

and a general lack of qualified workers to fill technology education and STEM related jobs results in employment gaps at industrial and national levels.

With the rising threat of terrorism, along with the possibility of losing its global leadership and economic edge, United States political advisors, industry leaders, and other professionals have called for change efforts to stop this growing crisis (Building Engineering & Science Talent, 2002, 2005; Business and Higher Education Forum, 2005; Jackson, 2004; President's Council of Advisors on Science and Technology Workforce/Education Subcommittee, 2004; United States Government Accountability Office, 2005; Wyer & Adam, 2000).

#### *Existing Data in Technology Education Research*

Much of the existing data on gender in technology education and the STEM fields have been informed by research from the science fields. A review of related literature revealed a lack of qualitative research about low female enrollment in technology education programs. Due to the prevalence of gender inequity in technology education courses and the researcher's interest in discourse with students who directly experience gender inequity issues, qualitative methods were chosen for the study: specifically, observation, focus groups and small group interviews, document analysis, and member-checks (Bogdan & Biklen, 2003; Barbour, 2007; Krueger & Casey, 2000; Litoselliti, 2003).

Two previous analyses of technology education research analyzed research studies conducted in technology education from 1987 to 1993 (Petrina, 1998; Zuga, 1994). The findings of these analyses revealed that 83% of existing studies were

quantitative; 87% of the researchers were male; and 11% of the studies involved students in the schools. Few of the articles examined by Zuga (1994) and Petrina (1998) referred to constructivist learning and only one article, O'Riley (1996), used feminist theory (Petrina, 1998; Zuga, 1994). In her conclusions, Zuga (1994) noted a recurring theme of gender and cultural bias in technology education. She concluded that technology education content and instructional strategies could be sources of gender-bias in the field. As Zuga (1994) stated, all genders, cultures, and abilities deserve access to the best technology education training possible. However, according to Zuga (1994), from 1987 to 1993, technology education researchers did not address the needs of women, minorities, or students with disabilities.

This finding is supported by Petrina (1998) in which he reported that in technology education research, women and other minorities were significantly overlooked. As noted by Zuga (1994) the "main purpose of technology education in schools is to prepare students to understand and participate in a technological society through experience with technological methods, resources, and knowledge" (p. 1). Yet, more than a decade later, females are not getting the knowledge and skills needed to compete in the global economic society.

#### *Barriers and Solutions to Low Female Enrollment Cited in Existing Research*

The examination of the existing research on low female enrollment in technology education revealed several barriers and solutions to the problem. Barriers to female involvement in technology education included:

- technology education perceived as a male-dominated field (Bryson, Petrina, Braundy, & deCastell, 2003)
- disenfranchisement of female technology education teachers and students (Bryson, et al, 2003)
- loss of interest among females in technology education classes after middle school (Jones, Howe & Rua, 2000; Silverman & Pritchard, 1996)
- lack of female role models and mentors in technology education (Committee on the Status of Women Faculty at Caltech, 2001; Gilbert, 2001; Jovanovic & King, 1998; Massachusetts Institute of Technology, 1999)
- effects of stereotypes about technology education (Clewell & Campbell, 2002; Greenfield, 1996; Lantz, 1985)
- sexism and gender-bias in technology education programs (Brickhouse, 2001; Cano, 1990; Committee on the Status of Women Faculty at Caltech, 2001; Guttentag & Bray, 1976; Henry, 1994; MIT, 1999; Muraskin, 1989; Olivares & Rosenthal, 1994; Rolling, Burnett, & Huh, 1996)
- lack of knowledge of career options (Bryson et al., 2003; Silverman & Pritchard, 1996)
- effects of teacher gender on female choice of classes (Bryson, et al., 2003; Darling, 1992; Henry, 1994; Muraskin, 1989; Olivares & Rosenthal, 1994; Pottker & Fishel, 1977; Rolling, Burnett, & Huh, 1996)
- funding and other administrative support (Bryson, et al., 2003; Silverman & Pritchard, 1996)

- biological differences (Clewell & Campbell, 2002)
- parental expectations and input (Clewell & Campbell, 2002)
- effects of guidance counselor and teacher discouragement (Bryson, et al., 2003)
- female lack of confidence and self-efficacy (Clewell & Campbell, 2002; Wyr & Adam, 2000)

While researchers reported numerous barriers to low female interest in technology education and the other STEM areas, they also made suggestions for overcoming these barriers. Those solutions include:

- hire and provide more female mentors and role models for female students in technology education (Gilbert, 2001; Greenfield, 1996; Silverman & Pritchard, 1996)
- examine scheduling of technology education classes (Silverman & Pritchard, 1996)
- encourage guidance counselors to provide female students with information about technology education classes (Silverman & Pritchard, 1996)
- examine the possibility of making systemic changes in technology education curriculum and instructional strategies (Bryson, et al., 2003; Greenfield, 1996)
- provide extracurricular technology education experiences for females (Campbell & Steinbrueck, 1996; Dark, Clewell, & Savo, 2002; Gilbert, 2001; Jovanovic & King, 1998)

The goal of the current study was to combine an examination of barriers and solutions present in existing research with findings from a new qualitative study on the topic in order to offer fresh and contemporary solutions to raising the number of females in technology education and the other STEM areas. The study was based on a theoretical framework of constructivist learning and feminist pedagogy. A synthesis of constructivist learning strategies and feminist pedagogies could offer a new framework for improved learning for all STEM students, especially those who may not have been successful with traditional STEM teaching strategies. The findings of the current study could offer new ways of removing barriers and attracting females to technology education and the other STEM fields.

### Purpose Statement

In many parts of the world female participation in the areas of science, technology education, engineering, and mathematics (STEM) in both educational and career settings is extremely low (NSB, 2006; Plonski and Saidel 2001; Roger and Duffield, 2000; van Langena, Boskerb, and Dekkers; 2006). North Carolina's series of technology education classes for sixth, seventh and eighth grade, Exploring Technology Systems, is currently required for middle school students, and, therefore, has no problem with enrollment of female students. However, by high school, when technology education classes become optional, the number of females in these classes drops considerably (NCDPI, 2005; Tom Shown, personal communication, 2006). This problem continues at higher education levels with low female enrollment in technology education, engineering, the sciences, and related fields of study.

There is not a great deal of empirical evidence that pinpoints one particular reason why females do not elect to take technology education classes beyond middle school, nor does the research offer many suggestions for how to attract females to technology education classes. The purpose of this study was to examine factors that influenced female course choices during middle and high school and continue to influence their course choices on the university level. Qualitative research based methods, including observations, focus group interviews, small group interviews, document analysis, and member checks were used to collect data for the study. Six female technology education majors, seven male technology education majors, and seven females outside of the major participated in the study. The seven females outside of the major were made up of

students who were enrolled in an introductory graphic communications course. A total of twenty students participated in the study.

### Significance of the Study

The study is significant because it could possibly contribute to a gender-equitable technology education program across the United States and abroad. It has been some time since researchers have approached this problem from a qualitative stance nor have any researchers asked students their opinions about existing barriers that keep females from enrolling in technology education classes and choosing the field as a career choice (Petrina, 1998; Zuga, 1994). Clearly, from education to industry to government, there is a major concern that not enough students, women or men, choose technology and engineering as careers, and, as a result, STEM jobs in the United States remain vacant (Bybee & Starkweather, 2006; Jackson, 2004). The findings of this study could uncover new ways of removing barriers and attracting females to not only technology education, but to all STEM fields. Finally, the study could address other needs found in the research such as discovering avenues for challenging stereotypes about technology education, finding ways for female students to have female role models, teachers, and mentors, and suggesting ways to create a technology education curriculum that attracts all students to technology education.

### Research Questions

1. Why do females choose not to enroll in technology education classes?
2. What are the barriers that discourage females from enrolling in technology education classes?

3. How can females be encouraged by their community (parents, teachers, counselors) to enroll in technology education programs?

### Limitations of the Study

There are several limitations to the study:

1. The sample could possibly be tainted since the study is limited to volunteers.
2. Participant responses in focus group discussions and small group interviews are subject to researcher interpretation.
3. Observation and interpretation of behavior by the researcher might be different than what participants intend.
4. In any interviewing situation, one does not know for sure if subjects are saying what they really feel or what they think the researcher wants to hear.
5. The researcher's presence could influence participant responses.
6. The study is limited to one university in one county in one southern state.
7. The study findings will not be able to be generalized. The ability to generalize findings from samples to populations is weak in qualitative studies because the purpose of the research is to increase understanding of a particular event, situation, or occurrence, not to try to generalize findings to the population. The methods chosen are unique to that particular study. Researchers in qualitative studies look for patterns, themes, and categories for use in other settings, but do not focus on replication (Bogdan & Biklen, 2003).
8. The study was conducted over a short period of time. A longer time period for the study would result in more consistent findings.

### Definition of Key Terms

*Qualitative research*: a type of research in which a researcher collects descriptive data in natural surroundings and gives voice to the participant's point of view (Bogdan & Biklen, 2003).

*Focus group*: a group discussion in which participants' ideas, thoughts, and suggestions on a specific area of researcher interest are shared in a non-threatening environment (Barbour, 2007; Krueger & Casey, 2000; Litoselliti, 2003).

*STEM*: an acronym that stands for science, technology, engineering, mathematics.

*Feminism*: the philosophical commitment to the end of sexual inequality and to the full empowerment of women (Richardson, Taylor, & Whittier, 2003); doctrine that advocates social, political, and other rights of women equal to those of men (Dictionary.com. Unabridged. v. 1.0.1, n. d.).

*Feminist pedagogy*: the integration of the essentials of feminism into the curriculum, teaching strategies, classroom practices, and relationships between student and teacher (Crabtree & Sapp, 2003).

*Feminist research*: research that locates women and women's experiences at the center of discovery and analysis; research that aims to empower both women researchers and women and children who serve as the center of feminist research (Richardson, Taylor, & Whittier, 2003; Seale, 1999).

*Gender*: the social characteristics associated with biological femaleness or maleness in any society (Richardson, Taylor, & Whittier, 2003)

*Gender inequity*: socially structured differences in wealth, privileges, resources, opportunities, prestige, and power granted to men and women in any particular society (Richardson, Taylor, & Whittier, 2003).

*Pedagogy*: the interactions and relationships between the teacher, students, the educational environment, and the learning tasks; includes the curriculum, and the teaching techniques and planning of the teacher as well as the learning style and assessment of the students (Murphy & Gipps, 1996).

*Constructivism*: a theory of learning in which learners make meaning of new concepts based on previous knowledge (Cobb, 1994; Richardson, 2003).

### Summary of Chapter One

Low female participation in technology education and other STEM-related fields is a documented problem in education, industry, and government (Bybee & Starkweather, 2006; Gordon, 2007; InterAcademy Council, 2006; Jackson, 2004; Kirkegaard, 2007; NCMST, 2000; Wyer, et al., 2007). It affects not only those in the United States, but is also an international problem (Braundy & deCastell, 2003; Bryson et al., 2003; Hazzan, Tal & Keida, 2006; Jenkins & Pell, 2006; Petrina, 1998). If this problem is ignored, women will be deprived of academic and employment opportunities in the STEM fields; and, ultimately, society will not benefit from the important contributions women could make. Through a combination of constructivist learning theory and feminist pedagogy, this researcher hopes to offer some suggestions on breaking down the barriers and adapting the curriculum so that the number of females in technology education programs and the other STEM areas will rise at all levels. By talking directly to the students who

are currently experiencing these issues, I hope to discover exactly what the barriers are, why they are still so prevalent, and how they can be broken down.

## CHAPTER 2: REVIEW OF THE LITERATURE

A review of the literature was conducted to uncover existing themes that might be evident in low enrollment of females in technology education and related fields such as science, mathematics, and engineering. In addition, a theoretical framework is discussed to provide a foundation for the research, and a pilot study completed in 2005 by the researcher is analyzed.

### Gender Inequity and Education

According to Jones, Howe, and Rua (2000), by the end of elementary school, male and female student interest and disposition toward STEM-related classes begins to change. Boys become more interested in science and technology classes while girls become less interested in these classes (Jones, Mullis, Raizen, Weiss, & Weston, 1992). Research by Truluck and Courtenay (1999) revealed that students of both genders enjoy hands-on learning exercises and problem solving activities. Both boys and girls are attracted to science and technology education classes because they offer a chance to be creative and participate in hands-on learning. According to Silverman and Pritchard (1996), field observations showed that hands-on activities attracted girls and that they learned quickly and demonstrated skill and ability in hands-on lessons in technology education classes. Moreover, other research suggests that high school classes that utilized hands-on activities, female role models, and other varied approaches to curriculum such as internships and field trips strengthened self-confidence and interest in STEM areas among female students (Campbell & Steinbrueck, 1996; Dark, Clewell, & Savo, 2002).

Since they are required, courses such as North Carolina's required technology classes for middle school have equal enrollment levels for both boys and girls. However, in high school, technology education classes are not required and, as a result, female enrollment is much lower in these classes (NCDPI, 2005; Tom Shown, personal communication, June 6, 2006). Since research shows that females in elementary and middle school enjoy the hands-on learning and problem solving environment that technology education classes have to offer, why are female students staying away from these classes and what can we, as a society, do to address this important issue?

#### Gender Inequity in Career and Industry

The struggle for gender equality in the sciences initially emerged due to the efforts of feminist activists who fought for women's access to the same knowledge that only men were privy to up until the movement began in the early 1970's (Gilbert, 2001). Consequently, special programs were created to make females aware of possible science and technology-related careers as well as expose them to hands-on science and technology activities and experiments (Gilbert, 2001). The goals of these programs were to offer girls avenues for positive experiences with science and technology and to supply them with female role models and mentors in the fields (Gilbert, 2001; Jovanovic & King, 1998).

Even though women and other feminists in the past fought hard for equality in the sciences, there is still a glaring lack of women working in the STEM fields. As noted by Williams (2002), females are most visible in "traditionally female" low-paying careers such as "health care, child care, clerical work, and the service industry," while males are

being prepared for higher-wage skilled careers (p. 287). Female students are under-represented in coursework and training that could provide them with opportunities to pursue high-tech careers.

Findings reported by United States Government Accountability Office (2005) showed that although enrollment in colleges and universities has grown over the past ten years, the number of students pursuing STEM degrees decreased from 32% to 27% (p. 6). The same report noted that 40% of students said that inefficient preparation in high school contributed to students dropping out of STEM majors. Most students had not taken upper level mathematics or science classes in high school that would have better prepared them for their classes in college (USGAO, 2005; Wyer & Adam, 2000).

According to Williams (2002), male students are six times more likely than female students to receive associate's degrees in STEM-related fields and only one-third of females receive bachelor's degrees in these majors. Preparation in technology education and other STEM programs can provide women with higher paying employment. As Williams (2002) reported "the median income of a chemical engineer in 1998 was over \$64,000 in 1990, compared to that of a preschool teacher, which was only \$17,310" (p. 287). Clearly, the lack of females in technology education and other STEM areas presents economic implications for women.

According to Williams (2002), high school standardized testing scores may be one reason that females do not enroll in technology education and other STEM areas. On pre-college admissions tests, female students regularly scored lower than males. Scores from the mathematics section of the 1999 Scholastic Aptitude Test (SAT) showed that

female students averaged 36 points less than male students. Given that SAT scores are designed to predict college academic performance for students and are used for college admission and advanced placement courses, female students may be limited in academic opportunities (Williams, 2002). Even if high school females choose to enter science-related fields, many of them do not complete these programs. This attrition is known as the leaky pipeline (Dreves & Jovanovic, 1998; Jacobs & Simpkins, 2006; Jayaratne, Thomas, & Trautmann, 2003; Kekelis, Ancheta, & Heber, 2005; Stake & Mares, 2001) and efforts to stop the leak have had little effect.

According to a 2005 United States Government Accountability Office report, "from academic year 1995-1996 to 2003-2004, the percentage of students in STEM fields increased from 21 to 23 percent...the total number of graduates in STEM fields increased by 8 percent from the 1994-1995 academic year to the 2002-2003 academic year...graduates in non-STEM fields increased 30 percent" (n.p.) Although the number of minorities such as African Americans and Hispanics increased in the STEM areas from 1995 to 2004, there are no statistically significant change in the number of females in these areas (USGAO, 2005). Additionally, the researchers found no increase in the employment level in STEM-related fields. Moreover, in 2006, the National Science Foundation found that about two-thirds of people with college degrees in STEM areas did not have jobs in or related to those fields. The number of women working in the STEM fields only rose from 38% to 39% between 1994 and 2003 (USGAO, 2005).

Leaders in industry and the corporate world are beginning to recognize the issue of low female participation in technology education and related fields and endorse

diversity in both academic and business settings (Coleman, 2002). According to the Business-Higher Education Forum (2002), businesses prefer employees who “have studied and lived with people from a range of racial, ethnic, and cultural backgrounds [who] are better prepared to collaborate with colleagues around the globe, as well as to perceive and respond to world-wide business opportunities” (p. 72).

The deficit of students in the science and technology majors could create a loss of future employees which could cause the United States to fall behind and lose its reputation as the economic and technological leader of the world (BEST, 2003; BHEF, 2005). In their 2005 report, *America’s Role in the World: Challenges to American Businesses and Higher Education*, the BHEF stated, “the federal government will also need to continue to encourage technological innovation. America’s prosperity has always rested on its ability to develop and exploit new technologies. The challenge of remaining on the forefront of technology is even greater today in a globalizing world” (p. 3).

#### Gender Inequity and the Nation

Along with academia and industry, the United States is globally and economically affected by the under-representation of women in science and technology. Currently, there are not enough qualified workers of either gender to fill existing and future positions in the STEM fields. Jackson (2004) states that the problem is due to the gap between the nation’s need for STEM workers and the fact that college students are dropping out of or transferring out of STEM majors. Rita Colwell, then president of the National Science Foundation and member of the Blue Ribbon Panel, urged in BEST’s *Interim Progress Report to Congress* (2002) that the well-being of the people of this

nation depends on those who have knowledge and skill in science, engineering, and technology. However, a recent Commerce Department report found that 60% of all jobs by the year 2020 will necessitate the skills that only 22% of the workers of today possess (BEST, 2002).

In the report *Maintaining the Strength of Our Science and Engineering Capabilities* submitted by the President's Council of Advisors on Science and Technology Workforce/Education Subcommittee (2004), members point out another issue that could possibly contribute to the loss of workers in STEM careers. Women, minorities, and people with disabilities make up two-thirds of the American workforce in the United States. However, they only fill about 25% of the STEM positions. In the past, the United States relied on students from other countries to come to the United States to pursue higher degrees in STEM fields, but that is no longer happening due to the effects of terrorist attacks on September 11, 2001 (Jackson, 2004). Foreign students who wish to enter the United States to obtain higher degrees in education will now find it harder to get into and stay in the country due to stringent rules that the United States government implemented as a result of the attacks of September 11, 2001 (President's Council of Advisors on Science and Technology Workforce/Education Subcommittee, 2004). As noted in the 2005 Business and Higher Education Forum report "...homeland security and immigration policy will need to find ways to keep out terrorists without turning away talented foreign students and experts who historically have been a major source of technological innovation, entrepreneurial spirit, and job creation" (p. 3).

According to the 2006 Report to the Nation from the National Commission on Mathematics and Science Teaching, attention to the mathematics and science fields should be of the utmost importance to the government. In the report's introduction, John Glen asserts:

From mathematics and the sciences will come the products, services, standard of living, and economic and military security that will sustain us at home and around the world. From them will come the global marketplace . . . We are just as strongly convinced that downstream the cost of not turning this problem around will be higher than the cost of beginning to solve it now (p. 6).

This position is reinforced by Jackson (2004). She states that according to the United States Department of Labor, by the year 2008, jobs that require degrees in STEM fields will be three times what they are today. Moreover, there will be an estimated six million jobs for trained workers, most of those in the STEM areas. Finally, according to Jackson (2004) there will be an estimated two million newly created jobs in the science and engineering fields alone by the end of the decade.

Gender inequity in the STEM fields has potentially negative consequences. If changes are not made in the issue of low enrollment of females in technology education and STEM professions, female contributions to the field could be lost as they have been throughout the history of technology education (Zuga, 1994, 1996, 1999). Consider the 2004 North Carolina Numbers Report for Career-Technical Education for the 2003-2004 school year. Of the 57,096 students enrolled in middle school technology education courses, only 21,261 were female. In high school, only 2,919 of the 21,757 students

enrolled in technology education courses were female. Not only was there a considerable drop in female enrollment between middle and high school in North Carolina, but also in overall student enrollment for both genders in technology education courses (NCDPI, 2005). Until the STEM community addresses gender inequities in its respective fields, success for girls and women may never be realized. The findings and recommendations within the following literature review introduce only a few of the many ways that society, administrators, guidance counselors, teachers, and parents can help dissolve the gender gap in all the STEM fields. The problem needs to be examined from as many different angles and methodologies as possible.

#### Rationale for Using Qualitative Research

Much of the current gender research in the STEM fields that exists today originated in research in the science fields. Due to the existing gender inequity prevalent in technology education, and the researcher's interest in discourse with students who directly experience gender inequity issues, qualitative methods were chosen for the study, specifically observation, focus groups and small group interviews, document analysis, and member-checks (Barbour, 2007; Bogdan & Biklen, 2003; Krueger & Casey, 2000; Litoselliti, 2003). As soon as the search for related literature was begun, a lack of current research about low female enrollment in technology education programs, especially qualitative research, became evident. In a 1994 study entitled *Implementing Technology Education: a Review and Synthesis of the Research Literature*, Zuga analyzed research literature and dissertations in technology education from 1987 to 1993. Another study by Petrina (1998) entitled *The Politics of Research in Technology Education: a Critical*

Content and Discourse Analysis of the Journal of Technology Education, Volumes 1-8 was a meta-study of research in the first through sixteenth issues of the Journal of Technology Education from 1989 through 1997. Table 1 provides a summary of the findings from the Zuga (1994) and Petrina (1998) studies.

Table 1.

Findings of Analyses by Zuga (1994) and Petrina (1998)

<b>Zuga (1994)</b>	<b>Petrina (1998)</b>
50% analyzed curriculum status, development, and change	87% of researchers were male 13% were female
63% examined secondary education	84% of researchers were from US, 68% of those were teacher educators
53% examined teachers and teacher educators	83% of articles were quantitative, 65% of those were descriptive
83% were quantitative	11% involved students in the public schools, only one of these studies focused on gender
65% used descriptive methods	O'Riley (1996) only researcher who used feminist theory
Most studies conducted by a handful of people in a few institutions.	Very few articles referred to constructivist learning theory, only one of those mentioned situated learning
Two studies focused on gender issues (both researchers were female)	

Findings of the research studies conducted by Zuga (1994) and Petrina (1998) showed that there was a glaring absence of qualitative research in technology education, especially in the area of gender. Since so much time had passed since the completion and publication of the Zuga and Petrina studies, I wanted to find out if the landscape of the

literature had changed over the last thirteen years. To do so, I emailed Dr. Zuga, who, at the time of this study, was the National Science Foundation's Division of Elementary, Secondary, and Informal Education Program Director. My goal was to see if she could give me information about the current state of qualitative research in technology education. She stated that, as far as she knew, with the exception of Dr. William J. Haynie at North Carolina State University and Dr. Jim Flowers at Ball State University, there was no new qualitative research conducted in the area of gender and technology education (Dr. Karen Zuga, personal communication, October 18, 2006). The fact that there was little existing current qualitative research in technology education focused on gender and that I felt certain I could get more meaningful information from participants by conducting focus groups and group interviews rather than sending out surveys or questionnaires, were the main reasons I had chosen to conduct a qualitative dissertation.

In addition to the findings in Table 1, Petrina (1998) discovered that the change in the name of the program from Industrial Arts to Technology Education made little to no significant difference as far as female enrollment. Girls continued to feel that technology education was a male field. Technology education was found to be largely a homogenous profession, predominantly male. Indeed, the males in the field, at least during the time of that study, cared very little about minority enrollment levels, which, according to Zuga (1994), was evident by fact that only two studies in her analysis were about minorities in technology education.

As cited by Zuga (1994), Bame and Dugger (1990) and Bame, Dugger, and deVries (1993) conducted studies that included 10,000 middle school students who had

taken technology education classes. They found that the boys had more positive attitudes toward technology education after taking these classes than did girls. Girls reported that they felt even more strongly than before taking the classes that the field was male-oriented and not for them. Although the study found that technology educators believed theirs was a subject for all students, it seemed that girls did not believe this to be true. These findings suggested that the way in which technology education was being taught in 1994 did not encourage girls to continue in the field.

In her conclusions, Zuga (1994) noted that a recurring theme of gender and cultural bias in technology education. She concluded that the content and the activities chosen to teach that content could possibly be a source of bias in the field. As Zuga (1994) stated, all genders, cultures, and abilities deserve access to the best technology education training possible. However, according to Zuga (1994), from 1987 to 1993, technology education researchers did not address the needs of women, minorities, or students with disabilities. This finding is supported by Petrina (1998) in which he noted that in technology education research, women and other minorities were significantly overlooked (p. 62). According to Zuga (1994) the “main purpose of technology education in schools is to prepare students to understand and participate in a technological society through experience with technological methods, resources, and knowledge” (p. 1). Yet, more than a decade later, female students are not getting the knowledge and skills needed to compete in the global economic society.

### Examination of Existing Studies in Technology Education

A limited number of researchers in the United States have examined and completed their own research studies on the issue of gender inequity and technology education. As opposed to most of the existing studies on gender issues which typically focused on science and mathematics, studies by Silverman and Pritchard (1996) and Bryson, Petrina, Braundy, and deCastell (2003) specifically focused on gender inequity in technology education. Silverman and Pritchard (1996) completed a two-year gender study in Connecticut technology education classes. The researchers wanted to find out why so many female students chose not to take courses in mathematics, science, and technology education, and how it might be possible to attract girls to take more of these types of courses. Furthermore, as stated by Silverman and Pritchard (1996), “[the study] was designed to identify viable strategies to change enrollments and attitudes toward the success of girls and women in technology education” (p. 3).

Another focus of Silverman and Pritchard’s (1996) study was to examine “the impact of teaching methods, classroom organization and atmosphere, and teacher interaction on girls in technology” (p. 1). The first part of the study focused on observation of middle school girls in technology education classes while part two explored similar issues in high school level technology education classes. Classes observed included “construction, manufacturing, communication, woodworking, and drafting” (p. 4.) One of the main differences the researchers found in technology classes as opposed to mathematics and science classes was that technology education courses were held in lab settings and were taught using the technique of hands-on learning.

Additionally, lessons were often completed in small groups and were sometimes competitive. Silverman and Pritchard (1996) were encouraged by the finding that middle school girls enjoyed technology education classes and had confidence in their abilities to be successful in these classes. However, they were discouraged by the fact that positive middle school experiences in technology education classes did not carry over to the high school level and influence the girls to enroll in technology education classes in high school.

Like their counterparts in the United States, Canadian students are also required to take technology classes in middle school, but not in high school (Bryson, et al., 2003). Therefore, according to their findings, in grades nine and ten, female student participation rates were approximately 50% lower than that of male students. In grade 11, female student participation drops to 34% of all students, and in grade 12 to 21%. Unfortunately, when female students are allowed to choose their electives, they opt for courses that are stereotypically female-oriented. As Bryson, et al. (2003) noted:

In the educational context...empirical evidence suggests that female staff and students (in comparison with males) (a) are disenfranchised with respect to access and variety of use, (b) are less likely to acquire technological competence and confidence, and (c) are more likely to be actively discouraged from playing a leadership role in technology. (p. 186)

In an attempt to improve the gender inequity situation in Canadian technology education programs, various organizations have called for a national analysis of gender trends in participation and academic achievement in technology education classes.

Bryson, et al. (2003) answered that call and extensively analyzed Canada's student enrollment in technology education classes. This analysis revealed inequities in all classes except business education and home economics.

Other studies completed on the issue of low female enrollment in technology education and the other STEM areas revealed barriers that either already existed in the research conducted by Silverman and Pritchard (1996) and Bryson et al. (2003) or raised new concerns related to attracting female students to those fields. Those studies related to female enrollment in technology education and the STEM fields are discussed in the next section.

#### *Existing Barriers to Enrollment of Females in Technology Education Classes*

##### *Stereotypes*

Lantz (1985) found that female personal beliefs about mathematics and science influenced their decisions to take these types of courses. She discovered that the masculine overtones pervading some mathematics, science, and technology education courses created stereotypes that discouraged girls from enrolling in them. Greenfield (1996), after examining ten years of research, found that girls who ignored the stereotypes related to mathematics, science and technology education classes had different experiences in these classes.

Reasons noted for this difference included teacher attention to students, boys' higher level of comfort with equipment, curriculum and classroom materials designed with boys in mind, instructional strategies used by teachers, and lack of encouragement for girls by adult teachers and mentors. Several other factors that contributed to the

gender inequity issues that permeated technology education classes in Connecticut were teacher inattention to the sexism that infected their classrooms, inattentiveness to girls and what activities might interest them, lack of knowledge about technology career options, girls' fear of confronting existing stereotypes, and lack of female role models from community technology fields (Silverman & Pritchard, 1996).

Like other researchers, Greenfield (1996) found that their middle school technology education experiences had no impact on whether high school girls chose to take technology classes in high school or not. They were neither made aware of nor encouraged by middle school experiences to continue in technology education classes in high school. Most girls admitted that they did not take technology education classes in high school because of stereotypes about male occupations. They did not have confidence that they would be successful nor did they have the courage to fight stereotypes about appropriate classes for girls to take.

### *Funding*

Funding may be another barrier to female equality in mathematics, science, and technology education classes. According to the Silverman and Pritchard (1996), although funding for technology education existed, female students did not benefit from these expenditures because they did not enroll in the classes. Similar situations existed in engineering, design, and trade classes. For example, as stated by Bryson, et al. (2003):

...the percentage of women completing baccalaureate degrees in engineering increased in the United States through the 1960s and 1970s but has remained between 15% -20% of the total since the late 1980s (National Science

Foundation, 1977b). Women account for about 15% of the total product and industrial design graduates in Canada and England and about 90% of the graduates in textile design (Clegg, Mayfield & Trayhurn, 1999). In Canada, women account for between 0.51% (sheet metal fabricators) to 3.5% (machinists, painters/decorators) of all apprenticeships, when chefs and hairdressers are removed from calculations (Ministry of Women's Equality, 2000; Skof, 1994). The point of these indicators is not to belabour the under-representation of women but rather to stress the importance of sex disaggregated data for accountability and policymaking. (p. 187)

During the methods and objectives section of their research, Bryson, et al. (2003) analyzed British Columbia's Ministry of Education statistics on participation and performance of students in technology education courses on the secondary level of education. Additionally, the researchers examined 13 schools that had programs in place to encourage female participation in technology education classes. The analyses completed by the researchers revealed similar findings to United States researchers. Except for business education and clothing and textiles, boys outnumbered girls in Canadian technology classes, a fact that has not changed in over fifteen years. Although their findings were based on data collection in secondary schools, the researchers asserted that gender inequity in technology education classes was a systemic problem that started at the elementary school level.

Although there are more boys than girls in Canadian technology classes, higher grades in these classes were more prevalent among girls. However, as noted by the

researchers, this finding was not statistically sound due to the under-representation of girls in the technology education classes. Of the 375 schools contacted, only 13 offered information about any local initiatives concerning technology and gender. The researchers asserted that this fact suggested that administrators on the local level apparently took little interest in creating equality in their technology education classrooms.

### *Sexism and Gender-Bias*

Middle school girls enjoy technology education classes, but are affected by sexism which influences their choices to continue in technology classes in their future academic endeavors. All students enjoy the informal atmosphere of technology education classes and are willing to help their classmates with activities no matter what gender they are. However, if the teacher does not establish rules and monitor behavior, sexism and gender bias emerges among students. Many teachers admitted that they were aware of this sexism, but did not have the skills to deal with it. One final finding noted by researchers was that Canadian teachers feel that the name change from Industrial Arts to Technology Education took the focus off of heavy machinery and, as a result, attracted more girls to the program (Bryson, et al., 2003).

### *Biological Differences*

On January 14, 2005, Harvard President Lawrence Summers spoke at the National Bureau of Economic Research Conference entitled *Diversifying the Science & Engineering Workforce: Women, Underrepresented Minorities, and their S & E Careers in Massachusetts*. His comments suggested that women were inferior to men in their

ability to succeed at mathematics and science and that socialization played a role in the issue of low female presence in the STEM fields. Many people at the conference were offended by his remarks and several people, including Dr. Nancy Hopkins, left during his speech (Bennett, 2005).

After Summers' controversial remarks about gender differences and science, Joe Palca (2005), anchor and host of National Public Radio's Talk of the Nation, interviewed several professional women in science and technology fields about the issue. Palca (2005) sought to find out why more men than women go into the science, mathematics, and technology fields. He began the conversation by noting the findings of two previous studies, one from Massachusetts Institute for Technology (1999) and one from California Institute of Technology (2001). At both institutions, only 10% of the tenured faculty was female. Dr. Nancy Hopkins, professor of biology at MIT stated that although the instance of undergraduate female students in science is high, the number in graduate studies and on faculties is small. Palca (2005) added, "...somewhere between starting a career in science and actually getting a job, [women] drop out."

Some researchers cite biological differences between males and females as reasons for differences in student choice and academic success in mathematics, science and technology classes. In an interview with National Public Radio's Madeleine Brand (2005), Dr. Nicole Weekes, Associate Professor of Psychology and Neuroscience at Pomona College, Clairmont, California proposed that the cognitive differences between the sexes might account for differences in numbers of females and males in science and technology classes.

According to Weekes, there is biological evidence to suggest that men and women differ in spatial abilities. Hormonal changes can also contribute to differences since they fluctuate. However, there are other factors including environment, exposure to video games and other computer technologies, and support and/or discouragement by parents and mentors, which can contribute to and account for gender differences in cognitive ability. Men are often stronger in visual-spatial abilities, such as the ability to mentally rotate things in space. Women show strength in verbal tasks, language fluency, and memory, along with dominance in use of fine motor skills and attention to details. Although Weekes asserted that there is some statistically significant evidence to suggest that gender affects cognitive ability, to say that men are better at science and mathematics is disputable. She recommended that further research be conducted to find more conclusive confirmation of this relationship.

### *Career Options*

The issue of gender equity plays a major role not only in the educational setting, but also in students' future career choices. If the goal of education is to introduce and expose students to possible educational and career paths, the notion of gender equality for all educational and career fields must be included. Limiting students to gender-specific roles in their careers can lead to insecurity and confusion among students and an economically depressed society (Bryson, et al., 2003; Silverman & Pritchard, 1996). In fact, in 2003, only 20% of technology jobs in Canada and the United States were held by women (Bryson, et al., 2003). Responding to these findings, the researchers ask, "Why, then, is it still the case, at the dawn of the twenty-first century, that a large number of

girls and women (a) remain limited to domestic, clerical, medical and service uses of technology, and (b) occupy subordinate roles in many scientific and technical fields?" (p. 186).

As posited by Bryson, et al. (2003) male domination in the field and lack of knowledge about future careers in the mathematics, science, and technology education fields kept middle school girls from continuing in technology education classes once they reached high school. First, "...until recently [technology education has] been a field dominated by men" (p. 7). Second, "girls [were] uninformed about economic realities of the world or work...and lacked basic information about careers, including...salaries, promotion... [and] training" (p. 7). However, there were several other barriers that kept girls from enrolling in technology education classes in high school. Students were uninformed about career opportunities and were influenced by masculine stereotypes in technology careers. More girls than boys were discouraged from taking technology education classes by teachers, counselors, and mentors.

In addition to the previous findings, Bryson, et al. (2003) reported that the British Columbian Ministry of Education, school administrators, and college teacher preparation programs were not addressing gender inequities on the teacher level which ultimately affected student enrollment. As a result of these findings, Bryson, et al. (2003) recommended the following solutions to gender equity in technology classes. British Columbian Ministry of Education, school administrators, and college teacher preparation programs should:

- create classes that purposefully enroll female students rather than simply hoping that girls will elect to take a technology class.
- create and teach technology classes on all levels of required K-12 curriculum.
- give female students more access to technology tools and classes.
- value gender equity in technology classes and put forth an organized effort to encourage girls to take technology education classes.

### *Effects of Teacher Gender*

In order to further gender equity, not only does society need women in technology-related career positions, but also in technology education teaching positions. There are very few female teachers in technology education classrooms in the U.S. and Canada (Bryson, et al., 2003; Silverman & Pritchard, 1996). Only 1 out of every 30 teachers in technology education classes was female. Even in business education classes where there were more female students than in other technology classes, 1 out of 8 teachers were women (Bryson, et al., 2003).

Gender bias in hiring technology education educators and the lack of women in technology education teaching positions could be another contributing element to low enrollment of females in technology education classes. If female students see only male teachers and male students, they may be less interested in being in that class. Although gender bias for hiring teachers in technology education is less overt in than it has been in the past, discrimination continues to exist. Muraskin (1989) noted that the progress made toward eliminating gender bias in technology education has led to “cynicism and

ambivalence toward these issues” (p. 1). The researcher posited “until the attitudes of technology education educators and other educational authorities reflect a willingness to accept any otherwise-qualified person, regardless of gender, in any program of technology education, there is unquestionably a need for change and room for improvement” (p. 3).

It is recommended that since many administrative positions in public schools are currently held by men, women should be encouraged to pursue these positions (Darling, 1992). Typically, principals make the final decision about who gets hired to teach in their schools. In their research on Louisiana principals’ perceptions of hiring non-traditional gender technology education teachers, Rolling, Burnett, and Huh (1996) attempted to determine attitudes high school principals exhibited toward hiring females in teaching positions that have been historically held by men. The researchers thought a study of administrative attitudes toward hiring non-traditional teachers in technology education teaching roles could help discover how to address gender inequity in technology education in Louisiana. The purpose of this study was to “...determine the attitudes of secondary school principals toward hiring technology education teachers for positions where the teacher is from the minority gender (e.g.—females as agriculture teachers and males as home economics teachers” (p. 3).

Rolling, et al. (1996) designed the following objectives for their study. The study should describe secondary schools in Louisiana regarding technology education programs offered and selected other characteristics, determine the attitudes of high school principals toward hiring technology education teachers into nontraditional gender

teaching roles, compare principals' attitudes toward nontraditional occupations for men with their attitudes toward nontraditional occupations for women, and determine if relationships exist between principals' attitudes toward hiring technology education teachers into nontraditional teaching roles and selected school characteristics.

To begin their study, Rolling, et al. (1996) conducted an extensive review of the existing literature on the subject. Some of the major points they discovered were as follows. Sex role stereotyping had been accepted in the educational setting for years (Guttentag & Bray, 1976). Although most people believe that school success will bring career success, this is not necessarily true for female students which causes great loss for society (Pottker & Fishel, 1977). Gender equity issues have gotten better in the last thirty years, but teachers and students still function in a gender-biased environment (Henry, 1994). Many school environments reinforced sex biases and most teachers were not aware that they showed evidence of gender bias in their classrooms (Olivares & Rosenthal, 1994).

Despite numerous attempts to promote gender equity in technology education, enrollment of females in these classes is still lower than that of males (Wirt, Muraski, Goodwin, & Meyer, 1989). Evidence suggests that people have different expectations, standards for behavior, and rewards and punishments for male and female students (Fear-Fenn, 1986). Finally, there is on-going discrimination, gender bias, and sexual harassment of female technology education teachers by male technology education teachers (Cano, 1990; Haynie, 2003, 1999).

In their study, Rolling et al. (1996) found that the majority of schools offer business education, technology education, home economics, and agricultural education courses. School size was distributed relatively evenly from very small to large schools. Principals were ambivalent toward hiring technology education teachers into nontraditional teaching roles. Population density of the geographic location is positively related to principals' attitudes toward sex equity for both genders. School size was positively related to principals' attitudes toward sex equity for both genders.

#### Recommendations and Implications from Existing Research for Removing Barriers in Technology Education

Based on the findings from their previous research, Silverman and Pritchard (1996) recommended the following solutions to eliminating the gender gap in technology education. School administrators must strive to hire more female technology teachers so that girls interested in pursuing a career in “high-tech” jobs have role models. Teachers should consider inviting successful women in technology careers to come to the classroom and talk to students about the possibilities that exist for girls interested in technology careers. Administrators and educators should meet and discuss strategies to attract more female students to technology education classes and focus on ways to make classroom and career connections in technology classes (Silverman & Pritchard, 1996).

Scheduling changes that maximize the number of female students in technology classes should be considered. Middle school students should be made aware of high school technology education classes before they get to high school. Visiting the high schools, having girls in high school technology visit middle schools, elective fairs, or

product shows could help middle school girls learn more about what is available in technology at the secondary level. Finally, guidance counselors should provide more information about technology education electives and technology careers to both middle and high school students (Silverman & Pritchard, 1996).

Rolling, et al. (1996) made several recommendations based on the findings and conclusions from their study. Programs should be developed and implemented to target change in ambivalence about gender equity exhibited by principals. A course should be included in pre-service education programs that address how to attain an unbiased school environment. Institutes of higher learning should strive to provide future school principals the skills and willingness to hire teachers in non-traditional teaching positions as well as continue to recruit students that can fill non-traditional teaching positions in the public school system.

Responding to the research conducted by Bryson, et al. (2003), the British Columbian Ministry of Education suggested that technology education objectives be integrated into other classes up to grade 11. However, as the researchers pointed out, using technology education as a tool in other courses was not enough to solve the issue of gender inequity in technology education classes. They argued that only through structural and systemic changes in curriculum design can gender inequity issues truly be resolved.

### Theoretical Framework

There are two theories that will underpin this study: constructivist learning theory and feminist pedagogy. These two theories have a great deal in common and promote many of the same techniques related to improving gender equity in research and

instruction. Unfortunately, although these methods are valuable in education and in research, they are little used in either field (Lewis, Petrina, & Hill, 1998; Petrina, 1998; Zuga, 1995, 1997).

## Constructivism

### *Emergence of Constructivism*

Constructivist learning theory emerged from research in several areas including psychology, socio-linguistics, the natural sciences, and education. The early origins of constructivism are typically attributed to Jean Piaget, Lev Vygotsky, John Dewey, and Jerome Bruner (Duffy & Cunningham, 1996). Each of these researchers contributed research findings that led to theory of constructivist learning. Table 2 provides a brief description of the research focus of each of these men.

Table 2.

## Early Constructivist Theories

Researcher	Research Findings
Jean Piaget (1896-1980)	Theory of Cognitive Development Learners construct cognitive abilities in developmental stages through interacting with their world (Vérillon, 2000; Cheek, 1992; Hersh, 1979).
Lev Vygotsky (1896-1934)	Social Conditioning Culture and social environment of learner determines individual development; language is main tool of intellectual adaption (Vygotsky, 1978).
John Dewey (1859-1952)	Pragmatism Education should support the needs of the society (Duffy & Cunningham, 1996).
Jerome Bruner (1915- )	Discovery Learning Learning is an active process focused on discovery in which students construct new ideas and concepts based on previously learned knowledge.

Constructivism is often put on a continuum where on one end is the belief that knowledge is only within the individual and, on the other end; knowledge relies on social interaction with others (Doolittle & Camp, 1999; Palincsar, 1998). According to Cobb (1994), constructivism represents two combined fundamentals of learning. The first is individual cognition, which is based on the research of Piaget, von Glasersfeld, and

Fosnot. Individual constructivism emphasizes the individual trying to make sense of the world. Learning occurs when the student encounters the unexpected and must resolve a conflict and adjust to new experiences (Fosnot, 1989; Piaget, 1977; von Glasersfeld, 1989). The second fundamental, the sociocultural approach, is based on the work of Dewey and Vygotsky. This method emphasizes the social and cultural influences on learning. Group work and situated learning are crucial to acquisition of knowledge (Duffy & Cunningham, 1999).

Dougiamas (1998) describes five types of constructivism based on the two fundamentals reported by Cobb (1994). Cognitive constructivism, based in Piaget's work, is the simplest form of constructivism. It proposes that the learner actively constructs knowledge rather than passively receiving it from his or her environment and that the learner must be actively engaged in the environment in order to construct new concepts. Cognitive constructivism has led to instructional strategies such as graphic organizers and concept maps, transfer teaching, practice elaboration, and problem solving strategies (Doolittle & Camp, 1999).

Radical constructivism presents another facet to cognitive constructivism in that learners use previous knowledge and new concepts to interpret and understand their experiences in the world. Radical constructivism provides learners with the opportunity to interact with a concept, come to a personal understanding about the concept, apply the concept, and seek a solution that addresses the concept. Radical constructivism has a strong emphasis on problem solving and trouble shooting (Doolittle & Camp, 1999).

The third type, social constructivism, attributed to Vygotsky, proposes that the people in the learner's environment play a large role in learning and emphasizes collaborative learning as a way to learn new concepts. This theory of constructivism proposes that learning new concepts can occur only as a result of group effort to find answers. Students are put into cooperative learning groups and introduced to a new concept. The concept is explored socially and discussed by the members of the group. Through student interactions, discussions, and problem solving, the group would discover a solution to the problem and an understanding of the new concept (Doolittle & Camp, 1999). The concept of group problem solving is supported by Moshman (1982) who proposed that the solution could only be reached by cooperation among the group and not by any individual group member.

Cultural constructivism, the fourth type of constructivism, adds an element beyond the people and the environment of the learner. This type of constructivism emphasizes cultural influences, tools, artifacts, and language. Cultural constructivism is dictated by the learner's culture. Vosniadou (1996), a proponent of cultural constructivism, called for "a new concept of the mind, not as an individual information processor, but as a biological, developing system that exists equally well within an individual brain and in the tools, artifacts, and symbolic systems used to facilitate social and cultural interaction" (n.p.).

According to Vérillon (2000), technology education is focused on making and using artifacts and tools. The goal of using tools or machines is to transform some type of material in the environment to give it new properties and enhance its value. However,

using the tool properly requires a combination of previous knowledge, intellectual operations, and motor skills. Without a basis of cognitive knowledge about using tools and integrating that knowledge into intellectual and physical interaction with the tools, students would not be successful in transforming the cultural environment (Vérillon, 2000).

### *Constructivist Learning Theory in Technology Education*

Constructivist learning theory proposes that students bring previous knowledge, beliefs, and skills to every learning experience. As a result, according to constructivist theorists, a learner's prior knowledge combines with new information to create a new understanding of a concept (Brooks & Brooks, 1993; Fosnot, 1996; Wilson, Phillips, Spence, & Gibbons, 2000) Recent researchers have proposed that the use of constructivist learning principals could lead to curricular reform in academics areas including technology education, science and mathematics (Brooks & Brooks, 1993; Doolittle & Camp, 1999). Proponents of constructivist learning propose that this pedagogy provides a link between theory and practice (Doolittle & Camp, 1999). There are up to nine essentials of learning that were developed from constructivism depending on the research consulted (Brooks & Brooks, 1993; Doolittle & Camp, 1999):

1. Learning is an active, hands-on process that should, in as much as possible, happen in real world, authentic environments.
2. Learning is a social experience and that connection with human beings is necessary for the development of skills, knowledge, and language.
3. Learning and content should be made relevant to the student.

4. Learner's prior knowledge should be the framework for new knowledge.
5. Learners should be formally assessed as to create future learning experiences based on this assessment.
6. Learners should be encouraged to be self-aware, self-regulated, and self-mediated.
7. The instructor should serve as a guide and facilitator of the learning rather than the distributor of knowledge. Responsibility in the classroom is shared by everyone, students and teacher (DeVries & Zan, 1995).
8. The instructor should offer and encourage variations of content and numerous standpoints.

As noted by Fox (2001) and Phillips (1995), there are an immense number of academic articles and research studies focused on constructivism and, since it is not a new educational theory, academics and teacher educators have debated it for years. However, according to Doolittle and Camp (1999), the theory of behaviorism continues to dictate curriculum planning in technology education. Behaviorism, based on the work of Pavlov and Skinner, consists of using stimuli, response, and positive and negative reinforcement for teaching a desired behavior (Wirth, 1972). Further, proponents of behaviorism theorize that human behavior and actions are simply a reflexive response to stimuli. This theory of learning worked well in early technology education since the aim of Industrial Arts programs was to teach students specific skills which would allow them to be productive in society and meet industry employer expectations (Doolittle & Camp, 1999).

However, from the 1980s to the late 1990s, several technology education leaders including Doty and Weissman (1984), Hill (1994), Gregson (1997), Grubb (1997), Lynch (1996, 1997), Moore (1999), and Osbourne (1999) called for a theoretical reform in technology education toward critical pedagogy which has its roots in constructivist learning theory and has similarities to feminist pedagogy. Critical pedagogy, first recognized by Freire, is a teaching theory that seeks to help students think critically about their learning experiences and attempt to recognize connections between their individual experiences and social contexts. As noted by Shor (1992), critical pedagogy embraces raising consciousness of students, valuing student opinions and honoring their individuality, allowing them to freely critique society, and creating a learning situation in which students can become members of society and examine and change that society to increase freedom for everyone. Kincheloe (2008) offers several basic tenets of critical pedagogy:

- Education is inherently political and teachers and students should be aware of this condition.
- Education should be grounded in a desire for social justice, removing oppression and human suffering, and equality.
- Educations should promote political change and allow students to question and examine how power and privilege operate in educational institutions.

Since technology education is still often seen as a profession that provides trained workers for occupations, change in theoretical frameworks from behaviorism to critical pedagogy or any other type of constructivist learning theory can be challenging (Bragg,

1997; Dobbins, 1999). However, as technology education continues to change based on technical and psychological advances, the theoretical underpinnings of the field need to be examined.

When looking at preparing technology education students for employment through a constructivist lens, teachers must consider not only teaching knowledge and skills necessary for job performance, but should also teach the necessary knowledge and skills to prepare students for manipulation of future technological advances, adaption to new innovations and change, and the ability to construct and discover new knowledge and insights on their own (Doolittle & Camp, 1999). In other words, students should be prepared to be “self-regulated, self-mediated, and self-aware” (Doolittle & Camp, 1999, p.13). According to Doolittle and Camp (1999), a combination of cognitive and social constructivism might be the answer to creating a new theoretical framework for technology education.

As reported by Brooks and Brooks (1993) "in order for learning to take place in schools, teachers must become constructivist, that is, in the classroom, they must provide a learning environment where students search for meaning, appreciate uncertainty, and inquire responsibly" (p. 5). Technology education stresses the importance of creating technology-based projects as a necessary part of learning. In creating technology-based projects in laboratory settings, students are able to socially construct technological concepts (Pannabecker, 1991). Technology education teaching strategies should include interaction between students, projects that successfully incorporate group learning, and, most importantly, encourage students to become more responsible for their own learning

(Bonnstetter, n.d.). Constructivist learning theory has the potential to provide a framework to extend student and teacher understanding of technology education concepts and advances.

### Feminist Pedagogy

Feminist pedagogy has its roots in feminism and feminist research. Feminism has played an important role in the creation of social science research paradigms. Focusing on gender differences in society, feminist theorists drew attention to the general oppression of women and challenged prevailing notions of consensus in society (Babbie, 1998). The feminist movement of the 1970s made people aware of treatment of women and the lack of opportunities for women in certain professions. Consequently, educators began to question gender-bias in the school system (Sandell, 1991). The word feminism has many connotations, implications, and meanings. However, the phrase feminist pedagogy is a fairly well established and accepted phrase in the field of education (Eschenbach, Cashman, Waller, & Lord, 2005). A brief definition of feminism is belief in the social, political, and economic equality of both genders. A definition for feminist pedagogy is harder to pin down, but for the purposes of this paper, it can be defined as the integration of the essentials of feminism into the curriculum, teaching strategies, classroom practices, and relationships between student and teacher (Crabtree & Sapp, 2003).

According to Webb, Walker, and Bollis (2004) there are six essentials of feminist pedagogy:

1. New relationship between the teacher and the student: shared knowledge rather than teacher having all the knowledge.
2. Student empowerment: power is shared among students and teacher, no one individual in the classroom has all the power.
3. Community building: collaborative learning on projects and activities, especially on projects that address the needs of the students.
4. Voice as “currency”: hearing each individual voice; if only the teacher’s voice is heard, the student’s thoughts and ideas are left out and everyone is deprived of that student’s contributions to the community.
5. Diversity is respected: personal experiences are valued and are a crucial element of learning.
6. Traditional values are challenged: origins of ideas, theories, positions, how knowledge came to be are often challenged and discussed.

#### Feminist Pedagogy in Technology Education

Over the past twenty years, feminist researchers have made important contributions to technology education and STEM. Research focused on gender equity issues is especially valuable to technology education and STEM. Feminist researchers consistently focus on gender inequalities and a political commitment to change institutions and other structures that are historically male-dominated (Brickhouse, 2001). Like constructivism, feminist pedagogy encourages students to use previous knowledge

to create new learning, participate with other learners, and interpret and integrate their surroundings. Like Piaget, feminists believe that learner knowledge symbolizes experience in the world and that what a student can do is connected to what she knows (Grumet, 1989).

Feminist constructivism, or socialist feminism, proposes that technology is gendered and historically male-dominated due to the combination of patriarchy and capitalism (Hodgkinson, 2000). Furthermore, contributions and inventions of women to technology have been excluded in historical accounts. As a result, feminist constructivists have begun to document the ways women have contributed to technological advancements so that they are no longer “hidden from history” (Hodgkinson, 2000, p. 123). According to Wajcman (1991), technology as male identified is a result of historical, cultural, and societal construction of gender that has excluded women from the field. This notion is confirmed by Zuga (1996) who pointed out that women’s contributions in early technology education were excluded.

Gender equity may be a challenge to existing structures in technology education. However, most feminists believe that women can make a difference in technology. Optimistic feminists believe that if the number of females rise in engineering and other STEM areas, the culture of these areas will be forced to change and the presence of women can reshape relationships between the genders (Hodgkinson, 2000). However, as noted by Schiebinger (1999) and Glover (2000), many women entering technology-related fields are neither feminists nor agents of change. Examination of culture versus content is an issue that should be addressed in all the sciences. According to Hodgkinson

(2000), increasing representation of women in technology fields might contribute to a gender-neutral technology culture. Hodgkinson's (2000) article brings up several questions that might be answered in this study:

- Is it culture or the content that discourages females from entering these fields?
- If getting more women into technology education and other STEM fields has the potential to change the landscape of these disciplines, how do we attract more women to these areas?
- Can we be sure that the women who overcome the obstacles and choose to enter a technology or science related field will work for change or will she assimilate to the male-dominated culture?

Feminist pedagogies have the potential to challenge outdated theoretical foundations, improve curricular approaches in technology education, and bring socio-cultural change to technology education and the STEM areas. I propose that through a combination of constructivist learning theories and feminist pedagogies, technology education and the other STEM areas can be improved to make them more attractive to females. These two theories of learning have many similar characteristics and few differences, which will help to support my proposition of a theoretical synthesis between the two theories to change the field of technology education. Figure 1 illustrates the similarities and differences between constructivist learning theory and feminist pedagogy.

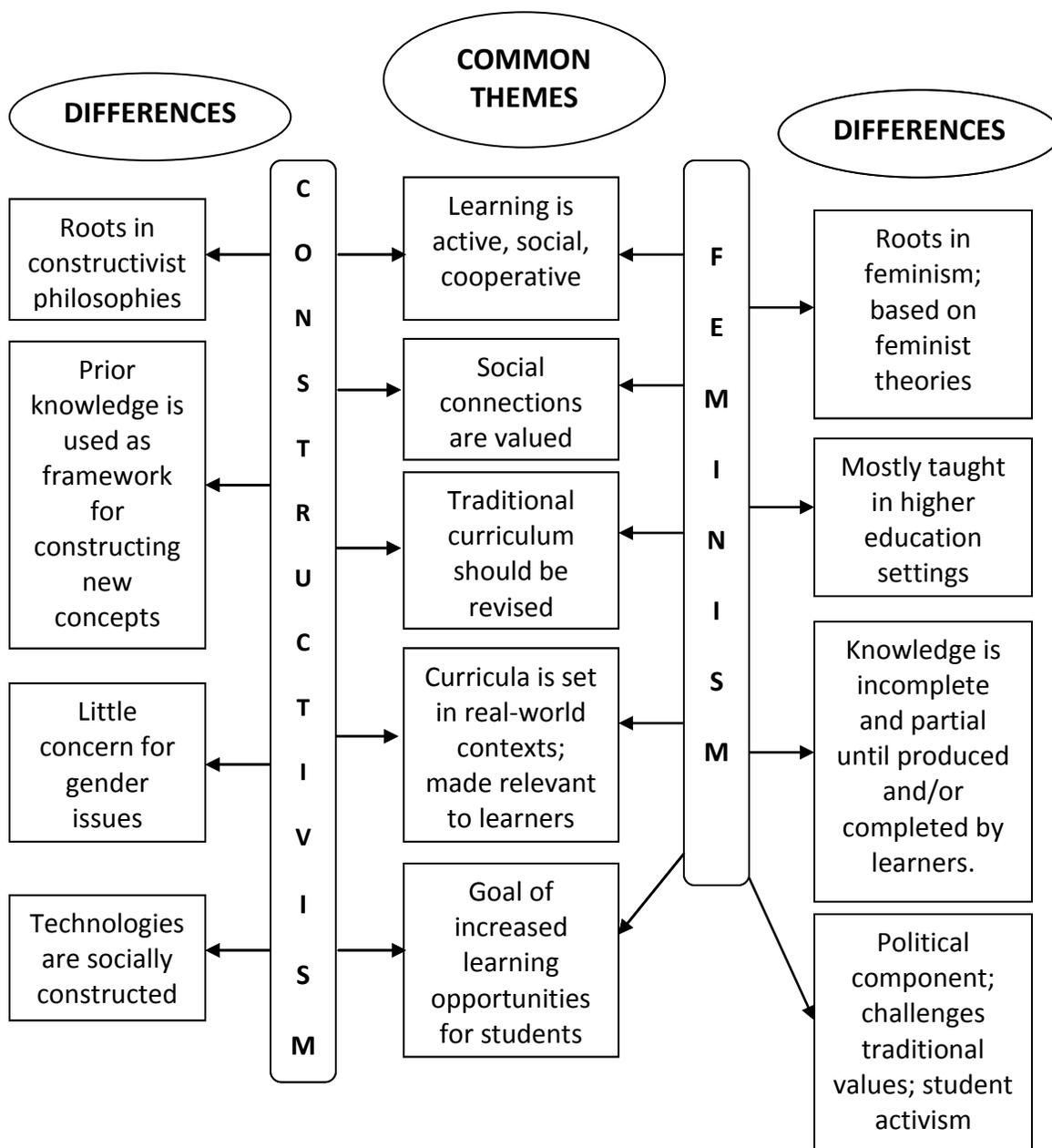


Figure 1. Comparison of Constructivist Learning Theory and Feminist Pedagogy

A combination of constructivist learning strategies and feminist pedagogies could offer a new framework for improved learning for all technology education and STEM students, especially those who may not have been successful with traditional STEM teaching strategies. Suggestions for a new framework will be further discussed in Chapter 5.

## 2005 Pilot Study

### Introduction

In his research on relationships between male and female technology students, Haynie (1999, 2003) interviewed male and female high school technology education teachers and female technology education higher education academics respectively. In his 1999 findings, Haynie discovered that teachers of technology education were generally comfortable with each other, but were very conservative when it came to suggestive or sexual talk or behavior amongst themselves and students. It should be noted that male teachers were evidently more tolerant of inappropriate statements and activity among students in their classes. One of the most important findings of this study was that women in technology education wanted to be acknowledged for their skills and abilities rather than their gender.

In his 2003 study, Haynie found that all the women interviewed were comfortable with the climate in technology education at the time. However, several of the participants noted that they were more comfortable with the younger male professors in technology education rather than the older male professors. The older males, according to the interviewees, still considered technology education to be a “good old boys club” (p. 22).

The participants also reported that they were aware of and concerned about the lack of females in the technology education field. They stated that having female teachers as role models and a shift in curriculum away from shop classes might be ways to attract more females to the field.

Although Haynie (1999, 2003) uncovered important issues among professors of technology education, he has not taken his studies to the student level. As supported in existing literature about qualitative research methods, focus group participants can be reluctant to offer their opinions and experiences about an issue if interviewed by a researcher who is different from them (Barbour, 2007; Litoselliti, 2003). I hypothesized that since Haynie is a white male and was a professor and, therefore, in a position of power during his interviews, female interview participants might not have been as forthcoming with information about their experiences as they might have been with a female interviewer. Moreover, the participants were interviewed in one-on-one public settings, which also might have impeded their willingness to talk about their experiences as females in technology education. Thus, a pilot study was conducted by a female researcher with focus groups composed of two to four participants.

#### Description of 2005 Pilot Study

The data for the pilot study, based on Haynie's (2003, 1999) previous research, was collected at the ITEA (International Technology Educator's Association) National Conference during the month of March 2005. Participants included female college students involved in TECA (Technology Education Collegiate Association) who were present at the conference. A questionnaire based on Haynie (1999, 2003) was used in

order to get specific information from participants. As a result of conducting this research, I gained information about the best approach to data collection for the dissertation qualitative study.

### Participant Demographics

Participants included seven female technology education students between the ages of 18 and 25 years of age with 3.5 to 11 years of involvement in the field. Participants were either student teaching or pursuing required classes in their college technology education departments during the time of the pilot study. All participants were read an introductory paragraph, which guaranteed that their names would not be used in the study and asked for their permission to record the interviews. Participants were interviewed in groups of two or three at a time and each discussion lasted approximately 45 minutes.

### Summary of Pilot Study Participant Responses

The participants in this study reported that what they were generally comfortable with their male counterparts and professors and liked technology education because it was “fun.” However, many participants still had negative responses when it came to relationships with male professors, male classmates, and curriculum. To begin the interviews, participants were asked about the current climate of the technology education field with the notion that it is still male-dominated. Most of the women reported that while they agree that technology education is still a male-dominated field, it is becoming more and more accepting of female students. Three of the participants reported that being comfortable in technology education programs depended on the

college one attended. One participant noted that at her school, female students were always welcome and that gender was not an issue. However, at the other end of the spectrum, a participant from a different college stated and another noted that “boys are everywhere” in her department and that “very few girls in our program like the shop classes.”

The next question asked what girls perceived as the biggest barriers in the field and whether these barriers had to do with how females are treated by males. All participants felt that relationships between the genders were not a barrier to attracting females to technology education. In fact, most of the participants reported that inexperience, lack of confidence with tool use, and lack of knowledge about technology education programs were the biggest barriers to attracting women to the field of technology education. They stated that many male students come into the program with a familiarity in tool use, while most female students do not. Participants also reported that technology education programs should be more specialized which would allow students to choose certain courses based on interest. One participant noted that, “guys in the department are willing to dive right in and try it [projects] [while] girls need to think about it and always do it right and try to figure it out.” Automotive, construction, circuits, and metals courses were specifically pointed out as being classes that lacked interest for female students.

Another question asked if participants envisioned changes in the future that might attract more females to the technology education field. Participants felt that there were several changes that could be made to attract more females to the field of technology

education. Attracting more female teachers to the field, starting technology education programs for girls at a younger age, and allowing specialization in technology education programs were mentioned as possible ways to attract more females to the field. Several of the participants mentioned a program called Project Lead the Way<sup>®</sup>, a pre-engineering program for students in middle and high school, which is a standards-based, hands-on, project-oriented approach to teaching mathematics, science, technology education, and language arts (Rogers, 2006). One study participant noted that Project Lead the Way<sup>®</sup> “has made leaps and bounds in getting girls in the department because it’s engineering [based].”

Allowing students to specialize or focus on one aspect of the technology education program was a solution suggested by several of the women. At one college, according to one participant, “they let us do what we want to do and focus on what we want to focus on so it let[s] us choose our education and make it fun for ourselves.” However, as one participant noted “some school districts [still] don’t allow girls in TED classes” and that “middle and high schools don’t know what TED is,” a dumping ground or an honors program. Additionally, she noted that she, “never saw any literal curriculum based on the national standards” at the school where she was student teaching.

Two questions surrounded the issue of feminism in technology education. Participants were given choices of answers for those questions. The questions asked about the women’s rights movement in society. All but two women considered themselves to be women’s rights activists although not “hardcore.” The other two women were neutral on the issue and considered themselves basically uninterested in any type of

feminism position. However, when asked about having a door held open for them by a male, all but one woman, who felt neutral, said they were pleased when a man held a door open for them.

When participants were asked about whether male or female students had an advantage in technology education classes, five of the women felt that girls had the advantage whereas three of the girls felt that boys had the advantage. Two participants noted that being in the minority was an advantage and could help them get jobs. The participants that felt that girls had the advantage had comments to support their reasoning. One student stated that “it depends on the class [but] from my experience, it’s been mostly advantage toward girls because there are less and they tend to be better students.” Another noted that girls had the advantage in a negative way because male students continually pointed out when there was a female in the class and that teachers expected more from the female students. Several participants noted that teachers try so hard not to favor the boys that they end up favoring the girls, which makes females feel singled out and uncomfortable in technology education classes.

The next series of questions was about the social trends surrounding the telling of jokes in mixed company, the language of past and current television shows, student comments about other students’ bodies, and how professors handled inappropriate language and behavior among students. Most of the women felt jokes were acceptable with the exception of homosexual jokes. Although calling someone “gay” is in the vernacular of current time among high school and college students, these participants thought it was completely inappropriate and unacceptable to use the word “gay” in any

joking way. Most participants thought the suggestive language of some television shows was acceptable. However, one participant stated that the “media portrays women as objects and not people, dressing and looking a certain way” implying that if a woman does not look a certain way, she will not be accepted by society. None of the women thought it was permissible to comment on fellow students’ bodies or sex appeal. Most of them stated that if a male student commented on their bodies, they would offer an opinion or call the male student out in some way. However, one participant reported that she would, “look down and keep walking or give him a look,” and that this was “normal behavior” for male students. In most cases, the participants thought that professors handled inappropriate language and behavior between male and female students in an acceptable way. However, two participants felt that it depended on the professor and the situation and one participant felt that professors were oblivious to inappropriate language and behavior among students.

Participants were asked if they felt there were “universal signs” that could be used to react to something done by a male student that they found offensive or inappropriate. Most participants reported that there was a “look” that could possibly be used to deter offensive behavior. Other facial expressions, called, “the evil eye,” “a dirty look,” and “looks that could kill” were also mentioned. Participants reported that using a facial expression was usually successful. However, if looks did not work, participants admitted to physical reactions such as hitting male students, pushing them away, or smacking them if necessary.

The next group of questions was about working in the lab. Participants were asked how they would react if they saw a male student trying to take over a project that a female student was doing. Additionally, they were asked how they would react to a male student taking over a project they were working on. Most participants felt that if the female student actually needed the help, they would stay out of the situation. However, if they found themselves in the situation, they would “deny [the male student’s] help” or tell the male student to let them do it themselves. One participant, however, reported that she would “deal with it, suck it up [because] if you say anything they don’t listen and say ‘I’m joking.’”

The next series of questions asked the participants to speak about any events in a technology education situation that might have embarrassed them or made them feel uncomfortable in any other way. These questions asked about events involving male students as well as professors. Several participants had short answers to these questions.

**P2:** When men do not listen to your opinion, you feel unworthy.

**P3:** Oh, she is going to do this because she is smarter than me.

**P4:** Do this, it’s a girl’s job.

**P5:** My teacher called me a man in two different classes. He also forgets about me. I feel mortified and scared, and uncomfortable, sad.

**P6:** Some of the teachers make me feel like an idiot if I ask a question. I ask the male students instead.

**P7:** Some of the teachers talk down to the females and it makes me feel dumb.

One participant had several adverse events that happened both in the

coeducational dorm and in the technology education building. In phrasing her comments, the participant was visibly upset and animated and even used some profane language to express the emotion of her experiences. The participant reported a significant number of negative events including unwelcomed and uninvited touching of inappropriate parts of the body, unwelcomed sexual advances, and harmful physical abuse by male peers. Additionally, she reported that a male faculty member had made several antagonistic comments that were hurtful. When asked about the teacher's reaction to the treatment of this participant, it was reported that "teachers are pretty much oblivious or they just allow it because they think it is funny, too. They don't do anything."

The participants had other concerns about their teachers and the treatment of female students. Many of these comments had to do with teacher assumptions about female students' knowledge and skill level related to tool use. As one participant noted:

**P2:** It's a matter of getting them to explain it enough. A lot of teachers think that most of the class already knows [how to use the tools] because it's mostly guys. They're gonna think 'Oh, they're already going to know how to use this. I only have to give a brief demo.' And then, we feel like idiots having to ask [the male students for help].

The participants reported that the female students at their college had been putting forth an effort to get their teachers to create and teach a course on laboratory maintenance, but were having little success in doing so. One of the participants had been chosen to serve as a teaching assistant for one of the laboratory courses. Although it was March, and there were only six weeks left in the semester, she reported that her professor

had not given her any training for the position. The participants also revealed that some professors at their university repeatedly told them that they were going to fail because they were taking too many hours each semester. As noted by P1, “I am taking 23 credits and he said, ‘You’re going to fail. Have fun.’ Our entire department underrates us.”

The participants were asked if they thought the people who were offending them knew they had done so. Additionally, participants were asked if they had ever considered telling the people, male students and professors, who were involved in these events that their behavior or language was offensive or inappropriate. Most participants were not sure if the offending parties knew the females were upset, thought the offenders were unaware of or oblivious to their feelings, or deemed the situation to be a joke. Only one participant claimed that the offenders were aware that they were upsetting their female classmate. Only two of the seven participants informed the offending party that they were upset by the behavior. Most participants reported that it was not worth the effort to tell the offending party that they were annoyed. Finally, when asked if they would ever consider reporting such activity or filing formal grievances, four participants reported that they would consider filing formal grievances, while three would not and one was uncertain.

Although some of the participants had experienced negative events in their technology education departments, most of them reported that they felt respected by their male classmates as well as their male teachers. However, most participants reported that females spoke and acted more appropriately in class than the male classmates.

Main reasons for the low female enrollment in technology education programs

offered in the pilot study included:

**P1:** Girls don't like it because they don't know it.

**P2:** Girls don't know about [technology education] or what they can do with it.

**P3:** I think a lot of them don't know about it. They don't know what you can do with it.

**P4:** The lack of knowledge of what goes on in [technology education] and what they can do with it and how it can benefit them.

**P5:** There's still [an] "only boys do that" mentality. There are gender specific toys, dolls versus tools, and boys are usually the ones to help dads.

**P6:** The way males and females are raised, father daughter relationships.

**P7:** A lot of it has to do with the teachers and professors, too. If you have a teacher who doesn't want women in his class, you have no hope.

To summarize, according to these participants, the main reasons that more females do not enroll in technology education programs are program marketing and letting female students know that there is a place for them in technology education. Secondly, there still seems to be a "locker room" mentality among some males in technology education programs and women do not feel they belong there. Finally, participants reported that the way some females are raised has an effect on what programs they choose and their comfort levels with some of the classes and tools in technology education.

Other factors besides inexperience and uncomfortable relationships with male peers and teachers that created an unwelcoming atmosphere for women in technology

education were being the only freshman girl in a design class and getting hazed by the juniors and seniors in the class, and the notion of taking a motor apart and putting it back together. Additionally, professors' directions being unclear and "[talking] over [students'] heads" so that students did not understand the class concepts was another issue that made female students feel uncomfortable in technology education classes.

When asked what the best thing about being involved in technology education was, most participants agreed that working with their hands and creating products was the best thing about their programs. As noted earlier in this study, participants also reported that technology education was a "fun" major. However, two participants reported that being a minority worked in their favor and was the best thing about being involved in technology education. As one participant stated, "I'm a minority [and] when I am looking for a job...a lot of people [who] talk to me about teaching at their school are like, 'Oh, you're a female. We don't have any females here.' It's been good for me so far."

Participants were asked about experiences in other male-dominated situations outside of technology education. Many reported that being involved with TECA (Technology Education Collegiate Association) was a positive experience in which they met and worked with other female students. Participants pointed out that there were generally more female students involved in TECA than there were in regular technology education classes which made the females feel more comfortable than they had in their regular coursework. One participant reported that being involved in TECA competitions and being visible while promoting technology education were very satisfying experiences. However, most participants noted that their experiences with TECA were

not significantly different from their regular classroom experiences. Participants reported mixed opinions about male-dominated situations outside of their college environments.

The next question asked the participants to discuss changes that could be made to create a climate in technology education programs that would be more inviting to female students. One participant suggested that male students and professors learn to be more accepting of women in the field and give them a chance before judging them to be incompetent. Others suggested that it had to do with high school advisors encouraging younger females and making them aware of technology education programs, and having teachers and administrators with positive attitudes toward female students.

All participants stated that they would consider teaching technology education when they graduated from college. Other career options reported were construction, architecture, design, photography, teaching on a corporate level, and promoting geothermal heat. Participants offered advice for their future daughters and sons who might be interested in technology education programs. For daughters, participants suggested that they explore all aspects of technology education and then focus on one aspect, and to stand up for themselves and not let anyone push them around. However, some would give different advice to sons. Sons would be told to treat people equally, regardless of gender, color, or religion, and to treat women with chivalry and respect.

Finally, the participants were asked for their final thoughts on gender in technology education. Some participants had strong suggestions for change while others from one particular college thought their particular department had no gender inequity issues.

**P1:** A girl has to be the one to take charge or nothing will get done.

**P2:** Teachers and boys ignore us in class and outside class when we make suggestions.

In my manufacturing class, I was the only girl and my input about the product was ignored.

**P3:** Women and men should increase their communication and get sex and inequality off the subject.

**P4:** It's okay. From what I've seen in my own experiences, I don't have a problem with anything.

**P5:** I haven't really had any horrible experiences so I really don't think it is an issue. My experience has been very supportive for girls. I don't think [male/female relationships] is the issue. I think the fact that we have, even when we didn't have a girl as one of our professors, the men that were there were so supportive of the women and they were so excited to have women in the program and they really supported it.

**P6:** Guys need to accept the girls in TED. They have male nurses, why can't we have female TED teachers? There are too many born again rednecks. They come to school and all of a sudden they are hicks.

**P7:** It's okay from my experiences. There are no problems...It was never really an issue like, "Oh, you're a girl, welcome to [technology education]. It was like, "Fine, you are here."

### Summary of Pilot Study Findings

According to the pilot study data, it can be extrapolated that five out of seven females in technology education programs have or will experience some type of negative interaction with their male peers or professors. In contrast, only two out of seven females in technology education reported having mostly positive experiences at their college and these two women were from the same university.

Participant one (P1) had several negative experiences in technology education classrooms, hallways, and dorms at her university that must be given special consideration. Although her classmates did not report similar treatment, they did point out that this particular participant is “tortured” by the male technology education students. None of the participants from other universities reported any of this type of treatment by male classmates. Nonetheless, P1 endured disturbing treatment that must be acknowledged. She very possibly represents a percentage of women in technology education who are treated to that extreme although her experiences were different from the other females in the study.

Another area where females in technology education reported having negative treatment is by the technology education professors and teachers. Five of seven reported having had at least one negative interaction with their male teachers or professors. One of the participants stated that she had one negative interaction with a supervising teacher at the school where she was student teaching. Although this experience did not happen on campus, it suggests that female technology education students not only experience negative treatment on their own college campuses, but in other educational environments

including public schools and other technology education events such as conferences.

Despite the number of negative experiences reported during the interviews, the females participants in the pilot study were generally positive about their respective programs. Reasons reported for staying in the program were “[because] it’s fun” and that they got to work with their hands. They noted ideas such as implementing Project Lead the Way<sup>®</sup>, and specializing in one aspect of technology education as ways to get more females involved in technology education. Certainly, as noted by two participants from the same school who were very satisfied with their programs, some positive changes are already occurring in technology education. However, although most participants in the pilot study suggested that male/female relationships were not a barrier in technology education, the overall findings from this pilot study seem to suggest otherwise.

### Summary of Chapter Two

Chapter Two provided an examination of existing literature. The review of literature was conducted in order to discover themes that might be evident associated with low enrollment of females in technology education and other technical fields such as science, mathematics, and engineering. Issues examined in Chapter Two included gender inequity in education, industry, and on national and global levels. Barriers related to low female enrollment in technology education and the other STEM areas included stereotyping, funding, sexism, biological differences, career options, and teacher gender. Recommendations from existing literature for removing barriers to female participation in technology education and the STEM fields were reported. In addition, a synthesis of constructivist learning principles and feminist pedagogy was proposed to provide the

theoretical framework for the study and a rationale for using qualitative research based on previous analyses conducted by Petrina (1998) and Zuga (1994) was provided. Finally, findings and implications from a pilot study completed by the researcher in 2005 were presented.

## CHAPTER 3: METHODOLOGY

### Introduction

This study was conducted in order to examine existing barriers that discouraged females from enrolling in technology education classes in middle school, high school, and college and to make suggestions on ways to break down those barriers so that women at both the academic and career levels can freely choose a path in any desired field. Qualitative research methods were used including a demographic survey, focus group interviews, document analyses, and member checks. Participants for the study were selected using purposeful sampling (Babbie, 1998; Rossman & Rallis, 2003).

The sample for the study was chosen from students attending a major university who were enrolled in technology education classes in the Mathematics, Science, and Technology Education Department. Three types of students were chosen: females majoring in technology education; males majoring in technology education; and females who were taking a class in the graphic communications program but were not technology education majors. All students who expressed interest in study participation were screened to determine whether or not they had attended high school in North Carolina. Once screening was complete, participants were chosen and interviewed in focus group settings. Analysis of the data, which will be further explored in Chapter Four, proposes possible explanations for and solutions to low female enrollment in technology education and related fields.

## The Qualitative Research Paradigm

To conduct research, one must collect, analyze, interpret, and report data. The two main types of research currently conducted in the social sciences are quantitative and qualitative (Babbie, 1998; McMillan, 2004). Whereas quantitative research can be defined as “a systematic attempt to define, measure, and report on the relationships between various elements” through the use of statistical analysis, qualitative research is “a way to study people or systems by interacting with and observing the subjects regularly” (Center for Research on Education, Diversity, and Excellence, 2002). As noted by Rose (1994), “the aim of qualitative research is to portray the reality of the area under investigation, and to enhance understanding of the situation and the meanings and values attributed to this by individuals; it does not involve the quantification of facts” (p. 39).

Qualitative researchers value the input and experiences of the study participants. They do not rely on statistical analyses for analyzing and interpreting data, but use numerous approaches to collect and analyze data. According to Coffey and Atkinson (1996), there are as many as 26 strategies for analyzing qualitative data. From these analyses, the particular phenomena of researcher interest are constructed through narrative reporting.

## Defining Qualitative Research

Lichtman (2006) defines qualitative research as:

...a way of knowing that assumes that the researcher gathers, organizes, and interprets information (usually in words or in pictures) with his or her eyes and ears as a filter. It is a way of doing that often involves in-depth interviews

and/or observations of humans in natural and social settings. It can be contrasted with quantitative research, which relies heavily on hypotheses testing, cause and effect, and statistical analyses. (p. 23)

Quantitative research involves the development and use of statistical models and hypotheses to measure and investigate phenomena. Findings of quantitative research are considered to be objective, or without emotional or personal influence and typically answer the questions of what, when, and where (Creswell, 2003; Marshall, 1996).

Qualitative research involves an in-depth study of phenomena typically using data collection methods such as observation, focus groups, archival research, and descriptive reporting (Bogdan and Biklen, 2003; Goetz & LeCompte, 1981). Findings of qualitative research are considered to be subjective, or influenced by researcher presence, and typically answer the question why (Creswell, 2003; Marshall, 1996). Quantitative research is measurable and conclusive, while qualitative research cannot be explained with mathematical equations or statistical tables (Denzin and Lincoln, 2000). Table 3 provides a comparison quantitative and qualitative research.

Table 3.

## Comparison of Qualitative and Quantitative Research

<b>Theoretical</b>	<b>Qualitative</b>	<b>Quantitative</b>
Nature of Reality	Multiple realities	Single reality, in a well-designed study, a reasonable approximation of reality can be observed
Objectivity/Subjectivity Dichotomy	Subjectivity, researcher involvement expected	Objectivity critical, scientific approach to acquiring knowledge
Role of Researcher	Researcher central to study; interpretations based on researcher experience and background	Researcher tries to remain outside the system keeping bias to a minimum
Generalizing Cause and Effect	Not interested in cause and effect or generalizing, want people to apply to own situations	Goal is to apply to other situations
Ways of Knowing	Multiple ways of knowing; we can learn about something in many ways	Best way of knowing is through the process of science.
Purpose	Understand, interpret social situations	Test hypotheses; look at cause and effect; prediction
Group Studied	Tends to be smaller, non-random; researchers may get involved in lives of those studied	Tends to be larger, randomly selected; anonymity important
Variables	Study of the whole rather than specific variables	A few variables studied
Type of Data Collected	Emphasis on words; increasing interest in the visual data	Emphasis is on numbers
Type of Data Analysis	Coding and themes	Statistical analysis

Note. From "Qualitative Research in Education: A User's Guide," Lichtman, M. (2006)

### Qualitative Researcher Characteristics

Qualitative researchers share the goal of improving social situations that occur in real-world settings (Lichtman, 2006). They collect data in context to discover certain characteristics of a particular situation or group of people. They hope to not only collect data about a situation, but also to offer suggestions for making that situation different or more satisfying. As Rossman & Rallis (2003) noted about qualitative researchers: They do research in natural settings rather than in laboratories or through written surveys. Their purpose is to learn about some aspect of social world and to generate new understandings that can then be used. As qualitative researchers, they become part of the process, continually making choices, testing assumptions, and reshaping their questions. (p. 5)

The qualitative researcher is an integral part of the study. Researcher background and experience play a part in data interpretation (Lichtman, 2006). Qualitative researchers are interested in conducting studies that will allow them to go into the world of their participants. Rossman and Rallis (2003) offered eight characteristics of qualitative researchers which are illustrated in Figure 2.

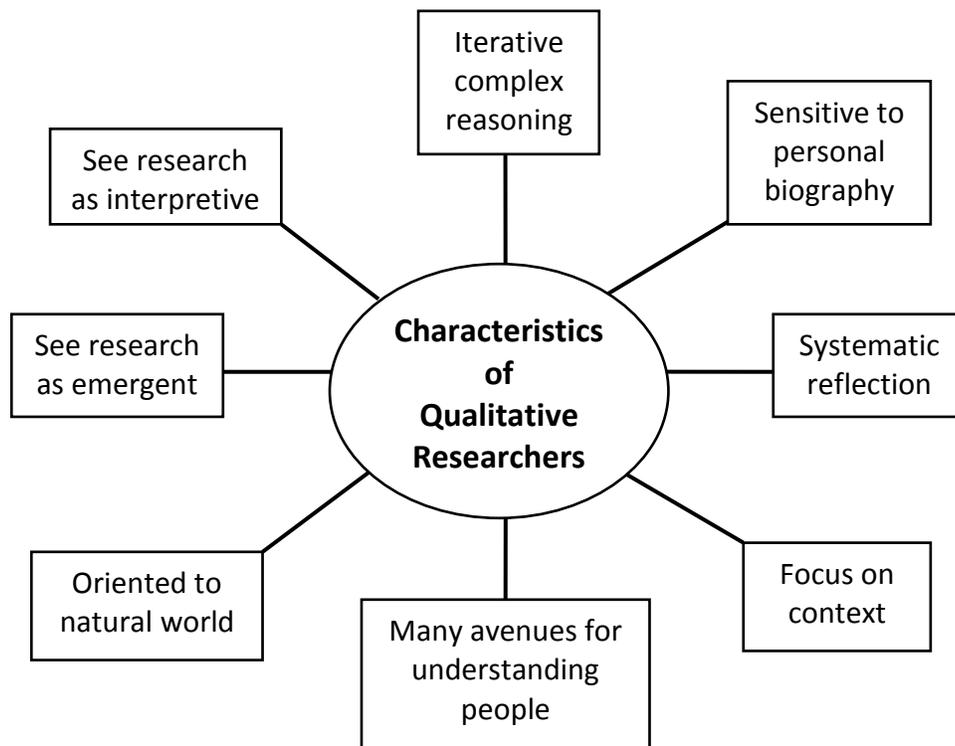


Figure 2. Characteristics of Qualitative Researchers

### Focus Groups in Qualitative Research

Qualitative research focuses on words and observation in order to obtain data about participants in natural settings. Many qualitative researchers utilize focus group interviews as a data collecting method. In focus group settings, participants are able to disclose information about their experiences in a comfortable, trusting atmosphere (Auerbach & Silverstein, 2003; Krueger & Casey, 2000; Lichtman, 2006; McMillan, 2004; Rossman & Rallis, 2003; Wolcott, 1997). Krueger & Casey (2000) define focus groups as "carefully planned series of discussions designed to obtain perceptions on a

defined area of interest in a permissive, non-threatening environment" (p.5). Powell (1996) offers a similar definition. He describes focus groups as selected groups of participants chosen and assembled by a researcher to talk about personal experiences on a topic of interest to the researcher.

According to Krueger & Casey (2000), social scientists became interested in focus group methods around the 1930s. At that time, researchers were using a methodology in which pre-written questionnaires with close-ended response questions were given to research subjects. Under this method of research design, participant responses were influenced because they were not able to give full responses to the questions on the research instrument producing inaccurate research findings (Krueger & Casey, 2000). Not satisfied with these research methods, social scientists began to seek new ways to obtain more accurate research findings and give research subjects a more pronounced role in data collection. The new method used by social scientists was called the "nondirective interview" and eventually become known as "focus groups" (Krueger & Casey, 2000, p. 6). Focus group interviews can be used as the primary or secondary source of data collection (Bogdan and Biklen, 2003; Creswell, 2003).

### Analyzing and Interpreting Qualitative Research

The analyzing and interpreting processes are at the core of qualitative research (Flick, 2006). As Flick (2006) explains:

Interpretation of text [data] may pursue two opposite goals. One is to reveal and uncover statements or to put them into their context in the text that normally leads to an augmentation of the textual material; for short passages, in

the original text, page-long interpretations are written sometimes. The other aims at reducing the original text by paraphrasing, summarizing, or categorizing. These two strategies are applied either alternatively or successively. (p. 296)

Most qualitative research experts recommend that analysis and data collection begin simultaneously as this approach improves the overall study (Bogden & Biklen, 2003; Coffey & Atkinson, 1996; Eisner, 1998; Flick, 2006; Gall, Gall & Borg, 2003; Glesne & Peshkin, 1992; Hatch, 2002; Lichtman, 2006; Rossman & Rallis, 2003). When analyzing and interpreting data begins early, researchers gain an emergent understanding of the collected data. To begin analyzing and interpreting data, qualitative researchers must immerse themselves in the data which allows them to organize the data into coherent themes, bring meaning to the themes, and create a narration so that others can understand what the data has revealed (Rossman & Rallis, 2003).

Qualitative researchers utilize an iterative approach to data analysis, while typically choosing either an inductive or deductive system (Lichtman, 2006). The iterative approach denotes that data analysis is a cyclical and constantly changing process. According to Babbie (1998):

Induction reasoning moves from the particular to the general, from specific observations to the discovery of a pattern that represents some degree of order among all the given events....Deductive reasoning moves from the general to the specific. It moves from (1) a pattern that might be logically or theoretically expected to (2) observations that test whether the expected pattern actually occurs.

Deduction begins with ‘why’ and moves to ‘whether,’ while inductive moves in the opposite direction. (pp. 35-36)

Figure 3 represents the difference between inductive and deductive analysis conducted in qualitative research.

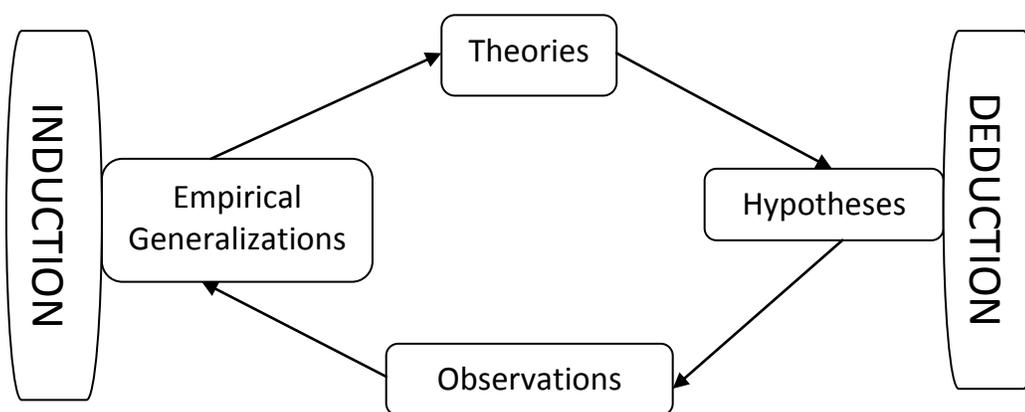


Figure 3. Inductive and Deductive Processes. From “The Practice of Social Research,” Babbie, (1998).

Rossmann and Rallis (2003) suggest that data analysis in qualitative research originate with the development of the research questions and continue throughout data analysis. As seen in Table 4, they offer several steps for completing a thorough data analysis.

Table 4.

## Qualitative Data Analysis Techniques

- 
1. While collecting data, refer to conceptual framework but be aware of new insights.
  2. Keep research questions in mind as data is collected.
  3. Modify data collection as appropriate to what researcher is learning.
  4. Keep track of ideas generated using note-taking or graphic organizers.
  5. Have discussions with others about ideas gathered during data collection.
  6. Immerse yourself in previous research and literature about topic of interest.
- 

Note. From “Learning in the Field” by Rossman, G & Rallis, S. (2003).

Although qualitative researchers do not use numbers and statistics in data analysis and interpretation, they do perform a complete systematic examination of the data (Hammersley, 1981). Thus, all qualitative researchers must be able to organize, manage, and select the most important pieces of the data (Coffey & Atkinson, 1996). As Marshall and Rossman (2006) observed concerning data analysis:

...[data analysis is] the process of bringing order, structure, and interpretation to a mass of collected data is messy, ambiguous, time-consuming, creative and fascinating. It does not proceed in a linear fashion; it is not neat.

Qualitative data analysis is a search for general statements about relationships and underlying themes. (p. 154)

One of the most commonly used strategies for making sense of data in qualitative research studies is the coding technique (Kerlin, 2002; Rossman & Rallis, 2003). Most

analyses of qualitative data begin with the identification of important patterns and themes (Coffey & Atkinson, 1996). Coding is the most common technique of discovering these patterns and themes. When coding, the researcher is condensing data into units that can be analyzed by the creation of categories from the data (Coffey & Atkinson, 1996). When using coding, the researcher reads the data collected while looking for common words and phrases. These common words and phrases are coded and then put into categories to create themes (Hewitt-Taylor, 2001; McMillan, 2004). As stated by McMillan (2004):

[Codes are] related to setting and context, subjects' definitions of a setting, subjects' perspectives about other people, and aspects of a setting, process changes over time, activities, events, techniques subjects use to accomplish things, and relationships and social structures....Some may be major codes, which tend to be broad, general categories, while others may be subcodes, which are divisions among the major codes. (pp. 267-268)

According to McMillan (2004), there are several steps to coding. Table 5 displays McMillan's qualitative coding techniques.

Table 5.

## Qualitative Data Coding Techniques

- 
1. Use some type of systematic approach to creating codes such as the research questions that guided the study.
  2. Summarize the organized data.
  3. Analyze the data for “patternized regularities” that can aid in generalization (p. 268).
  4. Interpret the findings inductively.
  5. Synthesize the information.
  6. Draw inferences from the data and report it.
- 

Note. From “Learning in the Field” by Rossman, G & Rallis, S. (2003).

The coding procedure is continued until the researcher reaches theoretical saturation, which is when coding, naming of categories and other activities related to coding fail to uncover new knowledge (Flick, 2006). The next process in a qualitative research study is writing and reporting of the data.

#### Reporting Qualitative Research

As stated by Rossman and Rallis (2003), “qualitative inquiry is both a science and an art (p. xiii). Qualitative data is typically reported in narrative form. When reporting qualitative data, the researcher must find a balance between scientific language and artistic expression. If the writing is too scientific and technical, those who are unfamiliar with reading research may not understand the analysis. If the writing is too creative, the

careful and deliberate inquiry conducted by the researcher may be hidden in the prose (Rossman and Rallis, 2003). Additionally, when reporting data findings, qualitative researchers seek to collect the etic, or the participant, view of a situation and represent those views from the emic, or outsider's position (Rossman & Rallis, 2003). In short, qualitative researchers listen to people's stories and intertwine them to create an understanding of real-world experiences (Rossman & Rallis, 2003).

#### Description of Current Study

A qualitative study was conducted in order to discover existing barriers that discourage females from enrolling in technology education classes in high school and college and to make suggestions on ways to break down those barriers. Qualitative research methods were used including a survey for demographics, focus groups, and document analysis. The subjects were students attending a southeast university who were enrolled in technology education classes.

#### Study Participants

Participants for this study were chosen using purposeful and critical sampling methods and were then screened to make sure they met the necessary criteria for study participation. Purposeful sampling involves recruiting participants from people easily accessible to the researcher (Auerbach & Silverstein, 2003). Critical sampling allows the researcher to choose participants who have had certain experiences in a certain setting (Marshall, 1996). It was necessary to screen potential participants in order to be sure that they met the criteria necessary for the study. Figure 4 illustrates the flow chart created to screen possible study participants.

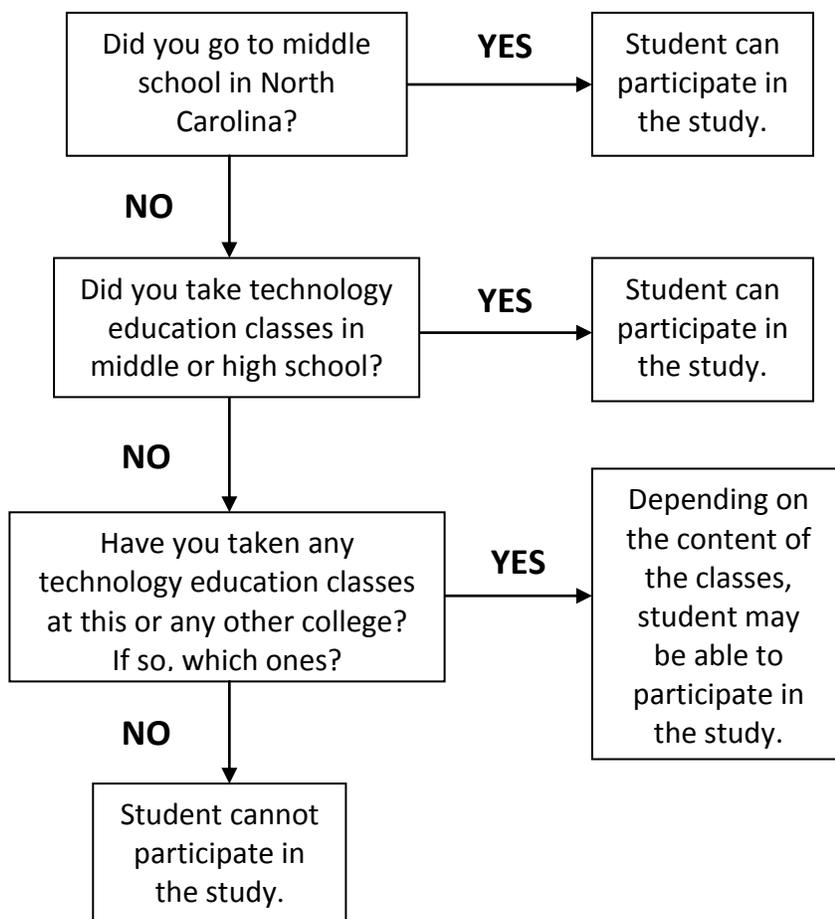


Figure 4. Flow Map for Screening Potential Study Participants

### Data Collection

Although triangulation, or the use of more than one data collection method to increase validity of findings, is not a requirement in conducting qualitative research, I chose to use primary and secondary sources of data to contribute to validation of the findings. By supplementing the primary data collection method, more credibility can be given to the data findings. In other words, the researcher can be more confident with the findings if using different research methods leads to the same result (Morgan, 1997).

Methods used to collect data for the study included demographic surveys, focus groups, interviews, member checks, and document analysis. The focus group discussions were the primary method for collecting data for the study. Focus groups were chosen as the primary method of data collection because of the ability of this strategy to produce meaningful and detailed information in the shortest amount of time. Not only do focus groups produce verbal answers from participants, but they also generate responses through body language, and other non-verbal signals (Edmunds, 1999). According to research, focus groups are especially fitting for feminist research as they are non-hierarchical and contextual (Wilkinson, 1999).

The survey was strictly to collect demographic information and was used only for statistical purposes such as averages of age, academic information, and parental occupations. Document analysis, another secondary method of data collection, was a necessary aspect of the study. Enrollment lists, school catalogues, university administrative reports and academic departmental web pages were examined throughout the data collection process.

Often qualitative researchers will use a secondary method called member checking. A member check is a technique in which a researcher shares interview notes with the participant so that he can verify that the information is correct (Bogdan & Biklen, 2003). This method can be formal or informal as the opportunity to use the technique arises (Lincoln & Guba, 1985). Member checks were used throughout the data collection process of the study. Using member checks with study participants verified and strengthened the data.

The non-technology education major focus groups and interviews were conducted separately from the technology education groups. Using this method, rather than interviewing all female participants together made the participants more comfortable expressing their true feelings without self-censorship. Therefore, participants were able to express themselves fully about how they felt about technology education classes and the students who do or do not take them (Dr. Catherine Warren, personal communication, May 28, 2006).

Each focus group meeting lasted approximately 45 minutes and was held in conference rooms in the technology education building. Focus group discussions with the technology education majors were recorded with a video recorder and transcribed after all data was collected. Two larger focus groups made up the technology education majors. However, interviews in groups of twos and threes made up the interviews with the non-technology majors. The non-technology major interviews were recorded on a digital recorder and transcribed after all data was collected.

In qualitative research, the number of groups depends largely on the size of the research team (Morgan, 1997) or the research questions (Edmunds, 1999). Since I was the only researcher, with the exception of a male counterpart leading the male group, I had to limit the number of focus groups. Additionally, given complicated student schedules, I had to meet a total of six times: two focus groups with the technology education majors and four interviews with the non-technology education majors.

There were six participants in the group of female technology education majors and seven participants in the male technology education majors group. The number of participants chosen for each focus group was based on research of focus group methodology. The basic rule of thumb for number of participants in a focus group in qualitative research is 4 to 10, depending on the research team and the actual research (Casey, 2000; Krueger & Morgan, 1997; Lichtman, 2006; Litoselliti, 2003;). Having fewer than four participants could cause the group to have very little interaction and discussion while having ten or above might cause the researcher to have trouble controlling the conversation and getting all the information for the study (Lichtman, 2006; Litoselliti, 2003; Morgan, 1997). Having six to seven participants in each group created a comfortable atmosphere where every participant was heard and allowed the discussion to proceed at a satisfactory pace (Krueger & Casey, 2000; Litoselliti, 2003; Morgan, 1997).

Since my goal was to interview participants in a group setting, I chose a semi-structured or guided approach to conducting focus groups. In this type of approach, the researcher has a preconceived idea of how the discussion might go and, as such, develops

a list of questions to use as a way to guide this focus group discussion. However, with the semi-structured approach, the researcher allows the participants to freely discuss anything that comes to mind when discussing each particular question. If the researcher allows for this type of free thinking in a focus group, where participants interact and are stimulated by one another's thoughts, more data can be collected than might be in a more structured approach to focus group interviews (Lichtman, 2006).

Based on the semi-structured approach to data collection in focus groups, a list of questions that would lead participant discussion was developed prior to focus group scheduling (Appendix C). The questions were based on the review of existing literature and researcher interest. The questions were used as prompts so that participant discussion could be guided by the questions, but also allowed for sharing other thoughts from participants' technology education experiences. There were no problems with keeping the participants on task and keeping the conversation on the subject and productive. A total of twenty participants were interviewed using questionnaires as guides for the discussions. As mentioned previously, responses were recorded using a video camera and a digital recorder.

### Data Analysis

Data was transcribed and analyzed by the researcher concurrently and after collection. Certain themes and patterns emerged which will be analyzed and discussed in Chapters 4 and 5. Coding was begun early in the data collection process and continued throughout the analyzing process. Notes were taken while analyzing the data, another qualitative method, which contributed to the creation of emerging patterns and themes.

Participant responses, document analysis, member checks, notes made during analysis, and document examination were combined to discover the emergent themes which will be discussed in Chapter 5.

## CHAPTER 4: FINDINGS AND ANALYSIS OF THE DATA

### Introduction

This chapter presents an analysis of the data collected from the focus group discussions which was the primary data collection technique used in the study. Research design and participant responses are carefully examined and discussed. Male and female technology education majors' responses to the focus group questions are compared and analyzed concurrently. Since their questions were different, the non-technology education female participant responses are discussed after the technology education majors' response analysis and discussion. The final two questions, which addressed barriers that discouraged female technology education students to enter the program or its classes and how the technology education program could be improved to make it more attractive to female students, are discussed near the end of the analysis as all three focus group questionnaires included these two questions. Each focus group question serves as a section subheading and is followed by a discussion of that question by the study participants.

### Research Design

Qualitative research methods were chosen to collect data for this study. Focus groups and small group interviews were chosen in order to gain a more personal insight of the participants' feelings about female involvement in technology education. Two separate focus group discussions were held with the male and female technology education majors. The male focus group was facilitated by a male graduate student during this study, while I facilitated the female focus group. In an effort to uncover as much

information as possible, data was collected from technology education majors as well as majors from other colleges at the university. Due to scheduling conflicts among participants, one focus group meeting could not be held to gather data from the female participants that were not technology education majors. Instead, smaller focus group interviews with two to three participants were scheduled in order to collect the data.

A selected list of questions was used to prompt discussion in the focus groups. (Appendix C). The same instrument was used for both the female and male technology education majors although the male participants were asked several extra questions. A shorter, separate list of questions was used to gather data from female participants who were not technology education majors. The male focus group facilitator asked only the questions listed on the focus group questioning guide while I interjected follow-up questions and related responses which are included in the transcripts (Appendix D). Data was triangulated for validity using secondary methods of data collection including document analysis and member checking. Data was transcribed, coded, analyzed, and examined in order to find emerging themes. Emerging themes will be discussed in Chapter 5.

### Study Participants

Participants for the study consisted of six female technology education majors, seven male technology education majors, and seven females from other majors at the university. One of the female technology education majors was student teaching in a local public middle school at the time of the study; while the other five female technology education participants were enrolled in required departmental classes. All of the seven

male participants were student teaching either at middle or high school level during the time of the study. The females interviewed from other majors were enrolled in an introductory graphic communications class offered by the Mathematics, Science, and Technology Education Department.

All students interested in the study were selected or eliminated using a preliminary screening questionnaire which was designed to determine whether or not they had attended high school in North Carolina (Appendix B). As information about participant experiences in middle and high school technology education programs were of particular interest, students who had not attended high school in North Carolina were not chosen to participate in the study. The North Carolina public school system has some required coursework in technology education while many other states do not. Therefore, choosing students who had attended public school in North Carolina was the best way to ensure collection of pertinent information about their middle, high school, and college level technology education experiences.

#### Selection of Participants

Potential participants for the study were solicited in various ways. Male and female technology education participants were selected from majors in the technology education program in the spring 2007 semester. Female students who had majors outside the technology education department were chosen by examination of enrollment in graphic communications introductory classes which included students from various other majors at the university. Potential participants were asked to participate through email. If students who had been sent email messages asking them to participate in the study did

not reply to the messages, I followed up the email invitations with phone calls or contacted those students in person.

Since only 4 of 50 technology education majors during the spring 2007 semester were women, female students who were graphic communications majors were included in the solicitation for participation in the study. Nine of 35 majors in graphic communications during the time of the study were female. At this university, students who major in graphic communications are required to take a minimum of eight technology education courses. Based on this requirement and the preliminary screening process, the researcher felt that allowing female graphic communication majors to participate in the study was permissible. Inclusion of the female graphic communications majors brought the total female technology education focus group participants to six. The male technology education majors' focus group had seven participants. The non-technology education majors' focus group was composed of seven female students from mechanical engineering, aerospace engineering, civil engineering, industrial engineering, physics, and business management.

#### Participant Demographics and Background

A survey-type instrument based on Haynie (1999, 2003) was completed by each study participant prior to the beginning of each discussion (Appendix C). The demographic survey was composed of questions designed to gather basic demographic and background information related to previous coursework and involvement in technology education. This information revealed similarities and differences in the

background and experience of the study participants. Tables 6 through 8 illustrate the specific responses from each participant to several of the demographic survey questions.

Table 6.

Demographic Information for Female Technology Education Majors

<b>Minor</b>	<b>Class</b>	<b>Yrs in TED*</b>	<b>Father Occupation</b>	<b>Mother Occupation</b>
None	Jr.	No answer	Office Worker	Teacher
TED	Jr.	2	N/A	Teaching Assistant
Religious Studies	Jr.	1	N/A	Homemaker
None	Sr.	2	Custom Contractor	Social Worker
None	Sr.	3	Retired Teacher	Ret. Insurance Adjuster
None	Jr.	10	Parking	Manager

Note. N=6

\* Includes middle school, high school, and college levels

Table 7.

## Demographic Information for Male Technology Education Majors

<b>Minor</b>	<b>Class</b>	<b>Yrs in TED*</b>	<b>Father Occupation</b>	<b>Mother Occupation</b>
Naval Science	Sr.	4	Metals Instructor	Farmer
Business	Sr.	3	Commercial Real Estate	Accountant/ Homemaker
None	Sr.	3	Farmer/ Management	Farmer/ Social Worker
Naval Science	Sr.	3	Government	Teacher
Graphic Com.	Sr.	3	Chemist & boat builder	Nurse
None	Sr.	4	N/A	N/A
None	Sr.	7	Police Officer	Insurance Agent

Note. N = 7

\* Includes middle school, high school, and college

Table 8.

## Demographic Information for Non-Technology Education Females

<b>Minor</b>	<b>Class</b>	<b>Yrs in TED*</b>	<b>Father Occupation</b>	<b>Mother Occupation</b>
None	Fr.	1	Mail Carrier	Self-employed
None	Fr.	No answer	Marine	Homemaker
None	Fr.	3	Sales	Sales
Art & Design	Jr.	2	Building & Construction	Director Occupational Health
None	So.	13	Electrical Engineer	Kitchen & Bath Designer
FL: Spanish	So.	1	Not answered	Social Worker
Statistics	Jr.	1	Home Builder	Mathematics Teacher

Note. N = 7

\* Includes middle school, high school, and college

*Age Range of Participants*

Ages of study participants varied among the different focus group members.

Female technology education focus group members ranged in age from 20 to 29 with a mean of 23 and a mode of 21. Male technology education focus group members ranged in age from 21 to 29 with a mean of 24 and a mode of 22. The female participants from outside the technology education program ranged in age from 18 to 21 with a mean of 19.5 and a mode of 20. The mean age of all study participants was 22. Table 9 displays the ages of participants in by group.

Table 9.

Ages of Study Participants

<b>Female TED Group</b>	<b>Male TED Group</b>	<b>Non-TED Female Group</b>
20	21	18
21	22	19
21	22	19
22	22	20
25	24	20
29	28	20
----	29	21
<b>Mean</b> 23	24	19.5
<b>Mode</b> 21	22	20

Note. N=20

### *Parental Occupation Influence*

According to the findings of the demographic surveys, few of the technology education majors had parents who were employed in technology-related fields. As illustrated later in the focus group discussion analysis, family pressure was not a factor in choosing fields of study for the female or the male technology education majors. However, the participants that were not technology education majors reported that family pressure played a considerable role in choosing their fields of study.

### *Participants' Pre-College Technology Education Experiences*

One of the questions on the focus group guides addressed whether or not participants had taken technology education classes at the middle and high school levels. A detailed breakdown of these classes and numbers can be found in Appendix C. To summarize this data, 3 of 7 female technology education majors had taken technology education classes in middle school while four had not. Only 1 of 7 male technology education majors had taken technology education classes in middle school. In the group of female participants who were not technology education majors, only one had taken middle school technology education classes. On the high school level, two female technology education majors had taken drafting courses, one had taken three years of AutoCAD<sup>®</sup>, and one had taken bridge making, use of Global Positioning Systems (GPS) and computer-simulation classes. The student who had taken the last group of classes noted that although “woodshop” had been offered in her high school, she had been pushed by her teachers and counselors toward computer courses and away from hands-on laboratory participation classes.

The remaining four female participants had not taken any technology education classes in high school. Three of the 7 male technology education majors had taken technology education classes in high school. One of seven males reported that he had thought the technology education classes at his high school were vocational in nature and, therefore, assumed he would be stereotyped if he had chosen to take any of the classes. Finally, 3 of the 7 female participants who were not technology education majors had taken technology-related classes in high school which, according to the screening process for the research, made them eligible to participate in the study.

#### *Involvement in Major-Related Organizations*

Many participants, both in and out of the technology education program, reported major-related involvement beyond classes including professional and volunteer organizations and school clubs. Several technology education majors reported involvement in Technology Student Association (TSA) which is a middle and high school group, Technology Education Collegiate Association (TECA), which is similar to TSA but is on the college level, and Epsilon Pi Tau (EPT) which is the technology education honor society. Both male and female TED majors had about the same amount of involvement in groups related to their majors outside of their classes. However, the female participants from the other majors were not as involved as technology education students in groups outside of their coursework related to their majors.

Of the seven male participants, two were involved in the Technology Student Association (TSA) in high school, two were involved in the Technology Education Collegiate Association (TECA) and one was a member of Epsilon Pi Tau (EPT), the

technology education honor society. Of the six female technology education participants, none had been in TSA when in high school, two were in TECA, one was in EPT, one was involved in a professional organization not related to technology education, and four were not involved in any organizations outside of classes. Of the seven female participants from outside the major, one was on the robotics team in middle and high school, one was in the Institute for Industrial Engineering during the time of the study, and five were not involved in any professional organizations.

#### *Participant Plans to Take Future Technology Education Classes*

All study participants were asked whether or not they had plans to enroll in technology education classes in the future. Of the seven male participants, three stated they would be taking remaining coursework required to obtain their bachelor's degrees, two had plans to go to graduate school, and one participant had no plans to take further technology education classes. Of the six female technology education majors, five planned to take remaining required courses, and one planned to take professional development coursework while student teaching.

Of the seven female participants outside the major who had taken at least one class in the department, three stated that they would probably take either technology education or graphic communications classes in the future, one would possibly take another graphic communications class, and one participant stated that she was not interested in taking further classes in either the technology education or graphic communications programs. However, as reported in the analysis of the focus group

discussions, taking a future class in technology education or graphic communications would depend on whether the classes benefit their majors or fit into their schedules.

#### Discussion of Focus Group Participant Responses

This section of the chapter includes a discussion of participant responses to the questions used to guide the focus group discussions. Each question is listed in order followed by a summary of the responses from all the groups. Relevant quotations from focus group discussion transcripts are included where appropriate. In some cases, participants may not have answered all of the discussion questions.

#### Participant Interest in Technology Education

**Q1:** Why did you enter Technology Education? How did it become an interest for you?

As reported in their responses to this question, the majority of female technology education participants were attracted to the field because of the hands-on, tangible activities, artistic aspects, and project-based approach to the curriculum. Many technology education majors, both female and male, started college in some type of engineering major and transferred into the technology education program when they learned that engineering classes were not hands-on or project-based until much later in the curriculum. Table 10 illustrates the degree program each technology education participant was in before they decided to change their major in technology education.

Table 10.

## Participant Areas of Study before Entering the Technology Education Program

<b>Major Started In</b>	<b>Females</b>	<b>Males</b>
TED or TGC	3	1
Engineering	2	5
Any other major	1	0
First Year College	0	1
<b>Total:</b>	<b>6</b>	<b>7</b>

Female participant 2 (FP2) stated that she entered the technology education major because she ultimately wanted to work with mentally and physically handicapped children through art therapy. She “figured that there were a lot of technologies involved with helping [these children]. I guess it’s just blending the technology and art aspect.” FP1 reported that she started her college career as a psychology major because she wanted to work with children in some capacity after graduation. However, since, as she asserted “kids don’t go see psychologists, they talk to their teachers,” she changed her major to technology education. FP3 began college in one of the engineering fields but the courses were too challenging for her. She subsequently took an introductory materials processing class in the technology education program and, as a result, decided to change her major.

As illustrated in Table 10, many technology education majors in the study were in some type of engineering major before they decided to change their majors to technology education. When asked why they decided to change majors from engineering to technology education, participants, both male and female, reported that technology education offered a more “hands-on” curriculum than engineering. FP4 reported that she “had always been in drafting.” She, too, started college in an engineering field, and then changed her major to technology education:

**FP4:** ...but when I took [an introductory graphic communications class], I found out that there was a major that did the same stuff that we did in high school and that just changed my mind and I thought, “That’s where I’m going.”

FP5 reported that she had taken and “enjoyed” drafting classes in high school and had an interest in design. However, when she entered the university, FP5 did not have the required portfolio for application to the school of design. During that time, she was employed by the university and worked with someone who was familiar with the technology education program.

**FP5:** He told me about the different aspects of it and...I applied for TED and I’ve been in TED full-term. I’ve been in and out of [the program] for 10 years.”

Male technology education majors had similar responses to the question of how they became interested in the technology education field. Five of 7 male participants started in some type of engineering major before they became technology education majors. Only two male technology education participants did not come to technology education from an engineering major, and only one of those two participants started his

college career as a technology education major. One of those two participants, MP4, started college as a technology education major after serving as a machinist in the Marine Corps. When he got out of the military, MP4 was uncertain as to what to do next. After exploring his options, MP4 decided to attend college and obtain a teaching degree. Since he was interested in teaching and thought the technology education program would fit with his machinist background, M4 elected to pursue a technology education licensure.

MP1 was the second of two male participants that did not come to technology education from an engineering major. He started his higher education studies in the First Year College Program (FYC) which is designed to provide new students with a support system for choosing a major. Additionally, FYC provides advising on educational matters as well as helping students to become comfortable in their college surroundings. Students who participate in the FYC program are given the time and knowledge needed to choose a major.

**MP1:** My freshman year I was in FYC [First Year College] which was for people that were in an undecided major and part of the FYC program [is an] assignment to look at all the curriculums, like five or six different majors. I was in the curriculum of TED when I saw that you could take woodworking classes, metalworking classes, construction technology and those were all things I was real interested in and that's the reason why, because of the curriculum, of the classes that were available. I made that decision my freshman year.

The remaining five male technology education majors transferred to the technology education program from an engineering program. The following excerpt is from the male

technology education majors' focus group discussion. Each participant explains how and why he decided to become a technology education major.

**MP2:** I started out in engineering, but ended up getting deployed three times in the military. So, when I came back, calculus was foreign to me. I took everything that I have always liked doing engineering wise and I especially like working with my hands, then went to find a curriculum that I would really like and it just happened to be technology education.

**MP3:** I was talking to an electrical engineer and he was telling me about the easy courses and the easy majors here; and he kept making fun of one major, TED. He said all they did was take field trips and work in a shop. So, I figured that had to be better than what I was in because I was about to quit college anyway because I didn't like mechanical [engineering], so I switched over. It's what I've been doing my whole life so it worked out.

**MP5:** I started off in Material Science Engineering and got talking to people in the field and they said take Woods Processing Technology and I loved it, so, I come over here and started this program and everything's cool.

**MP6:** I did two and a half years of Mechanical Engineering and I hated it, and I heard that if you didn't like Engineering, all that engineering stuff, go to the hands-on part which is Tech. Ed. I been tutoring since I was twelve for other things so education seemed like a fine choice, so I came over here.

**MP7:** My sophomore year in Engineering I was getting very tired of engineering. About that time I prayed that if God, I am a Christian, wanted me to do something

other than engineering he would have to show what that thing was. About that time, I learned about GC and Tech Ed. I also prayed that if I was to get out of Engineering, that I would have to be dragged out of it kicking and screaming, since I have a hard time quitting anything. About that time my reasonably good grades in Engineering dropped due to bad scheduling [and] partially due to a new student advisor. In addition, I have always been mechanically inclined, but not mathematically inclined. Tech. Ed. fits my skill set.

#### Participant Likes and Dislikes about Technology Education

**Q2:** What do you like the most and least about being involved in technology education?

This question asked the participants to discuss their likes and dislikes about the technology education program at their university. Many of the female technology education majors stated that they enjoyed technology education courses because of the hands-on, tangible aspect of the projects created in the classes, and the creative and artistic aspects of the program. As one participant reported, “I love having a tangible product. I can take it to my parents and say, ‘Look what I made!’” Another female technology education participant pointed out two classes in which they were allowed to be creative and noted that in one class, “We get to make all the buttons and t-shirts.”

Although the female technology education majors had several positive things to say about the program, they had many adverse comments as well. Many of these comments had to do with low number of professors in the program, dislike of particular classes in the program, inappropriate or unavailable supplies, working in groups, and course scheduling. One female technology education major reported that she wished there

were more technology education professors so that more classes could be offered in the program. The researcher pointed out that a recently added new course, an introductory robotics class, had always filled up quickly and seemed very popular. However, when polled about this class, only one of the seven female technology education majors admitted that she liked the class. Most of the female technology education majors stated that since it was a required class, they had to take it, but did not enjoy the course curriculum. One participant commented that when the students paired up for projects, she was unable to procure a partner as there was an odd number of students in class that day. Therefore, the student was confused about how to complete some of the rotational projects in the class since she had to complete them on her own.

**FP4:** I didn't like it because I was the only person in both sections in the class that was stuck by themselves on the rotations and robotics already doesn't appeal to me, so, I was totally confused the whole time I was doing the rotations. I guess I was by myself because somebody added the class late or something.

#### Participant Input about Working in Groups

Although the participants had brought up several likes and dislikes about the technology education program, I was interested in learning more about how the participants felt about working on projects in groups of mixed gender. There is a great deal of literature that addresses the issue of cooperative learning and gender. Both male and female technology education participants had much to say about this issue which came up naturally when the researcher asked for final input on likes and dislikes about the technology education program.

**FP6:** Group projects. I hate group projects...

**Researcher:** This is something I read in the literature. Do the men expect the women to do all the work?

**FP5:** We get stuck with all the secretary stuff and they get to do all the hands-on stuff. It's not fair to us because I love playing with stuff.

**FP6:** But then if you take a stand, then nothing gets done.

**FP5:** That's how it was with our first project. I was a huge part of it, but when I left them, they did it wrong. Then the second one, I just wasn't into it. I was so terrible, but I told them what to do. Then the third one, I did the project and they didn't do their part at all. This time, they are like, "Oh yeah, we are going to do it," and they are taking care of everything and I'm like, "All right, men," but we see a difference in our robotics group.

**FP6:** Oh yeah, that's on their terms. They have jumped all over building it and putting it together, doing the programming, the SolidWorks® and stuff like that.

**FP5:** But what's going to happen when it comes time to do the paper? Who's going to write it? We are. They will not touch it, I bet you.

**FP6:** They rely a lot on our opinions when it comes to what the ideas are. Some of them do. There is one guy, he doesn't care what I say, but I still interject because... They always assume that you will take care of the secretary part and that you've already got all your work taken care of and everything is beautiful. When you do try to do it, for instance that very project, if you try to take care of the "male" typical part, well, they do not. Here's another example. Yesterday,

when I was trying to work on my solid modeling part, my partner had stepped away. He was doing most of it, and I was just like, “well, we need to keep going,” and I’m pretty good at SolidWorks®. I just started putting some parts on the model and he came back and started looking at it and said, “What did you do?” like completely freaking out about it, like I had messed up the whole thing and I’m like “I did exactly what I would have done if I tried working on in myself, I could have completed it.” He deleted everything I did and put it back the way it was before he left. I was like, “Fine, I will go work on something else.”

**FP2:** I don’t think it works well.

**FP1:** In grade school and high school I would agree with that statement, but I think it’s even worse here [at the college level]. I pick groups [based] on personality. If I’m not going to get along with you, it doesn’t matter if you are male or female; I’m just not going to get along with you.

**FP2:** We were doing groups in [name of class omitted] and I would never be in a group with [male student, names omitted]. All the people in his group are like that. Well, not all of them. He is a nice enough guy, but he doesn’t do any work. I mean all those guys...

**FP4:** He comes to our class from [another technology education class] and gets [another male student, name omitted] and says, “Oh, are you coming with me?”

**FP2:** Those kind of students in general, who don’t have a good work ethic, and the fact that they are male, I guess...

**FP2:** This might be a stupid observation, too, and I might be a sorority girl, but in our robotics class, [male student, name omitted] started sitting with me where the class is

U-shaped. I sat in the very front and [same male student, name omitted] sat in the back of the class. When [same male student, name omitted] started sitting with me, he would bring his work to class and do his work, but when he sat with [another male student, name omitted], he didn't. If it seems like I am debasing [name omitted], I'm not. It's people similar to that that have that kind of work ethic and that kind of issues in the classroom.

**FP1:** See, I'm with all the seniors now, so we don't have issues. We're in the mile stretch and we've all been with each other for a long time.

**FP2:** I guess I am, too. I am really serious about school. I want to make a 4.0 and people that don't care about good grades and stuff...

**Researcher:** I just brought the issue of groups up because other female students have mentioned that male students pick female students for their groups and the male students do all the "fun stuff" while the female students do all the "work."

**FP3:** I don't really agree with that, but I just jump in, and, sometimes it drives me crazy because it's like I am in charge again. Everyone looks at me like robotics is amazing because [male student, name omitted] is in charge. He is in charge. Everyone reports to [same male student] and everything gets done, and it's not me. I don't necessarily agree with that comment because I would rather jump in and get my hands dirty.

**FP1:** I know women who are...

**FP4:** I think everyone ought to do their own part.

Male participants had different opinions about working in mixed gender groups on projects. In summary, male technology education majors stated that choosing group members for class projects depended on student personality rather than gender.

**MP1:** Male or female, I usually choose whoever I'm better friends with in the class. I have an equal number of guy and girl friends.

**MP2:** Some I would, and some I would not. It really depends on the character of the female. If I didn't know the female, or know of her well enough, then I honestly have to say I would choose an unknown male over an unknown female, just being honest. I would do it because I would feel that the male would put more effort and know more of design and mechanical things.

**MP4:** I try to choose the students that will carry their weight. [It] does not matter if [they are] male or female.

**MP5:** Honestly, it depends on the project. Females tend to bring an extra bit of creativity that is great for most projects, but there are some things that guys seem to just understand easier. This rule isn't true of all guys or all girls. So, really it depends on the project and the girls in the class. But, I have no problems and have seen no problems with co-ed groups and, honestly, most of the time; I would rather be in a co-ed group for projects.

**MP6:** Yes. It can be difficult, though, when there are twelve people in a class and only two are female. I look for diversity in a group. Females, generally, have a

different way of looking at things. Whether that is nature or nurture, I don't know. A different point of view is always good.

**MP7:** Yes, they are cute, and listen to directions much better than I do.

#### Participant Comfort Levels in Technology Education Classes

The next set of questions on the focus group guide was designed to determine comfort levels among male and female students in technology education classes. Most male students felt very comfortable with the female students in their classes while the female participants conveyed several situations in which they felt uncomfortable in their technology education classes. The two main issues cited by the female participants that made them uncomfortable in technology education classes included often being the only female student in the class and professors singling them out as the only females in technology education classes. In order to illustrate the context of this question, male responses from the discussion are presented before the female responses.

The next set of questions posed to the male participants included:

- Are you comfortable with having females in technology education classes?
- Do you think your peers are comfortable with having females in their classes?
- Do the women in your technology education classes make you feel uncomfortable?

These questions were designed to move participant responses from the general issue of female presence in technology education programs to the specific issue of having females in their technology education classes. Although the questions were intended to elicit responses about male comfort levels with females in their technology education classes,

the male technology education participants also offered their opinions about female comfort levels in technology education courses. Most male technology education participants felt fine about having females in their classes although the last participant (MP7) admitted that “from a student perspective, I really could care less, though female classmates are better to look at” and that “from a student teacher perspective, I don’t mind either way...although I can be much more transparent with my male students when I don’t have to worry about saying something to offend a female.” The following excerpts from the focus group transcripts provide more details about how male technology education majors felt about this issue.

**MQ3:** Are you comfortable with having females in technology education classes [in general]? Do you think your peers are comfortable with having females in their classes?

**MP1:** Yes, I am comfortable with girls being in TED class. It's not an issue at all. Do I think everybody else is comfortable as well? Yeah, I think so. I don't think it's too much of an issue. Actually, I don't think it is an issue at all.

**MP2:** I think for me, even when I went to high school, I took the A.G. [academically gifted] classes. [Students that took] vocational classes were kind of thought of as a different kind of person. [They] were kind of like a second class citizen. I think maybe that is, in a lot of ways, what forces women to not take it. I mean even though I know a lot of them do, especially in racing, they are interested in it, but none of them have taken any classes like that. I don't have any problem with it.

**MP3:** Yeah, I think on the tail of what MP2 said, people would consider TED not like Science, Math, Social Studies, and so a lot of people don't even look into it. A lot of guys like working with their hands because that is something they've done from early on. A lot of females may not be introduced to that. I am fine with females in the program. I enjoy it so I am fine with whoever.

**MP2:** It adds a whole new aspect.

**MP4:** That would end a burden. That was one of the things that I disliked about it. So I definitely wouldn't have a problem with females in TED. I am student teaching and see girls in the classroom and what's really cool for me to see is that they are on projects that they are building. Most of the females in my class are getting better grades on the projects than most of the guys in the class, which is pretty cool I think, so I think they are getting involved.

**MP5:** Yeah, I am good with having more girls in the program and everything. I kind of enjoy having them around in class and stuff to give a different perspective on projects and assignments and stuff and, um, I think all of us would like to see some more women in classes.

**MP6:** I have no problem with females in TED. I try and encourage my students to stay in the TED classes in school because in my 6th through 8th grade [classes]. I see a severe drop off [in female participation] from 20% to 0%. I don't think it's a class problem. I think it's [due to] a stereotype that people are trying not to fall into which is causing more stereotypes.

**MP7:** From a student perspective, I really could care less, though female

classmates are better to look at than male classmates. I think us fellows are sometimes too comfortable in TED classes. From the [student] teacher perspective, I don't mind either way what my class makeup is although I can be much more transparent with my male students when I don't have to worry about saying something to offend a female.

Male participants had similar, but more succinct answers to the more specific question about their comfort levels with female technology education students.

**MQ8:** Do the women in your technology education classes make you feel uncomfortable?

**MP1:** No.

**MP2:** No absolutely not.

**MP3:** It's just like any math class I've ever taken or any other class. If there's a girl there, they don't make me feel uncomfortable.

**MP4:** Nope.

**MP5:** No.

**MP6:** No.

**MP7:** Nope.

Finally, the male participants discussed their views related to female student comfort levels in technology education classes. Although one of the male participants indicated that he thought female students felt comfortable in technology education classes, the six other male participants acknowledged that the comfort level of females in technology education classes “depended” a combination of variables. One of the major

variables that caused female students in technology education classes to feel out of place was treatment by male professors and teachers who often “singled out” female students.

**MP1:** Yes, I think all the girls are comfortable. I think it’s just fine. Although I have heard from other girls that, like, from the student teaching experience that. Uh, I have two classes in which [there is] one girl student and about twenty guys, and, um, the girls have not told me this but I have heard from others that when it’s one girl and twenty guys, the girl feels uncomfortable.

**MP2:** When I started my [student] teaching, after we switched nine weeks, I had a class full of 20 guys and one girl and, uh, she seemed uncomfortable. Actually, I approached her and said, "If you feel this uncomfortable, we can change your elective to a different elective." Right or wrong, I think it's good that she knows she has options, but again, I think sometimes you just got to ask them.

**MP3:** I think so, too. I've seen both ways. I've seen one girl in a class and she definitely did not feel awkward. She was one of the more rowdy people in the class, one of my most “problem children.”

**MP4:** I, uh, I think it depends a lot on the teacher. I think it depends if the, um...I think there are situations where they can feel uncomfortable if they are being singled out...If the instructor treats them like they are all [equal] students and does not single them out, then they can be comfortable. I've heard that [it] does make them uncomfortable to be singled out.

**MP3:** Yes, yes, definitely. I know several instances of my couple years here where a female had been singled out in a manner of praise, but, the manner of

praise didn't have the desired effect.

**MP2:** It puts emphasis on them being the single female in your class.

**MP3:** Yes, the token female.

**MP5:** I think it depends on the teacher and the student. Um, I know in one of my classes I teach, there's about one girl and about ten guys, She gives as good as she gets. I mean, they're always back and forth on each other, picking on each other and they get along fine. But, I know in another one of my classes, there are four or five girls and about six or seven guys and they seem not quite at the same level as where the one girl [from the other class] is at. Like, it depends on where they're at in their mindset as well not just how the teacher treats them. As far as the student, I think it is a combination.

**MP6:** I think it depends on the class, the single or double student, and the teacher. Um, it was like they've said, I've seen situations where the single female is fine and some not at all; but, I think if the class has the "locker room syndrome" even though a female is present, it makes them feel extremely uncomfortable so that's where the teacher has to try and make it not as bad.

**MP2:** A level of professionalism...

**MP6:** Yeah, so it depends on a lot of different variables.

**MP7:** No, especially if they are in the minority or possibly the only female in a group of males.

Having been in the program for some time, most of the female technology education majors in the study reported that they currently felt comfortable in their

technology education classes, but did not always feel that way. Three of 7 female technology education participants described examples of incidents that had happened in technology education classes that made them feel uncomfortable as female students. Most of these incidents had to do with how professors handled situations, singling females out or making a big deal out of a small incident, rather than how the male students acted in the incidents. However, male comments in class often served as the impetus for several of the professor's reactions.

FP1, who was student teaching at the middle school level during the time of the study, reported that female students in her middle school classes appeared to be uncomfortable in technology education classes. FP1 explained that her middle school female technology education students seemed to find comfort in having a female technology education teacher and “gravitated” toward her during the time that she taught the class.

Other things that made female technology education students uncomfortable included intimidation by male peers, the male student “buddy system” that isolated female technology education students, female technology education students feeling left out when working on group projects, and the feeling that female technology education students needed to “be one of the guys” and be forceful with their opinions in order to fit in and be heard in their classes. The following excerpts from the focus group transcripts offer more details about these issues.

**FP5:** I would say I am pretty comfortable just because I started off with pretty good confidence. Even when I was in high school, I always ended up being the

person that the guys came to for help, so, I ended up tutoring other people as we go through the class so that we kind of, not necessarily become friends, but I'm the person they come to when they need help. I am stuck with this thing for helping, but I don't just find myself in the corner sitting behind my computer or anything. I am pretty involved with the class. I get to know people a little bit. Being the only girl in the class, I can't say because there is always at least one other girl in my class. In the beginning, I didn't talk much with the girls. I made better friends with the guys than I did with the girls. I know that might sound a little odd.

**FP6:** When I was in your [referring to researcher] class last semester and that girl switched sections over to my section, I was so surprised why she switched over. I was the only girl in that class before she came and she was the only girl in the other [section]. I told her she better get used to being the only girl in her classes. She palled around with me and she told me that some of the guys did make her feel like she wasn't smart enough.

**FP5:** I mean they kind of intimidate you if you let them. It takes a while to adjust to but once you do it, they are perfectly fine.

**FP6:** I haven't had any problems, but, you know, I don't know if it's because I am older, or if I've worked in male-dominated fields, or anything. I'm used to that. I am used to having a lot of men around. I do see the buddy system and I do see the guys going to each other and talking and even in our group projects, you have to interject yourself. You have to be a little more forceful to get your opinion

across.

**FP5:** You've got to be one of them. You have to use reverse psychology that says that you have to act like a guy to fit in to get your voice heard.

**FP6:** I just know that it's going to be a male-dominated field and if I want my voice to be heard, I have to make it heard. I'm not going to be part of it, because I'm not a guy. If you are shy or passive, like [name omitted]. She got frustrated that the guys would treat her like she didn't know anything or that some of them would come up to her and try to start helping her when she hadn't even begun to use a piece of machinery or something like that. She would get frustrated and I'm like, "Well, you don't [know how to use the machines]."

**FP5:** I used to be very shy. My personality was very... I didn't talk much to people. I didn't really speak out if I was asked for an opinion in a group setting or anything. Sometimes I am still like that; but, I had to learn being one of the only girls in the class that that was the only way I could ever get help or help other people was just to get involved and not isolate myself. I hate being by myself. I learn to adjust to it and it doesn't bother me too much anymore.

**FP1:** There was one time when I wasn't comfortable.

**FP2:** Like the first day you walked into your first class?

**FP1:** No, it was that time in...

**FP2:** [Professor's name omitted] class? Yeah, [the professor] makes a big deal out of it. If he wouldn't make a big deal out of it, it wouldn't be a big deal.

**FP1:** A male student implied that a woman's place was in the kitchen. Whether

he meant it or not, he corrected himself right then and there. He looked at me and [another female student in the class] and said, "I'm sorry. I didn't mean it. I am building this thing for my mom and that's what I meant." And we were like, "All right." But [the professor] made a huge deal out of it. For like fifteen minutes, he was like how you shouldn't down talk to women and it put all of us on the spot.

**FP2:** I think I got up and left actually. I felt really uncomfortable.

**FP1:** I did, too, actually.

**Researcher:** He made it seem like such a big deal that it made it worse?

**FP1:** Yep.

**FP3:** Sometimes there's, like, it's really not discrimination like I don't belong here, but when I walk into class it's like, "Okay, I'm the only girl again."

**FP2:** But [the program is] pretty small now, too, so you get to know the guys in your classes pretty well. Like the first semester that you are in it you are like, "Oh no, what's up? I'm the only girl."

**FP1:** I remember my first class. I had her [points to researcher who is female], so I was all right.

**FP3:** I feel like I walk into class and it's like, "Okay..." especially because I'm in a couple of different levels of classes, so, it's not always the same people and the first couple of days it's like, "I can't do this. I really don't belong here." [Name of professor omitted] has jumped on people. I was in a class or somewhere. He was in the lab that I was in or something. One of those boys said something stupid and I think they were kidding because I don't remember being that upset about it at

all, or not even laughing it of knowing that he really meant it. [The professor] is like, “You do not say that about women. Women do well in TED. Blah, blah, blah.” He was jumping all over this guy, but where it’s appreciated like, “Thank you so much coming to my aid if I’m carrying a heavy thing I also appreciate that, so please, carry this big heavy thing.” It was just excessive. If I had a problem with that, if I was really struggling with being the only woman in here, then this isn’t the program for me. If I was looking for reasons to be offended...

**FP1:** I agree with that big time.

#### Treatment of Females in Technology Education Classes

**Q5:** Do you think females are treated differently in technology education classes? By the teachers? By the male [students]?

This question is very similar to the preceding questions about participant comfort levels with the other gender in technology education classes. Female technology education participants felt that their treatment in classes depended on the teacher, but they also felt intimidated and isolated by many of their male counterparts. One male teaching assistant tended to call all the students in his class “ladies” as well as tell them that “women are failures” which, as the female technology education participant put it, “perpetuates” the idea that women should not be in technology education programs. Another professor would often announce that male students should always pick females to be in their groups because “girls are smarter.” A few of the female technology education participants admitted that they do not talk to male classmates unless the males approach them first. However, most female technology education participants felt that

being friends with their male classmates made it easier to be in the program. Another issue reported by the female technology education participants was male students using curse words in class, particularly the “F-bomb.” The following expert illustrates these points further.

**FP2:** I think it depends on whose classroom you are in. Sometimes I appreciate [the special treatment], if it’s something I can’t figure out.

**FP5:** I remember one teacher specifically saying out loud that the girls were smarter. He said is straight out loud, “Remember, when you are picking your groups, girls are smarter.” I have called one male teacher out on calling every person in the class, male or female, “ladies.” I am like, “What does that mean? What does that mean?”

**FP6:** [Professor name omitted] calls us “ladies and germs” all the time. We [females] always get the higher end.

**FP5:** He has a thing about women in TED. He always comes up to us and asks us if we were offended by something and he will apologize even if we weren’t offended.

**FP4:** I really don’t talk to the guys. I only talk to the ones that make the first move or I need help or something. I say, “Hey, can you help me? Hey, how are you doing?”

**FP1:** Yeah, I never talk to the guys in my classes until they talk to me.

**FP3:** Yeah, I mean, like it helped. [Male technology education student, name omitted] is my friend now. We spend a lot of time together. It helped that I knew

somebody that knew a lot of people down here. Some people have filtered into your class, like [name omitted] and [name omitted]. I know them very well. It's not usually a problem, but I do feel like I would rather be friendly than, "I don't want to talk to the people." It makes life easier if there's more people to study with or... Now it doesn't really matter. But as far as teachers, the only example I can think of is [name of class omitted]. I was the only girl. My class had football players.

**FP1:** That's one thing I don't like is all the football players.

**FP3:** So, I walked in and [the male professor] must have been a few minutes late and I walk in and [male technology education student, name omitted] has the baby from the emerging technologies lab. I don't know why that thing is down there. I think that might be on my list of dislikes is having that almost-conceived woman model. So, I walk in and everyone stops, "Oh, there's a girl in this class." I'm like, "Okay, that's cool." Anyway, [male technology education student, name omitted] [has] this thing and they've been throwing the baby around. So I come in and I start looking around and everyone starts looking at me and somebody yells, "You want it?" and I'm like, "No" and they chuck it across the room. Then, somebody in that class... Some people had had [this male professor] [before] and some people hadn't. So, one of them starts cussing like a sailor about something. [The male professor] gave out the syllabus and I guess that's why they were cussing. There was a lot of work on it or something. Anyway, it's the "F-bomb" all over the place and [the professor] is like, "You do not talk like that in front of

women.” I looked up at the guy like, “What are you doing?” I looked up like, “You don’t talk like that in front of me period.” If they talk like that when I am not in the room, that’s okay, too. I don’t particularly like the F-bomb and I prefer it’s not used and if he can talk like that in front of the rest of the guys, and whatever.

**FP2:** I was raised in a really southern family and my dad wouldn’t use language like that around me; but, we have in our house screened in doors and my brothers would be out on the porch talking to my dad... and if he was raised like that, I can understand that. I mean, that’s how I was raised.

**FP3:** I wasn’t offended and throwing the baby, I’d appreciate being included in the class baby throw, although I appreciate the symbolic gesture or whatever. They hold the doors open and I really appreciate that. I have seen them do it for [female technology education student, name omitted].

**FP1:** Yeah, they always do it for me, too.

**FP2:** But when [male teaching assistant] calls everyone in the class “ladies,” it got to me the first couple times. I was offended, but I just got over it. He’s going to do it and he’s not going to stop.

**FP3:** He also tells me that women are failures. He perpetuates, you know...I mean it’s kind of funny because people in that class, people that it referred to as “ladies” are people that aren’t some sort of man so “ladies” is a better name for them.

Most male technology education participants were aware that female technology education students were treated differently in technology education classes. Because most of them were student teaching at the time of the study, male technology education participants were able to provide both the college student as well as the student teaching viewpoints about treatment of female technology education students in technology education classes.

Two of the 7 male technology education participants conveyed that they felt female technology education students were not treated differently than male technology education students. However, the five other male technology education participants maintained that, depending on the “generation that the professor or instructor came from” female technology education students were sometimes treated differently by teachers. As teachers, they admitted that they sometimes treated female technology education students differently than male technology education students, but that they were not always aware that they were doing so or that they “couldn’t help it.”

About half of the male technology education participants suggested that treatment of female technology education students was influenced by societal norms and expectations. One male participant stated that “society has changed to where [it] is not even an issue anymore.” One male participant contended that “we are all socialized to treat females differently than males. Females treat males differently than other females. That is the natural order of things.” The question of female technology education student treatment is presented in further detail in the following excerpt from the male technology education participant transcripts.

**MP1:** I don't think [female students are treated differently], not in my experience.

**MP2:** Unfortunately, I'd have to say yes, and it's not a bad thing. It's almost like you can't help it. It's like having a diamond in the rough or something new. It is a rarity anymore. So, even though you try to be fair, sometimes you kind of catch yourself allowing a little bit more here and there. I do it in my student teaching now and I try to be fair across the board; but, you just have to try to limit your way like I don't look at papers now when I grade them. I don't look at the name. I just grade it as it is; but, yeah, it does happen.

**MP3:** I used to see females being treated differently in the lab setting and what not; but now that I have started with student teaching, I see that now a lot of girls understand a lot better the concepts that we are going over, the more abstract concepts, the 3-D perspectives and what-not that the guys don't understand. I end up having to spend a lot more time with some of the guys explaining to them what the concepts are.

**MP4:** Yeah, the uh, I think teachers...I think society has changed to where that is not even an issue anymore. I think it's normal [that] women are working with guys at various work places in society. That is an issue that is slowly going away, but yet, it still exists, sure. There are some teachers out there, but I think it's isolated, I don't think it's a wide spread thing. I think it's getting better to where women are being treated on the same level as the men.

**MP5:** I would have to say that it depends on the class and the generation that the professor or instructor or teacher came from because it is improving, the treatment

of girls in the program, as we progress; but, then, depending on where that particular teacher was at in their program it would affect how much extra help or leniency or whatever [female students] get in the class. I would have to say, yes, there are still some differences, but I have to agree with [name omitted] that it is improving, at least upon my inspection.

**MP6:** Yes and no. I'd say there is a difference, but I don't think people do it consciously. Um, when you are in a class full of guys, the class behaves differently than when you throw a female or two or ten in the mix, so the atmosphere changes even if you never notice the difference. It still happens. I don't think it's a good or bad thing. I think it is just a fact that's not really easily controlled. I know like with us the more we get to know the females in the program, the more we act ourselves. I guess that's the best way to put it. So, I would say yes there are some differences in how the females are treated in the program, but I don't think it's a conscious thing, I don't think we are treating them differently than we would treat anyone else.

**MP7:** Yes, we are all socialized to treat females differently than males. Females treat males differently than other females. That is the natural order of things.

#### Treatment of Female Students in and out of Technology Education Areas

**Q6:** Do you think females that take technology education classes and females who are not in Technology Education are treated differently by other students in the school?

Most female participants in the study, both technology education majors and non-majors, indicated that there was a stereotype or stigma attached to being a female

technology education student. The existence of stereotypes and stigma were cited as barriers that discouraged female students from enrolling in technology education courses at both the high school and college levels. Furthermore, according to the female technology education participants, stereotypes and stigma exist at all levels of education, has existed for many years, and continues to exist today. Female participants also noted that, depending on how they were dressed, male students would treat them differently. This notion was also addressed by the female technology education participants who were interviewed for the 2005 pilot study introduced in Chapter 2.

The female technology education participant who was student teaching in middle school during the time of this study pointed out that even at that level, female students who took technology education classes were treated differently than female students who avoided technology education classes.

**FP1:** I'm [student teaching] in middle school and [they are] in middle school, I would say, watching them.

**Researcher:** Is there a stereotype or stigma?

**FP1:** I think there [was] even when I was in school. I had a lot of problems in high school. I was the only woman in auto body for ten years and it was my sister before that. But I think there is [a stigma] and then if you're going to teach, they [female students] are going to gravitate to you. They've really grabbed on to me, the girls have.

**FP4:** I think the stereotype [was that it was] not cool or something because I did the same thing. I didn't take those classes, like woodshop and all that stuff until I

got to college. I really didn't take them because none of my friends were taking them and the girls that were taking them were not interesting. I wasn't trying to down anybody, but it was [mostly] guys. And in high school they did encourage guys to [take Technology Education classes]. I like to draw and stuff and they were like, "No, you can't take it."

**FP1:** I took auto mechanics and drafting in high school.

**FP3:** People ask me to fix things. They ask me to fix vacuum cleaners. I don't know the first thing about vacuum cleaners.

**FP6:** Not bad enough to make you want to get up and take off. I mean there are different people. Even guys treat guys [differently] for different reasons.

**Researcher:** Do you feel like you have to be "one of the guys" sometimes?

**FP5:** Sometimes except when you actually dress like a girl. They actually start talking to you and I hate that. It hasn't happened in the classes that you've been in. Or if I wear a low cut shirt or short skirt like I am wearing now, they notice it. You've never noticed that?

**FP6:** I've never noticed it!

**FP5:** They treat us like "ladies" I guess.

Two of five male technology education participants felt that female students in technology education classes were treated differently than females who were not enrolled in technology education classes.

**MP1:** Everybody is treated differently. I mean people get treated differently depending on what school they go to. If you go to [our university], you are a

much different person in general than if you go to like a real liberal arts type of school and Tech. Ed. classes are typically hands-on. You are definitely a different type of person; you know what saw dust smells like. You know what grease is as opposed to a person who can read a seven hundred page book in a few nights. I can't myself read a book in two nights, so you are treated differently. I carry a pocket knife in my pocket. Other people might carry a bookmark.

**MP2:** I do hate the fact, but it does happen, like I do know some people, I mean, how many times have you heard it? Somebody's in Tech. Ed. and all of a sudden she's a dyke? I mean how many times do you hear that? It's a totally wrong stereotype, but it happens. That just goes along with and it's ridiculous. You just have to overcome it, but I do think that it sounds terrible.

The other male participants gave their responses to this question from the viewpoint of a student teacher. These five participants pointed out that when technology education classes are not referred to as "shop" classes, more female students, at least in middle and high school, were more attracted to the classes.

**MP3:** No, not in my school, no. In my school, the core electives have just as many females as males from all different ranges of social order. You can just tell, I guess, by what social class they hang out with in the classroom. They take that course, its "Exploring Technology." It's not referred to on school as "shop class," so it's sort of referred to almost the same as any other course you might take like French or Spanish. It's not got a bad connotation or evil connotation to it.

**MP2:** Are you referring more to our student teaching or to our college classes?

**Interviewer:** I think it means the school that you teach at or work at.

**MP2:** Oh, okay.

**MP3:** It is kind of funny that I got the question right.

**MP4:** There are a lot more number of males in the class than there are females; but, at the same time, the females that are in the class they don't seem. I mean, I didn't observe any type of problems they would have than other students and they are, I mean, there are all different types. The social classes, or social groups, cliques, whatever you want to call it. There's various different girls from various different cliques and whatnot. You get a variety of girls in the class. It's not like you get a certain type of girl whether it be "Fundamentals of Technology" or "Manufacturing Systems." She's not the only type of girl. There's many different girls from many different high school groups that take the classes. So, I don't think there is too much of a problem in my school.

**MP5:** I think in my school I don't really notice that much of a difference with the way they are treated; but then again, our courses aren't really considered shop-based courses. We have "Principles of Technology." We have a lot of computer stuff and it's like physics, so they really take to physics and computers. They haven't gotten that much different treatment, but then again, our courses don't carry that connotation of the shop class so maybe it's just the perception.

**MP6:** In my classes my girls aren't treated any differently if they do or don't take the class. In my school, they can take the class up to six times in three years there

which is retarded, but that's a different story. We won't go into that here. Um, but some people they take it and they tell their friends. Well, mine's considered the "fun class" where you learn, but you get to do hands-on and it's not "shop." It's a lot of different, sort of hands-on activities, while they are learning and it's a little bit more of a relaxed atmosphere which I think they like. So, I don't think anyone gets treated differently whether or not they take the class.

**MP2:** Now that I know the question better, I'd like to go back and reiterate. With me, I am at a magnet middle school so they pipe in diversity as part of the magnet program. So [the] classes, they are not really in depth. I mean, we do a lot of hands-on projects, but they are not so much like here where they would need to be a shop person or something like that. So, no, I don't have an issue.

**MP7:** No.

#### Adequate Skills Required for Technology Education Classes

**FQ7:** Do you feel you have adequate skills to be in technology education classes?

**MQ9:** Do you think females have adequate skills to be in technology education classes?

These questions were created to elicit responses related to female technology education students and get opinions from both male and female participants as to whether they thought female technology education students had the skills necessary to be successful in the technology education program. Interestingly, all the male participants agreed that females did possess these skills. As noted by one male participant, "I think some of the stuff women build is just beautiful especially, and, uh, one good friend of mine is a female welder and she loves ink and all that other stuff but she can spin metal."

Female technology education participants felt that if they did not have the skills when they came to the technology education department, they certainly have them now. Two of the female participants felt they entered the program with the necessary skills, while two of the participants stated that working with the tools, materials, and processes involved in technology education was “foreign” to them when they started technology education classes. Two of the female participants did not answer this question.

**FP1:** My dad was an industrial arts teacher. I worked for a construction company.

**FP2:** My dad owns a construction company and before that he owned a “Crazy Joe’s.” I have an older brother and a younger brother so it wasn’t foreign to me.

**FP4:** It was foreign to me. When I took your class [Materials Processing], I felt like I was on equal ground as everybody. I felt pretty equal; but when I took other classes, I really felt lost, even when we [were] working as a group. I tried to put ideas out. That’s the only thing I felt [I could contribute].

**FP3:** I guess I feel like I have the skills now. I think I would have been really stuck if I had walked in on another...like the way that our project team has been in robotics. We’re using wood. I haven’t spent much time in the robotics lab because I am in the [wood] shop all the time using the stuff. So, if that was my introduction to technology education classes instead of your shop class, I would have been stuck. But, your class did me some good. I don’t know what that big shiny thing that we use is, but I can learn. So, I think the only experience I’ve ever had [before entering the technology education program at the university] was in a

class at the Craft Center with a bunch of old men. I feel like I have adequate skills.

**Researcher:** What would you do if you didn't know how to do something in a technology education class and the teacher wasn't available?

**FP2:** I know everyone in all my classes now, so I would just [ask] whoever is closest to me. I'd say, "I need help."

**FP1:** Me, too.

**FP3:** [I would] make sure they are knowledgeable.

**FP4:** I would pick a person that I felt comfortable with like maybe a female because I am more comfortable with the girls in my class. I would go to somebody and ask them if they couldn't do anything [to help me], then I would ask that guy over there.

**FP2:** When I had [Materials Processing] with [male teacher, name omitted], I would ask you [the researcher] all that stuff. If I had a question, I would ask you because I see you as someone who understands everything really well. I feel like you do know a lot of stuff so I feel comfortable with you.

As a follow-up to this question, male technology education participants were asked if they felt that technology education was a program that should include both males and females. All seven participants agreed that technology education should include females, some stating that women were equally, if not more skilled, than their male counterparts.

**MP1:** Yes, because if I said no it'd be a terrible answer. Absolutely, anyone can teach in technology education or a technology type field. It's not like...I'm just going to say yes.

**MP2:** Well, I'm not really going to get into the education part, but just for an example, um, I'm really meticulous and mechanically-minded, so, whenever I do a resume lately, I have everything listed out. Then, I turn it over to my aunt who is very artistic and, you know, she completely changes it. I get compliments in all the interviews, whereas, mine they would have probably looked at it and thought, "too plain Jane." So, there's different mindsets and it is great to have that diversity in the field, so that you can see different aspects of what's happening. That's what I would say.

**MP3:** My cooperating teacher is a female. I really like what she does. I like how she manages the class. I don't think there is anything that I can do that she can't do better.

**MP4:** I think it's for males and females both alike and I think the machines we have now a-days, can be operated the same no matter whatever you have or whatever you are. Going back again to my classroom, during student teaching, I have females that are outdoing the boys on some projects and, in some cases, all of the boys. It's just that there are more boys than girls. The boys outnumber the girls. If there were a 50/50 ratio, I guarantee it would be [all of the projects] which just proves it to me that it is something that can be done.

**MP5:** Yes, definitely. Um, the reason is because there is nothing that cannot be

done just as good if not better by the females in the program.

**MP6:** Yes, I don't think there is a why or why not. I just think its yes.

**MP7:** Fundamentally it is; [the state department of public instruction] and other curriculum writing organizations have done a great job creating a course which is equally appealing to both sexes. However, after talking to several females about the subject, I have found that many females don't see the need to know why their car drives or how their cell phone works. Just so that the technologies continue to function properly and if they stop [working], they will just get a male to fix the problem.

Male students were also asked if they thought male and female students treated each other respectfully in technology education classrooms compared to other classes. All participants said that they thought all technology education students respected each other. However, some of the male participants pointed out that until they had experienced being the minority in certain classes or other situations, they were not able to understand how it felt to be the minority. Being in those situations helped the male technology education participants understand how the female technology education students might feel as minorities in the technology education program.

**MP1:** Classes [here]? I think [they do] in TED classes here, especially these past years for us seniors. I think both genders respect each other very much and it might have to do more with TED at [our university] being such a small major, or the fact that we're friends with each other and everyone knows each other very well. So, I am sure, I'm positive that has something to do with it, so, um, and as

for comparable to other classes, non-TED classes, um, well I've never been disrespected by a female. I guess I've never been disrespected by a female in a non-TED class [either], so I guess it's the same.

**MP2:** I think that's a lesson learned with humility in a lot of ways. A few summer sessions ago I had taken a class, a sociology class, and there were only three guys in a class full of twenty something women and the teacher had written several books about feminism. So, I've seen how that kind of reacts, you know, as far as being understanding [about] where they come from. So, I think once you see that, it opens your eye to it. I think that both males and females treat each other equally with respect to class, but not so much respect to projects. Typically, most males will plow right into a project and leave the female out or let her read the instructions. That's the biggest difference that I have seen.

**MP3:** I think in the Technology Education major, females are more equal to males, um, than they are in other classes. Um, in other classes there is the distinction between guys and girls. I think in TED classes, we've been stressed so much to have everything equal that it is a lot more equal. It's not, we don't see them as a female, we see them as a college student rather.

**MP4:** Yeah, the students, male or female, especially in our TED classes, I think females get respected by males and, if the student is deserving of respect, they get respect. We're in such a small community here in the TED classes, that, you know, I think it actually. I think you had said it that women kind of get not necessarily more respect but there is more of a family environment so, um, yes, I

believe they treat each other respectfully. This has a lot to do with individual maturity. I believe people disrespect others all of the time in many situations. I do not think TED classes contribute to this behavior, and it would not be different in any other classes.

**MP3:** They're equal.

**MP4:** Yeah, they're like, they're treated as a fellow student; and, in a lot of my other classes, they are so big that there isn't really a lot socializing going on with other students. You know, you are in a big auditorium setting or you've never seen the other people before. There is really no need to socialize with them because you never see them anyway. Maybe the atmosphere that the teacher provides doesn't offer a lot of time to talk and what not. I think in our TED classes, more than any, it's easier for females to get respect.

**MP5:** Yeah, I definitely think we treat our women very well here in the TED department. I mean and really, they do us, too. It's just we all help each other out. We all work together and like they were saying, this is a small group; we know each other really well. But, um, we all really do look out for each other. It doesn't matter whether it's females or males or anything. There are really no differences.

**MP6:** I just want to point out that it's funny how you say, "We treat our women."

**MP5:** Well, I was just referring to the women in the department.

**MP6:** I know. We still take it as a protective role even.

**MP5:** Well, I just meant as a department, like the TED department, the women in there, not necessarily our women.

**MP6:** Right. It's just the way it sounded.

**MP5:** I guess I could have chosen a better word.

**MP6:** I'd say we treat each other as equals. I'd say there is not a difference at all.

**MP7:** Pretty much the same.

Another question asked of the male technology education participants referred to whether they thought the female technology education students were treated equally and fairly by the technology education teachers. Most of the male technology education participants felt that females were treated equally and fairly by most technology education professors, but, as can be seen in the transcript, seemed to be aware that female students did not like being "singled out" in any way by their professors. Four of seven male technology education participants answered this question.

**MP1:** Yes. I think students are treated equally.

**MP2:** Yes and no. We had issues with one teacher who liked to point out that this girl was the only female in the classroom; but, not in a cynical way. He just liked to give her more praise for being in the room, which singled her out and made her feel very uncomfortable

**MP5:** Yeah, pretty much. I think that we are all pretty equal in Tech. Ed. and from my observations in area high schools; I would say that the girls tend to get treated a little better than the guys if anything.

**MP6:** I do. I have heard of some preferential treatment, but never witnessed it. I believe that there is a push towards treating everyone fairly that may be singling people out.

The final two questions on the focus group question guide were designed to determine specific barriers that discouraged females from pursuing coursework in technology education programs and how those barriers could be reduced. Female participants pointed out that, being historically male-dominated, there were many barriers that kept females from technology education programs. The following excerpts address the question about barriers for females interested in technology education programs.

**FP2:** I think there is just a stigma, historically, that it's all men, no women. I feel like now it's a novelty as soon as they see a female teaching. It's a whole entire group of men. They don't want women coming in and changing everything, sexual harassment. There have been so many men forever that they don't feel like they need to worry about that.

**FP2:** There's a difference between a class of all men and a class with men and women.

**FP4:** I think they think they are all comfortable.

**FP1:** I don't think it's uncomfortable.

**FP2:** But they have to watch their language and they can't just fart and stuff. They can't just relax. I didn't know it would be all men.

**FP1:** I don't know if it's that because I still experience all that.

**Researcher:** Yeah, but you have middle schoolers.

**FP1:** But even in college, I still experience all that.

**FP2:** I didn't know it was going to be all men.

**FP4:** I thought going into Graphic Communications, it was going to be a whole bunch of girls. That's what I thought, just girls.

**Researcher:** Maybe that's because it is a part of the Technology Education program.

**FP4:** If I knew, I wouldn't be in this department.

**FP3:** Social stereotypes [say] girls can sit more easily. They can sit at a desk for long periods of time. Like all of us as older women can sit in a chair, and nobody is fidgeting around. Nobody's had this compulsive need to stand up and run around, but males, everyone's taught they need hands-on things and so then they are pushed into more hands-on [programs] whereas I should be able to sit and write poetry and so it's I have to be "utsey-cutesy" all the time. So, even teaching TED, it's not an "utsey" field. When you take these general education classes that have Science majors and History majors, it's like we talk about feelings all the time. It's revolutionary because we don't do it. I mean, TED isn't an "utsey" field. I work with my tools and my robots.

**FP1:** I like that.

**FP3:** I do, too. So, especially if we are teachers, we teach elementary school and we teach English because you can talk about feelings and experiences and it's more challenging to integrate those into the content area of Technology Education and get that done in [technology education].

Male participants focused a great deal on how societal expectations have discouraged females from pursuing programs related to technology, and that the two genders are taught to think differently as they are raised.

**MP1:** Yeah, um, I've taken some psychology classes here, you know the kind where there is like one professor and about 500 students so you basically learn something about every other class? What I did learn is that, from a young age, typically girls are better at handwriting and arts and crafts, maybe not arts and crafts, maybe more artsy, vocal-oriented, English and the other type stuff; whereas guys are more hands-on and more hammer and nail type stuff. And that starts at a really young age is what I learned in one of my psychology classes, like one out of the ones I attended. But, it's one of those things that at an early age you just kind of learn that guys should be hands-on and more math and science-oriented and girls are typically for the most part more vocal-oriented. I guess you could say and Tech. Ed. classes are obviously hands-on, build stuff, read instructions, take it apart, put it back together. So, I believe that it started at a young age, preschool, real young, and, um, probably some girls just have it in mind all the way up through sixth or seventh grade or high school years when they start deciding on classes.

**MP2:** I believe I was in the same class. I do think I remember I think it was called "Personality," but that is basically what happens. Girls wear pink. Boys wear blue. That kind of stuff. That's basically what it boils down to, but there has been a trend lately where more women are entering the science fields and stuff, science

and math, which there was a huge divide. So, that's a good sign.

**MP3:** I am in agreement with what was said. I couldn't have said it any better.

**MP4:** I am in agreement, too. The only thing is if the girl is interested in technology [education], I don't think that there is. There is a little bit, but, I don't think there is too much that would stand in her way of pursuing that. Here we have women at the top of our field. I am sure they've hit some bumps along the way because they are female, okay, but it can be done. They have proven that, yet there are obstacles, there are obstacles of every type. There might be more for women, but, I think if it is something that they want to do, I think they can do it.

**MP5:** Um, I don't know if there is a specific barrier other than what you were talking about with the gender roles; but, typically, you think of what we call "Technology Education" as what we would call a "male profession;" but, then again, teaching throughout history would usually be a "female profession" so I don't know exactly where we fall in that mix there of putting the hands-on education; but, I don't know. I think gender roles are becoming more blended in today's society. I think we are seeing that barrier dissipate substantially, so, I don't know really if there is a specific barrier other than the experience of society to give help.

**MP6:** I agree with them, but I'd say if you want a specific barrier, I'd say it's that the technology field is male-dominated and just like everything else, once something is dominated, it's hard for something else to break into it whether its

females breaking into a male role or a male breaking into a female role. It's just not as accepted, therefore, people shy away from it; but I think the biggest barrier is that it is dominated by males so people look for other options.

**MP7:** Other than the issue of being the only girl in a room full of guys there are no barriers. However, that in itself is quite a barrier.

The final question on the focus group guide was designed to elicit suggestions for ways to attract more females to the technology education field. The male technology education participants were more forthcoming than were the female technology education participants about ways to make the program more attractive to females. While females did suggest a few ideas related to marketing and creating support organizations, male technology education participants were much more specific about suggestions for making the field more attractive to females. Although one male technology education participant suggested that I “ask the women,” most of them offered good suggestions such as creating new curriculum that would attract females including:

- have projects that appeal to “artists” as well as to “constructionists”
- ask departments that were more female-dominated for suggestions about the situation
- reach out to the arts community and incorporate those suggestions into the technology education curriculum
- create outreach programs that had both male and female representatives from the technology education program

- create programs that expose females to technology education concepts and coursework at a younger age.

The following excerpts from the focus group transcripts illustrates, in detail, the suggestions expressed by both male and female technology education participants.

**FP2:** I don't think it's necessarily that a change needs to happen.

**FP1:** I think so, too.

**FP4:** I think we need to get the word out. I don't think a lot of people here know about Technology Education. They know about education but not Technology Education.

**Researcher:** How would you get the word out?

**FP4:** I guess T-shirts. I went to an event at Harris Field, behind the management building. They were giving out a bunch of stuff about the management department, giving tours and they had games so you could win T-shirts and stuff.

**FP2:** This isn't like a teaching school either. Like in North Carolina, you know that if you are going to be a teacher, you go to Appalachian. You can go other places, too, but if you want to be a teacher, go to Appalachian. So, I feel like a lot of people don't know about [our college] and our program.

**FP4:** Organizations, like a little group.

**FP3:** It would be good if there could be a group like this that could be involved because we are involved in TED and it could be a group that would support women. Not that I feel like I need extra support, but that would be available to feel like you are doing something worthwhile and important. Maybe if TED put

advertisements around the school. We've got a shadow box for TED. There needs, it sounds silly, but there needs to be more pictures of women involved because it's hard to change when there aren't any pictures of women. Just to kind of, if it was advertised as more women focused and maybe even potential TED teachers, they should [leave that] to you or to someone else because if [name omitted] was the first contact I had with TED...

**FP2:** I would have gone to Psychology or transferred.

**FP3:** I think he means well, but he would've probably said something about how women do so well. I suddenly feel like I'm a test rabbit or something.

**FP4:** I would have gone to Communications.

**FP6:** The only thing I can think of is that women are intimidated by it being a male-dominated thing. Girls always go into Psychology areas or something more intellectual. Guys always get into more computer, hands-on stuff, I guess. I don't know. I started off in engineering so that's the only thing that scared me going into the area, but when, and I don't know if it's a buddy system thing, but I feel more comfortable if I found another girl that was in there with me because at least you are like, "Well, at least I am not the only freak in here." It's just the way my brain works that it's maybe different from other girls. It's a comfort thing, that maybe if you show that more girls are there, it might make them more comfortable with coming to the major.

**Researcher:** How do you think it became male-dominated to begin with?

**FP5:** I would say it's the ending line of work that you get from Technology Education. The only reason why I didn't go into TED was because when I was first introduced to it, it was shop. You had to be a shop teacher and I was like, "I don't want to be a shop teacher and work with wood or engines. I want to do something more artistic" and that may be the way it is advertised per se. I don't know if all women feel that way but I assume they do because we only have, what, eleven women in the program?

**FP6:** When I was in middle school, I wanted to take wood shop but it just wasn't done. Girls didn't just sign up for that class so I never signed up for it. I mean, I don't know if that would have changed anything but...

**FP5:** Women tend to stay away from math and even though this degree program is not heavy in math at all.

**FP6:** We don't have any math at all really. We have like two small math requirements.

**FP5:** I don't feel like I am comfortable with math or any related field and maybe women perceive that this is a higher math related field. I wanted to take that electronics class over the summer and the first thing I did was email [name omitted] and ask him how much math concentration was in it and he said it was really not, that it was a way to explain math. Well, I'm taking it because I am interested in electronics but if he had told me that it had a high math concentration, I wouldn't have taken it.

**FP6:** Math doesn't scare me I guess.

**FP5:** It scares me initially. I will do it if I have to.

**FP6:** If it has to do with calculus or physics, see that's what actually took me out of engineering is because I actually failed Physics and I got a D the first time I took calculus so...

**FP5:** The main thing is that in elementary school I was very good in math, but the fear came from somewhere. I don't know if it is because I haven't touched it in a long time or what. I think this is a very interesting program. I think that the average program is what is the problem. How do they get all the women into summer school? Do they have a lot of women in summer school? How many are there that could be over here?

**FP6:** I found out about this program because I talked to [name omitted] about it. I talked to my GC 120 teacher to begin with and he told me about the GC major and that sparked my interest in that and then I started talking to the Industrial Engineer department head and the Civil Engineer department head and I would love to do some hands-on activities and he said, "We don't do any," so I thought, "Well maybe this isn't where I am supposed to be." Then, I really wanted to be in the design school but I didn't have a portfolio and I didn't have anything to show them; but, I could do this stuff and this program was a loophole I found where I could do this stuff without being in the design school.

**FP5:** I took drafting in high school and I was the only girl in there.

**FP6:** I was, too. No one told me about this stuff. I asked my teachers in high

school if they had majors for this stuff and no one knew it even existed.

**FP5:** Female shop teachers as role models!

Male technology education majors, who met separately with a male facilitator, had several original ideas for attracting female students to technology education. Suggestions ranged from improved presentation of laboratory work areas to seeking input about curriculum from female-dominated programs. The following excerpts from the focus group transcripts illustrate the input from the male participants.

**MP1:** The field doesn't need to be changed. I enjoy the field. What needs to be changed is the psychological concept [that] girls are meant to work at home and wear pink, while guys go out and do "manly work."

**MP2:** Aesthetics play a major role in any aspect of life. If you present a house that is messy, people think you are a messy person. If you present a male dungeon of construction testosterone, then people will see that, too, and make choices accordingly. Make the program look organized and neat with projects that appeal to artists as much as constructionists and advertise what technology education is all about because most people do not know, even a principal that I talked to at the job fair.

**MP4:** This is a hard one. For some reason, TED attracts more males than females. Perhaps it is due to the subject matter. I'm sure there are other majors or fields of study that are more attractive, too, and dominated by women due to subject matter. I do believe that the more we get away from [vocational education] and the Industrial Arts roots, and become more of courses that allows students to see

practicality in what they are learning in their other classes such as math, science, English, social studies, then that will allow for more gender diversity. Perhaps we could work more with other departments that are dominated by women to get a fresh perspective on new projects. Maybe reach out to the arts community and incorporate some of their ideas in our curriculum's projects. What is good about TED is that is pretty flexible and we could use more ideas when it comes to projects rather than the old CO2 cars and balsa bridges, even though I do like these projects.

**MP5:** Don't really know, ask the women.

**MP6:** If there is an outreach program, then a female and male coordinator should be in charge and visible. At a much earlier time in school, females need to be convinced to look into the field and shown its benefits.

**MP7:** No explosions, loud noises, potentially dangerous projects. Instead of taking apart a two stroke engine, make a poster about how they work.

#### Discussion of Responses from Participants outside the Technology Education Major

Before the discussion of the responses from the non-technology education female participants, a table is provided listing the pseudonym major of each participant (Table 11). These pseudonyms and majors will be useful for reading the data collected from these participants in that it will provide a context for the responses.

Table 11.

## Non-Technology Education Female Pseudonyms and Majors

<b>Pseudonym</b>	<b>Major</b>
NTF1	Industrial Engineering
NTF2	Physics/ Math
NTF3	Engineering
NTF4	Mechanical Engineering
NTF5	Mechanical Engineering
NTF6	Civil Engineering
NTF7	Business Management

The purpose of interviewing female students who were not technology education majors was to acquire an outsider's view of the technology education program. I thought that females who could examine a technology education program from the point of view of another major might be able to see and point out issues that those of us who are technology education majors might not see. Before participating in the focus group discussion, these students were sent a short letter which informed them about the definition and background of technology education (Appendix B). There were a total of seven participants in this group.

As mentioned previously, these students were enrolled in an introductory graphics class in the Department of Mathematics, Science, and Technology Education during the

time of this study so they were somewhat familiar with the technology education program. The seven females from outside the technology education program were interviewed in smaller focus groups made up of two to three participants. The interviews were held either in a small conference room or a borrowed professor's office in the education building on campus. The non-technology education majors were given four questions to discuss for the study (Appendix C).

#### Plans for Enrolling in Future Technology Education Classes

**NTFQ1:** Given that you have taken or are taking a graphics communications class and are somewhat familiar with the technology education program and classes, would you ever consider taking a technology education class? Why or why not?

Six of seven non-technology education female participants (NTF) stated that they might take further classes in the technology education program. However, they would do so only if the class benefitted or was related to their majors. Only one of the seven participants, an industrial engineering major, commented that she was thinking about minoring in technology education.

Non-technology education female participants presented several reasons for the possibility of pursuing technology education classes in the future. NTF1 noted that curriculum in the technology education program encouraged students "to look at [concepts in] a different way and figure out different ideas for [solving] them." NTF2 was not interested in pursuing future classes in the technology education program stated that, as a physics and mathematics major, she saw no benefit from pursuing further technology education or graphic communications classes. She added that she had

encountered problems in her first graphic communications class because she was not “mechanically minded” and that the curriculum was not what she expected it to be. She also felt that the graphic communications class that she was taking during the time of the study was all based on the “design of mechanical parts” in which she had no interest.

NTF3 acknowledged that taking technology education classes would “make you a more valuable employee.” She stated further that, although her graphic communications class only gave students a basic knowledge “of how to draw a few things,” it was a very creative and artistic class and “a lot of fun.” NTF4, an aerospace engineering major, observed that after seeing the metals technology lab in the technology education program, she “would love to take something like that,” and “always wanted to take shop class” but could not fit it into her schedule. NTF5 remarked that seeing the robotics in the technology education program robotics laboratory reminded her of robotics classes that she had taken in middle and high school. NTF6 reported that she liked learning how to do SolidWorks® and would be interested in further exploration of computer-related courses that are offered in the technology education program. NTF7 noted that the artistic and design aspects of technology education courses would support her art and design minor and would take more technology education classes if they related to her minor, but not if those classes did not fit into her time restrictions or the curricular requirements of her major, business management.

#### Female Involvement in Technology Education

**NTFQ2:** What do you think about females being involved in technology education?

Should females be involved in technology education? Why or why not?

All of the participants from outside technology education felt that females have a place in the field although they recognized the existing barriers that discourage females from entering technology education and most of their majors which are also low in female enrollment. In general the non-technology education female participants felt that female students are not aware of programs like technology education and graphic communications and that if they were aware, they would be attracted to them because of the artistic aspects of the programs.

Additionally, they reported that in other experiences such as at the high school level or at a vocational school, even if they wanted to take technical classes, teachers, administrators, counselors, and sometimes parents, discouraged them from doing so. NTF3 reported that if there were more females in the technology education and engineering fields, she would feel more comfortable in those settings. She stated that, from her perception, there existed “an aggressive kind of competition between [female students] and the guys,” and felt that gender equity in technology education programs would not be realized “at least in our day” because of the “hostile” atmosphere between male and female students. NTF3 further noted that there were more women in biological and chemical engineering than in her field of aeronautical engineering or technology education and the former two areas are “still not seen as a woman’s place.”

NTF2, a physics and mathematics major, was the only participant of the seven that asserted that her department was welcoming and respectful of female students and that the professors “really want to make sure all the girls succeed.” She stated that she felt comfortable in her graphic communications class as well and that she and the other two

female students in the class “didn’t really get any problems from any of the guys.” NTF4 felt that technology education classes would greatly benefit female students “because it gives them more of a range of ideas and [that women] are more prone to logical thinking.” However, as she asserts, “we were never really told about it...they never really brought it out to you, gave you much option.”

NTF5 stated that female interest in technology education classes depended on each individual female because for some female students, “[technology education courses] wouldn’t be their kind of thing.” However, she added that some female students might choose to be involved in technology education “because of the art thing.”

NTF6 stated that although society at large is becoming more gender-integrated, at the beginning of life, one is taught about gender roles and societal expectations about those roles. Although NTF6 believed that females should be involved in technology education and that it would have a positive impact on society if more females were in the field, she stated several reasons for the issue of low female enrollment in technology education. According to this participant, the technology education curriculum should offer more lessons and activities that would appeal to female students. If technology education had more females, other female students would be more interested in enrolling in technology education courses. Additionally, early toy play could have influenced female course and career interests. For example, according to NTF6, the “typical girl” played with Barbies® while the “typical boy” played with Hot Wheels® cars. Having played with more technically-designed children’s toys could have influenced more females to choose courses and careers in technology-related fields in their futures.

NTF7 maintained that “females have different interests and maybe that’s why there’s not as much [female] involvement as males comparatively.” She added that stereotyping could have also contributed to low female enrollment in technology education. NTF7 reported that in her graphic communications class, she was the only female student which made her feel “weird” because she was not familiar with the technology software utilized in the class. In fact, she felt like she was “labeled” as someone who did not know what she was doing in the class because the rest of the students were already familiar with the software program. NTF7 noted that during her time in the graphic communications class, the instructor of the class, although trying to be helpful, would single her out which brought more focus on the fact that she was the only female student in the class. In her opinion, this practice could “carry over into other things that are more stereotypically male dominated.”

#### Reasons for Low Female Enrollment in Technology Education

**NTFQ3:** What do you think are some of the reasons why females might choose not to take technology education courses or pursue careers in technology-related fields?

This group of female participants cited several barriers they had either observed or experienced that discouraged females from pursuing careers in the technology education and other STEM fields. NTF1 listed stereotypes, family, peer, teacher, administrative and counselor pressure as barriers that keep female students away from technology education and related areas. She noted that all the “drafting” classes were made up of “all boys and that as female students, she “wanted to take clothing design with all [her] friends.” NTF1 proposed that many people adhere to the notion that

technology education and the STEM fields are largely male-dominated. In her opinion, this belief contributes to a general feeling of discouragement among females who might be interested in pursuing education and careers in these areas. NTF1 reported that, as a high school student, she considered the technical and vocational students to be “slackers” and, although she was interested in taking some of those courses, she did not want to be labeled as such. This participant reported that she had experienced a great deal of family pressure to pursue a nursing career rather than an engineering field, but that besides not being interested in a medical career, NTF1 “could never do it because [she] couldn’t stand the sight of blood.”

NTF2 reported that her parents encouraged her toward the engineering field as most people in the engineering fields make sufficient incomes to support themselves financially. Still, this participant chose to major in physics or, as she phrased it, become a “physicianator.” In response, her parents argued that “physicianators” were “weird.” Regardless of her parents’ input, NTF2 continues to have an interest in and during the time of this study, was actively pursuing a double major in physics and mathematics.

NTF3 reported that her high school guidance counselors “led [high school students] to believe that if you were taking vocational or technology education classes, you were not going to go to college, you were going to get a skill and go straight into the work field.” Although this participant stayed on the college track that would lead to acceptance into a four year university while she was attending high school, she concurrently pursued community college classes in a dual enrollment program. The classes that NTF3 took prepared her to be an automobile mechanic. After completing this

community college coursework and graduating from high school, NTF3 applied to and was accepted to a four year university.

At this point in the conversation, I asked NTF3, who had trained to be an automobile mechanic during high school, if she had ever experienced the issue of stereotyping as it relates to females in the STEM fields. NTF3 was the only participant in this group who had previous training and education at a community college as well as work experience as an automobile mechanic. During the time of this study, she was working at a local discount store chain as a salesperson while she pursues her degree in aerospace engineering. She reported that as a salesperson at the discount store chain, she was often confronted by prior customers from her automobile mechanic employment who would ask her if she was a lesbian. As she stated, “it’s just something that’s set in their head[s].” NTF3 acknowledged that many people, in her opinion “older people mainly,” maintain that females who take classes or work in “mechanics or anything boyish...are going to be either a tomboy or a lesbian.” This is a stereotype that has been raised by many of the research participants, as an issue that contributes to low female enrollment in technology education and other STEM-related fields.

In answering question three, NTF5, a mechanical engineering major, reported that she would feel out of place in technology education classes which might also discourage other females from taking the classes or pursuing careers in technology education related fields. NTF4, a mechanical engineering major, reported that although she enjoyed her introductory graphic communications class, she did feel somewhat uncomfortable as one of the few females in the class. She stated that she was “basing this [answer] on both her

introductory graphic communications class as well as her previous experiences in robotics.” She noted that “there were so many guys [that it seemed as if] girls aren’t really supposed to be in it...it’s like they belong there and we don’t.” She added that “you have to put yourself in the mindset that you really aren’t supposed to be there, that this isn’t what you are really supposed to be doing, that you are supposed to be in the arts or taking care of children.” NTF5 concurred that this type of thinking was “a cultural handicap.” NTF4 further reported that when she was considering changing her major from mechanical engineering to architecture, her great-grandmother was happy because she felt that having a degree in architecture would allow NTF4 to provide for future family and children better than a degree in the engineering field. NTF4 felt that although women who wanted to have children should do so, it should not matter what their career choice was, whether it be something artistically related, or a career “in the technologies.”

NTF5 added that she had recently considered the idea of having children while having a technology-related career. She was somewhat concerned about the issue of having a full career while also taking care of children and family. This issue is of great concern to this participant. As she reported:

**NTF5:** I’d like to go to work [full time or] work toward my master’s [degree]...but those people work so many hours a week they don’t have a lot of time to themselves...that just kind of scared me because I don’t have children but I want to have them and I thought about taking some time off [to have children] but that puts you at a disadvantage in your field because of the time you lose.

These two participants raised other issues that might contribute to the low rate of female involvement in technology education and technology-related fields. They both reported that they, like other participants in this group, had experienced parental pressure and influence when choosing their majors. NTF4 indicated that her mother owned an art gallery while she was growing up, and that she had been “around art galleries since I was six years old,” but that she also had an interest in technology. NTF4’s mother did not seem to understand why her daughter had an interest in technology and although she was supportive that NTF4 was planning to go to college, she was concerned that her daughter would not have time to pursue her interest in the arts, that, in fact, she would be “throwing it away.” NTF4’s father encouraged her to pursue a career as a graphic designer because of her artistic background, but another influential person in NTF4’s life, her step-father, was a mechanical engineer. In a desire to find a place where she “could put the art and technology together,” NTF4 chose to pursue a minor in art and design while majoring in mechanical engineering.

NTF5 reported that neither of her parents went to college. During her childhood, her father was in the military and gone a lot, and that he really did not understand why she would want to pursue a degree in mechanical engineering. Due to her father’s absence, her mother taught her to be very independent and to “take care of things you have to fix.” As a result, this participant’s mother was always supportive of her educational and career interests and NTF5 did not have to consider family influence in those choices.

In response to question three, NTF6 reported that females may not choose technology education and technology-related fields because “[they are] typical male major[s] or male career[s].” She further states that even if a female student overcomes barriers and makes a decision to be in a technology-related field, “they know it’s one of the hardest things they could have chosen.” She notes several barriers that might discourage females even once they are in technology education and technology-related majors. As NTF6 explains:

**NTF6:** There are not very many girls in your class and if you haven’t grown up being a stereotypical engineer, then it’s hard for you to find people that are like you because it’s hard for you to find people that are like you. I think for girls, technology and that kind of thing might turn them off because it’s not going to be the easiest road for them. It may not be the most fun thing knowing that your classes are going to be pre-dominantly male, that it might not be easy for you to get a study partner, knowing that getting into the career will be awfully difficult unless the company you are going for is looking for the minority. Finding connections [is] a lot easier for males when they are in a predominantly male field. [They] get connections with other employers because they will know more people and their dad does it and their dad’s friend does it.

Another barrier noted by this participant was the lack of required technology education classes. Many majors such as history, English, and computer science have classes that are required by all students on campus. If such a class did exist and was “vital

to real life” by taking this required class, female students would become more aware of the technology education field and, as a result, take more classes in the department. I asked this participant what she thought about the idea of an all girls’ technology education class. She noted that, although more girls might be interested in signing up for that class if it did exist, it might pose a problem because it singled out female students. However, as she reported, more girls might take the class initially, “find out they like it,” and pursue more classes in the technology education department.

NTF7, a business management major, suggested that the reason female students do not enroll in technology education classes is because they do not know that these classes or the program exist or what the field is. She adds that she herself did not know what the technology education program had to offer and that the technology education class descriptions and the name of the field itself “speak male.” According to this participant, just the term “technical” itself “has a connotation of being male.”

I asked the participant to think about the question in the context of a high school female student who wanted to take a woodworking class and what might inhibit her from taking the class. NTF7 said that the student might get made fun of if she were the only girl in class and unless she was really good at woodworking and respected for that skill she might feel more comfortable but, “you can’t always be good at something the first time you tried it and...it would be difficult to learn if you weren’t accepted in that class.” Additionally, NTF7 suggested that the media might “point [girls] in a different direction than it should and that may have something to do with it.” NTF7 ended by stating that “you have to work a whole lot harder if you are going into a field where your gender isn’t

found...it works the same way when guys go to work in a salon. You have to break down all the barriers.”

#### Suggestions on Ways to Make Technology Education More Attractive to Females

**NTFQ4:** Based on your experience, how do you think the field of technology education could change to make it more attractive to females?

NTF2 reported that there seemed to be a lack of communication in the technology education program and that she heard about her introductory graphics class from someone who was enrolled in the class and told her to take it because it was “a fun class.” She stated that before she enrolled in that class, she was not aware of the classes technology education had to offer, specifically the software and design aspects of the class. She further admitted that she had not looked at the course catalogue for any other classes in technology education but that she knows “you can get a minor in it and it gets further into how to design parts.” NTF3 admitted that she had not looked at the course catalogue for further technology education or graphics classes either. NTF1 reported that she knew there was at least one more advanced class beyond the introductory graphics class that she had taken, but only because of the professor who had been her instructor in the introductory class.

When asked about course descriptions in the university course catalogue, NTF1 stated that the wording for one of the advanced graphic communication course descriptions made the class “sound kind or scary.” This particular course focuses on aiding students in developing visual and drawing skills. The university course catalogue description states that the course is designed to:

...develop visual thinking skills through a series of exercises using various visual media. Integrates and stresses drawing and construction activities essential to visual thinking. Emphasis on direct observation (seeing), mental imagery and sketching that is based upon three-dimensional space. Develops students' visual and drawing skills and provides for their application toward solving open-ended spatial problems. Intended for the scientific and technically oriented student.

NTF1 stated that she had been advised by her department that this would be the best class for her to take in the technology education program. However, after reading the class description, both the researcher and the participants agreed that the description was a bit confusing and might deter female students from taking the class.

NTF4 felt that if females were more aware of what technology education had to offer, they would be more attracted to the field. That, in fact, she had never heard of the program before she enrolled in the introductory graphic communications class. NTF5 stated that now that she had taken the graphic communications class, she and the other research participants would know about the program and possibly take more technology education classes in the future. However, NTF5 noted that the program could be better marketed so that all students would know it existed.

These participants were asked to offer their thoughts about the name Technology Education, and if they thought students would know what the program offered based on the name. NTF5 admitted that the current name was not very descriptive and that perhaps putting the word "art" back into the name would illustrate the more creative aspects of the field which would make it more attractive to females. NTF4 reported that the name

makes the program sound like a strictly a teacher education program. I told the two participants about how the program was described to me when I first inquired about the field in 2002. The professor that I met with told me that the goals of technology education were to encourage students to examine emerging technologies and design new technologies. He asked me if I liked robots, playing with Legos®, making things, and taking things apart and putting them back together. Both NTF4 and NTF5 stated that this statement should be in the description of the program in the university's course catalogue as it would attract both of them to technology education.

NTF6, a civil engineering major, stated that although she was not interested in “putting things together” but rather in “creating something, putting it on paper, and letting someone else put it together.” However, she admitted, that the “class you told me about [in which students] make [mechanical toys], I would love to do that.... so maybe creating a class that would appeal to girls” but would not single out girls would make the program seem more like “there was something out there for everyone.” Other suggestions from this participant for making the field more attractive to females included creating technology education classes that included gender equitable projects that would appeal to females and males, market the department better so that females know it is there and exists for them as well as for male students, and make classes “prove vital [and be] a requirement so that more people would experience...the basics” and find they are interested in the field.

NTF6 reported that low female enrollment is an issue in her major, civil engineering, as well. She noted that engineering classes do not have many female

students in them and if there are other females present, it is because these students are taking the engineering class as an elective for another major. She felt that her department was getting less and less female students so she could understand the issue of low female enrollment in the technology education field. She reported that there were five girls in her introductory graphic communications class, but that all five of those girls were from majors outside the technology education program. She reported that although she was comfortable in her introductory graphic communications class, she did feel that the male students came into the class with more knowledge about the subject and that she often got behind on class assignments.

NTF7 thought that the biggest barrier to female involvement in the technology education field was the name Technology Education. She noted that she would be more likely to choose a field that had the word arts in its title. She further noted that if “you were applying for a design position, ‘technology education’ is obviously related to design, but the ‘industrial arts’ title would look better on the resume. It would seem more applicable.” I suggested the name Technological Arts to replace Technology Education. This participant affirmed that while this name would be better than the current one, “Technical Design” would be a better name because “that’s what it is” and that although she did not intend to “judge a book by its cover...you’ve got to make sure that what you are saying and telling is the same thing as people perceive it” and that the current name does not do so. In fact, when NTF7 enrolled in the introductory graphic communications class, she did not see one of the more technical words in the description. She stated that the description appealed to her creative side and that, although missing the technical word

would not have affected her choice to take the class or not, once she began taking the class, she thought “this is a drafting class” and it did not meet her expectations. She reported that the reason she remained in the class was because of the laid back attitude of her instructor and that “if I had to make the lines to a ‘T’, I would have driven myself crazy.” Ultimately, NTF7 conceded that the description of the class probably appealed to people interested in “design and technical stuff and more industrial type things.” However, it did appeal to her even though she is not in a technical field, and the introductory graphic communications class was not required by her major.

#### Summary of Chapter Four

The findings presented in this chapter are based on data collected in focus group discussions from a sampling of female technology education majors, male technology education majors, and females from other majors who were enrolled in an introductory graphics class during the time of the study. Qualitative data collection methods including focus groups interviews were used to gather the data for the study. Six female technology education majors, seven male technology education majors, and seven females outside of the major were chosen to participate in the study. The seven females outside of the major were made up of students who were enrolled in an introductory graphic communications course shared by the technology education program at a major southeast university. A total of twenty students participated in the study.

Based on the research questions that guided the study and the existing findings from a literature review, participants were asked several questions relating to barriers and solutions to those barriers in a focus group setting. Focus group discussions resulted the

generation of much needed new information about how to make the field of technology education more attractive to females. Participants offered input on barriers to initial female interest and involvement in technology education, obstacles those female students who are currently in the field face, and suggestions for implementing ways to raise female enrollment in technology education and the other STEM areas. Many of the solutions offered by the participants were discovered in pre-existing literature; however, many of their suggestions were new and should be considered when creating avenues for improving female involvement in technology education and the other STEM fields. These themes will be further discussed in the following chapter.

## CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

### Introduction and Background of the Problem

#### Universal Effects of Low Female Enrollment in Technology Education and STEM

The issue of low female enrollment in the areas of science, technology education, engineering, and mathematics (STEM) affects education, industry, and global and economic leadership of the United States (National Science Board, 2006). In the United States, there is a growing difference between supply and demand of qualified workers for technology and STEM-related fields (Bybee & Starkweather, 2006; Gordon, 2007; InterAcademy Council, 2006; Jackson, 2004; Kirkegaard, 2007; NCMST, 2000; Wyer, 2007).

With the rising number of foreign graduates in the STEM fields returning to their countries of origin, and the decreasing number of United States graduates in these areas, the nation could possibly lose its position as the global and economic leader of the world (CPGE, 2005; Kirkegaard, 2007; NSB, 2006). Moreover, the attacks of September 11, 2001 have caused the United States government to be exceptionally aware of and concerned about terrorist threats to national defense and the need for technical workers to support national defense (Jackson, 2004; NSB, 2006; NSF, 2007). With the threat of terrorism, the competition for global and economic leadership, and one-quarter of the current STEM workers retiring by the end of this decade, the need for recruiting women into technology education and the other STEM fields becomes crucial (Jackson, 2004).

### Technology Education and Science Interest among Female Students

Existing research revealed that students of both genders are initially attracted to and enjoy science classes (Arambula-Greenfield, 1997; Truluck & Courtenay, 1999). Although this fascination with the sciences typically begins at the elementary school level, by the time they begin middle school, male and female student interest and disposition toward STEM-related classes begins to change (Jones, Howe, & Rua, 2000). Males become more interested in science and technology classes while females become attracted to other types of courses (Jones, Mullis, Raizen, Weiss, & Weston, 1992). In North Carolina, there is a large presence of female students in middle school technology education classes, however; by high school, the number of females in technology education classes drops to less than half the total number of students enrolled in high school technology education classes (NCDPI, 2005; Tom Shown, personal communication, 2006). By the time female students begin to make college and career choices, few of them select majors in technology education and the other STEM areas (Bybee & Starkweather, 2006; Jackson, 2004).

Female students losing interest in technology education and other STEM areas, and a general lack of qualified workers to fill technology education and STEM related jobs results in employment gaps at industrial and national levels. With the rising threat of terrorism, along with the possibility of losing its global leadership and economic edge, United States political advisors, industry leaders, and other professionals have called for change efforts to stop this growing crisis (BEST, 2002, 2003; BHEF, 2005; Jackson,

2004; President's Council of Advisors on Science and Technology Workforce/Education Subcommittee, 2004; USGAO, 2006; Wyer & Adam, 2000).

### Existing Data in Technology Education Research

Much of the existing data on gender in technology education and the STEM fields have been informed by research from the science fields. The review of related literature revealed a lack of qualitative research about low female enrollment in technology education programs. Due to the imbalance of gender equity in technology education courses and the researcher's interest in discourse with students who directly experience gender inequity issues, qualitative methods were chosen for the study, specifically, observation, focus groups and small group interviews, document analysis, and member-checks (Barbour, 2007; Bogdan & Biklen, 2003; Krueger & Casey, 2000; Litoselliti, 2003).

Two previous analyses of technology education research analyzed research studies conducted in technology education from 1987 to 1993 (Petrina, 1998; Zuga, 1994). The findings of these analyses revealed that 83% of existing studies were quantitative; 87% of the researchers were male; 11% of the studies involved students in the schools; only one article used feminist theory (O'Riley, 1996); and only a few of the articles referred to constructivist learning (Petrina, 1998; Zuga, 1994). In her conclusions, Zuga (1994) noted a recurring theme of gender and cultural bias in technology education. She concluded that technology education content and instructional strategies could be sources of gender-bias in the field. As Zuga (1994) stated, all genders, cultures, and abilities deserve access to the best technology education training possible. However,

according to Zuga (1994), from 1987 to 1993, technology education researchers did not address the needs of women, minorities, or students with disabilities. This finding is supported by Petrina's (1998) study in which he reported that in technology education research, women and other minorities were significantly overlooked.

As noted by Zuga (1994) the "main purpose of technology education in schools is to prepare students to understand and participate in a technological society through experience with technological methods, resources, and knowledge" (p. 1). Yet, more than a decade later, females are not getting the knowledge and skills needed to compete in the global economic society.

#### Barriers and Solutions to Low Female Enrollment Cited in Existing Research

The examination of the existing research on low female enrollment in technology education revealed several barriers and solutions to the problem. Barriers to female involvement in technology education included:

- technology education perceived as a male-dominated field (Bryson, et al., 2003)
- disenfranchisement of female technology education teachers and students (Bryson, et al, 2003)
- loss of interest among females in technology education classes after middle school (Jones, Howe & Rua, 2000; Silverman & Pritchard, 1996)
- lack of female role models and mentors in technology education (Committee on the Status of Women Faculty at Caltech, 2001; Gilbert, 2001; Jovanovic & King, 1998; MIT, 1999)

- effects of stereotypes about technology education (Clewell & Campbell, 2002; Greenfield, 1996; Lantz, 1985)
- sexism and gender-bias in technology education programs (Brickhouse, 2001; Cano, 1990; Committee on the Status of Women Faculty at Caltech, 2001; Guttentag & Bray, 1976; Haynie, 1999, 2003; Henry, 1994; MIT, 1999; Muraskin, 1989; Olivares, & Rosenthal, 1994; Rolling, Burnett, & Huh, 1996)
- lack of knowledge of career options (Bryson et al., 2003; Silverman & Pritchard, 1996)
- effects of teacher gender on female choice of classes (Bryson, et al., 2003; Darling, 1992; Henry, 1994; Muraskin, 1989; Olivares & Rosenthal, 1994; Pottker & Fishel, 1977; Rolling, Burnett, & Huh, 1996)
- funding and other administrative support (Bryson, et al., 2003; Silverman & Pritchard, 1996)
- biological differences (Clewell & Campbell, 2002)
- parental expectations and input (Clewell & Campbell, 2002)
- effects of guidance counselor and teacher discouragement (Bryson, et al., 2003)
- female lack of confidence and self-efficacy (Clewell & Cambell, 2002; Wyer & Adam, 2000)

While researchers reported barriers to low female enrollment and interest in technology education and the other STEM areas, they also made suggestions for solutions to reducing these barriers. Those solutions include:

- hire and provide more female mentors and role models for female students in technology education (Gilbert, 2003; Greenfield, 1996; Silverman & Pritchard, 1996)
- examine scheduling of technology education classes (Silverman & Pritchard, 1996)
- encourage guidance counselors to provide female students with information about technology education classes (Silverman & Pritchard, 1996)
- examine the possibility of making systemic changes in technology education curriculum and instructional strategies (Bryson, et al., 2003; Greenfield, 1996)
- provide extracurricular technology education experiences for females (Campbell & Steinbrueck, 1996; Dark, Clewell, & Savo, 2002; Gilbert, 2001; Jovanovic & King, 1998)

The goal of the current study was to combine an examination of barriers and solutions present in existing research with findings from a new qualitative study on the topic in order to offer fresh and contemporary solutions to raising the number of females in technology education and the other STEM areas. The study was based on a theoretical framework of constructivist learning theory and feminist pedagogy. A synthesis of constructivist learning strategies and feminist pedagogies could offer a new framework for improved learning for all STEM students, especially those who may not have been successful with traditional STEM teaching strategies. The findings of the current study could offer new ways of removing barriers and attracting females to technology education and the other STEM fields.

It has been established through a careful examination of existing literature that technology education and the other STEM areas have historically exhibited low female interest and involvement. Although in the infancy of technology education, when the field was known as the Industrial Arts, there were several females that contributed to the advancement of the field, largely those contributions and names have been ignored and, as a result of this and other issues, low female involvement in contemporary technology education and the STEM programs continues to exist (Zuga, 1996).

In light of the findings from the literature review, qualitative data was collected to determine if study participants, both male and female, could offer reasons for low female involvement and suggestions for attracting more females to the STEM fields, specifically in technology education. Several themes emerged from the focus group discussions held during the data collection process of the study. In the following section of this chapter, the emerging themes will be interpreted and discussed in relation to the research questions that guided the study.

This chapter includes a summary of the significance of this study as well as a discussion of emerging themes and implications from the data collected. The themes will be examined within the context of the research questions that framed the study. Conclusions and implications for practice will be presented. Finally, suggestions for further research on the topic of gender equity in technology education and the other STEM areas will be proposed.

### Purpose of the Study

In many parts of the world, including the North Carolina, female participation in the areas of science, technology, engineering, and mathematics in both educational and career settings is extremely low. North Carolina's series of technology education classes for sixth, seventh and eighth graders, Exploring Technology Systems, is required and, therefore, has no problem with enrollment of female students. However, by high school, when technology education classes become optional, the number of girls in these classes drops considerably (NCDPI, 2005). This problem continues at the higher education level with low female enrollment in technology education, engineering, the sciences, and related fields of study. At the time of the study, in the technology education program at the university where the study took place, only 4 out of 44 majors in technology education were female.

There is not a great deal of empirical evidence that pinpoints one particular reason why females do not elect to take technology education classes beyond middle school, nor does the existing research offer many suggestions for how to attract and retain females in technology education and other STEM fields. The purpose of this study was to examine factors that influenced female course choices during their middle and high school technology education experiences and continue to influence their course choices at the university level.

### Significance of the Study

The study is significant because it adds to the existing literature that examines low female enrollment in technology education, specifically how gender roles affect student's

academic and career choices. Additionally, as a result of the study, I hope to encourage gender-equity in technology education programs across the United States and abroad that will attract and retain students of both genders.

Few researchers have approached the issue of low female participation in technology education from a qualitative stance. Moreover, most researchers who have explored this issue used quantitative data collection methodologies rather than qualitative methods such as interviewing male and female students (Hoepfl, 1997; Petrina, 1998; Zuga, 1994). The most recent studies related to gender and technology education are by Haynie (1999, 2003). In his 1999 study, Haynie used a quantitative data collection methodology, surveys, to poll technology education professionals about the cultural climate of the field. In his 2003 study, Haynie employed qualitative methodologies in a “quasi-ethnographic” study of female technology education professionals (p. 16). In both studies, Haynie (1999, 2003) emphasized the importance of raising the numbers of females in technology education and expressed a hope that other researchers would conduct further studies related to the issue. In fact, Haynie’s work on the issue was the impetus for this study.

Clearly, from education to industry to government, there is a major concern that not enough students, male or female, are choosing technology and STEM-related fields as careers, and, as a result, STEM jobs are going unfilled (Bybee & Starkweather, 2006; Jackson, 2004). The findings of this study could find and suggest new ways of removing existing barriers and attracting females to technology education and other STEM fields. Finally, the study could address other needs found in the research such as uncovering

avenues to challenge stereotypes about technology education, finding ways for female students to have role models as teachers and mentors, and suggesting ways to create curriculum that attracts all students to technology education.

### Data Collection Procedures

Qualitative data collection methods including focus groups interviews were used to gather the data for the study. Six female technology education majors, seven male technology education majors, and seven females outside of the major were chosen to participate in the study. The seven females outside of the major were made up of students who were enrolled in an introductory graphic communications course in the technology education program at a major southeast university. A total of twenty students participated in the study.

### Research Questions

1. Why do females choose not to enroll in technology education classes?
2. What are the barriers that discourage females from continuing in technology education programs?
3. How can females be encouraged by their community (parents, teachers, counselors) to enroll in technology education programs?

### Discussion of Research Questions and Related Themes

#### Emergent Themes Related to Research Question 1

**RQ1:** Why do females choose not to enroll in technology education programs?

*Theme 1: Technology Education is Perceived as an Historically Male-Dominated Field*

As suggested by the participants of both the current and pilot studies as well as the existing literature, one of the biggest barriers to female enrollment and interest in the field is that technology education has traditionally been perceived to be male-dominated, and, as such, female students do not think they will be accepted in the programs. Female participants suggested that many technology education programs employ the “good old boy” system and that this system contributes to female lack of interest in those programs.

*Theme 2: Female Students are Unaware of the Existence of Technology Education Programs*

According to the female study participants, most female students in both high school and college settings are not aware of the existence of technology education programs. Even if female students become aware of existing technology education programs, they do not think that these programs will be welcoming of female students or that the courses will be of interest to them.

*Theme 3: Parent and Counselor Influence on Female Class Choices*

Female participants stated that parents, school counselors, and teachers influenced their course choices in high school. Participants added that many female students are discouraged from taking technology education classes in high school and, therefore, do not pursue these classes at the college level. They also suggested that the “tracking” system employed by many school districts pushes female students away from technology education classes and into classes that, as defined by the school systems, build a foundation for that student to go on to a four year university. Participants noted that

females tend to be pushed toward arts-based fields while male students are encouraged to pursue the more technology-based majors.

*Theme 4: Stereotypes, Stigmas, and Peer Pressure Surrounding Female Participants in Technology Education and the Other STEM Areas*

Both male and female study participants suggested that there is a stigma surrounding female interest in technology education and that female students who do enroll in technology education classes are subject to stereotyping. Additionally, female students reported that peer pressure, especially at the high school level, plays a role in female enrollment in technology education classes.

*Theme 5: The Name of the Field is Misleading*

Participants of the study, especially those participants from outside the technology education program, found the name Technology Education to be misleading. They felt that the name Technology Education did not describe or represent the content of the field, especially the hands-on, artistic and creative, and design aspects. These participants added that the course descriptions in the school catalogue misrepresented what the class offered. They noted that the descriptions of the courses were too technical and contributed to female lack of interest in taking technology education courses.

*Theme 6: Intimidation*

Since the technology education program was perceived by the participants of this study to be male-dominated, most female participants stated that they felt or would feel intimidated in technology education classes. Specifically, female participants felt that they would not be as prepared for many of the technology education classes as male

students might be. Most female participants felt that they would enter technology education classes with little to no skills or knowledge about the tools, materials, and processes used to complete projects and assignments in those classes. As a result, female students would feel intimidated and, therefore, avoid enrolling in technology education classes.

### Emergent Themes Related to Research Question 2

**RQ2:** What are the barriers that discourage females from continuing in technology education programs?

#### *Theme 1: Treatment of Female Students by Teachers and Male Classmates*

Both female and male study participants indicated that female students are treated differently than male students in technology education classes and that this treatment comes from male professors as well as male classmates. The main issue, according to study participants, is that some professors tend to overreact when they feel that females have been mistreated by male students. Study participants suggested that this type of treatment made female students feel singled out and made the situation worse than it might have been if the professor had not gotten involved in the situation. Females also stated that they feel pressured by some professors to be the “smart” ones in classes which made them feel uncomfortable and singled out. Female participants added that in technology education classes, females, as the “smart” students in the classes, are encouraged by some professors to work on the research or written aspect of projects, while male students are encouraged to work on the hands-on aspects of projects.

Participants suggested that, as a result of this attitude, this is the way most projects are completed in technology education classes.

According to study participants, male students in technology classes also treat female classmates differently. Participants offered several examples of this mistreatment by male classmates. First, participants remarked that male students had a type of “buddy system” that contributed to ostracizing of female students. With male students pairing up for projects with only each other, females often felt isolated or unwelcomed in technology education classes, particularly if there was only one female student in the class, which is often the case, at least at this university. Secondly, female participants felt that they had to be “one of the boys” in technology education classes order to fit in. They added that in order to be heard, or have their suggestions utilized in technology education projects, female students have to be much more assertive than they have to be in classes outside of the technology education department.

Treatment by some male professors and classmates contributes to a general feeling of intimidation among female technology education students. As reported in the discussion of themes for research question one, intimidation was reported as a barrier that keeps female students from enrolling in technology education programs.

### *Theme 2: Female Lack of Interest in Technology Education Courses*

Female participants in the study suggested that technology education curriculum is designed to be more attractive to males than females. Although they are attracted to certain classes in the program, most female students had a list of courses in technology education that they were not interested in taking. For example, most female technology

education students like classes such as woods and metals processing where they create hands on, tangible projects designed to teach them how to use the tools and materials related to the wood and metal and design and create their own final projects. However, most female students stated that they would not or do not enjoy classes where one might take an engine apart and put it back together. Moreover, when asked about a recently revised class in the technology education program based on robotics technology, only one of six female participants stated that they enjoyed the class while all of the male participants who had taken the class stated that they enjoyed the class. As reported in the discussion of themes for research question one, the issue of technology education course curriculum design was also reported by the non-technology education females in the study as a barrier to why students outside the program may not be attracted to technology education.

*Theme 3: Technology Education Losing Focus on Arts and Creative Aspects*

All female participants reported that they felt that technology education programs are losing or getting rid of classes that are artistic and hands on-based and promote creativity among students. Because most females are attracted to the program because of the artistic and creative aspects, study participants felt that if technology education loses that focus, it will lose female interest in the field. Participants suggested that anybody can learn to type a program into a computer that will then create a part, but what makes technology education unique is that students are given the opportunity to create parts and projects in hands-on laboratories using tools and materials, as well as on computers.

*Theme 4: Low Number of Teachers Means Low Number of Courses Offered*

Participants in the study reported that course scheduling was a big issue for students in the technology education program. They felt that, during the time of the study at their university, there were not enough instructors to teach the number of course sections necessary to include all students who needed the course. They added that due to the low numbers of professors in the program, it was prohibited from offering new courses as well as more sections of existing courses. Participants added that this issue contributed to scheduling problems noting that they sometimes had to wait two or three semesters to take a required course which inhibited them from graduating in four years.

*Theme 5: Lack of Female Professors, Role Models, and Mentors*

Study participants reported that the lack of female technology education professors, teachers, role models, and mentors is an issue that makes it hard for them to thrive in technology education settings. During the time of this study, there was one female technology education professor and one female technology education teaching assistant.

*Theme 6: Career versus Family*

As with any career decision, female students in and out of technology education feel that they will eventually have to choose between family and career, while males are expected to have a career and support the family. Female study participants suggested that as a result of choosing to major in a technical field, they might have more career demands and obstacles than if they chose to major in a field that is more gender balanced.

This feeling is common among females inside as well as outside the technology education major.

*Theme 7: Laboratory and Classroom Physical Environments*

Study participants indicated that the physical environments of some technology education laboratories and classrooms contributed to low success in recruiting and retaining female students. Participants noted that most technology education laboratories and classrooms were dirty, unkempt, and unorganized. Additionally, the machines and tools in those laboratories were outdated, often broken and unusable.

Emergent Themes Related to Research Question 3

**RQ3:** How can females be encouraged by their community (parents, teachers, counselors) to enroll in technology education programs?

Three main themes emerged from the discussion of how to attract more females to technology education and other STEM fields. The three themes are marketing, presentation, and curricular changes. Study participants felt that changes in these three areas would have a large impact on female interest and enrollment in technology education.

*Theme 1: Marketing*

Study participants suggested that improvements in marketing would have the most impact on attracting and retaining female students to technology education programs. Participants offered several ideas for better marketing of technology education programs.

Create outreach teams made up of male and female students and professors that would participate in school, community, and national events in order to attract more females to the technology education field.

- Encourage more female involvement in professional organizations such as TSA, TECA, and ITEA so the female presence in technology education is more visible.
- Schedule tours of the program facilities and provide special events to raise awareness of technology education programs.
- Advertise the design, building, and artistic aspects of the technology education program and field.
- Emulate the positive changes that society is making in the area of expected female societal roles.
- Advertise the courses, flexibility, and other opportunities that are unique to the technology education field.
- Make one or two technology education classes required electives so that more students outside the major can be exposed to the major.
- Demonstrate/advertise how concepts such as problem-solving, logical thinking, hands-on projects, and inquiry-based learning in technology education courses can transfer to other areas.
- Re-examine and re-write course catalogue descriptions so that students in and out of the technology education major can better understand them.

- Expose students at the elementary school level to technology education concepts to start awareness and interest in the field at a younger age.

#### Theme 2: Presentation

Although presentation is closely related to marketing of technology education programs, study participants had very distinct suggestions for both areas. According to study participants, several changes could be introduced that would improve presentation of the technology education program.

- Clean, organize, and update technology education laboratories and classrooms.
- Refer to technology education work spaces as “laboratories” rather than “shops.”
- Create support groups for female students within technology education programs.
- Explore resources to provide female professors, role models, and mentors for female students.
- Reach out to the arts and other creative fields for suggestions on how to attract female students to technology education programs.

#### Theme 3: Curriculum

Study participants pointed out several curricular issues within technology education programs that contributed to lack of female enrollment and retention in the program. They thought that if changes were made to the existing curriculum, more

females might be attracted to the field. Participant suggestions for addressing curricular issues included:

- Consider changing the name of the field from “technology education” to a name that includes the words “design” or “art” which attract students from outside the technology education major to the field.
- Redesign existing technology education curriculum so that it is attractive to both male and female students.
- Explore new perspective on technology education projects by reaching out to the arts community for input on new projects that will appeal to both genders.
- Replace old projects such as CO2 cars and bridge building and with more gender-blind projects or offer more choices of projects that will meet the criteria of the assignment.
- Design and implement assignments and projects that appeal to both the artistic as well as construction interests of students.
- Teach students about contributions of females to creation of the industrial arts field.
- When asking students to work in groups on required projects, implement a management style in which every student in the group participates equally in completing the hands-on and the research and writing processes of the project.
- Examine departmental scheduling of courses in order to create a more accommodating and reasonable overall course plan for students.

### Summary of Research Question Discussions

Based on the research questions that guided the study, participants provided input relating to barriers and solutions to those barriers in a focus group setting. Focus group discussions resulted in the generation of much needed new information about how to make the field of technology education more attractive to females. Participants offered input on barriers to initial female interest and involvement in technology education, obstacles those female students who are currently in the field face, and suggestions for implementing ways to raise female enrollment in technology education and the other STEM areas. Many of the solutions offered by the participants were discovered in pre-existing literature; however, some of their suggestions were new and should be considered when creating avenues for improving female involvement in technology education and the other STEM fields.

The barriers reported by participants that discourage female students from enrolling in technology education and other STEM fields included technology education being perceived as a male-dominated field, female student lack of awareness of technology education programs, influence of adults in authority positions on female academic and career choices, stereotypes and peer pressure, the name “technology education” being misleading and uninformative, and intimidation in the form of lack of preparation and skills necessary for success in technology education classes.

According to study participants, several obstacles also exist that contribute to low retention of females in technology education and other STEM fields. Those obstacles included treatment of females by males in the field, female lack of interest in technology

education curriculum, a general lack of focus on the creative and artistic aspects of technology education, lack of enough professors to teach technology education classes and limited offerings of technology education classes, lack of female role models and mentors, laboratory and classroom cleanliness, and choosing between having a career and having a family. Participants offered several solutions to removing barriers to female interest in technology education. These solutions included addressing the overall themes of marketing, presentation, and curriculum changes.

#### Discussion of Study Findings

As examined in Chapter Two, researchers in technology education and the sciences have explored and reported findings related to barriers, obstacles, and solutions to attracting more females to technology education and the other STEM fields. Although many of the barriers and solutions noted by study participants had been uncovered in previous research, some new barriers and solutions were reported. Barriers and obstacles to attracting and retaining females in technology education included the name of the field “technology education” as being misleading and uninformative, the potential curricular shift away from the artistic and creative aspects of technology education to a more computer-based curriculum, and technology education course catalogue descriptions being too technical and, as noted by one participant, “speaking male.”

Solutions resulting from the findings of this study included issues related to marketing, presentation, and curriculum changes. As proposed by Foster (2005), “in the mid-1970s, when the debate was raging over whether to include ‘technology education’ in the name of the industrial arts profession, we didn’t foresee that the name ‘technology

education' would still be confusing three decades later." Foster (2005) added that whether to change the name of the field or not should be dictated by the needs of the students. The name change from Industrial Arts to Technology Education, although not intended to serve as a way to attract more females to the field, may, according to this study, have an impact on female interest and enrollment. According to study participants, the name Technology Education, leads those who are not familiar with the program to perceive the field as specifically a teacher education program or to have no understanding of the program at all. Additionally, they suggested that the name Technology Education did not portray exactly what the program has to offer students. Participants suggested that the name of the field should be re-examined and suggested Technological Design or Technical Arts as replacements which would retain the arts and design emphasis in the field and potentially help attract more females to the program.

Several researchers have championed hands-on learning as an avenue for making technology education more attractive to females (Berry, Reed, Ritz, Lin, Hsuing, and Frazier, 2005; Silverman & Pritchard, 1996; Truluck & Courtenay, 1999). As articulated by Zuga (1991):

...laboratory practice has been fundamental to the study of technology, whether the emphasis has been on materials and processes or the study of human adaptive systems. The activities conducted in technology education labs have been created to illustrate the relationships of means to ends, of content to practice, and of our use of technology to [address] social problems... While most educators support a variety of educational laboratories in schools, few discuss the unique activities

that take place in those laboratories...the activity unites theory and practice through action. (p. 264)

All female technology education study participants stated that the reason they were attracted to and enrolled in the field was because of the hands-on, tangible products that are created in many technology education classes. However, the technology education program at the university in which this study took place is implementing a curricular shift away from the creation of large projects toward a prototype-based curriculum (Haynie, personal communication, 2007) which females foresee as a step away from attracting females to technology education. Given that these participants asserted that the reason they were attracted to the technology education program was due to the unique hands-on approach to teaching and learning, and the infusion of art and technology, perhaps this curricular shift should be reconsidered.

According to female students outside the technology education major, technology education course and program descriptions, which can be found on most university and college websites, can be misleading, intimidating, and uninteresting. The technology education community, being accustomed to the technical wording utilized in technology education course descriptions, may not recognize that these descriptions could be misunderstood by people outside the program. In light of this finding, perhaps an outside consultant should be asked to examine the technology education course descriptions to help make them more understandable and, therefore, more attractive to students outside the technology education field.

Study participants suggested several unique solutions to low female enrollment in technology education. Study participants noted solutions reported in existing literature including providing female role models and mentors, curricular changes, raising awareness of technology education programs, creating and implementing extra-curricular STEM integration programs for females, but also shared new ideas for attracting more females to the technology education program. Solutions included reaching out to the arts community for suggestions on gender-equitable curriculum ideas, reaching out to female-oriented fields for suggestions on creating a more gender-equitable program in technology education, and, as noted earlier, changing the name of the field to make it more attractive and informative. However, the suggestion that was most emphasized by all study participants was to advertise and emphasize how the arts are addressed in technology education programs.

Study participants reported a concern that changes in technology education curriculum was causing the program to get away from the origins of the Industrial Arts and that this shift would make technology education less attractive to both female and male students. Further, it was the male study participants who suggested reaching out to the arts and female-oriented communities and majors for help with this issue.

Findings of the study revealed many concerns about and solutions to the issue of low female enrollment in technology education. Male participants suggested that changes needed to be made in society and as it becomes more receptive to females in non-traditional career roles, technology education would emulate these societal changes. Female participants believed that changes can be made within the program that could set

precedence for societal changes. All participants believed in creating and implementing curriculum based on emerging technologies, but, not at the expense of the original aspirations of the field.

### Theoretical Framework Revisited

The two theories that served as the framework for this study were constructivist learning theory and feminist pedagogy. These two theories promote similar principles for gender equitable learning and instruction. Although the combination of these theories of learning could inform and provide the foundation for new instructional strategies in technology education and the other STEM areas, they have yet to be employed in any curricular shifts in the field (Lewis, Petrina, & Hill, 1998; Zuga, 1995, 1997).

Constructivist learning theorists believe that a learner's prior knowledge based on multiple frames of reference depending on their various backgrounds combined with new information creates understanding of new concepts (Brooks & Brooks, 1993; Fosnot, 1996; O'Loughlin, 1992). Constructivist learning-based teachers typically employ active, socially relevant learning either in or related to real-world settings, use learner's prior knowledge to scaffold learning new concepts, encourage self-awareness and initiative among learners, and see themselves as facilitators of learning (Brooks & Brooks, 1993; deVries & Zan, 1995; Dolittle & Camp, 1999; Fosnot, 1996). Additionally, constructivist proponents believe learning should be relevant to learners (deVries & Zan, 1995).

Feminist pedagogy is the integration of the essentials of feminism into creation of curriculum, teaching methodologies, and relationships between teachers and students (Crabtree & Sapp, 2003). Feminist pedagogy comes from feminism and feminist research

which focus on gender differences, oppression of women and minorities in society, and the balance of power in society (Babbie, 1998). Feminists believe that changes in political, societal, and economic areas can lead to improved gender equity in educational settings. Proponents of feminist pedagogies believe in changing traditional relationships between teachers and students. Classrooms should be a place of community building and cooperative learning, but each unique student voice, contribution, and personal experiences should be respected and valued.

Both constructivist learning theory and feminist pedagogy encourage sharing of knowledge between teachers and students, learner empowerment, collaborative learning, valuing of personal experiences and knowledge, and challenging of traditional societal ideals, theories, and positions (Webb, Walker, & Bollis, 2004). These theories were chosen as the theoretical framework to the study because I believe that a synthesis of the principles of each learning theory could offer a foundation for improved curricula in technology education and the STEM fields. The following section provides a discussion on how constructivist theory and feminist pedagogy can offer a basis for creation of a new academic framework.

#### Implications for Practice

Combining constructivist learning theory and feminist pedagogies to create a new framework for teaching technology education and STEM concepts was a major goal of this particular study. As noted in the literature review, these two theories share similar prescriptions for improved gender relations in academic settings. A combination of constructivist learning and feminist pedagogical theories could provide a foundation for

the design and construction of a new curricular paradigm that might attract more students, male and female, to technology education and the other STEM areas. Moreover, a contemporary framework could contribute to eradication of many of the existing barriers to female participation in technology education and the STEM fields.

In her 2002 study *Power, Voice and Democratization: Feminist Pedagogy and Assessment in CMC (Computer-Mediated Communications)*, Campbell reported that learning preferences among females included “learner centered approaches that place a high value on interaction...class discussion, cooperative learning, experiential learning, fieldwork, group projects, student-developed activities, and a broader range of evaluation techniques such as peer assessment” (p. 28). Before concrete projects and activities can be planned for a new approach to teaching technology education, traditional beliefs about current teacher/student relationships, classroom settings, learner expectations, and strategies for assessment must be challenged.

Campbell (2002) reported six concerns that she believed must be addressed before the creation of a new curricular framework can be undertaken. First, in a step Campbell (2002) refers to as necessary coercion, “learners must be encouraged to move from being dependent to independent learners” (p. 32). This task can be accomplished by valuing student input in class decisions, balancing power in classroom settings, and developing trusting relationships between teachers and students. In the second step, relocating authority in the classroom, “students must be encouraged to recognize authority within themselves and each other as well as accept legitimate self and peer assessment” (p. 32). As a result of this step, individual and group assessment standards can be negotiated

between teacher and students. The third step, challenging taken-for-granted assumptions in a new culture, proposes that “faculty members explore ways to balance power and allow their positions to evolve from teachers to facilitators while keeping their legitimate intellectual authority intact” (p. 33). The fourth issue, safety and assessment, advises that learners must be provided with a safe learning environment before they will feel comfortable with major changes in curriculum. The fifth issue proposed by Campbell (2002), evaluating process as a learning product, touches upon assessment and mastery of content through process. As defined by Campbell (2002), “process includes interpersonal and intrapersonal intelligence and the development of relationships that support and encourage the voice of others” (p. 35). As part of this step, students in Campbell’s study (2002) were encouraged to think creatively about process, value process over product, demonstrate mastery through self-designed projects and criteria, and use rubrics for assessment. Finally, in the sixth step, addressing equity in online assessment, although focused on online learning is relevant to curricular changes in face-to-face environments. This step assumes that learners come to classes with different social, cognitive, emotional, and professional levels which influence expectations for learning. Additionally, students bring different comfort levels and access to technologies that might be used in the course (p. 35).

Without addressing and implementing the six steps proposed by Campbell (2002), it would be difficult to implement changes in any educational field. Attention to these steps can provide an intellectual foundation on which to build concrete lessons, projects and activities in a new framework for technology education and the other STEM areas.

The challenge for instructional designers and educators might lie in examining their own values and methodologies while working to change traditional societal and institutional norms about authority and student-teacher relationships.

#### Recommendations for Further Research

This study was designed to discover barriers and solutions related to the issue of low female interest and enrollment in the technology education field. The findings and conclusions of the study presented several areas for further research.

Exploration in the area of development of a gender-equitable curriculum that will attract both males and females to technology education and the other STEM areas is one research possibility. Participants suggested that designing curriculum geared toward female students is not the solution, but rather creating curriculum that is of interest to both genders might attract more females to technology education and the other STEM areas.

- Research on the issue of low female enrollment in technology education at the middle and high school levels in different parts of the state or country is another possibility for further research. Cities or towns that are geographically close to industry might prove to have different approaches or emphases to technology education programs.
- A longitudinal study could be conducted that follows a group of female students from middle to high school to college in order to study what affects academic and career choices related to time and experiences.

- Research should be conducted on the effects of female versus male teachers on enrolling and retaining female students in technology education.
- Research should be conducted to examine the implications of starting technology education coursework at the elementary school level to see if exposing females to technology education at earlier ages influences interest and enrollment of females in technology education at higher grade levels.
- More qualitative studies similar to the current study should be conducted in the other STEM areas to see if solutions could be discovered that will help all STEM fields with improving female enrollment.
- The study should be replicated at the middle and high school levels so that solutions found in data collection could be implemented at lower grades.

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APPENDICES

Appendix A

IRB Review Board Application

IRB Review Board Approval Letter

Letter of Invitation to Potential Participants

**North Carolina State University  
Institutional Review Board for the Use of Human Subjects in Research  
SUBMISSION FOR NEW STUDIES**

Title of Project: ***Gender Equity Issues in Technology Education: A Qualitative Approach to Uncovering Barriers***

Principal Investigator Jennifer A. Lee Department MSTE

Source of Funding (**required** information): No funding required.  
*(if externally funded include sponsor name and university account number)*

Campus Address (Box Number) 7801

Email: jaleencsu@gmail.com Phone: 919-247-0577 Fax: 919-515-6892

RANK:  Faculty  
 Student:  Undergraduate;  Masters; or  PhD  Ed.D.  
 Other (specify): 3<sup>rd</sup> Year Teaching Assistant in Technology Education Department

*As the principal investigator, my signature testifies that I have read and understood the University Policy and Procedures for the Use of Human Subjects in Research. I assure the Committee that all procedures performed under this project will be conducted exactly as outlined in the Proposal Narrative and that any modification to this protocol will be submitted to the Committee in the form of an amendment for its approval prior to implementation.*

**Principal Investigator:**

Jennifer A. Lee  1-2-07  
 (typed/printed name) (signature) (date)

*As the faculty sponsor, my signature testifies that I have reviewed this application thoroughly and will oversee the research in its entirety. I hereby acknowledge my role as the **principal investigator of record**.*

**Faculty Sponsor:**

Dr. Ted Branoff  1-2-07  
 (typed/printed name) (signature) (date)

PLEASE COMPLETE IN DUPLICATE AND DELIVER, ALONG WITH A PROPOSAL NARRATIVE, TO:  
**Institutional Review Board, Box 7514, or email as an attachment to [debra\\_paxton@ncsu.edu](mailto:debra_paxton@ncsu.edu)**

\*\*\*\*\*  
 For SPARCS office use only

**Reviewer Decision** (Expedited or Exempt Review)  
 Exempt  Approved  Approved pending modifications  Table

Expedited Review Category:  1  2  3  4  5  6  7  8a  8b  8c  9

\_\_\_\_\_  
 Reviewer Name Signature Date

**For SPARCS office use only****Reviewer Decision (Expedited or Exempt Review)**

Exempt                       Approved             Approved pending modifications

Table

Expedited Review Category: 1 2 3 4 5 6 7 8a 8b 8c

9

\_\_\_\_\_  
Reviewer Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

North Carolina State University

Institutional Review Board for the Use of Human Subjects in Research

#### GUIDELINES FOR A PROPOSAL NARRATIVE

In your narrative, address each of the topics outlined below. Every application for IRB review must contain a proposal narrative, and failure to follow these directions will result in delays in reviewing/processing the protocol.

##### A. INTRODUCTION

Briefly describe in lay language the purpose of the proposed research and why it is important. The study will examine factors that influenced female choices during their middle and high school technology education experiences and continue to influence their choices on the university level. Many females are successful in and enjoy their required

middle school TED classes, but choose not to continue in TED classes when they go on to high school and college. What happens between the middle and high school experiences that causes female enrollment in the North Carolina Technology Education program to drop from 21,261 females to 2,919 females during the 2003-2004 school year for example? How can we, as a society, help to break down the barriers females face and attract more to the field on academic as well as professional levels?

If student research, indicate whether for a course, thesis, dissertation, or independent research. This research is for my doctoral dissertation research.

#### B. SUBJECT POPULATION

1. How many subjects will be involved in the research? Approximately 18 students: three focus groups comprised of 5 to 6 participants
2. Describe how subjects will be recruited. Please provide the IRB with any recruitment materials that will be used. Participants will be recruited from the Technology Education Program and Graphic Communications courses at North Carolina State University. Non-technology education majors will be recruited from the 19 sections of the spring 2007 Graphic Communications courses that we offer in the Math, Science, and Technology Education Department. GC 120 is a general education class, so majors from all over the university take it, bringing many majors into our department.
3. List specific eligibility requirements for subjects (or describe screening procedures), including those criteria that would exclude otherwise acceptable subjects. Six participants must be females that are majoring in technology education. Six participants must be females that are not technology education majors. Six participants must be males

that are technology education majors. Participants that are not technology education majors will be screened by asking if they went to middle school in North Carolina. If they did not, they will be asked if the state they went to high school had required middle school classes in technology education in their state or if they took elective technology education classes in middle school. If they answered yes to either of these two questions, they can be in the focus group. If not, they cannot be in the focus group as they will have not have had exposure to technology education classes.

4. Explain any sampling procedure that might exclude specific populations. Males in the Graphic Communications major will be omitted from the study.

5. Disclose any relationship between researcher and subjects - such as, teacher/student; employer/employee. None

6. Check any vulnerable populations included in study:  
minors (under age 18) - if so, have you included a line on the consent form for the parent/guardian signature

Fetuses

pregnant women

persons with mental, psychiatric or emotional disabilities

persons with physical disabilities

economically or educationally disadvantaged

prisoners

elderly

students from a class taught by principal investigator

other vulnerable population.

If any of the above are used, state the necessity for doing so. Please indicate the approximate age range of the minors to be involved.

### C. PROCEDURES TO BE FOLLOWED

1. In lay language, describe completely all procedures to be followed during the course of the experimentation. Provide sufficient detail so that the Committee is able to assess potential risks to human subjects. Research will be conducted with three focus groups. All participants will be in one of three focus groups: one group of six females enrolled in TED classes, one group of six females not enrolled in TED classes, and one group of six males enrolled in TED classes. Each focus group will meet during a time that works with each participant's schedule. The researcher will provide lunch or some type of other incentive for the participants during the meeting time. Each group will be asked a set of questions relevant to the research questions. These questions are attached to this IRB. One-on-one interviews after completion of all focus group interviews are possible if the interviewer feels it is necessary to speak further with one or more of the focus group participants. These interviews will last approximately 20 to 30 minutes. At the beginning of each focus group and/or interview, the researcher will explain to the participants that all conversation within the context of the focus group meeting must be kept confidential and that no participant should tell anyone outside their particular group the names of the participants in that group.
2. How much time will be required of each subject? Approximately 40 to 60 minutes will be required for each focus group meeting in which all subjects will participate. If a

follow-up interview with a participant is needed for clarification of information previously stated in the focus groups, another 20-30 minutes of participant time will be necessary.

#### D. POTENTIAL RISKS

1. State the potential risks (physical, psychological, financial, social, legal or other) connected with the proposed procedures and explain the steps taken to minimize these risks. There are no risks involved with this research.

Will there be a request for information which subjects might consider to be personal or sensitive (e.g. private behavior, economic status, sexual issues, religious beliefs, or other matters that if made public might impair their self-esteem or reputation or could reasonably place the subjects at risk of criminal or civil liability)? There could possibly be discussion about sensitive issues (private behavior, feelings/thoughts on gender discrimination issues) that come up in the course of the conversation that feels uncomfortable to some of the participants. Although the questions for the focus groups are not designed to bring up uncomfortable topics, due to the basis of the research, some participants might offer information that could possibly make others in the group a little uneasy.

If yes, please describe and explain the steps taken to minimize these risks. When I begin the group discussions, I will tell the participants to keep their answers appropriate. In other words, they should be respectful to one another. While I do not want them to self-censor, I also want them to be courteous to each other during the discussion. If something

comes up during the conversation, I will remind them of this “rule.” If the participant continues to be disrespectful, I will ask him/her to leave the group.

Could any of the study procedures produce stress or anxiety, or be considered offensive, threatening, or degrading? If yes, please describe why they are important and what arrangements have been made for handling an emotional reaction from the subject. I don’t think there will be any problems with this, but the same answer as #2 would apply if such an issue should arise.

How will data be recorded and stored? The focus groups and the follow-up interviews will be recorded using a video camera and a digital voice recorder. I believe that if I do not use a video camera as well as voice recording, I will miss out on a great deal of information. This age group uses a great deal of body language, facial expressions, and gestures along with verbal communication, and I want to make sure that I get every nuance of the participants’ opinions.

How will identifiers be used in study notes and other materials? There will be no identifiers used in the notes as the entire process will be confidential. Pseudonyms will be used when referring to people and places.

How will reports will be written, in aggregate terms, or will individual responses be described? Individual responses will be recorded and taped in real time. Although the report will be written as a whole, some individual quotes may be cited. However, as I mentioned before, pseudonyms will be used to protect the identity of the participants.

5. If audio or videotaping is done how will the tapes be stored and how/when will the tapes be destroyed at the conclusion of the study. Data collected using video camera and

digital recorder will be transferred to my personal computer for transcription, and backed up to my personal hard drive. The data on the digital recorder will be erased, as will the data on the video tapes. I have a program that will erase the data from the tapes as it transfers it from the camera to the PC. Transcriptions, video on the PC, and any notes will be destroyed (shredded) when they are no longer needed for writing the dissertation. All data will be password protected.

6. Is there any deception of the human subjects involved in this study? If yes, please describe why it is necessary and describe the debriefing procedures that have been arranged. No, there is no deception.

#### E. POTENTIAL BENEFITS

This does not include any form of compensation for participation.

1. What, if any, direct benefit is to be gained by the subject? If no direct benefit is expected, but indirect benefit may be expected (knowledge may be gained that could help others), please explain. There will be no direct benefits to the participants, other than getting free lunch or some type of food or beverage from the researcher. Indirect benefits will be participation, a place to share concerns, and input on ways to make the Technology Education field more attractive to females. In that way, they will be a part of making their school, and society a better place for everyone.

#### COMPENSATION

1. Explain compensation provisions if the subject withdraws prior to completion of the study.

There will be no compensation given for participation in the study.

2. If class credit will be given, list the amount and alternative ways to earn the same amount of credit. N/A

#### **G. COLLABORATORS**

1. If you anticipate that additional investigators (other than those named on cover page) may be involved in this research, list them here indicating their institution, department and phone number. There will be an additional male involved with the research team. His role will be to facilitate the male focus group. At this time, however, we do not know exactly who this person will be. However, we do know that it will be one of my peers in the TED program here at NCSU.
2. Will anyone besides the PI or the research team have access to the data (including completed surveys) from the moment they are collected until they are destroyed? No one else will have access to the data.

#### **H. ADDITIONAL INFORMATION**

1. If a questionnaire, survey or interview instrument is to be used, attach a copy to this proposal. At the end of this application are the questions that I will use in the focus groups and the interviews as well a copy of the demographic survey that I will have each participant complete at the end of each focus group meeting.
2. Also included are copies of the informed consent form to this proposal and the letter explaining the study that will accompany the consent form.

Please provide any additional materials that may aid the IRB in making its decision.



North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina

**Office of Research  
and Graduate Studies**

**NC STATE UNIVERSITY**

Sponsored Programs and  
Regulatory Compliance  
Campus Box 7514  
1 Leazar Hall  
Raleigh, NC 27695-7514

919.515.7200  
919.515.7721 (fax)

From: Debra A. Paxton, IRB Administrator  
North Carolina State University  
Institutional Review Board

Date: October 16, 2007

Project Title: Gender Equity Issues in Technology Education: A Qualitative Approach to Uncovering Barriers

IRB#: 343-07-9

Dear Ms. Lee;

The project listed above has been reviewed in accordance with expedited review procedures under Addendum 46 FR8392 of 45 CFR 46 and is approved for one year from its date of review. **This protocol expires on February 10, 2008, and will need continuing review before that date.**

NOTE:

1. This board complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU the Assurance Number is: FWA00003429..
2. The IRB must be notified of any changes that are made to this study.
3. Your approval for this study lasts for one year from the review date. If your study extends beyond that time, including data analysis, you must obtain continuing review from the IRB.

Please provide a copy of this letter to your faculty sponsor. Thank you.

Sincerely,

Debra Paxton  
NCSU IRB

North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina.

Department of Mathematics,  
Science and Technology  
Education

**NC STATE UNIVERSITY**

January 1, 2007

College of Education  
Campus Box 7801  
Raleigh, NC 27695-7801

919.515.1061 (tel)  
919-515.6892 (fax)

Dear Students,

Hello, my name is Jenny Lee and I am a 3<sup>rd</sup> year doctoral student and teaching assistant in the Math, Science, and Technology Education Department at North Carolina State University. I am interested in conducting research concerning the issue of low enrollment of females in technology education programs.

My specific research questions include:

1. Why are there so few females in technology education programs?
2. Do barriers exist that discourage females from enrolling in technology education programs?
3. How can females be encouraged by their community (parents, teachers, advisors) to enroll in technology education programs?

Research has shown that simply collecting written information through surveys and questionnaires do not reveal the complete picture of how participants feel about an issue. Therefore, I have chosen to conduct focus group interviews to collect the data for my study. Groups will be made up of female students with experience in technology education, female students without experience in technology education, and male students with experience in technology education. Additionally, I will conduct one-on-one, follow-up interviews with some of the participants after the focus group data has been collected.

After carefully examining the list of majors in the Technology Education and Graphic Communications Departments at North Carolina State University, I chose your name as a possible participant for one of my focus groups and possible follow-up interviews. Please see the attached *North Carolina State University Informed Consent Form for Research* for details on the data collection process.

I would very much appreciate your input about this important issue in Technology Education and related fields. If you could meet with me and a group of your peers next semester for one focus group meeting over dinner that I provide and possible a follow-up one-on-one interview, please sign the attached consent form and either mail it to me in the stamped envelope provided, or place it in my box in Poe Hall, Suite 502. Exact meeting times will be scheduled at a later date once all participants have been chosen.

This is a great opportunity for your thoughts and suggestions to be heard. I would appreciate your participation. If you have any questions, please do not hesitate to call me at 919-247-0577 or email me at jaleencsu@gmail.com.

Sincerely,

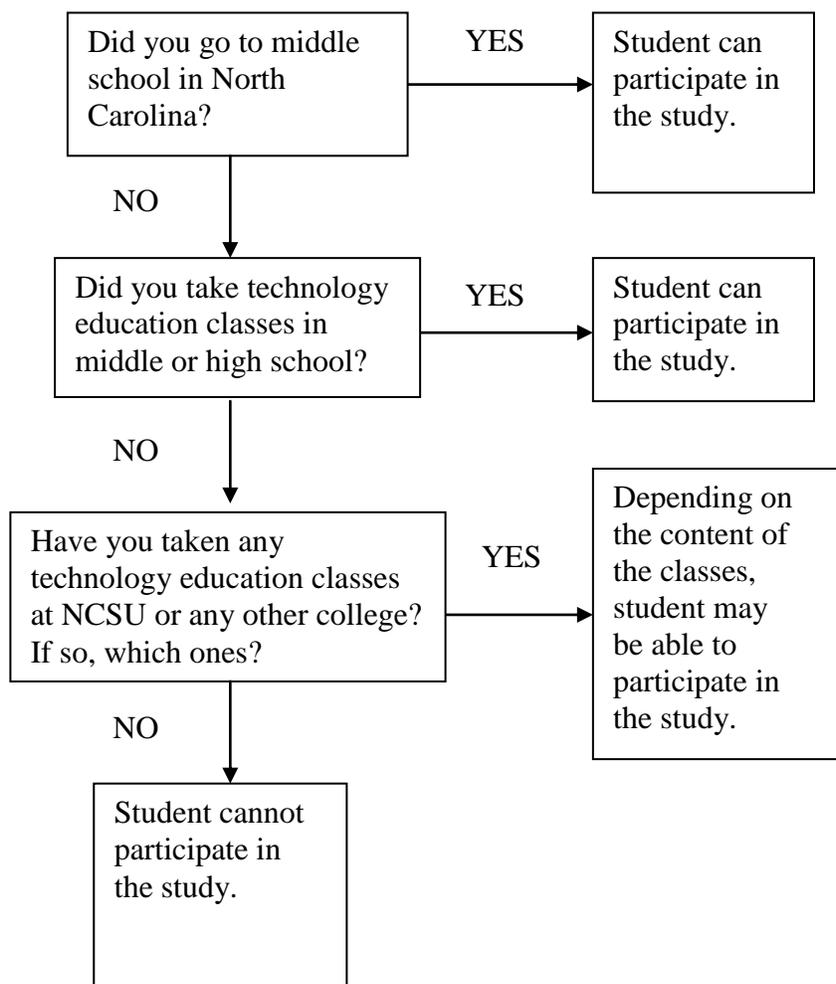
Jenny Lee  
Doctoral Candidate/Teaching Assistant  
Technology Education Department  
North Carolina State University

Appendix B

Flow Chart Used for Participant Screening

Letter of Information to Non-Technology Education Participants

## Flow Chart Used for Participant Screening



April 23, 2007

To study participants who are not technology education majors,

I hope this information will help you when you come to your focus group meeting to discuss the issue of low female enrollment in technology and technology-related careers such as engineering, the sciences, and mathematics. Since you are all from departments outside of mathematics, science, and technology education, you may not know exactly what comprises technology education. Therefore, I want to give you some information about technology education before I ask you a bunch of questions.

In the technology education department, we define technology education as a program that helps students develop an appreciation and basic understanding of technology through the study and application of materials, tools, processes, inventions, structures and artifacts of the past and present. Technology may be defined as how people change their natural world to make their lives better (Technology for All Americans, 1996). Many people think the only focus of our department is computer technology, but actually, we look at new and emerging technologies in many fields including construction, transportation, manufacturing, communications, biotechnology, agriculture and biomedical. We also study the impacts of technological advances on the environment and humankind and whether those advances will have positive or negative effects.

You were chosen because, at some point in your academic career, you were exposed to technology education in some way. It may have been middle school, high school, or college. During that time, you made a conscious decision not to pursue a future in or take more classes in technology education. I would like to hear why you decided not to pursue classes and/or careers in technology education. What were the things that kept

you from taking more technology education classes or veering away from technology and technology-related fields as a career choice? Stereotypes? Peer or parent pressure? Didn't know the program existed? Not interested?

These are some things to ponder until I see all of you in your groups this week. Don't be scared or worried that you don't have answers. If you don't have an answer to a question, well, frankly, that gives me answers! I will see you all soon, and, once again, thanks for participating in my dissertation studies.

Sincerely,

Jenny Lee

Appendix C

Demographics Survey

Focus Group Questionnaire

Pre-College Technology Education Coursework Completed by Participants

## Demographics Survey (Based on Haynie, 1999)

Gender: \_\_\_\_\_ Current class: Fr. So. Jr. Sr.

Age: \_\_\_\_\_ Major: \_\_\_\_\_

Father's Occupation: \_\_\_\_\_ Mother's Occupation: \_\_\_\_\_

Siblings: Brothers # \_\_\_\_\_ Ages: \_\_\_\_\_ Sisters # \_\_\_\_\_

Ages: \_\_\_\_\_

Where is your hometown? (State and county)

\_\_\_\_\_

Are you currently taking any technology education classes? If so, which ones?

\_\_\_\_\_

Have you ever taken any technology education classes at [name of university omitted]? If so, which ones?

\_\_\_\_\_

What technology education classes did you take in high school?

\_\_\_\_\_

What technology education classes did you take in middle

school? \_\_\_\_\_

Do you plan to take any technology education classes in the future? If so, which ones?

\_\_\_\_\_

### **Focus Group Guiding Questions**

Female and Male Technology Education Majors

Note. Not necessarily asked in the same order in each group.

Why did you enter technology education? How did it become an interest for you?

Have you previously taken TED classes in middle or high school? If so, which ones?

What do you like the most/least about being involved in TED?

Are you comfortable with females being in TED classes? Do you think your peers (other females) are comfortable in TED classes?

Are you involved in TED outside of your classes? (Technology Education Collegiate Association, or any other or activities?)

Do you think females are treated differently in TED classes? If so, by whom?

Do you think females that take TED classes versus females who are not in TED are treated differently by other students in your school?

Do you think the field of technology education is a field for both male and female students? Why or why not?

Do the female/male students in technology education make you feel uncomfortable?

Do you think that the female students in you technology education classes feel comfortable in those classes?

Do you think female students have adequate skills to be in technology education classes?

How do you feel about female students being in technology education classes? Do you like having them in those classes or would you prefer that your technology education classes be all males? (Note. This question for male TED major participants only.)

Do you think male and female students treat each other respectfully in technology education classes?

Do you think technology education teachers treat male and female students equally and fairly?

Do you usually choose males or females to be in your groups when you are doing group projects in technology education classes? Why or why not?

Do you think there are specific barriers that keep females and women from pursuing careers in technology-related fields? If so, what are they?

How do you think the field of Technology Education could be changed to make it more attractive to females and women?

### **Female Non-Technology Education Majors**

Given that you have taken or are taking a Graphics Communications class and are somewhat familiar with the Technology Education Department and classes, would you ever consider taking a Technology Education class? Why or why not?

What do you think about females being involved in Technology Education? Should females be involved in TED? Why or why not? Explain your reasoning.

What do you think are some of the reasons why females and women might choose not to take Technology Education classes or pursue careers in TED-related fields?

Based on your experiences, how do you think the field of technology education could change to make it more attractive to females and women?

Answers Given Per Level	# of Female TED Participants	# of Male TED Participants	# of Female Non-TED Participants
<b>Middle School</b>			
Basic Computer	1	0	0
Wood Shop	2	0	0
Exploring Technology Systems	1	1	1
Not Offered	0	2	0
None	3	3	6
No Answer	0	1	0
<b>High School</b>			
Drafting	3	1	1
Computer Engineering Technology	0	0	1
AutoCAD	1	0	0
Basic Computer	0	0	0
Java I	0	0	1
Foundations of TED	0	2	0
Structural Technology	0	1	0
Communications Technology	0	1	0
Automotive Technology I & II	0	0	1
Ind. Study	0	1	0
Not Offered	0	2	1
None	4	0	4

Pre- College Technology Education Coursework Completed by Participants  
Note. N=20

Appendix D

Focus Group Discussion Transcripts

Complete Transcript from Focus Group Discussions

**Female Technology Education Majors**

**FPQ1: Why did you enter technology education? How did it become an interest for you?**

**FP1:** I started off as a psychology major because I wanted to work with kids and then I decided that kids don't go see psychologists, they talk to their teachers. I heard a speaker talk about Tech. Ed. and liked what he had to say, and that was it. I decided to come here.

**FP2:** I wanted to do art therapy with children who have physical and mental handicaps, I figured there were a lot of technologies involved with helping [them]. I guess it's just blending the technology and art aspect[s].

**FP3:** I started out as an [agricultural engineering] major. It was a phase which has now passed. Then I failed out of engineering and a friend told me to take your wood shop class because it's fun. I knew it would be something I would be interested in.

**Researcher:** Do you see some of the technologies as art forms?

**FP2:** Yes, definitely. It depends. I feel like something like AutoCAD isn't a piece of fine art, but I think it definitely has a creative aspect, especially in [professor name omitted] and [professor name omitted] classes. [Professor name omitted] class is where we get to make all the buttons and T-shirts and stuff. It's not like being a professional artist, but we've got a little bit of it.

**FP4:** I've always been in drafting. I started in high school and I started off in Engineering but when I took GC 120, I found out that there was a major that did the same stuff that

we did in high school and that just changed my mind and I thought “That’s where I’m going.”

**FP5:** I took drafting in high school and I enjoyed that. I didn’t have a portfolio to get into the design school and I actually worked here [at the university] and one of my friends that I worked with knew about TED and he told me about it. He told me about the different aspects of it and at that point I think there was just a GC minor so I applied for TED and I’ve been in TED full-term. I’ve been in and out of [the program] for 10 years.

**FPQ2: Have you previously taken technology education classes in middle or high school?**

Only two of the participants had previously taken technology education classes in middle and high school. Classes the participants had taken included drafting, bridge making, and “computer simulation.” One of these two participants reported that she had an “engineering course” in middle school. Although there was a woods lab at her high school, she was focused on computer testing and Global Positioning System (GPS) programming, not hands-on project building. The other participant who had technology classes in middle and high school reported that these classes were only in drafting. The following figure shows the number of classes each participant had in middle and high school.

**FP5:** I changed my mind a couple of times over the past ten years. At one point, I was going to go into radiology and I thought about nuclear science but other than that it’s been TED and then reintroduced myself to the program when I became more interested in it in the last three years when I became more serious about getting my degree. I guess it

would be about eleven years total.

**FP6:** Actually, I did a class that counts in 7<sup>th</sup> and 8<sup>th</sup> grade we did kind of an engineering course. I don't remember the program we used but we got to build bridges and stuff on the computer and it would do simulations to test for what we designed and stuff like that. We had wood shop and I was in a computer class that did a lot with GPS (Global positioning systems) programming. That's when I started doing computer stuff I guess. I don't know. I guess it was a different opportunity I got to take and I think I'm going with it.

**FPQ3: What do you like the most and least about being involved in Technology Education?**

**FP1:** I like the hands-on the most. You can hold it.

**FP3:** I like working in the metal shop the best. I found it really satisfying like, 'I made something and its cool.'

**FP1:** You can hold it.

**FP2:** Yeah, I love having a tangible product. I can take it to my parents and say, "Look what I made!"

**FP3:** People who'd come with me to class, like both my little sisters have come with me because these classes are more fun, instead of going to Psychology or Biology or some class where they just sit.

**FP1:** I would have to say the least about the program at this school.

**FP4:** I remember in [name of class omitted] I was going around a station and we didn't have something as simple as a light bulb so I couldn't complete whatever I was supposed

to do in the process.

**FP1:** What bothers me most is that that is not surprising.

**Researcher:** What about the new class [name omitted]? It fills up really quickly. Isn't that class interesting?

**FP2 and FP4:** No.

**FP4:** It's a requirement.

**FP2:** That's why I took it.

**FP3:** I liked it.

**FP4:** I didn't like it because I was the only person in both sections in the class that was stuck by themselves on the rotations and [the subject] already doesn't appeal to me, so, I was totally confused the whole time I was doing the rotations. I guess I was by myself because somebody added the class late or something.

**FP5:** The courses that we are required to take are only offered every other fall or every other spring which makes them hard to take, especially in my case where it's a non-traditional student it makes it hard to take these classes by the outline.

**FP6:** I have to take an extra semester just because I can't fit all the classes in at one semester. It will work out for me eventually; but, I mean, I can't take all the classes I want to take just one semester. I have to take it when they offer it.

**FP5:** Also, if you don't have the prerequisites by the time it's offered, then you have to wait another year, and that can be frustrating. One thing I do like, in GC particularly is that we are introduced to a diverse curriculum. We do have the metals, and the woods that we get to use and I like that knowledge.

**FP6:** It's kind of cool.

**FP5:** Then we go from graphic design to AutoCAD® to SolidWorks® then we've got these robotics. It's not my favorite [robotics], but I am used to it.

**FP6:** Most jobs require AutoCAD® and SolidWorks® and I keep saying, "Gosh, I need to get back to AutoCAD® and [get] familiar with all that."

**Researcher:** Anything else about what you like the most and the least in TED and GC?

**FP6:** Group projects. I hate group projects. They haven't been terrible, but when you get in a group that. I've been having big problems with groups in my GC 450 class because half the guys, two of them are group leaders, one of them doesn't even come to class and he doesn't tell us why he isn't coming. There is no attendance policy. I have emailed and talked with the professor a few times in class, but he hasn't done anything. And I'm like, "Okay, I'm getting really frustrated," because I feel like I should have stepped up and said, "Hey I'll be a leader" because I'm not trying to be conceited or anything, but I'm pretty good at organizing stuff and I thought that we could have a sense of organizing and time-tables and there just isn't any of that kind of stuff going on. We are just now starting [the project] and it is due Wednesday.

**Researcher:** This is something I read in the literature. Do the men expect the women to do all the work?

**FP6:** I don't know but I got assigned a really easy part. They [male students] took apart our hedge trimmer. I didn't even touch it.

**FP5:** I have a perfect example for that. Me and [name omitted] and [name omitted] were in the same group the whole time. Well, the two first structures that we built, I helped

them build the walls. I left for a minute to get paper and I came back and they had put the other two walls on backwards. They depend on us because they think, “Oh, the women are smarter.” It could be to a fault. For instance, when I wrote the papers and delegated what they needed to do and what needed to get done, the whole project was done. The third project we had to do which was build and emergency shelter, I said, “Let me build the shelter” because I wanted to use my sewing machine on it. They didn’t do any of their part and I had trouble working. I told them, “You take care of this, and you write the papers, and you do the CAD drawing,” and they turned it all in late and now I’m like, “It’s better when you build it and I write the paper, so I’ll write the paper and you guys build it.”

**FP6:** I hate that [but] that’s always how it is and it’s probably going to end up that way.

**FP5:** We get stuck with all the secretary stuff and they get to do all the hands-on stuff. It’s not fair to us because I love playing with stuff.

**FP6:** But then if you take a stand, then nothing gets done.

**FP5:** That’s how it was with our first project. I was a huge part of it, but when I left them, they did it wrong. Then the second one I just wasn’t into it, I was so terrible, but I told them what to do. Then the third one, I did the project and they didn’t do their part at all. This time, they are like, “Oh yeah, we are going to do it,” and they are taking care of everything and I’m like, “All right, men.” We see a difference in our robotics group.

**FP6:** Oh yeah, that’s on their terms. They have jumped all over building it and putting it together, doing the programming, the SolidWorks® and stuff like that.

**FP5:** But what’s going to happen when it comes time to do the paper? Who’s going to

write it? We are. They will not touch it, I bet you.

**FP5:** They rely a lot on our opinions when it comes to what the ideas are. Some of them do. There is one guy, he doesn't care what I say, but I still interject because. They always assume that you will take care of the secretary part and that you've already got all your work taken care of and everything is beautiful. When you do try to do it, for instance that very project, if you try to take care of the "male" typical part, why they do not. Here's another example. Yesterday, when I was trying to work on my solid modeling part, my partner had stepped away. He was doing most of it, and I was just like, "well, we need to keep going," and I'm pretty good at SolidWorks®. I just started putting some parts on the model and he came back and started looking at it and said, "What did you do?" like completely freaking out about it, like I had messed up the whole thing and I'm like "I did exactly what I would have done if I tried working on in myself, I could have completed it." He deleted everything I did and put it back the way it was before he left. I was like, "Fine, I will go work on something else."

**FPQ4: Are you comfortable as females being in Technology Education classes? Do you think your peers (female classmates) are comfortable in Technology Education classes?**

**FP5:** I would say I am pretty comfortable just because I started off with pretty good confidence. Even when I was in high school, I always ended up being the person that they guys came to for help, so, I ended up tutoring other people as we go through the class so that we kind of, not necessarily become friends, but I'm the person they come to when they need help. I am stuck with this thing for helping, but I don't just find myself in the

corner sitting behind my computer or anything. I am pretty involved with the class. I get to know people a little bit. Being the only girl in the class, I can't say because there is always at least one other girl in my class. In the beginning, I didn't talk much with the girls. I made better friends with the guys than I did with the girls. I know that might sound a little odd.

**FP6:** When I was in your [referring to researcher] class last semester and that girl switched sections over to my section, I was so surprised why she switched over. I was the only girl in that class before she came and she was the only girl in the other TED 110 [section]. I told her she better get used to being the only girl in her classes. She palled around with me and she told me that some of the guys did make her feel like she wasn't smart enough.

**FP5:** I mean, they kind of intimidate you if you let them. It takes a while to adjust to but once you do it, they are perfectly fine.

**FP6:** I haven't had any problems, but, you know, I don't know if it's because I am older, or if I've worked in male-dominated fields, or anything. I'm used to that. I am used to having a lot of men around. I do see the buddy system and I do see the guys going to each other and talking and even in our group projects, you have to interject yourself. You have to be a little more forceful to get your opinion across.

**FP5:** You've got to be one of them. You have to use reverse psychology that says that you have to act like a guy to fit in to get your voice heard.

**FP6:** I just know that it's going to be a male-dominated field and if I want my voice to be heard, I have to make it heard. I'm not going to be part of it, because I'm not a guy. If

you are shy or passive, like [name omitted]. She got frustrated that the guys would treat her like she didn't know anything or that some of them would come up to her and try to start helping her when she hadn't even begun to use a piece of machinery or something like that. She would get frustrated and I'm like, "Well, you don't [know how to use the machines]."

**FP5:** I used to be very shy. My personality was very. I didn't talk much to people. I didn't really speak out if I was asked for an opinion in a group setting or anything. Sometimes I am still like that; but, I had to learn being one of the only girls in the class that that was the only way I could ever get help or help other people was just to get involved and not isolate myself. I hate being by myself. I learn to adjust to it and it doesn't bother me too much anymore.

**FP1:** There was one time when I wasn't comfortable.

**FP2:** Like the first day you walked into your first class?

**FP1:** No, it was that time in.

**FP2:** [Professor's name omitted] class? Yeah, [the professor] makes a big deal out of it. If he wouldn't make a big deal out of it, it wouldn't be a big deal.

**FP1:** A male student implied that a woman's place was in the kitchen. Whether he meant it or not, he corrected himself right then and there. He looked at me and [another female student] and said, "I'm sorry. I didn't mean it. I am building this thing for my mom and that's what I meant." And we were like, "All right." But [the professor] made a huge deal out of it. For like fifteen minutes, he was like how you shouldn't down talk to women and it put all of us on the spot.

**FP2:** I think I got up and left actually. I felt really uncomfortable.

**FP1:** I did, too, actually.

**Researcher:** He made it seem like such a big deal that it made it worse?

**FP1:** Yep.

**FP3:** Sometimes there's, like, it's really not discrimination like I don't belong here, but when I walk into class it's like, 'Okay, I'm the only girl again.'

**FP2:** But it's [the department] pretty small now, too, so you get to know the guys in your classes pretty well. Like the first semester that you are in it you are like, "Oh no, what's up? I'm the only girl."

**FP1:** I remember my first class. I had her [points to researcher], so I was all right.

**FP3:** I feel like I walk into class and it's like, "Okay," especially because I'm in a couple of different levels of classes, so, it's not always the same people and the first couple of days it's like, "I can't do this. I really don't belong here." [Name of professor omitted] has jumped on people. I was in a class or somewhere. He was in the lab that I was in or something. One of those boys said something stupid and I think they were kidding because I don't remember being that upset about it at all, or not even laughing it off knowing that he really meant it. [The professor] is like, "You do not say that about women. Women do well in TED. Blah, blah, blah." He was jumping all over this guy, but where it's appreciated like, "Thank you so much coming to my aid if I'm carrying a heavy thing I also appreciate that, so please, carry this big heavy thing." It was just excessive. If I had a problem with that, if I was really struggling with being the only woman in here, then this isn't the program for me. If I was looking for reasons to be

offended.

**FP1:** I agree with that big time.

**FPQ5: Do you think females are treated differently in Technology Education classes? By the teachers? By the males?**

**FP2:** I think it depends on whose classroom you are in. Sometimes I appreciate it, if it's something I can't figure out.

**FP5:** I remember one teacher specifically saying out loud that the girls were smarter. He said is straight out loud, "Remember, when you are picking your groups, girls are smarter." I have called one male teacher out on calling every person in the class, male or female, "ladies." I am like, "What does that mean? What does that mean?"

**FP6:** [Name omitted] calls us "ladies and germs" all the time. We [females] always get the higher end.

**FP5:** He has a thing about women in TED. He always comes up to us and asks us if we were offended by something and he will apologize even if we weren't offended.

**FP4:** I really don't talk to the guys. I only talk to the ones that make the first move or I need help or something. I say, "Hey, can you help me? Hey, how are you doing?"

**FP1:** Yeah, I never talk to the guys in my classes until they talk to me.

**FP3:** Yeah, I mean, like it helped. [Name omitted] is my friend now. We spend a lot of time together. It helped that I knew somebody that knew a lot of people down here. Some people have filtered into your class, like [name omitted] and [name omitted]. I know them very well. It's not usually a problem but I do feel like I would rather be friendly than, "I don't want to talk to the people." It makes life easier if there's more people to

study with or. Now it doesn't really matter. But as far as teachers, the only example I can think of is [name of class omitted]. I was the only girl. My class had football players.

**FP1:** That's one thing I don't like is all the football players.

**FP3:** So, I walked in and [the professor] must have been a few minutes late and I walk in and [name omitted] has the baby from the emerging technologies lab. I don't know why that thing is down there. I think that might be on my list of dislikes is having that almost conceived woman model. So, I walk in and everyone stops, "Oh, there's a girl in this class." I'm like, "Okay, that's cool." Anyway, [name omitted] [has] this thing and they've been throwing the baby around. So I come in and I start looking around and everyone starts looking at me and somebody yells, "You want it?" and I'm like, "No" and they chuck it across the room. Then, somebody in that class, some people had had [this professor] [before] and some people hadn't. So, one of them starts cussing like a sailor about something. [The professor] gave out the syllabus and I guess that's why they were cussing. There was a lot of work on it or something. Anyway, it's the f-bomb all over the place and [the professor] is like, "You do not talk like that in front of women." I looked up at the guy like, "What are you doing?" I looked up like, "You don't talk like that in front of me period." If they talk like that when I am not in the room, that's okay, too. I don't particularly like the f-bomb and I prefer it's not used and if he can talk like that in front of the rest of the guys, and whatever.

**FP2:** I was raised in a really southern family and my dad wouldn't use language like that around me. But we have in our house screened in doors and my brothers would be out on

the porch talking to my dad and if he was raised like that, I can understand that, I mean, that's how I was raised.

**FP3:** I wasn't offended and throwing the baby, I'd appreciate being included in the class baby throw, although I appreciate the symbolic gesture or whatever. They hold the doors open and I really appreciate that. I have seen them do it for [female name omitted].

**FP1:** Yeah, they always do it for me, too.

**FP2:** But when [professor name omitted] calls everyone in the class "ladies," it got to me the first couple times. I was offended, but I just got over it. He's going to do it and he's not going to stop.

**FP3:** He also tells me that women are failures. He perpetuates, you know. I mean it's kind of funny because people in that class, people that it referred to as "ladies" are people that aren't some sort of man so "ladies" is a better name for them.

**FPQ6:** Do you think females that take Technology Education classes and females who are not in Technology Education are treated differently by other students in the school?

**FP1:** I'm [student teaching] in middle school and [they are] in middle school, I would say, watching them.

**Researcher:** Is there a stereotype or stigma?

**FP1:** I think there [was] even when I was in school. I had a lot of problems in high school. I was the only woman in auto body for ten years and it was my sister before that. But I think there is [a stigma] and then if you're going to teach, they [female students] are going to gravitate to you. They've really grabbed on to me, the girls have.

**FP4:** I think the stereotype [was that it was] not cool or something because I did the same thing. I didn't take those classes, like woodshop and all that stuff until I got to college. I really didn't take them because none of my friends were taking them and the girls that were taking them were not interesting. I wasn't trying to down anybody, but it was [mostly] guys. And in high school they did encourage guys to [take Technology Education classes]. I like to draw and stuff and they were like, "No, you can't take it."

**FP1:** I took auto mechanics and drafting in high school.

**FP3:** People ask me to fix things. They ask me to fix vacuum cleaners. I don't know the first thing about vacuum cleaners.

**FP5:** I remember one teacher specifically saying out loud that the girls were smarter. I was happy with that. He said it straight out loud, "Remember, when you are picking your groups, girls are smarter." I have called one male teacher out on calling every person in the class, male or female "ladies." I am like, "What does that mean? What does that mean?"

**FP6:** [Professor's name omitted] calls us "ladies and germs" all the time. We [females] always get the higher end.

**FP5:** He has a thing about women in TED. He always comes up to us and asks us if we were offended by something and he will apologize even if we weren't offended.

[Addressing the males part of the question] You are the only female in there so you are different. But, the only thing that I can think of is when we are trying to work in groups and they kind of buddy off a little bit and you just have to protect yourself. But other than that I don't think I am treated any differently. I mean they always presume that I know,

that I'm smart or.

**FP6:** Not bad enough to make you want to get up and take off. I mean there are different people. Even guys treat guys [differently] for different reasons.

**Researcher:** Do you feel like you have to be "one of the guys" sometimes?

**FP5:** Sometimes except when you actually dress like a girl. They actually start talking to you and I hate that. It hasn't happened in the classes that you've been in. Or if I wear a low cut shirt or short skirt like I am wearing now, they notice it. You've never noticed that?

**FP6:** I've never noticed it!

**FP5:** They treat us like "ladies" I guess.

**FPQ7: Do you feel you have adequate skills to be in technology education classes?**

**FP1:** My dad was an industrial arts teacher. I worked for a construction company.

**FP2:** My dad owns a construction company and before that he owned a "Crazy Joe's." I have an older brother and a younger brother so it wasn't foreign to me.

**FP4:** It was foreign to me. When I took your class [TED 110: Materials Processing], I felt like I was on equal ground as everybody. I felt pretty equal, but when I took other classes, I really felt lost, even when we [were] working as a group. I tried to put ideas out. That's the only thing I felt [I could contribute].

**FP3:** I guess I feel like I have the skills now. I think I would have been really stuck if I had walked in on another, like the way that our project team has been in [name of class omitted]. We're using wood. I haven't spent much time in the [name of lab omitted] because I am in the [wood] shop all the time using the stuff. So, if that was my

introduction to Technology Education classes instead of your shop class, I would have been stuck. But, your class did me some good. I don't know what that big shiny thing that we use is, but I can learn. So, I think the only experience I've ever had [before] was in a class at the Craft's Center with a bunch of old men. I feel like I have adequate skills.

**Researcher:** What would you do if you didn't know how to do something in a Technology Education class and the teacher wasn't available?

**FP2:** I know everyone in all my classes now, so I would just [ask] whoever is closest to me. I'd say, "I need help."

**FP1:** Me, too.

**FP3:** [I would] make sure they are knowledgeable.

**FP4:** I would pick a person that I felt comfortable with like maybe a female because I am more comfortable with the girls in my class. I would go to somebody and ask them if they couldn't do anything [to help me], then I would ask that guy over there.

**FP2:** When I had [TED 110] with [professor's name omitted], I would ask you [the researcher] all that stuff. If I had a question, I would ask you because I see you as someone who understands everything really well. I feel like you do know a lot of stuff so I feel comfortable with you.

**FPQ8: Do you feel that there are specific barriers that keep females from pursuing careers in Technology Education and technology-related fields?**

**FP2:** I think there is just a stigma, historically, that it's all men, no women. I feel like now it's a novelty as soon as they see a female teaching. It's a whole entire group of men.

They don't want women coming in and changing everything, sexual harassment. There have been so many men forever that they don't feel like they need to worry about that.

**FP2:** There's a difference between a class of all men and a class with men and women.

**FP4:** I think they think they are all comfortable.

**FP1:** I don't think it's uncomfortable.

**FP2:** But they have to watch their language and they can't just fart and stuff. They can't just relax. I didn't know it would be all men.

**FP1:** I don't know if it's that because I still experience all that.

**Researcher:** Yeah, but you have middle schoolers.

**FP1:** But even in college, I still experience all that.

**FP2:** I didn't know it was going to be all men.

**FP4:** I thought going into Graphic Communications, it was going to be a whole bunch of girls. That's what I thought, just girls.

**Researcher:** Maybe that's because it is a part of the Technology Education program.

**FP4:** If I knew, I wouldn't be in this department.

**FP3:** Social stereotypes [say] girls can sit more easily. They can sit at a desk for long periods of time. Like all of us as older women can sit in a chair, and nobody is fidgeting around. Nobody's had this compulsive need to stand up and run around, but males, everyone's taught they need hands-on things and so then they are pushed into more hands-on [programs] whereas I should be able to sit and write poetry and so it's I have to be "utsey-cutesy" all the time. So, even teaching TED, it's not an "utsey" field. When you take these general education classes that have Science majors and History majors, it's

like we talk about feelings all the time. It's revolutionary because we don't do it. I mean, TED isn't an "utsey" field. I work with my tools and my robots.

**FP1:** I like that.

**FP3:** I do, too. So, especially if we are teachers, we teach elementary school and we teach English because you can talk about feelings and experiences and it's more challenging to integrate those into the content area of Technology Education and get that done in Tech. ed.

**FPQ9:** How do you feel about working in groups with male students in Technology Education classes? Do you think male students pick female students to be in their groups? How does it feel to be a female student with a bunch of male students in Technology Education?

**FP2:** I don't think it works well.

**FP1:** In grade school and high school I would agree with that statement, but I think it's even worse here [at the college level]. I pick groups [based] on personality. If I'm not going to get along with you, it doesn't matter if you are male or female, I'm just not going to get along with you.

**FP2:** We were doing groups in [name of class omitted] and I would never be in a group with [names omitted]. All the people in his group are like that. Well, not all of them. He is a nice enough guy, but he doesn't do any work. I mean all those guys.

**FP4:** He comes to our class from [another Technology Education class] and gets [name omitted] and says, "Oh, are you coming with me?"

**FP2:** Those kind of students in general, who don't have a good work ethic, and the fact that they are male, I guess...

**Researcher:** They were really good in my class, but I noticed that once they hit [teacher name omitted] class...

**FP1:** It was all over.

**FP2:** This might be a stupid observation, too, and I might be a sorority girl, but in our robotics class, [name omitted] started sitting with me where the class is U-shaped. I sat in the very front and [name omitted] sat in the back of the class. When [name omitted] started sitting with me, he would bring his work to class and do his work, but when he sat with [name omitted], he didn't. If it seems like I am basing [name omitted], I'm not. It's people similar to that that have that kind of work ethic and that kind of issues in the classroom.

**FP1:** See, I with all the seniors now, so we don't have issues. We're in the mile stretch and we've all been with each other for a long time.

**FP2:** I guess I am, too. I am really serious about school. I want to make a 4.0 and people that don't care about good grades and stuff...

**Researcher:** I just brought the issue of groups up because other girls have mentioned that boys pick girls for their groups and the boys do all the fun stuff while the girls do all the work.

**FP3:** I don't really agree with that, but I just jump in and, sometimes it drives me crazy because it's like I am in charge again. Everyone looks at me like [name of class omitted] is amazing because [name of male student omitted] is in charge. He is in charge.

Everyone reports to [same student] and everything gets done, and it's not me. I don't necessarily agree with that comment because I would rather jump in and get my hands dirty.

**FP1:** I know women who are.

**FP4:** I think everyone ought to do their own part. Sometimes, I really don't know how to work some of the tools, but not all of them.

**FPQ10: How do you think the field of Technology Education could be changes to make it more attractive to females?**

**FP2:** I don't think it's necessarily that a change needs to happen.

**FP1:** I think so, too.

**FP4:** I think we need to get the word out. I don't think a lot of people here know about Technology Education. They know about education but not Technology Education.

**Researcher:** How would you get the word out?

**FP4:** I guess T-shirts. I went to an event at Harris Field, behind the management building. They were giving out a bunch of stuff about the management department, giving tours and they had games so you could win T-shirts and stuff.

**FP2:** This isn't like a teaching school either. Like in North Carolina, you know that if you are going to be a teacher, you go to Appalachian. You can go other places, too, but if you want to be a teacher, go to Appalachian. So, I feel like a lot of people don't know about [our college] and our program.

**FP4:** Organizations, like a little group.

**FP3:** It would be good if there could be a group like this that could be

involved because we are involved in TED and it could be a group that would support women. Not that I feel like I need extra support, but that would be available to feel like you are doing something worthwhile and important. Maybe if TED put advertisements around the school. We've got a shadow box for TED. There needs, it sounds silly, but there needs to be more pictures of women involved because it's hard to change when there aren't any pictures of women. Just to kind of, if it was advertised as more women focused. And maybe even potential TED teachers, they should it to you or to someone else because if [name omitted] was the first contact I had with TED.

**FP2:** I would have gone to Psychology or transferred.

**FP3:** I think he means well, but he would've probably said something about how women do so well. I suddenly feel like I'm a test rabbit or something.

**FP4:** I would have gone to Communications.

**FP6:** The only thing I can think of is that women are intimidate by it being a male-dominated thing. Girls always go into Psychology areas or something more intellectual. Guys always get into more computer, hands-on stuff, I guess. I don't know. I started off in engineering so that's the only thing that scared me going into the area, but when, and I don't know if it's a buddy system thing, but I feel more comfortable if I found another girl that was in there with me because at least you are like, "Well, at least I am not the only freak in here." It's just the way my brain works that it's maybe different from other girls. It's a comfort thing, that maybe if you show that more girls are there, it might make them more comfortable with coming to the major.

**Researcher:** How do you think it became male-dominated to begin with?

**FP5:** I would say it's the ending line of work that you get from Technology Education. The only reason why I didn't go into TED was because when I was first introduced to it, it was shop. You had to be a shop teacher and I was like, "I don't want to be a shop teacher and work with wood or engines. I want to do something more artistic" and that may be the way it is advertised per se. I don't know if all women feel that way but I assume they do because we only have, what, eleven women in the program?

**FP6:** When I was in middle school, I wanted to take wood shop but it just wasn't done. Girls didn't just sign up for that class so I never signed up for it. I mean, I don't know if that would have changed anything but...

**FP5:** Women tend to stay away from math and even though this degree program is not heavy in math at all.

**FP6:** We don't have any math at all really. We have like two small math requirements.

**FP5:** I don't feel like I am comfortable with math or any related field and maybe women perceive that this is a higher math related field. I wanted to take that electronics class over the summer and the first thing I did was email [name omitted] and ask him how much math concentration was in it and he said it was really not, that it was a way to explain math. Well, I'm taking it because I am interested in electronics but if he had told me that it had a high math concentration, I wouldn't have taken it.

**FP6:** Math doesn't scare me I guess.

**FP5:** It scares me initially. I will do it if I have to.

**FP6:** If it has to do with calculus or physics, see that's what actually took me out of engineering is because I actually failed Physics and I got a D the first time I took calculus

so.

**FP5:** The main thing is that in elementary school I was very good in math, but the fear came from somewhere. I don't know if it is because I haven't touched it in a long time or what. I think this is a very interesting program. I think that the average program is what is the problem. How do they get all the women into summer school? Do they have a lot of women in summer school? How many are there that could be over here?

**FP6:** I found out about this program because I talked to [name omitted] about it. I talked to my GC 120 teacher to begin with and he told me about the GC major and that sparked my interest in that and then I started talking to the Industrial Engineer department head and the Civil Engineer department head and I would love to do some hands-on activities and he said, "We don't do any," so I thought, "Well maybe this isn't where I am supposed to be." Then, I really wanted to be in the design school but I didn't have a portfolio and I didn't have anything to show them; but, I could do this stuff and this program was a loophole I found where I could do this stuff without being in the design school.

**FP5:** I took drafting in high school and I was the only girl in there.

**FP6:** I was, too. No one told me about this stuff. I asked my teachers in high school if they had majors for this stuff and no one knew it even existed.

**FP5:** Female shop teachers as role models!

### **Male Technology Education Majors**

**MQ1: Why did you enter technology education? How did it become an interest for you?** **MP1:** My freshman year I was in the FYC (First Year College Program) which

was for people that were in an undecided major and part of the FYC [is an] assignment to look at all the curriculums, like five or six different majors. I was in the curriculum of TED when I saw that you could take woodworking classes, metal working classes, construction technology and those were all things I was real interested in and that's the reason why. Because of the curriculum of the classes that are available, I made that decision my freshman year.

**MP2:** I started out in engineering, but ended up getting deployed three times in the military. So, when I came back, calculus was foreign to me. I took everything that I have always liked doing engineering wise and I especially like working with my hands, then went to find a curriculum that I would really like and it just happened to be Technology Education.

**MP3:** I was talking to an electrical engineer and he was telling me about the easy courses and the easy majors here; and he kept making fun of one major, TED. He said all they did was take field trips and work in a shop. So, I figured that had to be better than what I was in because I was about to quit college anyway because I didn't like mechanical [engineering], so I switched over. It's what I've been doing my whole life so it worked out.

**MP4:** When I was in the Marine Corps I was a machinist so I worked on machines for other marines. When I got out of the marines I didn't know what I wanted to do. Did I want to go to college? So, I thought I wanted to be a teacher, but I didn't know what I wanted to teach so I looked at the college of education here and with a machinist background it seemed to fit me real well so I decided to go that route.

**MP5:** I started off in Material Science Engineering and got talking to people in the field and they said take TED 115 (Woods Processing) and I loved it, so, I come over here and started this program and everything's cool.

**MP6:** I did two and a half years of Mechanical Engineering and I hated it, and I heard that if you didn't like Engineering, all that engineering stuff, go to the hands-on part which is Tech. Ed. I been tutoring since I was twelve for other things so education seemed like a fine choice, so I came over here.

**MP7:** My sophomore year in Engineering I was getting very tired of engineering. About that time I prayed that if God, I am a Christian, wanted me to do something other than engineering he would have to show what that thing was. About that time, I learned about GC and Tech Ed. I also prayed that if I was to get out of Engineering, that I would have to be dragged out of it kicking and screaming, since I have a hard time quitting anything. About that time my reasonably good grades in Engineering dropped due to bad scheduling [and] partially due to a new student advisor. In addition, I have always been mechanically inclined, but not mathematically inclined. Tech. Ed. fits my skill set.

**MQ2: What do you like the most and least about being involved in technology education?**

**MP3:** The part I most enjoyed about TED was my sophomore year, the year I took wood processing and metals; and, the open door policy, if you have taken that class and passed that class, you are allowed to go into the shop later on or during other classes and if you have your own kind of self project, you can kind of pace yourself. I guess my favorite part would be that room right there [gestures to shop] of Technology Education. Oh, and

I like how it's small. It's a really small major [and] we are all friends with each other. That's totally nice. Most majors you only know your advisors and your teachers or you are known by a number.

**MP4:** I think one of the things that I dislike about TED is its funding. If you look at most of our equipment it is like WWII surplus or something. It's hard, especially if you really want to make something nice like that Noguchi table [I made in TED 115]. It was supposed to be a certain dimension, but by the time I used the planer and the router, it was a totally different dimension before I got it right. So that's one thing I would love to fix is to update our equipment because it is very old. That's frustrating.

**MP3:** Can I have a restatement of the question? (Interviewer restates the question.) Oh, I like making jigs. It's something I enjoy. I don't know why. I just enjoy seeing if I can make something [that] makes something [else]. I don't want to actually finish it. I just want to make the jig. The thing I like least about TED is probably just what [name omitted] said, the tools. Uh, you can't make things without the tools that you need.

**MP5:** That's all you can do.

**MP3:** Exactly, that's why I had to make jigs because we had bad tools.

**MP4:** From a [student] teacher's aspect, I like TED because for me it's a way to teach. It's a way to get students excited about other subjects that they are learning through the projects that we do and that we go out and teach in the schools. That's why I think it's really cool. I think it's a very practical approach and a very progressive approach to education. I like working in a shop. I always liked the Industrial Arts program when I was in high school way back in the day. We didn't have TED, so this program is new to me. I

think one of the best things this program offers is a way to learn other core subjects that are being taught in high schools through doing projects that involved working with types of tools, fashioning stuff, and building stuff. Learning that [way] is more well rounded. I also like the fact that it is a little bit smaller, a little bit of a closer knit family here. Things I don't like about TED: I guess there's a little bit of lack of diversity. If there was a little bit more diversity it would probably be better. I love TED. It's hard for me to come up with something I don't like; but, if there had to be one thing [lack of diversity] would probably be it.

**MP5:** Uh, there [are] a lot of things I like about Tech. Ed. I like how we're small. I like being hands-on and everything. It's all the stuff I grew up with anyway on the farm. If I had to say one thing that I didn't like, it's the fact that a lot of the class stuff we've been learning is not really taught out in the field. So, [students] are already getting out way behind it feels like. So, that probably is the thing I dislike most about TED that what we are working with and what we are learning is way out dated. I'd like to see some new stuff come in.

**MP2:** Did you have the new "Emerging Issues" class?

**MP5:** No, it came after I went through already.

**MP2:** Oh, really?

**MP5:** Yeah.

**MP2:** I just took it last semester and it was fun and had new stuff.

**MP6:** Like [name omitted] said, I like having the shops over there we can use. I love the small classes and knowing everybody so well. When you start your class every semester,

you have the same people you know already. It's a comfort thing. I like that it's hands-on and its fun stuff. Even with the projects, it's usually some sort of fun going on with instruction or something. I dislike machines that can't cut a straight line if your life depended on it. And, uh, I think our curriculum [has] changed four times since I've been in the program and I've only been in for three years. Our [curriculum] is dated already that we have learned and they are changing the curriculum in the public schools to where what we've learned is not even applicable in some situations.

**MP7:** I do like the sense of community within the department. I do not like the lack of rigor in many of the content classes. There should be a reason for coming to class other than the attendance policy. Also, I do not like direction away from the traditional shop setting that Tech. Ed. is taking. I believe it waters the subject matter to the point it is no longer useful fun, and in some cases, correct.

**MQ3: Are you comfortable with having females in technology education classes? Do you think your peers are comfortable with having females in their classes?**

**MP1:** Yes, I am comfortable with girls being in TED class. It's not an issue at all. Do I think everybody else is comfortable as well? Yeah, I think so. I don't think it's too much of an issue. Actually I don't think it is an issue at all.

**MP2:** I think for me, even when I went to high school, I took the AG (academically gifted) classes. [Students that took] vocational classes were kind of thought of as a different kind of person. [They] were kind of like a second class citizen. I think maybe that is, in a lot of ways, what forces women to not take it. I mean even though I know a lot of them do, especially in racing, they are interested in it, but none of them have taken

any classes like that. I don't have any problem with it.

**MP3:** Yeah, I think on the tail of what [name omitted] said, people would consider TED not like Science, Math, Social Studies, and so a lot of people don't even look into it. A lot of guys like working with their hands because that is something they've done from early on. A lot of females may not be introduced to that. I am fine with females in the program. I enjoy it so I am fine with whoever.

**MP2:** It adds a whole new aspect.

**MP4:** That would end a burden. That was one of the things that I disliked about it. So I definitely wouldn't have a problem with females in TED. I am student teaching and see girls in the classroom and what's really cool for me to see is that they are on projects that they are building. Most of the females in my class are getting better grades on the projects than most of the guys in the class, which is pretty cool I think, so I think they are getting involved.

**MP5:** Yeah, I am good with having more girls in the program and everything. I kind of enjoy having them around in class and stuff to give a different perspective on projects and assignments and stuff and, um, I think all of us would like to see some more women in classes.

**MP6:** I have no problem with females in TED. I try and encourage my students to stay in the TED classes in school because in my 6th through 8th grade [classes], I see a severe drop off from 20% to 0% [female participation]. I don't think it's a class problem. I think it's [due to] a stereotype that people are trying not to fall into which is causing more stereotypes.

**MP7:** From a student perspective, I really could care less, though female classmates are better to look at than male classmates. I think us fellows are sometimes too comfortable in TED classes. From the [student] teacher perspective, I don't mind either way what my class makeup is although I can be much more transparent with my male students when I don't have to worry about saying something to offend a female.

**MQ4: Do you think females are treated differently in technology education classes?**

**MP1:** I don't think so, not in my experience.

**MP2:** Unfortunately, I'd have to say yes and it's not a bad thing. It's like almost you can't help it. It's like having a diamond in the rough or something new. It is a rarity anymore. So, even though you try to be fair, sometimes you kind of catch yourself allowing a little bit more here and there. I do it in my student teaching now and I try to be fair across the board; but, you just have to try to limit your way like I don't look at papers now when I grade them. I don't look at the name. I just grade it as it is; but, yeah, it does happen.

**MP3:** I used to see females being treated differently in the lab setting and what not; but now that I have started with student teaching, I see that now a lot of girls understand a lot better the concepts that we are going over, the more abstract concepts, the 3-D perspectives and what-not that the guys don't understand. I end up having to spend a lot more time with some of the guys explaining to them what the concepts are.

**MP4:** Yeah, the uh, I think teachers...I think society has changed to where that is not even an issue anymore. I think its normal [that] women are working with guys at various work places in society. That is an issue that is slowly going away, but yet, it still exists, sure. There are some teachers out there, but I think it's isolated, I don't think it's a wide

spread thing. I think it's getting better to where women are being treated on the same level as the men.

**MP5:** I would have to say that it depends on the class and the generation that the professor or instructor or teacher came from because it is improving, the treatment of girls in the program, as we progress; but, then, depending on where that particular teacher was at in their program it would affect how much extra help or leniency or whatever [female students] get in the class. I would have to say, yes, there are still some differences, but I have to agree with [name omitted] that it is improving, at least upon my inspection.

**MP6:** Yes and no. I'd say there is a difference, but I don't think people do it consciously. Um, when you are in a class full of guys, the class behaves differently than when you throw a female or two or ten in the mix, so the atmosphere changes even if you never notice the difference. It still happens. I don't think it's a good or bad thing. I think it is just a fact that's not really easily controlled. I know like with us the more we get to know the females in the program, the more we act ourselves. I guess that's the best way to put it. So, I would say yes there are some differences in how the females are treated in the program, but I don't think it's a conscious thing, I don't think we are treating them differently than we would treat anyone else.

**MP7:** Yes, we are all socialized to treat females differently than males. Females treat males differently than other females. That is natural order of things.

**MQ5: Do you think females who take technology education classes and females who do not take technology education classes are treated differently by students outside**

**of the major?**

**MP1:** Yes. I think so, definitely. The answer is yes but I am trying to think of an example. Everybody is treated differently. I mean people get treated differently depending on what school they go to. If you go to [our university], you are a much different person in general than if you go to like a real liberal arts type of school and Tech. Ed. classes are typically hands-on. You are definitely a different type of person; you know what saw dust smells like. You know what grease is as opposed to a person who can read a seven hundred page book in a few nights. I can't myself read a book in two nights, so you are treated differently. I carry a pocket knife in my pocket. Other people might carry a bookmark.

**MP2:** I do hate the fact, but it does happen, like I do know some people, I mean, how many times have you heard it? Somebody's in Tech. Ed. and all of a sudden she's a dyke? I mean how many times do you hear that? It's a totally wrong stereotype, but it happens. That just goes along with and it's ridiculous. You just have to overcome it, but I do think that it sounds terrible.

**MP3:** I am going to need the question repeated. I'm ADD. (Interviewer repeats the question). No, not in my school, no. In my school, the core electives have just as many females as males from all different ranges of social order. You can just tell, I guess, by what social class they hang out with in the classroom. They take that course, its "Exploring Technology." It's not referred to on school as "shop class," so it's sort of referred to almost the same as any other course you might take like French or Spanish. It's not got a bad connotation or evil connotation to it.

**MP2:** Are you referring more to our student teaching or to our college classes?

**Interviewer:** I think it means the school that you teach at or work at.

**MP2:** Oh, okay.

**MP3:** It is kind of funny that I got the question right.

**MP4:** There are a lot more number of males in the class than there are females; but, at the same time, the females that are in the class they don't seem. I mean, I didn't observe any type of problems they would have than other students and they are, I mean, there are all different types. The social classes, or social groups, cliques, whatever you want to call it. There's various different girls from various different cliques and whatnot. You get a variety of girls in the class. It's not like you get a certain type of girl whether it be "Fundamentals of Technology" or "Manufacturing Systems." She's not the only type of girl. There's many different girls from many different high school groups that take the classes. So, I don't think there is too much of a problem in my school.

**MP5:** I think in my school I don't really notice that much of a difference with the way they are treated; but then again, our courses aren't really considered shop-based courses. We have "Principles of Technology." We have a lot of computer stuff and it's like physics, so they really take to physics and computers. They haven't gotten that much different treatment, but then again, our courses don't carry that connotation of the shop class so maybe it's just the perception.

**MP6:** In my classes my girls aren't treated any differently if they do or don't take the class. In my school, they can take the class up the six times in three years there which is retarded, but that's a different story. We won't go into that here. Um, but some people

they take it and they tell their friends. Well, mine's considered the "fun class" where you learn, but you get to do hands-on and it's not "shop." It's a lot of different, sort of hands-on activities, while they are learning and it's a little bit more of a relaxed atmosphere which I think they like. So, I don't think anyone gets treated differently whether or not they take the class.

**MP2:** Now that I know the question better, I'd like to go back and reiterate. With me, I am at a magnet middle school so they pipe in diversity as part of the magnet program. So [the] classes, they are not really in depth. I mean, we do a lot of hands-on projects, but they are not so much like here where they would need to be a shop person or something like that. So, no, I don't have an issue.

**MP7:** No.

**MQ6: Do you think there are specific barriers that keep females from pursuing careers in technology education or technology-related fields? If so, what are they?**

**MP1:** Yeah, um, I've taken some Psychology classes here, you know the kind where there is like one professor and about 500 students so you basically learn something about every other class? What I did learn is that, from a young age, typically girls are better at handwriting and arts and crafts, maybe not arts and crafts, maybe more artsy, vocal-oriented, English and the other type stuff; whereas guys are more hands-on and more hammer and nail type stuff. And that starts at a really young age is what I learned in one of my psychology classes, like one out of the ones I attended. But, it's one of those things that at an early age you just kind of learn that guys should be hands-on and more math and science-oriented and girls are typically for the most part more vocal-oriented. I guess

you could say and Tech. Ed. classes are obviously hands-on, build stuff, read instructions, take it apart, put it back together. So, I believe that it started at a young age, preschool, real young, and, um, probably some girls just have it in mind all the way up through sixth or seventh grade or high school years when they start deciding on classes.

**MP2:** I believe I was in the same class. I do think I remember I think it was called "Personality," but that is basically what happens. Girls wear pink. Boys wear blue. That kind of stuff. That's basically what it boils down to, but there has been a trend lately where more women are entering the science fields and stuff, science and math, which there was a huge divide. So, that's a good sign.

**MP3:** I am in agreement with what was said. I couldn't have said it any better.

**MP4:** I am in agreement, too. The only thing is if the girl is interested in technology [education], I don't think that there is. There is a little bit, but, I don't think there is too much that would stand in her way of pursuing that. Here we have women at the top of our field. I am sure they've hit some bumps along the way because they are female, okay, but it can be done. They have proven that, yet there are obstacles, there are obstacles of every type. There might be more for women, but, I think if it is something that they want to do, I think they can do it.

**MP5:** Um, I don't know if there is a specific barrier other than what you were talking about with the gender roles; but, typically, you think of what we call "Technology Education" as what we would call a "male profession;" but, then again, teaching throughout history would usually be a "female profession" so I don't know exactly where we fall in that mix there of putting the hands-on education; but, I don't know. I think

gender roles are becoming more blended in today's society. I think we are seeing that barrier dissipate substantially, so, I don't know really if there is a specific barrier other than the experience of society to give help.

**MP6:** I agree with them, but I'd say if you want a specific barrier, I'd say it's that the technology field is male-dominated and just like everything else, once something is dominated, it's hard for something else to break into it whether its females breaking into a male role or a male breaking into a female role. It's just not as accepted, therefore, people shy away from it; but I think the biggest barrier is that it is dominated by males so people look for other options.

**MP7:** Other than the issue of being the only girl in a room full of guys there are no barriers. However, that in itself is quite a barrier.

**MQ7: Do you think the field of technology education is a field for both male and female students? Why or why not?**

**MP1:** Yes, because if I said no it'd be a terrible answer. Absolutely, anyone can teach in technology education or a technology type field. It's not like. I'm just going to say yes.

**MP2:** Well, I'm not really going to get into the education part, but just for an example, um, I'm really meticulous and mechanically-minded, so, whenever I do a resume lately, I have everything listed out. Then, I turn it over to my aunt who is very artistic and, you know, she completely changes it. I get compliments in all the interviews, whereas, mine they would have probably looked at it and thought, "too plain Jane." So, there's different mindsets and it is great to have that diversity in the field, so that you can see different aspects of what's happening. That's what I would say.

**MP3:** My cooperating teacher is a female [and] I really like what she does. I like how she manages the class. Um, I don't think there is anything that I can do that she can't do better.

**MP4:** Um, I think it's for males and females both alike and I think the machines we have now a-days, can be operated the same no matter whatever you have or whatever you are. Going back again to my classroom, during student teaching, I have females that are outdoing the boys on some projects and, in some cases, all of the boys. It's just that there are more boys than girls. The boys outnumber the girls. If there were a 50/50 ratio, I guarantee it would be [all of the projects] which just proves it to me that it is something that can be done.

**MP5:** Yes, definitely. Um, the reason is because there is nothing that cannot be done just as good if not better by the females in the program.

**MP6:** Yes, I don't think there is a why or why not. I just think its yes.

**MP7:** Fundamentally it is; [the state department of public instruction] and other curriculum writing organizations have done a great job creating a course which is equally appealing to both sexes. However, after talking to several females about the subject, I have found that many females don't see the need to know why their car drives or how their cell phone works. Just so that the technologies continue to function properly and if they stop [working], they will just get a male to fix the problem.

**MQ8: Do the women in technology education classes make you feel uncomfortable?**

**MP1:** No.

**MP2:** No absolutely not.

**MP3:** It's just like any Math class I've ever taken or any other class. If there's a girl there, they don't make me feel uncomfortable.

**MP4:** Nope.

**MP5:** No.

**MP6:** No.

**MP7:** Nope.

**MQ9: Do you think females have adequate skills to be in technology education classes?**

**MP1:** Yes.

**MP2:** Yeah, I mean I hate the fact that [the researcher is] watching this because I don't like to blow smoke up her nose, but have you ever seen some of the stage stuff that she's built? Her pictures of [them are] really awesome. I think some of the stuff women build is just beautiful especially, and, uh, one good friend of mine is a female welder and she loves ink and all that other stuff but she can spin metal.

**MP3:** Yes. You don't remember the question do you?

**MP4:** Yes I do and the answer is yes.

**MP5:** Yes.

**MP6:** Yeah.

**MP7:** Yep.

**MQ10: How do you feel about female students being in technology education classes? Do you like having them in those classes or would you prefer that your technology education classes be all males?**

**MP1:** I think it would be great if the girls would be in the class. I think the only advantage to having an all male class is what I call the "locker room syndrome" because when there's no girls present you can say whatever you want. If there weren't any girls in the class, maybe I wouldn't even mind. It wouldn't be like, "Aw, man, we need some girls in the classroom." It'd be cool if it were all guys. That maybe came out wrong that I said it would be cool if it were all guys. I'm just gonna stop now.

**MP2:** Like I said, I prefer female students. It's interesting to have different views.

**MP3:** Of course.

**MP4:** Yes, no wait. Repeat the question. (Interviewer repeats the question.) No, I like having them in the classes. Like I said, diversity is a good thing.

**MP5:** Yeah, uh, I like having them around and stuff. Yep, they're good to have.

**MP6:** I wish we could get more girls in TED classes. That's not to say having all guys is bad. It's just that diversity is a good thing.

**MP7:** On one hand I love having them. I like girls! On the other hand, girls being around causes guys to compete for their attentions, so instead of forming a brotherhood, you form opponents. This competitive atmosphere is bad for development of boys into men.

**MQ11: Do you think that the female students in your technology education classes feel comfortable in those classes?**

**MP1:** Yes, I think all the girls are comfortable. I think it's just fine. Although I have heard from other girls that, like, from the student teaching experience that. Uh, I have two classes in which [there is] one girl student and about twenty guys, and, um, the girls have not told me this but I have heard from others that when it's one girl and twenty guys, the

girl feels uncomfortable.

**MP2:** When I started my [student] teaching, after we switched 9 weeks, I had a class full of twenty guys and one girl and, uh, she seemed uncomfortable. Actually, I approached her and said, "If you feel this uncomfortable, we can change your elective to a different elective." Right or wrong, I think it's good that she knows she has options, but again, I think sometimes you just got to ask them.

**MP3:** I think so, too. I've seen both ways. I've seen one girl in a class and she definitely did not feel awkward. She was one of the more rowdy people in the class, one of my most "problem children."

**MP4:** I, uh, I think it depends a lot on the teacher. I think it depends if the, um. I think there are situations where they can feel uncomfortable if they are being singled out. So, I, uh, but, you know, if the instructor treats them like they are all students and does not single them out, then they can be comfortable. I've heard that [it] does make them uncomfortable to be singled out.

**MP3:** Yes, yes, definitely. I know several instances of my couple years here where a female had been singled out in a manner of praise, but, the manner of praise didn't have the desired effect.

**MP2:** It puts emphasis on them being the single female in your class.

**MP3:** Yes, the token female.

**MP5:** I think it depends on the teacher and the student. Um, I know in one of my classes I teach, there's about one girl and about ten guys, She gives as good as she gets. I mean, they're always back and forth on each other, picking on each other and they get along

fine. But, I know in another one of my classes, there are four or five girls and about six or seven guys and they seem not quite at the same level as where the one girl [from the other class] is at. Like, it depends on where they're at in their mindset as well not just how the teacher treats them. As far as the student, I think it is a combination.

**MP6:** I think it depends on the class, the single or double student, and the teacher. Um, it was like they've said, I've seen situations where the single female is fine and some not at all; but, I think if the class has the "locker room syndrome" even though a female is present, it makes them feel extremely uncomfortable so that's where the teacher has to try and make it not as bad.

**MP2:** A level of professionalism...

**MP6:** Yeah, so it depends on a lot of different variables.

**MP7:** No, especially if they are in the minority or possibly the only female in a group of males

**MQ12: Do you think male and female students treat each other respectfully in technology education classes? What about compared to your other classes?**

**MP1:** Classes [here]? I think [they do] in TED classes here, especially these past years for us seniors. I think both genders respect each other very much and it might have to do more with TED at [our university] being such a small major, or the fact that we're friends with each other and everyone knows each other very well. So, I am sure, I'm positive that has something to do with it, so, um, and as for comparable to other classes, non-TED classes, um, well I've never been disrespected by a female. I guess I've never been disrespected by a female in a non-TED class [either], so I guess it's the same.

**MP2:** I think that's a lesson learned with humility in a lot of ways. A few summer sessions ago I had taken a class, a sociology class, and there were only three guys in a class full of twenty something women and the teacher had written several books about feminism. So, I've seen how that kind of reacts, you know, as far as being understanding [about] where they come from. So, I think once you see that, it opens your eye to it. I think that both males and females treat each other equally with respect to class, but not so much respect to projects. Typically, most males will plow right into a project and leave the female out or let her read the instructions. That's the biggest difference that I have seen.

**MP3:** I think in the Technology Education major, females are more equal to males, um, than they are in other classes. Um, in other classes there is the distinction between guys and girls. I think in TED classes, we've been stressed so much to have everything equal that it is a lot more equal. It's not, we don't see them as a female, we see them as a college student rather.

**MP4:** Yeah, the students, male or female, especially in our TED classes, I think females get respected by males and, if the student is deserving of respect, they get respect. We're in such a small community here in the TED classes, that, you know, I think it actually. I think you had said it that women kind of get not necessarily more respect but there is more of a family environment so, um, yes, I believe they treat each other respectfully. This has a lot to do with individual maturity. I believe people disrespect others all of the time in many situations. I do not think TED classes contribute to this behavior, and it would not be different in any other classes.

**MP3:** They're equal.

**MP4:** Yeah, they're like, they're treated as a fellow student; and, in a lot of my other classes, they are so big that there isn't really a lot socializing going on with other students. You know, you are in a big auditorium setting or you've never seen the other people before. There is really no need to socialize with them because you never see them anyway. Maybe the atmosphere that the teacher provides doesn't offer a lot of time to talk and what not. I think in our TED classes, more than any, it's easier for females to get respect.

**MP5:** Yeah, I definitely think we treat our women very well here in the TED department. I mean and really, they do us, too. It's just we all help each other out. We all work together and like they were saying, this is a small group; we know each other really well. But, um, we all really do look out for each other. It doesn't matter whether it's females or males or anything. There are really no differences.

**MP6:** I just want to point out that it's funny how you say, "We treat our women."

**MP5:** Well, I was just referring to the women in the department.

**MP6:** I know. We still take it as a protective role even.

**MP5:** Well, I just meant as a department, like the TED department, the women in there, not necessarily our women.

**MP6:** Right. It's just the way it sounded.

**MP5:** I guess I could have chosen a better word.

**MP6:** I'd say we treat each other as equals. I'd say there is not a difference at all.

**MP7:** Pretty much the same.

**MQ13: Do you think technology education teachers treat male and female students equally and fairly?**

**MP1:** Yes, I think students are treated equally.

**MP2:** Yes and no. We had issues with one teacher who liked to point out that this girl was the only female in the classroom; but, not in a cynical way. He just liked to give her more praise for being in the room, which singled her out and made her feel very uncomfortable

**MP5:** Yeah, pretty much. I think that we are all pretty equal in Tech. Ed. and from my observations in area high schools; I would say that the girls tend to get treated a little better than the guys if anything.

**MP6:** I do. I have heard of some preferential treatment, but never witnessed it. I believe that there is a push towards treating everyone fairly that may be singling people out.

**MQ14: Do you usually choose females to be in your groups when you do group projects in technology education classes? Why or why not?**

**MP1:** Male or female, I usually choose whoever I'm better friends with in the class. I have an equal number of guy and girl friends.

**MP2:** Some I would, and some I would not. It really depends on the character of the female. If I didn't know the female, or know of her well enough, then I honestly have to say I would choose an unknown male over an unknown female, just being honest. I would do it because I would feel that the male would put more effort and know more of design and mechanical things.

**MP4:** I try to choose the students that will carry their weight. [It] does not matter if [they

are] male or female.

**MP5:** Honestly, it depends on the project. Females tend to bring an extra bit of creativity that is great for most projects, but there are some things that guys seem to just understand easier. This rule isn't true of all guys or all girls. So, really it depends on the project and the girls in the class. But, I have no problems and have seen no problems with co-ed groups and, honestly, most of the time; I would rather be in a co-ed group for projects.

**MP6:** Yes. It can be difficult, though, when there are twelve people in a class and only two are female. I look for diversity in a group. Females, generally, have a different way of looking at things. Whether that is nature or nurture, I don't know. A different point of view is always good.

**MP7:** Yes, they are cute, and listen to directions much better than I do.

**MQ15: How do you think the field of technology education could be changed to make it more attractive to females and women?**

**MP1:** The field doesn't need to be changed. I enjoy the field. What needs to be changed is the psychological concept [that] girls are meant to work at home and wear pink, while guys go out and do "manly work."

**MP2:** Aesthetics play a major role in any aspect of life. If you present a house that is messy, people think you are a messy person. If you present a male dungeon of construction testosterone, then people will see that, too, and make choices accordingly. Make the program look organized and neat with projects that appeal to artists as much as constructionists and advertise what Technology Education is all about because most people do not know, even a principle that I talked to at the job fair.

**MP4:** This is a hard one. For some reason, TED attracts more males than females.

Perhaps it is due to the subject matter. I'm sure there are other majors or fields of study that are more attractive, too, and dominated by women due to subject matter. I do believe that the more we get away from [Vocational Education] and the Industrial Arts roots, and become more of courses that allows students to see practicality in what they are learning in their other classes such as Math, Science, English, Social Studies, then that will allow for more gender diversity. Perhaps we could work more with other departments that are dominated by women to get a fresh perspective on new projects. Maybe reach out to the arts community and incorporate some of their ideas in our curriculum's projects. What is good about TED is that is pretty flexible and we could use more ideas when it comes to projects rather than the old CO2 cars and balsa bridges, even though I do like these projects.

**MP5:** Don't really know, ask the women.

**MP6:** If there is an outreach program, then a female and male coordinator should be in charge and visible. At a much earlier time in school, females need to be convinced to look into the field and shown its benefits.

**MP7:** No explosions, loud noises, potentially dangerous projects. Instead of taking apart a two stroke engine, make a poster about how they work.

**Female Students Outside of the Technology Education Major**

**NTF1: Given that you have taken or are taking a graphics communications class and are somewhat familiar with the technology education department and classes, would you ever consider taking a technology education class? Why or why not?**

**NTF1:** I would probably consider taking another Graphics class. I'm actually considering a minor, because I'm in Aerospace [Engineering] and a lot of the things that I'm going to be dealing with I'm going to have to know how to look at them a different way and figure out different ideas for them; but, I just figured that would help me with my major.

**NTF3:** Okay, um, I don't think I will because I am a Physics and Math major and it's not going to help me at all. Pretty much the reason I took GC 120 is because I am trying to get into a field where there is a lot of experimental design and I want to be familiar with it; but, I kind of had problems in GC 120 because I am not mechanically minded.

Everything you do is [in GC 120 is based on] design of mechanical parts and I don't really care about mechanical parts at all.

Researcher: What if you could make the part? Would that change your mind?

**NTF3:** Drawing them on SolidWorks®, I don't know. I'm just not very artistically oriented.

**NTF2:** My answer is completely opposite of hers. I do enjoy it. I think it would make you a more valuable employee to have more graphic knowledge under your belt. In GC 120, we just got a basic knowledge of how to draw a few things and I like the creativity of it and if you are artistic, it's a lot of fun.

**NTF5:** After what I saw in your metalworking class, I would love to take something like that. I mean I always wanted to take shop class, but I had a full schedule so I never could fit it in, but I am going to look back and see if I can find something, if I can fit it in.

**NTF4:** I feel the same way. When I walked in, it reminded me of in middle school when I took a Tech. Ed. class, and I just really loved it. It was great. I had so much fun with it [that] I wanted to look it up and take some classes as well; but, like she said, our school was on a block schedule, so we could only take four classes a semester. Also, with Pathways, we had to take things that they considered more important like arts and musicals, theatricals.

**Researcher:** One of you mentioned you were interested in robots.

**NTF4:** I was involved in robotics my junior and senior year and that [the robotics shop at the college] reminded me a lot of what we did and I really enjoyed that.

Researcher: And that's how you knew it was Vex.

**NTF4:** Yeah, we had bigger ones, like four feet tall, but like them. We had other ones that were like Vex and we had Lego® League. The Lego® League was for elementary school. The Vex was for middle school and the big robotics were for high school. I went to a different university for three years and then I came here.

**NTF6:** I would. I did really like the GC 120 [and] SolidWorks®, so I think I would like to explore some more of those types of computer programs. Not like writing code, but more like creating something with it. I think it would be nice to have more information out there about what classes there are and how they could help you in your career. I've only known about GC 120 because it's part of my curriculum. Make it something more

[so] people see that it will be fun and also help them in their career.

**NTF7:** Yes, if it would benefit my major or minor. My major is Business Management and my minor are Art and Design, so probably classes in TED would relate to the art and design major which is why I originally took GC as an elective. So, yes, in that case, but if not, no I wouldn't given the time restrictions and our credit issues.

**Researcher:** When I teach the class, I assume that every person in the class has never touched a tool in their life.

**NTF7:** Which is good. I think a lot of educational classes, the learning, not the actual what you are doing, but the thought processes that helps you figure out what you're doing, not so much memorizing stuff. That's why application stuff like building and drawing something, is, I think, a way better than just memorizing a date to a history event or something like that.

**NTQ2: What do you think about females being involved in technology education? Should females be involved in technology education? Why or why not? Explain your reasoning.**

**NTF2:** I wish there were more of us in it because even though I've been used to having different majors with very few females in them, it would probably make me feel more comfortable to take more of the classes. It seems almost like it's an aggressive kind of competition between you and the guys, not really just peer against peer. With graphics itself, I kind of doubt that there is going to be that many more [females], at least in our day, maybe later on because it's so hostile right now, I think.

**Researcher:** Are you basing that on your class or your other experiences?

**NTF2:** A lot of other experiences. It's still not seen as a woman's place and I keep going back to my major; but, I have not met anyone else that's a woman in my major yet besides my counselor so.

**Researcher:** How long have you been in your major?

**NTF2:** I'm a freshman this year, but it's still kind of weird.

**Researcher:** Do you see any upper classmen that are women?

**NTF2:** No, I've seen men.

**NTF1:** You will.

**NTF2:** Really? Good!

**NTF1:** I know some women that are in Aeronautical Engineering.

**Researcher:** She's in Industrial Engineering and now you've met her and she's in engineering.

**NTF2:** I see more women in Biological and Chemical Engineering.

**NTF3:** I have the exact opposite experience of her [gestures to NTF2]. Being a Physics and Math major, it's like they are so welcoming to girls in that program. I get along with all my friends and all my friends are guys. And it's not even like, "Oh you're a girl, so you probably haven't done this yet" or "Oh, you really don't understand." It's, "Hey, you're a girl; you probably have done this already." [There is] a lot of respect, actually, for girls who are in the program because they feel like if girls are in this program, it's because they want to be. It's not because, "Oh its biology. A lot of people are in Biology. I'll just do this." It's because I deep down, I really like Physics, so I get a lot of respect. It's actually very, I wouldn't say its bias like sexual bias, but they definitely try to attract

more girls and you can definitely tell in my classes. My teachers, I'll go up and talk to them about a problem and they'll actually listen to me but if a guy comes up they are like, "Whatever, go talk to your friends. They probably already figured out this problem." [Then to me the teacher will say] "Oh, yeah, well if you want to go back to my office we'll talk about this and we'll work on this problem. I want to make sure you know this." They really want to make sure all the girls succeed. It's kind of weird because in high school, I was hearing stories about how Physics is very hostile to women, but I haven't experienced that at all. GC 120 is the only class I've taken in the Technology Education Department and in that class; it's kind of the same deal. I don't really get any problems from any of the guys in that class. The other girl in the class doesn't really get any problems from any of the guys in that class, either. I mean, everyone gets along with her and they will ask her for help, too, doing stuff. From my experience, it's exactly opposite from hers [gestures towards NTF2]. I'm sorry if that's rude.

**NTF2:** Mine was more vocational, an actual community college, where I had hostility. It was like one-on-one with a mechanic, you know? Car parts are sometimes made where it's easier for women to get to because we have smaller shoulders and all that. If you are very competitive, like you are trying to get their job, a lot of times for some reason. It was a small community, so, I think at first they were trying to see whether or not I was doing it to see guys or trying to be one of the guys. I don't know. Here they are pretty supportive with the occasional little [problem]. Once you get past the first barriers, you are alright, but it's still hard to get in.

**NTF1:** I have had a completely different experience than both of them have had. I

haven't really been in a vocational type field. I spent most of high school doing the Math and Science stuff, and Pre-Engineering. I went to Governor's School for Science and Math in South Carolina. I have had positive experiences. I've had experiences much like hers [gestures to NTF3]. They [male teachers] are welcoming. Sometimes you get extra attention, extra help. I think they like the diversity and wish they had more. I enjoy being in a class with a bunch of boys. I get along better with them.

**NTF2:** Yeah!

**NTF1:** I get along better with them [male students]. I think they are better workers. I haven't had any bad experiences in my department.

**NTF5:** Absolutely, because it gives them more of a range of ideas and they are more prone to logical thinking.

**NTF4:** It depends on the person, too. Some girls, it wouldn't be their kind of thing, but some girls might be in it because of the art thing. It just would depend on their personality, I guess.

**NTF5:** It's not really expected. Like, I wanted to take auto mechanics.

**NTF4:** I wanted to take that, too.

**NTF5:** We were never really told about it. I know they have the books you can read and everything, but they never really brought it out to you, gave you much option.

**NTF6:** I do think that females should be involved in TED. I think that it would be helpful society-wise if more women were involved. It would help with Technology Education if there were more helpful things for women. Also, when other women see that women are a part of it, then it will appeal to them. I think nothing should be judged for one sex over

the other, especially career-wise. Things are becoming more integrated as far as the sex of who is working [where]. But, I think that most things in life like this come from how you are raised, the way your mind works. I was the typical girl who played with Barbies® and dolls and there's not really any technology involved with those. Guys grow up with little Hot Wheels® cars, and even the little kid toys have little ramps that you take the cars up. Girls' toys don't seem to be like that, and I don't think it should change Barbie® [to be] technologically advanced or anything, but maybe turn more technological things into girls' toys. That would create more of that kind of mind to where it wouldn't be something so obscure. I don't really know how that would happen, but something more into toys, just little things [so] you grow up seeing technology within the more typical girl things. I think that's [why] TED has more males. They grow up with that their whole lives, like tires, and rockets, and helicopters and all that stuff.

**NTF7:** Yeah, I don't think it's any different than a male being involved. I think females have different interests, and maybe that's why there's not as much involvement as the males comparatively; but, I don't think it should be considered any differently. Maybe because of values in society or the way a female is looked at. That might hinder that a little bit, too.

Researcher: Like stereotypes?

**NTF7:** Stereotypes, definitely. When I started the GC [class], I was the only girl in there until another girl added or something. I felt kind of weird just because I didn't already know how to do something; but, I already felt labeled as "Oh, you don't know how to do that." Maybe it was all in my head but maybe it's not.

**Researcher:** Some girls have told me that teachers go so far overboard trying to make them feel comfortable that it ends up bringing too much attention to the lack of girls in the class.

**NTF7:** Yeah, I think that is a little bit what happens. I mean, I haven't ever felt uncomfortable; but, I would receive more help than a male if it came to an issue like learning SolidWorks® or something like that. It's not bad at all. Don't get me wrong, but I could see how it would carry over into other things that are more stereotypical [and] male-dominated than GC or TED.

**NTQ3: What do you think are some of the reasons why girls and women might choose not to take technology education classes or pursue careers in technology-related fields?**

**NTF1:** Stereotypes, peer pressure, doing a "man's job." In high school, it's not a popular thing to want to take drafting. It's all boys. You want to take clothing design with all your friends. I got a lot of pressure from my family, actually, to be a nurse or something along those lines, but I could never do it because I can't stand the site of blood.

**NTF3:** Yeah, I did, too.

**NTF2:** Mine, too.

**NTF1:** I always felt in high school that a lot of the Vocational [Educational students] on campus were slackers. I don't know. Not all of them were, but it was kind of generally seen as that and I was always afraid that I would get into that kind of reputation where I didn't really feel like working. I don't know. I was just afraid to get into that.

**NTF3:** My parents encouraged me more towards Engineering or something where I

could make a lot of money because they were afraid of me being able to support myself. Their reason immediately after I told them I wanted to be a “physicianator” was that “physicianators” are weird.

**NTF2:** I think the guidance counselors led us to believe that if you were taking Vocational or Tech. Ed. classes you were not going to get to go to college you were going to get a skill now and go straight into the work field. You weren’t going to go to a college or a university. That’s the track I was on was four year university, not a technology track or the other choices. I remember now.

Researcher asks the participants about the issue of stereotype of being considered a lesbian if you are interested in technology education or the vocational education field.

**NTF2:** I still have former customers come up to me at work; I work at Wal-Mart, and in front of people, they’ll ask me if I am a lesbian. I do, it’s just something that’s set in their head.

**Researcher:** Did you go to a vocational school around here?

**NTF2:** No, it was a dual enrollment. I was working a job and doing high school during the day and college at night. So, I took care of the college stuff at night. There were only five people in the class. I would have my customers bring their vehicles in the next morning where I work at Wal-Mart and asking me what was wrong with their car and “Oh, have you decided to like boys yet?” like I am part of all my customers.

Researcher: That’s so rude.

**NTF2:** Well, I mean, I can understand it because a lot of people, it was older people mainly, still have that stereotype that if you’re in mechanics or anything boyish, then

you're going to be either a tomboy or a lesbian.

Researcher asks the participants about the issue of girls not thinking technology education as a program available for or to them.

**NTF2:** People always, when they talk about anything to do with technology, graphics, [or] video games that was as much as I had heard anyone talk about it as far as career choices, like video games and graphics on the computer. They never applied it to anything else.

**NTF4:** I think I'd feel kind of out of place because there are so many guys in it and it's kind of expected that guys major in it, that you [females] just feel like an outsider.

**NTF5:** I like it some, but sometimes it feels uncomfortable. I'm basing this on GC 120 and my robotics stuff. It's just that there are so many guys in it and girls aren't really supposed to be in it, you know? It's like they belong there and we kind of don't. You have to put yourself in the mindset that you really aren't supposed to be there, that this isn't what you are really supposed to be doing, that you are supposed to be in the arts or taking care of children or something.

**NTF4:** It's a cultural handicap actually.

**NTF5:** My great-grandmother, [when she heard that] I was going to switch from Mechanical Engineering to Architecture, she was happy that I was getting out of Mechanics. She [said], "You know you have to be there for your family. You have obligations to take care of your family and have children" and all that kind of stuff. I agree, to some degree, that women should have kids and that they should have time for their kids; but, I think you can have a Technology degree and work in the Technologies

and still have kids and be a loving mother. It doesn't really matter that you are in Technology as opposed to the Arts.

**NTF4:** What she said about taking care of your kids, that was one of the things that I tried to consider toward the end of last semester. I was like, "When am I going to have time to have children?" Because I'd like to go work for [unintelligible] or work toward my Master's; but, those people work so many hours a week, they don't have a lot of time to themselves. They don't have a lot of time. That just kind of scared me because I don't have children; but, I want to have them. I thought about taking some time off, but that puts you at a disadvantage in your field because of the time you lose. That would scare me, but, like she said, it's still important.

**Researcher:** I have found that the guys treat me differently once they find out I drive a motorcycle.

**NTF5:** I used to ride motorcycles with my grandparents when I was younger. I told some of my guy friends that I wanted to get a motorcycle, and they were shocked that I was a woman and I wanted to get a motorcycle.

**Researcher:** Do you think it intimidates the men, having women in the classes?

**NTF5:** Maybe. We'll let you know soon!

**NTF4:** I think there is a stereotype that men aren't going to go into Technology anymore because of more women coming in, that men will go to the arts.

Researcher brings up the issue of wording in school catalogue as well as other barrier possibilities.

**NTF5:** My mother owned an art gallery. I've been around art galleries since I was six

years old so I have the Technology thing; but, I also have a great knowledge of Arts. She seems to think that she should tell me what I should be doing. In truth, I am in Art right now because I have this training in this art stuff. If it was up to her, I would be in Architecture or some other design field [that] would be [more] beneficial to me; but, I like how things work and I like making things and that may be a result of me framing for so long. She's not against it in any way, but she would love it if I went into an Arts-related field. My dad feels differently. He wants me to be a graphic designer because of my arts background, but I like technology. So, I want to find somewhere that I can put the art and technology together. My stepdad is a mechanical engineer. He owns a water jet company, so I will be working for him this summer.

**NTF4:** My father is in the military so he works all day long and then he goes to appointments. So, my mom taught us to be very independent. I mean, "You guys do it yourself. Take care of things you have to fix." She's been really encouraging. She's been 100% behind me, supports me for everything I need. My dad doesn't really understand it, I guess. I think he does more now than he did before, that I was actually going to come here to college and study. My mom didn't go to college.

**NTF5:** I've never had anybody be not outright supportive. All the guys in my family are really big on it; but, my mom and my dad divorced when I was four and she didn't get remarried until about five or six years ago. When her computer crashed, I'd be the one to fix it because she is so technologically challenged, so I don't understand why she is surprised that I am interested in technology, why she doesn't think that it's not the best thing for me. She's supportive like, "It's good that you're going to college and its good

that you are getting your degree,” but she just thinks that there is a better way. I think she is concerned that I won’t have time for art anymore, that I will be throwing it away.

**NTF6:** I think a lot of it has to do with the [existing] notion in everyone that it’s pretty much a typical male major or male career. I’m in Engineering and it’s very difficult if a girl decides to make the choice to be an engineer. They know it’s one of the hardest things they could have chosen. There are not very many girls in [Engineering] classes and if you haven’t grown up being a stereotypical engineer, then it’s hard for you to find people that are like you. I think for girls, technology and that kind of thing might turn them off because it’s not going to be the easiest road for them. It may not be the most fun thing knowing that your classes are going to be predominantly male, that it might not be easy for you to find a study partner, knowing that getting into the career will be awfully difficult unless the company you are going for is looking for the minority. Finding connections, I think it’s a lot easier for males when they are in a predominantly male field to get connections with other employers because they will know more people and their dad does it and their dad’s friend does it. Another thing is you have your English requirement and your History requirement. Now, they are making people have computer proficiency. I think, maybe, if there was something in the Technology Education department that would be a pretty vital thing to real life, maybe there would more than one class, maybe two that were requirements. Then, everyone [would have] to take them and girls could see more [easily] what it’s about and that [female students] do enjoy it. That would get the rate up, maybe.

**Researcher:** What would you think about an all girl technology class?

**NTF6:** That would be good. Maybe more girls would sign up for it; but, I don't think that would solve the problem because having singled them out in order to get them there is such a problem in itself. So, I guess over time that could work because more girls would take the class initially and find out they like it and want to go ahead and pursue it regardless of the struggles they will have to deal with; but, I think it would be a long-term [solution].

**NTF7:** This is assuming that the female [student] has an interest in TED and then chooses not to because of the barriers? Right?

**Researcher:** Yeah, one of the barriers is that females don't understand that Technology Education is even for them, but yeah.

**NTF7:** That's a hard one.

Researcher repeats question.

**NTF7:** I would think because they just don't really know what it is. I mean I don't really know what it is specifically and maybe the descriptions of the classes [in the school catalogue] or the name of the major field, it speaks male. I mean, well, maybe "technical" has a connotation as being male. I don't know. You know how some words are just related to more feminine and masculine? Maybe "technical" is a masculine word. I don't know. Other than that, I'm not really seeing anything. I mean if you are interested in something and you haven't figured out how to get to it by college without any inhibitions or anything like that, you're probably never going to.

Researcher: Think about it in a different context: What if a high school girl wanted to take wood shop, for example. What do you think would inhibit her?

**NTF7:** Maybe she would get made fun of because she might be, you know, the only girl. I mean, I would say that she would be put in a totally different group because of that maybe or unless she's really good at it, [and] would be respected for it; but, you can't always be good at something the first time you tried it, you know? So, you'd actually have to learn it and that would be difficult if you felt you weren't accepted in the class or whatever. I think as far as media and television is concerned, it kind of points them in a different direction than maybe it should be or whatever. So, maybe that has something to do with it, too. You have to work a whole lot harder if you are going into a field where your gender isn't found, you know? It works the same way when guys go work in a salon. You have to break down all the barriers.

**NTQ4: Based on your own experiences, how do you think the field of technology education could change to make it more attractive to girls and women?**

**NTF3:** I think there is definitely a lack of communication, especially with Technology Education. I didn't hear about GC 120 from someone I met here or a friend of mine. I heard about it from a guy I knew who was taking it and he [told me] that he was taking it. I didn't know anything about it and I asked him about it. He told me it would probably be a good idea to take it because he thought it was a fun class. Before that, I didn't really even know there were any classes like that here. I have no idea who teaches other classes on SolidWorks® and Design.

**Researcher:** Have you looked in the catalogue at any more graphic communications classes?

**NTF3:** Actually, I haven't. All I know is that you can get a minor in it, and I guess it gets

further into how to design parts.

**NTF2:** No.

**NTF1:** I know [professor name omitted] is teaching a more advanced one. That's the only one I know about because I have looked at the minor.

Researcher raises the issue of how class descriptions are worded in the school catalogue which had come up in an earlier focus group.

**NTF1:** The spatial relations one sounds kind of scary the way they have it worded. I don't know anyone who has taken that class, but I've heard it's not bad. I think its GC 450.

Researcher: Graphic Communications 450 is actually a class in which students draw pictures and write in a sketch book. It's more of an arts-based class rather than a technical or computer-based class.

**NTF1:** They say it's the best one to take for my major.

Researcher: That's a good example of the description not matching the class. It's almost like a marketing issue.

**NTF5:** Let them [females] know it's there, what it's about. I didn't hear anything much about the Technology Education program itself.

**NTF4:** Now we'll know what's out there. We just have to worry about classes and stuff like that. I mean, I don't know what would be more, what would make women decide to do it, I guess marketing.

**Researcher:** What about the name "Technology Education?" If you saw the name "Technology Education" would you know what it was?

**NTF5:** Yeah.

**NTF4:** Not really. It's not very descriptive.

**Researcher:** What do you think about putting the word "Art" back in the name?

**NTF4:** I think that would make it seem like a more creative field. I think that would make it more attractive.

**NTF5:** The name makes it sound like just a teacher education program. The word needs to get out that it's not just a teacher education program.

Researcher tells participants about how she came to choose the program: I had never heard of technology education. I found the program on the school webpage and I came in and talked to one of the professors in the department. He said, "We study emerging technologies and design new technologies. Do you like robots? Do you like to play with Legos®? Do you like to build things? Do you like to take things apart and put them back together?"

**NTF5:** That should be in the description of the program or classes. That would attract me. That would be cool.

**Researcher:** Really? Just that simple?

**NTF5:** I think so.

**NTF4:** That attracted me!

**NTF6:** Maybe showing how it can be [design and building-based]. I'm not all that interesting in putting things together. I am more interested in creating something, putting it on paper and letting someone else put it together. That class that you were talking about where you make the project and what you told me about making carousels, I would love

to do that. I don't [usually] like to do stuff like that, and I would love to do something like that, so maybe making or creating a class where it's more making [projects]. Something that would appeal to girls, but it wouldn't say "Hey, only girls can be in this class." Maybe that would appeal to girls [or] maybe getting more girl enrollment into that [class] and they realize that they like it, whether it's a carousel on top or whether it's a [different project]. Something where there's more out there for everyone. Have certain classes that would appeal more to girls. I guess you have a metals class, but think of something that uses metal that a girl might be interested in, putting together or finding out how it works, something like that but not only stereotypically for girls. It wouldn't be just for girls. It might just appeal to more girls. Also, um, I don't know, besides what we've talked about, I don't know anything about the department so definitely somehow get more out there about what it is and what you'd do in it. And, um, maybe think about getting something pretty basic that you could prove was vital as a requirement. That way, more people would experience it firsthand like, "Here's the basics. Oh, I am actually pretty interested in this."

**Researcher:** I was trying to make a genderless project with the automata project that we do in TED 110.

**NTF6:** Right, maybe have that be how all the classes are run, so that all the girls that are taking it start telling their friends what they are doing and maybe interest other girls to see that it's not just for the males.

**Researcher:** How many classes have you taken in Civil [Engineering]?

**NTF6:** I have just taken the basics in Physics and all my math [classes]. I will start this

summer in most of them, so I'll have my Statics and my Solids this summer.

**Researcher:** Have you run into this issue yet with the females in your department?

**NTF6:** Oh yeah, of course, even in my Graphics class, there's not that many [females].

Pretty much any of the classes for engineering majors, there are not that many girls. The girls that are in there aren't in Civil [Engineering] or they are not in [any] engineering [major]. They are taking it for a Science or they're a physics major or something like that. Um, and the numbers keep going down, so if there aren't many in it now, then there aren't going to be many in it when I get to CE 313.

**Researcher:** What about in your GC 120 class? How many girls are in that class?

**NTF6:** There are five girls.

**Researcher:** That would be a lot in a TED class.

**NTF6:** But, two are in elementary education and I'm not sure about the other two. I know for sure one is engineering. That leaves one engineering, one possibly engineering and three not. Five girls in TED is good; but, they are taking it for a required course for another major, so, I don't think that they are in TED.

**Researcher:** Do you feel any weirdness from the boys in that class?

**NTF6:** Personally no, but they all do have more knowledge about it somehow. I don't know how.

**Researcher:** Do they try to help you?

**NTF6:** Oh yeah, most of them are very helpful; but, I will be working on the first part of my SolidWorks® and some of them will be done. Most of the boys are already done and I am still going "How do I constrain this?"

**NTF7:** Okay, what they can actually do? The name, I know we said that earlier, but it changed from Industrial Arts to TED. I would be a lot more likely to pick a field that had the word “Arts” in it. Even when you are applying for jobs, Technology Education and Industrial Arts, if you are applying for a design position, Technology Education is obviously related to design but the Industrial Arts title would look better on the resume. It would seem more applicable.

**Researcher:** What about “Technological Arts?”

**NTF7:** That would, I think that would be better. Maybe you should research [the name] and see what people’s responses to it would be. Maybe “Technical Design” or something like that, because that’s what it is. Maybe, I mean, don’t judge a book by its cover, but it happens so you’ve got to make sure that what you are saying and telling is the same thing as people perceive it. I don’t think it really is from what I understand. Funny story. When I registered for the GC class, I totally missed a technical word in the [class description] and so I mean, not that that would have changed, but I actually felt the GC 120 [class] was worded so that it appealed to the creative side of me and that side chose to take it because I thought that it would help; but, I missed the technical part [of the description]. It wouldn’t have mattered but when I got in there I thought, “This is a drafting class.” I’m glad I got [professor name omitted], too, because he is really laid back about things. If I had to make the lines to a T, I would have driven myself crazy. I thought it was worded well to appeal to people who are interested in design and technical stuff and more industrial type things. It appealed to me and I am not in any kind of engineering. It’s not required for me.

**Researcher:** We have to have twenty or more sections of GC 120 because of all the people who want to take it.

**NTF7:** So, maybe look at the wording for that one and see what's attractive about it. I just remember thinking, "Hmmm, that [class] would help me out" because I am doing design and it would be good to have. When I saw the technical part, I thought it would be good to have a technical background as well as a non-technical one.