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Relationship of Gender to Grades in a General Education Technology Course

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THE RELATIONSHIP OF GENDER TO GRADES IN A GENERAL EDUCATION TECHNOLGY COURSE

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CHAPTER I

Introduction

New technological advances are available almost daily. From improvements in cell phone cameras (Ali, 2006) to electronic medical records (Shaw, 2006) technology is ever evolving. Each new design however leads back to a basic question: How can society improve the products that have just been produced? Consumer demands fuel this, as the quest to continually improve our quality of life.

Creating the products to satisfy these demands require highly motivated and trained individuals. While high school provides a curriculum of basic technology courses, it is through advanced studies that individuals acquire the training and skills sought in today's employment market. Among the 20 fastest growing occupations, a bachelor's or associate degree is the most significant source of postsecondary education or training for 12 of them (*Tomorrows Jobs*, 2005). Professional and related occupations will grow the fastest, adding more new jobs than any other major occupational group; this group includes technical occupations, which project a growth of 21.2 percent over the 2004-14 period. With approximately 6,900 accredited postsecondary educational institutions and programs (U.S. Department of Education, 2005) sources appear abundant for completing advanced degree studies required for these occupations.

Postsecondary enrollment remains healthy although a growing gender gap appears on college campuses where women currently outnumber men by at least 2 million (Feller, 2006). This gap however does not extend to occupational and technical studies where various learning concerns continue to keep this a male dominated field.

With continued research, emphasis on gender-equity and increased public awareness, these concerns may be proven unfounded. Given the occupational opportunities and increased future technological demands a critical need exists for trained individuals, regardless of gender.

Statement of the Problem

The problem of this study was to determine the relationship between male and female student's final grades in a general education technology course to determine if gender plays a role in achieving academic excellence in the course.

Research Goals

To guide this study the following hypothesis was established:

H_0: There is no correlation between a student's gender and the achievement of academic excellence in a post-secondary technology course.

Background and Significance

Technology education has evolved into a major component of the academic world. From the "industrial arts" programs of the 1950's (Haynie, 1999) to the present day realm of courses involving bio, nano, and information technology, an image has emerged making technological studies an appealing choice among students.

There is still an area that requires attention and that is the gap in gender makeup of technology courses. The researcher has observed this gap in high school technology where the percentage of female students in a Principles of Technology class was 10%. Another high school posted its alumni of technology education, of the 15 students listed, not one was female (Herricks High School, 2001).

Research has been done to discover gender-based differences in learning (Gender Diversity in Science, Technology, Engineering and Mathematics Education [GDSE], 2003) and the perceptions of technology being a male-dominated field (Livardo, 2004). The results of these and other forms of research will hopefully bridge the gender gap in technology education. This study will show there is no evidence supporting that gender plays a role in the grade achieved in a technology course.

Limitations

The scope of this study was limited to students completing, OTS 110T, Technology and Your World, at Old Dominion University during Fall 2006.

Assumptions

This research was based on the assumption that:

1. Grades received in OTS 110T will correlate to grades in other technology courses.
2. Gender makeup of OTS 110T will be homogenous between male and female.
3. OTS 110T will include project-based learning that is used in other technology courses.
4. No gender bias will occur during grading of assignments.

Procedures

Course evaluation will include written examinations, group and individual projects, journals, and class participation. Student grades will be analyzed following course completion. Grades will be summarized and sorted by gender after which comparison will be made between female and male student grades in the course.

Definition of Terms

Key terms as related to this study are defined as follows:

Academic Excellence – Refers to an academic grade of A.

Grade for Course – Final grade will be a compilation of written exams, projects, class participation, and student journals.

OTS – Occupational and Technical Studies.

Technology Course – One that encompasses the realm of production, manufacturing, construction, communication, and energy topics or a combination of these and any similar areas of study.

Overview of Chapters

In Chapter I, the reader was introduced to Technology Education and the benefits of attending technological classes. This study will be limited to students completing OTS 110T, Technology and Your World, at Old Dominion University. The study was to determine the relationship between male and female student's final grades in a general education technology course to determine if gender plays a role in achieving academic excellence in the course.

Chapter II will review the literature concerning progress made in Technology Education achieving gender equity and the steps still needed to be taken. Chapter III will address the methods used for this study, and Chapter IV will discuss the findings. Chapter V will summarize and conclude the research.

CHAPTER II

Review of Literature

This chapter will provide an insight into academic achievement as related to gender and level of education. Information will also be presented concerning reasons females often bypass technology courses and the subsequent occupational fields sought. The researcher will discuss what has been done to help stop the misconception that technology is a man's world. References will be made throughout this chapter to mathematics and science, as they are closely associated to technology with regards to course material.

Early Education

Studies tend to agree that males and females start on a level playing field in the early years of education with females equal or ahead of males on standardized and psychological assessments. By high school graduation however, females have fallen behind their male counterparts (Owens, Smothers, & Love, 2003). Males and females also show an equal interest and aptitude in science until about the sixth grade when girls start to turn away from science, although they still have the aptitude for it (Ride, 2005). Females also outperform males on reading and assessments tests throughout school and are less likely to repeat grades. However in mathematics there is a perception that female's performance in math is lower than that of males (National Center for Education Statistics [NCES], 2004). What occurs that brings about these changes in scores and attitudes? It has to do with perceptions and appears that it starts with middle school and continues on from there.

Middle School

By the time girls are in the 7th grade, their occupational aspirations have little to do with their abilities (Eccles, 2005). Bypassing advanced or an honors mathematics and science class often has to do with school counselors, parental guidance, and the students themselves. Females lack science and mathematics confidence because parents provide messages that undermine their daughter's efforts. For example, when boys are successful in mathematics the parents attribute it to talent and effort equally, while parents of girls said hard work was more involved than talent. Evidence from time diaries and teachers did not bear that difference out (Eccles, 2005). School guidance counselors tend to single out females who have difficulty by offering dismissal from mathematics and science courses when the females are actually only seeking help; males are not as likely to be offered this course of action (Owens, et al, 2003). Females that are enrolled in middle school technology courses and have confidence in their abilities face emerging sexism among peers that begins to affect their participation in technology education (Horricks, 2000). Females also view careers in mathematics, science, and engineering as ones of solitary vice social, and they steer away from these (Eccles, 2005).

A focus group with 70 East Coast middle school girls expressed disinterest in computer careers because they saw the field as boring (Koch & Irby, 2002). Instead of providing factual information to better educate females, stereotyping begins, leading to assumptions that boys are more interested in computers and technology than are girls (Koch, 2002). Prevailing societal gender stereotypes include claims that women are relatively incompetent in mathematical and technological fields; that is, they are unlikely to have mathematics talent or to be very skilled in technical areas (Tatar & Emmanuel,

2001). From this assumption teachers unconsciously discourage girls from taking more computer courses and eventually pursuing degrees in technical fields. The foundation has now been laid that has females questioning their intelligence and abilities leading to relatively fewer girls enrolling in elective and advanced high school science and mathematics courses to prepare for college (GDSE, 2003).

High School

As females enter high school a decision on what courses to take often involves a reluctance to take a class where they would be one of the few girls. They tend to lack confidence in their abilities and worry about the reaction of friends and family (Horricks, 2000). This self-perception of poor ability in mathematics, science, and technology has been found to be a high predictor of course selection and of choosing these areas as major fields of study (Owens, 2003).

Unfortunately even when female students are proven to be equal in ability they tend to stay away from science–related careers. In one study of male and female students ranked in the top 2% of mathematical ability, it was found boys were more likely to enroll in science and mathematics classes than girls (Evans, Schweinger, & Stevenson, 2002). Possible reasons for this could be the patterns previously established that have diminished any interest the female students may have had in pursuing this area of study. These patterns might also account for the sharp drop in high school seniors' positive feelings toward school which is lower among girls than boys (Matthews, 2006).

Gender stereotyping is still prevalent with courses involving family preparation attributed to girls and courses involving technology career fields viewed for boys. It has been shown that the United States is not alone in this. In Israel, the prevailing gender

stereotypes in society reinforce the fact that female students choose predominantly humanities and domestic sciences, whereas male students choose science and technology. A differential in course placement is not explained by variations in students' abilities but by the masculine image of mathematics and science. Female students do not choose courses; schools, teachers, and counselors operate with different selection policies for female and male students regarding mathematics and science (Tatar, 2001). Given the unfortunate trends encountered to this point, the prospects awaiting females as they venture to college do not look bright when it comes to pursuing technological studies.

College

While there are indications that the gender gap is not as great at the college level of education, there remains a significant need for improvements. The Accrediting Commission of Career Schools and Colleges of Technology reported that as of June 30, 2005, based on 248,265 students, there was a 50-50 division in male and female students (McComis, personal communication, June 1, 2006). While this is good news, it has also been reported that gender differences in college majors exists with females still predominant in somewhat lower paying fields like education, and males more likely to earn degrees in engineering, physics, and computer sciences (NCES, 2004).

An audit of three semesters at Purdue University Calumet (PUC) found that women comprised 29 percent of the total enrollment in chemistry and physics, 35 percent in mathematics, computer science, and statistics, 11 percent in construction technology, 16 percent in engineering, 6 percent in electrical engineering, 41 percent in information systems and computer programming, and 28 percent in manufacturing engineering technologies and supervision (Bart, 2000). Disproportionately few of the young women

who do graduate in Science, Technology, Engineering, and Mathematics (STEM) disciplines continue on to attain graduate degrees in physical sciences, computer sciences, and engineering (GDSE, 2003).

All of these statements are further substantiated by the division of doctorates awarded to women from 1994-2003 as seen in Figure 1. With the fastest growing occupational area encompassing technology, education becomes tremendously important, as the difference in median earnings for having a doctorate is $24,000 more than having only a BS and $15,000 more than having a MS (*Education Pays*, 2002).

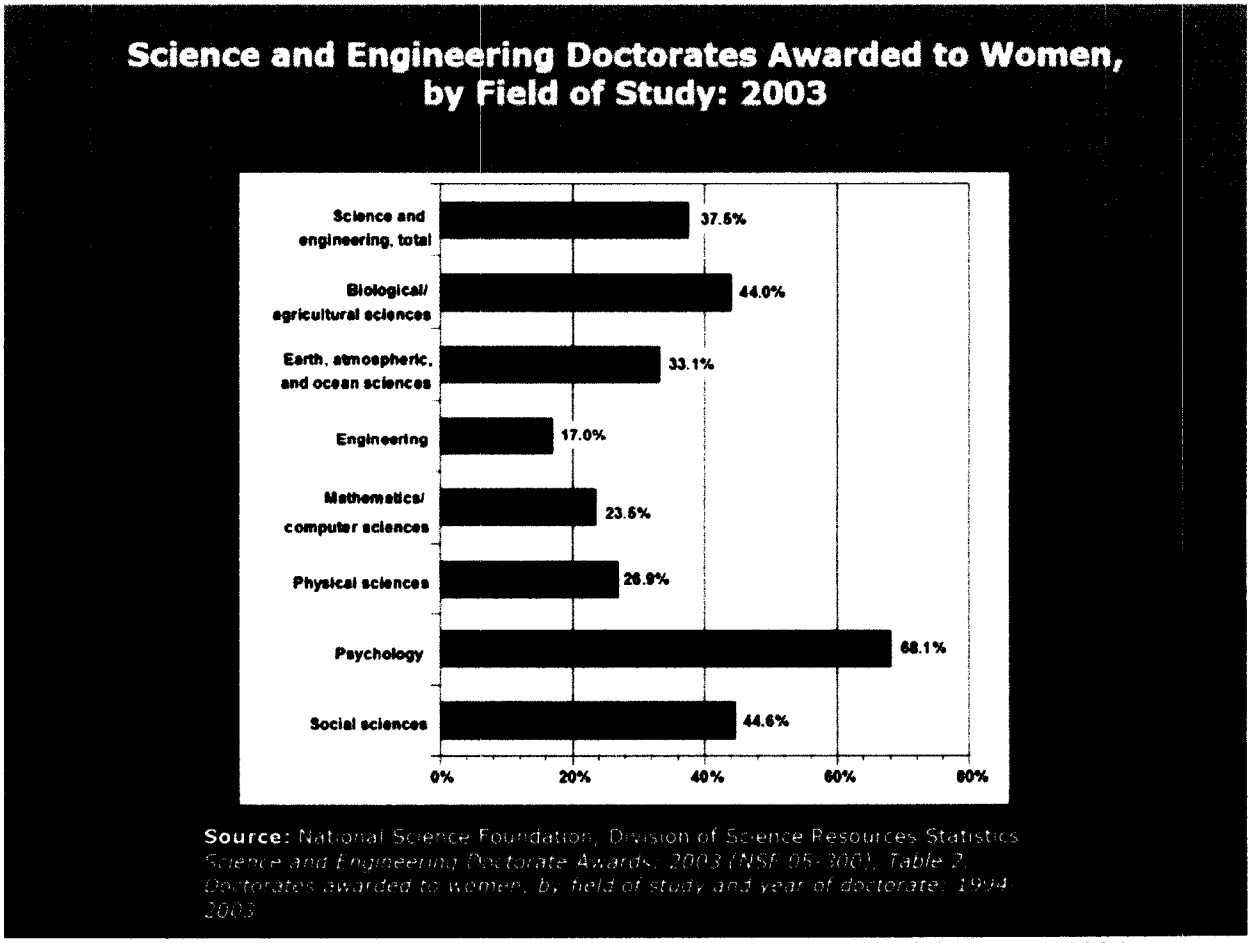

Figure 1. Doctorates awarded to women, by field of study and year of doctorate: 1994-2003.

Other Factors

It is interesting to note the gender gap in technology has to do with video games (*T.H.E. Journal*, 2006) and computer games (Miller, Schweingruber, & Brandenburg, 2001). Van Eck (2001) conducted video game research in cooperation with the Advanced Instructional Media (AIM) Lab at the University of Memphis. The AIM Lab attempted to find ways to engage girls in the use of technology and to see whether doing so changed the girls' feelings toward technology--and by association, mathematics and science. In this study, 92 fifth and sixth graders of both genders were exposed to various games including some targeted at girls, some aimed at boys, including adventure games, simulations, and puzzle games. When the children created their own video games with the help of a programmer, the girls became active, interested participants in the process. The game play did seem to confirm the theory, argued in past studies, that girls' unfavorable attitudes toward technology--and video games--is simply the result of being exposed to the wrong, boy-oriented types. It is hopeful that changing girls' perceptions of video games will make technology relevant to them, perhaps down the road leading them to pursue a professional path they previously had no interest in, or thought was not open to them.

The Future

Every student needs to know how to learn new skills as quickly as technology creates new challenges (National Education Association [NEA], 2006). With programs such as TECHBRIDGE, GIRLS and TECHNOLOGY, TECHGIRL, and WOMENTECH (*New Formulas for America's Workforce: Girls in Science and Engineering,* 2003), learning those skills will not be as apprehensive as before. As technology is demystified

among the female population, better representation will be gained in our classrooms and ultimately our occupational fields. The aim of this study is to help gain representation by showing that gender plays no role in academic excellence in a technology course.

Summary

Chapter II provided an insight into academic achievement as related to gender and level of education. Information was presented concerning reasons females often bypass technology courses and the subsequent occupational fields. Chapter III will address the methods used to collect data for this study.

CHAPTER III

Methods and Procedures

The scope of technology encompasses the realm of psychomotor and cognitive skills. To fully understand the technological process individuals must be able to analyze and solve problems on paper as well as complete or test the solution through hands-on, laboratory setting experiments. It is through these methods that the technical abilities of an individual may be determined. OTS 110T, Technology and Your World, at Old Dominion University provides students the opportunity to measure and develop their technological skills. Material in the course includes an overview of the resources and systems of technology. Emphasis is on impacts that technology has on individuals and their careers. Activities explore the evolution of technology, its major systems, and their impact on individuals and their careers.

Population

The subjects in this study were students completing, OTS 110T, Technology and Your World, at Old Dominion University. Student composition was 17 male and 23 female, freshmen though senior in class standing, from diverse educational and social backgrounds, and of varying ethnicities.

Research Variables

Independent variables in this study were the written projects, lab experiments, and tests completed by the subjects. The dependent variable was the grade each subject received upon course completion. The intervening variables were the learning and intelligence concepts of the subjects.

Instrument Design

The achievement of academic excellence in a post-secondary technology course was measured through written exams, group and individual projects, journals, and class participation. A grading rubric was utilized for group and individual projects to assess methods of design, comprehension of assignment, and group participation. Journals were assessed on content and written exams checked for retention of material presented. Student grades were analyzed following course completion. Grades were summarized and sorted by gender after which a graphical comparison was made between female and male students.

Classroom Procedures

Class met twenty-nine times, each time for one hour and fifteen minutes. Subjects received lectures and PowerPoint presentations on material relevant to the course. Class projects were detailed on handouts and described by the instructor for clarity. Subjects were all given the same testing material and assigned the same written work.

Methods of Data Collection

The researcher posted assignment due dates for all subjects work. Upon completion, work was scored and recorded for use in final grade tabulation. Students were assigned projects that required creativity, reading and comprehension, problem solving, and writing ability. Projects included following and completing circuit analysis in electricity, designing and constructing a prototype electronic computing accessory, constructing a model Maglev vehicle, preparing a billboard display, writing a biotechnology research paper, and providing an outline for a floor plan of a home design.

Statistical Analysis

The t-test method was used to determine if there was any significant difference in the grades received by gender. Following tabulation of final grades a table representation in relation to subject gender was prepared.

Summary

Chapter III reviewed the methods and procedures used to collect data for this study. Tools used for determining academic achievement as related to a post-secondary technology course were described. The subjects studied and setting for the study was described. Chapter IV will discuss the findings.

CHAPTER IV

Findings

The problem of this study was to determine the relationship between male and female student's final grades in a general education technology course to determine if gender plays a role in achieving academic excellence in the course. A total of 40 students, 17 male and 23 female, completed the class and their grades were determined.

Data were collected and analyzed as students completed assignments. Upon completion of final assignment student grades were summarized as written work, laboratory or project work, and by final grade. This representation was provided to show any variance in student work that may have occurred between types of assignments.

Project/Laboratory Assignments

Grade comparison for project or laboratory course work encompassed both in-class and take home assignments following PowerPoint and lecture presentations. Assignments required critical analysis, problem solving, and design techniques. Use of hand tools and Web research as well as oral and visual observations were also part of this process. Table 1 lists the comparison data for these assignments.

Table 1

Average Grade by Gender of Project/Laboratory Assignments

	Male		Female	
Maglev	**B**	**86.2%**	**C**	**76.5%**
Timeline	**A**	**92.3%**	**A**	**91%**
Future Wheel	**A**	**96.7%**	**A**	**91.3%**
Billboard	**A**	**96.5%**	**A**	**90.65%**
Housing	**A**	**99%**	**A**	**100%**
Materials	**A**	**100%**	**A**	**100%**
Electricity	**A**	**94.7%**	**B**	**90.3%**
Pneumatics	**A**	**94.7%**	**A**	**92.6%**

Written Assignments

Grade comparison for course work that was classified as written work included tests and journal writings. Students also completed a written report on a topic/product in the biotechnology field and a final paper on the forecast in a technological area. Table 2 lists the comparison data for these assignments.

Table 2

Average Grade by Gender of Written Assignments

	Male		Female	
Journal 1	**A**	**97.5%**	**A**	**91.8%**
Journal 2	**A**	**96%**	**A**	**92.3%**
Journal 3	**A**	**98%**	**B**	**90.6%**
Journal 4	**A**	**99%**	**A**	**93%**
Quiz 1	**B**	**89.2%**	**C**	**81%**
Quiz 2	**B**	**87.9%**	**B**	**89%**
Quiz 3	**C**	**81.1%**	**B**	**83%**
Biotechnology	**A**	**95%**	**A**	**91.5%**
Final	**A**	**96%**	**B**	**90.6%**

Final Grades

Following recording of all completed assignments, student's final grades were calculated for course completion. Table 3 shows the comparison for final course grade.

Table 3

Average Grade by Gender Upon Course Completion

Male	**B**	**89.2%**
Female	**A**	**92.4%**

Summary

The findings of this study document the grades attained by 40 students in a general education technology course. The data obtained from evaluating and documenting student work was tabulated and presented in this chapter. The t-test was the method used to complete the study. There were 17 male students with a mean grade of

392.5. There were 23 female students with a mean grade of 406.9. The t was determined to be 1.37. The degree of freedom was calculated as 17+23-2= 38 and the level of significance was $p < .05$. Chapter V will provide the conclusions and recommendations to be made.

CHAPTER V

Summary, Conclusions, and Recommendations

Technology education is a critical part of any individual's education. The growing and changing advances in technological fields will require dedicated professionals from all walks of life and from both genders. This study was undertaken to show gender plays no role in academic achievement in a general technology education course. The purpose of this chapter was to report and summarize the findings of the research.

Summary

This study was conducted to determine the relationship between male and female student's final grades in a general education technology course to determine if gender plays a role in achieving academic excellence in the course. The research was conducted with students completing, OTS 110T, Technology and Your World, at Old Dominion University during Fall 2006.

The research goal was to establish that there was no correlation between a student's gender and the achievement of academic excellence in a post-secondary technology course. The research was to show that given the same methods of instruction and evaluation material, students would achieve relatively the same academic results regardless of gender.

The significance of this study was the fact that technology education had evolved into a major component of the academic world. The present day realm of courses involving bio, nano, and information technology, has created an image making technological studies an appealing choice among students. There was, however, a gender gap in students pursuing technology education and related occupations. Perception has

much to do with this gap in that females are not always perceived as being capable of competing with their male counterparts in these fields. The results of this and other forms of research will hopefully bridge the gender gap in technology education. This study was to show there was no evidence supporting that gender plays a role in the grade achieved in a technology course.

This study was limited to students completing, OTS 110T, Technology and Your World, at Old Dominion University during Fall 2006. Student composition was 17 male and 23 female, freshman though senior in class standing, from diverse educational and social backgrounds, and of varying ethnicities.

Academic excellence was measured through written examinations, group and individual projects, journals, and class participation. A grading rubric was utilized for group and individual projects to assess methods of design, comprehension of assignment, and group participation. Journals were assessed on content and written examinations checked for retention of material presented. The class met twenty-nine times, each time for one hour and fifteen minutes. Subjects received lectures and PowerPoint presentations on material relevant to the course. Class projects were detailed on handouts and described by the instructor for clarity. Subjects were all given the same testing material and assigned the same written work.

Upon completion, assignments were scored and recorded for use in final grade tabulation. Students were assigned projects that required creativity, reading, and comprehension, problem solving, and writing ability. Projects included following and completing circuit analysis in electricity, designing and constructing a prototype electronic computing accessory, constructing a model Maglev vehicle, preparing a

billboard display, writing a Biotechnology research paper, and providing an outline for a floor plan of a home design.

This study showed how academic excellence is achieved by dedicating the time and effort to completing assignments, regardless of a person's gender. The t-test method was used to determine if there was any significant difference in the grades received by gender.

Conclusions

The goal of this research was to establish that there is no correlation between a student's gender and the achievement of academic excellence in a post-secondary technology course. The continuing need for technology research requires all qualified individuals be encouraged to engage in the study of technology. In reporting the conclusion of this study through the t-test method the researcher reports the degree of freedom was 38 and the t was 1.37. Since the obtained t-ratio of 1.37 did not exceed the p of 2.021 at the .05 level for the two tailed test, we can accept the hypothesis. We can conclude that gender does not make a difference in the achievement of academic excellence in a post-secondary technology course.

Recommendations

Using the results of this study, the author hoped to promote increased attendance by female students in technology education at the middle and high school level. This study will be used as a tool to help dispel perceptions that technology studies must be a male dominated field. To do so department chairs, deans, and senior administrative officials should be made aware of these findings in order to promote gender equality for technology education at conferences, community forums, and within the academic arena.

Their voices promoting technology education to all will assist in breaking the perceptions that the field is male oriented only.

Future studies can be conducted at secondary schools in advanced technology courses such as communication, construction, and manufacturing to further the advancement of equal participation by gender in technological courses.

Journal articles in women magazines should report these findings, so mothers will better guide their daughters that the study and occupations in technology are within their grasp.

Additional research can be conducted in future general education technology courses at Old Dominion University in support of the significance of this study.

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