EXPLAINING THE TECHNOLOGICAL GENDER GAP: SELF-EFFICACY, UTILITARIAN ATTITUDES, AND COMPUTER USE AMONG COLLEGE STUDENTS

by

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(ABSTRACT)

This research utilizes liberal feminism and social learning theory to explore the relationships among gender, computer self-efficacy, utilitarian attitudes toward computers, and computer use by college students. The analysis includes comparisons of male and female college students at Virginia Polytechnic Institute and State University on computer use, on computer self-efficacy and on attitudes about the utility of computers. Data are derived from a self-administered questionnaire from a non-probability sample of 243 undergraduates enrolled in an introductory sociology course at Virginia Polytechnic Institute and State University in the spring of 1996. Consistent with hypotheses, women in the sample report significantly lower levels of computer self-efficacy, although not of utilitarian attitudes toward computers, and consequently less computer use than men. Regression analysis shows that computer self-efficacy is a significant predictor of computer use, but that utilitarian attitudes are not. Implications for subsequent research and theory in this area include that computer use should be specifically measured as hours of use, that gender differences in computer use may be application-specific, and that a cause-and-effect relationship between attitudes about computers and computer use should be established.

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CONTENTS

CHAPTER I

STATEMENT OF THE PROBLEM

Ironically, technological advances have contributed to many problems, such as pollution, overpopulation, and environmental degradation, whose solutions will require further technological innovation. Some people believe that the solutions to these problems cannot be found until science and technology are no longer as male dominated as they are. The best indicator of the gendered nature of science and technological development is the unequal representation of women in careers in science and technology. For example, in 1992, women received only 21.9% of doctorates in the physical sciences, and only 9.2% of doctorates in engineering and engineering technology (Statistical Abstract of the United States 1995). If we hope to solve the problems that confront us, we need the contributions of both men and women as practicing scientists. Furthermore, a more "feminized" science might lead to a less destructive form of science. For example, Griffiths (1988) argues that it is the denial of feelings, emotions, and other "feminine" qualities that has led to many unsafe and destructive by-products of science, such as the environmental damage caused by technological advances in production.

Gender-biased socialization practices may partially account for the gendered nature of science. For example, boys, more than girls, are encouraged to excel in mathematics, and competency in math is an important prerequisite for having a science major in college (Reisman 1990). Computers are also an area of traditional exclusion for women (Reisman 1990), and computers comprise the most basic point of entry into the world of science and technology (Fetler 1985).

Although women were involved in much of the early work on computers,[1] once the power of computer use became apparent, men came to dominate the world of computer technology (Reisman 1990). This dominance has contributed to what is currently identified as a "gender gap" in the use of computers. There has been a lot of research on this "gender gap," particularly as personal computers (PC's) became more common in the late 1980's and were introduced into the curricula of schools at all levels. As the importance of computers in education became evident, so did the disadvantages of not being able to use them. The "gender gap" in computer use is thus seen as an educational problem, requiring the intervention of educational authorities.

The purpose of this thesis is to explore possible correlates of the gender gap in computer use. Although this has been the aim of a great deal of research, not a lot of progress has been made toward explaining what causes gender differences in computer use so that the education system can successfully address the problem.

I am using a liberal feminist framework to guide my inquiry. The basic tenets of liberal femininsm include: Gender is socially constructed; socialization and social learning play a major role in the social construction of gender; and the education system can serve as an agent of social change. Consequently, from a liberal feminist perspective gender inequality is neither natural nor inevitable. As social and educational practices change, we should be able to see a movement toward more egalitarian gender relations. Consistent with liberal feminist beliefs, there is evidence of some progress, although the historical inequity between men and women in the practice of science continues. For example, although in 1971 only 2.3% of doctorates were awarded to women in the field

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[1]For example, Grace Hopper was primarily responsible for developing COBOL, the first computer language based on words rather than mathematical symbols (Lee 1994). Also see Eastman (1991) for a discussion of women's creative use of computers.

of computer and information sciences, by 1992 that figure had increased to 13.3%. In the field of physical sciences and technologies, the number of doctorates earned by women went from 5.6 % to 21.9% between 1971 and 1992 (Statistical Abstract of the United States 1995). The increasing involvement of women in science is consistent with the liberal feminist assumption that as traditional gender-role attitudes and behaviors are re-evaluated due to a rational assessment of the current situation, changes in education and socialization will follow. These changes will result in social reform (Andersen 1993), including the practice of science and technology becoming less gendered.

Most research which has identified the existence of a "gender gap" in the use of computers also has tried to explore ways in which the "gap" can be reduced by looking for possible causal relationships. Consistent with the liberal feminist perspective, most of these explanations have involved differential socialization based on gender stereotypes as a potential source of this gender gap. Researchers note that such preconceptions as girls being more likely than boys to be averse to computers, to be less competent with computers, and to spend less time using computers often become self-fulfilling prophecies (Kramer and Lehman 1990). Consequently, some researchers began to explore social-psychological explanations for the gender gap in computer use. For example, some researchers have examined the relationships among gender, self-efficacy, and computer use. For the most part, this research indicates that although women have a lower sense of self-efficacy in relation to computer use than men, it is not statistically significant (Francis 1994; Heinssen, Glass, and Knight 1987; Nickell and Pinto 1986).

Another attitudinal variable that has received attention in the research on the relationship between gender and computer use is that of a utilitarian attitude toward computers. I define a "utilitarian attitude" as the perception of computers as useful. Several studies have found evidence to suggest a positive relationship between utilitarian attitudes and computer use, (Nolan, McKinnon, and Soler 1992; Schumacher, Morahan-Martin, and Olinsky 1993), although computer use is not specifically measured as hours spent using a computer.

In addition, there is some evidence indicating that a gender gap in utilitarian attitudes toward computers which favors males may not be a stable phenomenon. For example, in a survey of college freshmen, female students reported slightly more prior experience with computers than males (Wilder, Mackie, and Cooper 1985). Female MBA students also reported more experience with certain applications than males (Schumacher et al. 1993). According to sources cited by Schumacher et al. (1993), prior experience has been found to have an impact on attitudes of both self-efficacy and utility in relation to computers.

Although the evidence indicates that the perceived utility of computers and a positive assessment of one's ability to use them may have an impact on computer use, no studies have tested this relationship specifically with computer use measured as hours per week spent using a computer. Nor is there much research on the effects of gender and attitudes toward computers on actual computer use. In fact, there are little data available on gender differences in computer use among college students with "computer use" measured as actual time spent using a computer. In this thesis I will explore the relationships among gender, self-efficacy, utilitarian attitudes toward computers, and computer use among college students measured as hours per week spent using a computer. I will do so by means of a self-report questionnaire given to a sample of approximately 300 college students enrolled in an introductory sociology course. Specifically, this research will establish whether or not there is a "gender gap" in computer use among college students, and will then examine possible explanations for such a gap, if one is found.

This research is important for several reasons. First, there is no current data available on the gender gap in computer use as measured by the number of hours per week spent using a computer, and educators and policy makers should be aware of whether or not there have been any changes over time. Second, as I mentioned earlier, progress cannot be made if the problem is not identified and understood. Potential solutions to the problem of the "technological gender gap" cannot be based on the myths that women are less competent or that computers are more male-appropriate. More plausible (and testable) explanations, such as attitudes shaped by gender-based discrimination and socialization, must be considered as well.

CHAPTER II

REVIEW OF THE LITERATURE

This project will explore the relationships among gender, self-efficacy, utilitarian attitudes toward computers, and computer use among college students. The literature provides contradictory evidence about the existence of gender differences, or a "gender gap," in computer use, and these differences have been studied in several different ways. Research settings have also varied, although they share the common characteristic of being in educational institutions. Some studies also involve the workplace, but I did not include them because my concern is the unique characteristics of college students in a college setting.

2.1 Research on Gender Differences in Computer Use

Researchers who have explored the existence of a "gender gap" in computer use have conceptualized it in a number of ways. Researchers have conceptualized and measured the use of computers as access to computers, time spent in using computers, previous experience with computers, skill with computers, enrollment in computer courses, computer literacy, and preferred applications and software (Fetler 1985; Hess and Miura 1985; Nolan et al. 1992; Reisman 1990).

When looking at computer use among children, researchers often find gender differences. One important difference is that access to computers is often limited by gender. For example, girls do not have equal access to equipment and software in the classroom. Significantly fewer girls than boys in a sample of 6th and 12th graders reported having access to a microcomputer at school, and more boys reported having access to one at home (Nolan et al. 1992). In addition, girls attempting to use school computer facilities often encounter a subculture of male "computer jocks" who pre-empt equipment with the express purpose of blocking female access (Canada and Brusca 1991; Reisman 1990). Educators admit to giving boys more attention and encouragement during computer instruction, and even to consciously excluding girls if there is a shortage of time or materials (Reisman 1990).

Another common gender difference in computer use is time spent in using computers, as well as how that time is spent. Among secondary school students in New Zealand, boys reported spending much more non-class time using school computers than girls (Nolan et al. 1992). Boys also spend more time playing computer games than girls (Hess and Miura 1985; Nolan et al. 1992). In addition, boys are enrolled in elective computer courses in greater numbers (Hess and Miura 1985), and they are present in larger numbers than girls in classes concerned with programming as opposed to those which teach preparatory skills for such clerical work as word processing and data entry (Hess and Miura 1985; Reisman 1990). In the area of computer literacy, boys are found to outperform girls, at least at the pre-college level (Fetler 1985).

There are little data available on computer use at the college level, and researchers' conclusions indicate little evidence of a gender gap. Based on their own experience as educators, Hesse-Biber and Gilbert (1994) speculated that men and women put equal time into using computers if it is necessary for accomplishing class assignments. These researchers, however, offered no empirical support for their claims. In a study of the relationship between gender and attitudes toward computers, first-year college students showed some slight gender differences in computer use measured as prior experience with computers; 30% of males and 35% of females reported home access to a computer, while 46% of males and 50% of females reported having taken computer courses in high school (Wilder et al. 1985). Note that these gender differences were in the opposite direction from what was found among younger students. There were also some application differences in this sample, with males more likely than females to have taken a programming course and to know FORTRAN, a science and mathematics-oriented language, while females have more experience with PASCAL, a business and commerce language (Wilder et al. 1985). In a sample of MBA students, females reported more experience than males with spreadsheets and accounting packages, but there were no other significant gender differences (Schumacher et al. 1993).

The evidence suggests that although there are gender differences in computer use, the gender gap may narrow over time and even show a tendency to favor women at higher educational levels. Although application and software preferences persist, women's computer use at the college level, especially when measured as prior experience with computers, approaches and in some cases surpasses that of men. However, according to many social theorists (Canada and Brusca 1991; Griffiths 1988; Hawkins 1985; Hesse-Biber and Gilbert 1994; Kirk 1992), there are still gender differences in computer use that need to be explained.

2.2 Miscellaneous Explanations For Gender Differences In Computer Use

A variety of potential explanations for gender differences in computer use have been explored by social scientists, and so prior to focusing on those that are important for this research, I will briefly discuss some examples from existing research. One popular explanation for gender differences in computer use is the existence of discriminatory conditions towards women. As mentioned above, some research indicates that educators may be biased against girls in the classroom during computer activities and do not give them equal attention, encouragement, or access to equipment. Female access to school computer facilities is often blocked by a subculture of male "computer jocks" who define computer labs as "male turf" (Reisman 1990; Canada and Brusca 1991). In addition, parents are more willing to send sons than daughters to extracurricular camps and classes and are more likely to buy home computers for sons than for daughters (Hess and Miura 1985). Parents also spend more money on sons' computer equipment than on daughters' (Reisman 1990).

Many scholars believe that females are discouraged from using computers and therefore are socialized to "select themselves out" of participation in the computer culture. One way in which female participation is discouraged is through the use of male-biased language in programming and command languages, such as commands like "abort" and "execute" (Wiburg 1995). Another way participation is discouraged is through the male-centered construction of technical knowledge, which operates to make such knowledge irrelevant to women (Jansen 1989). Women also are socialized to see technology-oriented activities as more male- than female-appropriate (Griffiths 1988). For example, educational software is biased at all levels, for the most part being distinctly designed to reflect gender stereotypes such as the helpless female character in need of male rescue (Canada and Brusca 1991; Riesman 1990). Game software is also gender biased, focusing on such male themes and interests as sports and warfare (Canada and Brusca 1991; Hess and Miura 1985; Wilder et al. 1985). The assumption that computer use requires skill in mathematics, another traditionally masculine area of expertise, can lead to both covert and overt discouragement of feminine participation (Kramer and Lehman 1990). Furthermore, the role of advertising and the media in socialization is well-documented. These institutions typically use traditionally stereotypical images to sell products, and this is no different in the case of computer products (Reisman 1990). Finally, cultural values may encourage women to withdraw from situations they perceive as difficult because they have other options for security and success (Fiorentine and Cole 1992). Consequently, the stereotyped attitudes associated with computers may be particularly effective at excluding women from computer use.

Many researchers have looked at computer use in terms of individual attitudes about computers (Fetler 1985; Nolan et al. 1992; Schumacher, Morahan-Martin and Olinsky 1993; Wilder et al. 1985). As liberal feminism suggests, attitudes learned as a part of the socialization process may have an important impact on the gendering of computer use. If people are taught to believe that it is more appropriate for males than for females to use computers, these beliefs may explain why males are found to use computers more often and in different ways than females.

Studies looking at gender differences in attitudes toward computers cover a variety of topics, including whether or not respondents view computer use as more appropriate for one gender or the other, relative perception of competence, comfort with computer use, and the supposed relationships among science, math, and computer technology (Francis 1994; Meier and Lambert 1991; Pope-Davis and Twing 1991). For example, among younger students, both males and females consider computers more male-appropriate (Wilder et al. 1985), but college students do not share this belief (Francis 1994; Wilder et al. 1985). When the Computer Anxiety Rating Scale was administered to students in an introductory psychology course, women reported higher levels of computer anxiety than men, but this difference was not significant (Heinssen et al. 1987). A sample of first-year undergraduates also showed no significant gender difference in computer anxiety scores on the Computer Aversion Scale (Francis 1994). A test of the CAS using samples from several different universities showed indications of possible sex differences in levels of computer aversion, but the difference was significant in only one sample (Nickell and Pinto 1987). The evidence from studies of attitudes towards computers suggests that although there are some gender differences, they vary depending on the characteristics of the sample, the setting, and how they are conceptualized and measured.

Although the variety of explanations posited in the above section may in part explain gender differences in computer use, they are not the focus of this thesis because I do not believe that the attitudes described by them are adequate predictors of gender differences in computer use. Consistent with the liberal feminist perspective, which sees gender as a social construction shaped by socialization and social learning, I argue that a feeling of self-efficacy in relation to computers, along with a utilitarian attitude toward computers, are better predictors of gender differences in computer use. A discussion of my reasoning follows.

2.3 Self-Efficacy and Computer Use

One attitude concerning computers that I think is important for understanding gender differences in computer use among college students is self-efficacy. Self-efficacy is defined as "one's own capability to execute the actions required to deal with prospective situations" (Bouffard-Bouchard 1989). Although self-efficacy may be an important component for understanding actions, there are few studies which directly address this concept in relation to computer use. Taking an indirect approach, however, some useful conclusions about the relationship between self-efficacy and computer use may be drawn. For instance, when Meier and Lambert (1991) performed a factor analysis on the items in each of three computer aversion scales, efficacy expectations emerged as one of the primary factors. This finding suggests that self-efficacy may be implicated in aversion toward computers, and it is reasonable to assume that aversion toward computers will affect computer use. Mean scores for undergraduates enrolled in an introductory computer skills course responding to forty Likert-type statements indicated that, on average, males have a higher sense of self-efficacy in relation to computers than females, but the difference was not statistically significant (Pope-Davis and Twing 1991). However, in a survey of all first-year students at a highly selective university, although both sexes reported feeling comfortable using computers, females reported feeling significantly less comfortable than males (Wilder et al. 1985).

Even though a sense of self-efficacy in relation to computers may lead to greater computer use, there are still some potential obstacles, particularly for females. For example, they may experience disapproval for behavior that is considered "unfeminine." However, Gecas and Schwalbe (1983) argue that people are motivated to experience themselves as effective causal agents in their environment because this is very important to their self-concept. That is, even though individuals may be getting negative feedback from others about what they are doing (ie: societal disapproval for engaging in the "unfeminine" activity of computer use), developing a positive sense of self through acting on their environment may be more important to them than what other people think about what they are doing. In particular, if they are successful, the eventual positive feedback received justifies their disregard of the initial negative response.

Another important condition of efficacious action is that it requires access to the necessary resources to carry it out (Gecas and Schwalbe 1983). As past studies have shown, women often do not have equal access to either computer equipment or the knowledge to use it. However, the necessary resources for successful computer use, including information needed to learn how to use computers and access to computers themselves, are a part of the college setting. Another factor accounted for by the college setting is that the motivation for efficacious action is strong enough to overcome any negative reflected appraisals from others. This can be restated as the conscious desire to pursue one's goals regardless of how others may evaluate them. An illustration of the desire to succeed despite negative feedback is provided by the women in Fiorentine and Cole's (1992) study who persisted in medical school despite how difficult it got or how much social encouragement they received to drop out.

The perception of oneself as efficacious may be an important predictor in the case of computer use, because as Bouffard-Bouchard (1989) describes self-efficacy, it is situation-specific. That is, rather than being a generalized feeling of success, the perception of self-efficacy is an assessment of how well one can perform in a specific setting. Therefore, the perception of oneself as self-efficacious in relation to computers may encourage computer use, at least in certain settings.

2.4 The Importance of a Utilitarian Attitude Toward Computers

The other attitudinal variable I wish to look at as a possible explanation for gender differences in computer use is that of utilitarian attitudes toward computers. Although a gender gap in computer use may be partially explained by learned attitudes about what is gender-appropriate behavior, gender differences in computer use may also depend upon the individual's perception of the importance of computer skills to his or her immediate goals. This perception may in turn be shaped by the effects of social learning, which is consistent with a liberal feminist analysis of the "gender gap" phenomenon. For instance, some researchers who have found fewer gender differences in computer use tend to explain their findings as a result of participants' awareness of the utility of computers (Schumacher et al. 1993; Wilder et al 1985).

I argue that a utilitarian attitude toward computers encourages people to use computers and allows them to develop a sense of self-efficacy regarding their ability to respond positively to an environment which requires computer use. Hesse-Biber and Gilbert

(1994) arrived at a similar conclusion after observing the effects of a practical, utilitarian approach to computer use in their college classroom.

Some studies suggest that a utilitarian attitude towards computer use has a neutralizing effect on gender differences in computer use. For instance, a task-oriented program initiated in New Zealand schools at the 8th and 9th grade levels succeeded in reducing previously identified gender differences in computer use (Nolan et al. 1992). A follow-up study to this program showed no gender differences in attitudes about utility and much less marked gender differences in patterns of software preference (Nolan et al. 1992). The differences between those enrolled in the special program and those who were not are especially notable. Although there may have been some selection bias because participation in the program was voluntary, the practical motivation of having to use a computer as part of one's schoolwork may explain why gender differences, which persisted among non-participants, all but disappeared among program participants.

Samples of college students show fewer gender differences in utilitarian attitudes than those of pre-college students, even without special intervention programs. For example, when looking at the effects of age, gender, and experience on measures of attitudes regarding computers in a sample of 275 students enrolled in an introductory computer course, Pope-Davis and Twing (1991) found computer experience to be the only significant predictor, and then only on the subscale measuring "liking for computers." There were no significant gender differences on any of the other attitude subscales, which included perception of usefulness. The researchers explained this lack of gender differences in attitudes towards computers as perhaps being due to the increased emphasis on the use of computer technology as part of the daily routine and requirements in institutions of higher education.

Another study at the college level provides some support for the relationship between a utilitarian focus and reduced gender differences in computer use. A survey of computer-related attitudes was given to a sample of students in grades K-12, while a sample of college freshmen was asked about both attitudes toward computers and previous experience with computers (Wilder et al 1985). In the lower grades, the expected gender gaps favoring males were found, but at the college level they were not. For instance, females in the college sample saw computers as equally female-appropriate, and had just as much previous experience with them as males. Wilder et al. (1985) explained these results using several assumptions they made about women who have chosen to go to college:

1) They have different experiences with computers than non-college-bound women.
2) They aspire to careers in which computer experience is either expected or a great advantage.
3) They see themselves as in competition with men, both for grades and for jobs.

In other words, Wilder et al. argued that college women have already had sufficient experience to develop a sense of self-efficacy with computers, and also that they are aware of the utilitarian value of computers. In the lower grades, the responses of those females who are not college-bound cause the responses of those who are to be "hidden," so the potential for attitudes of self-efficacy and utility to explain gender differences in computer use do not become evident until individuals are surveyed at the college level.

In another study of college students from a variety of universities (Meier and Lambert 1991), a factor analysis showed that psychological aversion to computers consists of three factors. These three factors are: Outcome and efficacy expectations, attitudes about the usefulness of computers, and affective reactions to computers. The researchers concluded that remediation programs should explain benefits as well as provide training and experience, because people's attitudes about the utility of computers seem to have just as much of an effect on psychological computer aversion as either perception of efficacy or affective reactions. Although no evidence is provided by Meier and Lambert (1991), the relationship between computer aversion and computer use is assumed.

Finally, in a study conducted on MBA students, Schumacher et al. (1993) found little evidence of a gender gap in computer use, experience with computers, or utilitarian attitudes toward computers. The few differences found were primarily confined to experience with specific applications, with females reporting more experience than males on two of eight applications.[2] In terms of utilitarian attitudes, females were more likely than males to agree with statements about the relevance and importance of computer skills to career objectives. The authors suggested that more research is needed on the increasing importance of computer competence to career-oriented women, which is consistent with my argument that gender differences in computer use among college students can be partially explained by gender differences in attitudes about the utility of computers.

The research cited above suggests that male and female college students have similar attitudes about computer use because of the requirements placed upon most college students regarding computer use. These requirements constitute the situational variables (the expectation that they will effectively use computers, as well as access to the necessary information and equipment) that foster both a sense of self-efficacy and a utilitarian attitude towards computers. However, required use may vary according to academic major, which may be affected by gender-biased socialization into what is considered appropriate. Furthermore, both computer self-efficacy and utilitarian

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[2]Spreadsheets and accounting packages, with word processing also approaching significance.

attitudes toward computers themselves may be the products of gender-biased socialization practices. This institutionalized gender bias could result in the appearance of a direct relationship between gender and computer use, even though it is actually the attitudinal variables of computer self-efficacy and utilitarian attitudes toward computers which are affecting computer use. Therefore, computer self-efficacy and utilitarian attitudes about computers may be intervening variables in the the relationship between gender and computer use, and may offer a potential explanation for the reduction of gender differences in computer use found at the college level.

2.5 Hypotheses

Although a gender gap in computer use has been documented at various educational levels, this gap appears to be much less pronounced among college students. I will test for the existence of a gender gap in computer use in a sample of college students, and then I will explore the effects of computer self-efficacy, utilitarian attitudes toward computers, and gender on computer use. I argue from a liberal feminist perspective that, although in the past women were socialized to avoid the traditionally male-dominated areas of science and technology, including computers, this belief is losing its relevance because of the increasing importance of computer use in our society. In brief, competence with computers is necessary for the successful completion of college, which in turn is necessary to secure a desirable job. Although there is a gender gap in computer use among college students, it cannot be entirely explained by gender but instead is also due to gendered attitudes about self-efficacy with computers and the utility of computers. The best predictor of computer use may be attitudes such as computer self-efficacy and a utilitarian view of computers because women have traditionally been led to believe that they are not as good with computers as men are, and also that computers are not as useful to women as they are to men. Therefore, even though the college situation may somewhat reduce gender differences in computer use, these differences will still be found in a sample of college students because there will still be gender differences in the attitudes which affect computer use. The hypotheses I propose to test include:

H1: Males will use computers more than females.

H2: Males will have higher levels of self-efficacy with computers than females.

H3: Males will have more utilitarian attitudes toward computers than females.

H4: Self-efficacy will positively affect computer use.

H5: Utilitarian attitudes toward computers will positively affect computer use.

H6: Gender differences in computer use will be reduced after controlling for self-efficacy and utilitarian attitudes toward computers.

CHAPTER III:
METHODS

3.1 Survey Administration

Data for this thesis are derived from a self-administered questionnaire constructed for this research project entitled "Computer Use Among College Students." Approved by the Institutional Review Board of Virginia Polytechnic Institute and State University in the Spring of 1996, the survey was administered in the Spring of 1996 to 243 students attending an introductory sociology class. The response rate was 100% of those present because students were offered extra credit for participation, but those present represented less than half of those enrolled. Although the sample was not randomly selected or representative of the entire class, it produced a sufficiently large number of participants for most data analysis procedures. A copy of the survey is included in the Appendix.

3.2 The Survey Instrument

The questionnaire is intended to measure respondents' feelings about the utility of computers, their perception of self-efficacy, the amount of time they spend using computers, and various descriptive and demographic variables. Items 1-10, measuring self-efficacy and utilitarian attitudes, were formulated based on the Computer Aversion Scale (Meier 1988) and the Computer Attitude Scale (Nickell and Pinto 1986), but were modified to specifically reflect the attitudes of college students. Additional items include questions about computer use requirements, hours spent each week on computer use, applications, access to a computer, and descriptive and demographic questions. The survey is divided into three sections, each with a brief introduction.

A. Section I

Section I of the survey, questions 1-10, was designed to yield two scale scores, one for computer self-efficacy and one for utilitarian attitudes toward computers. Questions 1-5 concerned computer self-efficacy, with respondents rating their feelings of competence with computers on Likert-type scales ranging from 1 (agree) to 5 (disagree). Questions 6-10 concerned utilitarian attitudes toward computers, with respondents rating their beliefs about the usefulness of computers on five-point scales. Answers to questions 1-5 and 6-10 were used to form two additive scales for the two attitude variables that will serve as intervening variables in the examination of the relationship between gender and computer use.

B. Section II

In Section II of the survey, questions 11-22 asked respondents about their computer usage, questions 11 and 12 focused on requirements for computer use in school and at work, question 13 asked about hours spent on computer use in a typical week, and questions 14-22 asked about specific applications. It is important to note that computer use was not measured as a continuous variable, but rather through answer categories representing fixed intervals of time (i.e. 2-4 hours, 5-7 hours, 8-10 hours). Therefore, it was necessary to recode these responses to reflect the midpoint of each answer category so that an accurate estimate of the time spent on computer use could be obtained.

C. Section III

Section III of the questionnaire consisted of one item about access to a computer (question 23), and the remaining items were concerned with demographic or descriptive information which might be pertinent to the research question. This information included gender (question 24), academic level (question 25), family's approximate yearly income (question 26), and college of academic major (question 27).

3.3 Operationalization of Variables

A. Dependent Variables

Consistent with my research question of whether or not male college students spend more time using computers than female college students, the dependent variable used in this analysis is computer use, measured as hours per week spent using a computer. As mentioned previously, this variable was measured using answer categories rather than as a continuous variable, and so means were calculated from the midpoint of each category. To do this, answer choices were recoded to reflect the midpoint of each category. For instance, answer category 3, which in the questionnaire is "2-4 hours," has been recoded to equal "3 hours." Hours per week spent on computer use was also broken down into specific applications to see whether or not there are gender differences in types of computer use, with answers ranging from "1=0-1 hours" to "8=17 hours or more." These were also recoded to the midpoints of each answer category.

B. Independent Variable

The independent variable in the analysis is gender. Respondents were asked to indicate their gender as either "Male" or "Female." Gender was recoded as a dummy variable, with 0=Male and 1=Female.

C. Intervening Variables

The intervening variables are computer self-efficacy, and utilitarian attitudes about computers. Based on the literature, I hypothesize that attitudes about both computer self-efficacy and the utility of computers are important predictors of computer use. I further hypothesize that since they are influenced by the gender of the respondent, controlling for them will significantly decrease gender differences in computer use. Computer self-efficacy and utilitarian attitudes toward computers were operationalized using additive scales, which are described under section 5.2.

D. Control Variables

Several descriptive and control variables are also included in the analysis. Required computer use measured as the number of classes respondents are enrolled in, including currently, which require computer use may be important because the literature implies that computer use is increased if people are expected to use computers as a part of their daily routine (Hesse-Biber and Gilbert 1994; Nolan et al. 1992; Pope-Davis and Twing 1991; Wilder et al. 1985). Employment which requires computer use may have a similar effect. Academic level may also have an effect on computer use and attitudes towards computers because of increased experience with computers over time (Schumacher et al. 1993; Wilder et al. 1985), and there may also be increased expectations for computer use by more advanced students (Schumacher et al. 1993). In addition, family income should be considered because it may have an effect on access to a computer (Hess and Miura 1985; Nolan et al. 1992). Finally, respondents' college of academic major may play a part in computer use because some academic majors may require more computer use than others, and academic majors may be gender-segregated due to beliefs about what is gender-appropriate.

CHAPTER IV:

DATA ANALYSIS

4.1 Descriptive Statistics

Descriptive statistics for the sample are shown in Table 1. The sample is composed of 243 undergraduate students enrolled in an introductory sociology class, and about 55% of the sample was female. Academic level was mostly freshmen (67%) and sophomores (25%), with juniors making up 5% and seniors the remaining 3%. The most common college of academic major was Business, including 33% of respondents. Arts and Sciences followed at 25%, then Human Resources at 15%. Twelve percent of respondents were unsure; 8% were from the college of Engineering, and 2% were from each of the four remaining colleges. Almost 72% of respondents reported owning their own computer. The mean number of hours per week spent using a computer was 6.97 hours, with a standard deviation of 5.98. Only 12% of the sample reported using a computer for 17 hours or more per week, and 5% reported 0 hours of computer use per week (not shown in table). The mean number of classes taken which require computer use, including current enrollment, was 2.7, with a standard deviation of 1.57. Family income was fairly high, with most reporting an average family income of over $50,000.

4.2 Scale Construction

Table 2 shows factor loadings from a factor analysis of items 1-10 using principal extraction and varimax rotation. The two resulting factors were used to construct two scales, whose purpose was to evaluate respondent's self-efficacy and utilitarian attitudes about computers. Table 2 also shows a correlation matrix of items 1-5 and 6-10.

A. The Computer Self-Efficacy Scale

The computer self-efficacy scale consisted of questionnaire items 1-5, a series of statements about efficacy with computers with five Likert-type response choices ordered from "agree" to "disagree." An alpha coefficient reliability (Cronbach's Alpha) of .81 indicates high internal consistency for this scale. Items 1, 3, and 4 were reversed so that a higher scale score indicates a higher level of self-efficacy. Possible scores range from 1 to 5 because scores reflect each respondent's mean scale score. The mean and standard deviation for the computer self-efficacy scale are shown in Table 1, and scale scores were negatively skewed (-.886).

B. The Utilitarian Attitudes Toward Computers Scale

The utilitarian attitude scale consisted of questionnaire items 6-10, a series of statements about the utility of computers with five Likert-type response choices ordered from "agree" to "disagree." An alpha coefficient reliability (Cronbach's Alpha) of .70 indicates fairly high internal consistency for this scale. All items were reversed so that a higher scale score indicates a more utilitarian attitude toward computers, and possible scores range from 1-5. The mean and standard deviation for the utilitarian attitude scale are shown in Table 1, and scale scores were negatively skewed (-1.295).

4.3 Results of Hypothesis Testing

H (1): Men will use computers more than women. As shown in Table 3, a multiple analysis of variance (MANOVA) showed a significant gender difference in hours per week spent using a computer. Males spent significantly more time than females, with a mean of 8.57 total hours per week, while women had a mean of only 5.71 hours per week. This difference is statistically significant (F=14.400, prob=.000). Therefore, the first hypothesis is supported.

When computer use is broken down into specific applications, there are still some significant gender differences in time spent per week, although some of the differences are not significant. For instance, males spend significantly more time (2.85 hours per week) than females (.99 hours per week) playing games. This difference is statistically significant (F=19.125, prob=.000). There is another significant gender difference in time spent each week on the internet. The mean for males is 2.65 hours per week, while for females it is .96 (F=24.261, prob=.000). Applications for which there are no statistically significant gender differences include e-mail, statistics, chatting, word processing, spreadsheets, and database management.

H (2): Males will have a higher level of self-efficacy with computers than will females. Analysis of variance showed a significant difference in scores for males and for females on the self-efficacy scale. As shown in Table 3, males had a mean scale score of 4.13, while females had a mean scale score of 3.82. This difference is statistically significant (F=7.461, prob=.007). Therefore, the males in this sample had a higher level of self-efficacy with computers than the females, and this hypothesis is supported.

H (3): Males will have more utilitarian attitudes toward computers than will females. Analysis of variance showed that the difference in scores for males and females on the utilitarian attitude scale is not significant. As shown in Table 3, the mean utilitarian attitude scale score for males in the sample was 4.61, and the mean utilitarian attitude scale score for females in the sample was 4.51. However, this difference is not significant (F=2.852, prob=.093), and so hypothesis 3 is not supported.

H (4): Self-efficacy will positively affect computer use. The correlation between self-efficacy scale scores and computer use measured as hours per week spent using a computer is shown in Table 4. The correlation coefficient of .475 (prob=.000), indicates that self-efficacy and computer use are highly correlated, which provides support for hypothesis 4.

H (5): Utilitarian attitudes toward computers will positively affect computer use. The correlation between utilitarian attitude scale scores and computer use measured as hours per week spent using a computer is also shown in Table 4. The correlation coefficient of .257 (prob=.000), indicates that utilitarian attitudes toward computers and computer use are highly correlated, which provides support for hypothesis 5. Table 4 also shows that self-efficacy and utilitarian attitudes are highly correlated, with a correlation coefficient of .436 (prob=.000). This relationship will be further discussed later on.

H (6): Gender differences in computer use will be reduced when self-efficacy and utilitarian attitudes toward computers are controlled. In Table 5, results from a multiple analysis of variance (MANOVA) of hours per week spent using a computer and gender, with self-efficacy and utilitarian attitudes toward computers held constant, indicate that the gender difference in computer use, although slightly reduced, remains significant. The mean reported by males for total hours per week spent using a computer was 8.13 hours, while for females it was 6.15 hours, and the difference is statistically significant (F=7.89, prob=.005).

Bivariate correlates indicate that computer self-efficacy and utilitarian attitudes toward computers are related to computer use. However, when computer self-efficacy and utilitarian attitudes are controlled for in a multiple regression, gender still has a statistically significant effect on computer use (beta=-.17, prob=.005). As Table 6 shows, gender alone explains approximately 6% of the variation in computer use. Controlling for computer self-efficacy and utilitarian attitudes results in gender explaining only 3% of the variation in computer use. However, even though computer self-efficacy is the strongest predictor of computer use (beta=.40, prob=.000), gender remains as a significant predictor. Utilitarian attitudes are not a significant predictor of computer use (beta=.05, prob=.530), but one factor which may lead them to drop out as such is the high degree of correlation between utilitarian attitudes toward computers and computer self-efficacy. As shown in Table 4, the correlation coefficient for this relationship is .436 (prob=.000). As a result, the problem of multicollinearity may have served to distort the regression analysis. When utilitarian attitudes alone are regressed on computer use, they are a significant predictor (beta=.24, prob=.000).

4.4 Control Variables

In a multiple regression of computer use and all control variables, shown in Table 7, gender was still a significant predictor of computer use. (beta=-.15, prob=.016). Self-efficacy remained a strong predictor of computer use (beta=-.27, prob=.000), but computer ownership was also significant (beta=.25, prob=.000). Number of classes requiring computer use was significant as well (beta=.15, prob=.000). However, academic level (prob=.082) and family income (prob=.299) were not significant.

4.5 Additional Analysis

Although college was not included in regressions or analyses of variance because to do so would require extensive recoding, as shown in Table 8 college and gender were significantly related (chi-square=28.76, prob=.000). College also had a significant relationship to hours per week spent using a computer (results are not shown, but chi-square=92.95, prob=.001) and number of classes requiring computer use (chi-square=72.64, prob=.001).

Definition of colleges as "gender-appropriate" is subjective, and sample N's are small, but note in Table 8 the concentration of males in the colleges of Business and Engineering, as opposed to the concentration of females in the college of Human Resources. The college of Arts and Sciences appears to be relatively gender-neutral, but this shows that college may not be as accurate an indicator of gender segregation as academic major because some colleges are so heterogenous.

CHAPTER V:
DISCUSSION AND CONCLUSIONS

5.1 Summary of Findings

Using a sample of 243 undergraduate students enrolled in an introductory sociology course at Virginia Polytechnic Institute and State University, this research explored the question of whether or not there is a gender gap in computer use and also explored the relationships among gender, computer self-efficacy, a utilitarian attitude toward computers, and computer use. The hypotheses tested include that males will use computers more than females, that males will have higher levels of self-efficacy with computers than females, that males will have a more utilitarian attitude toward computers than females, that self-efficacy and utilitarian attitudes will both have a postive relationship to computer use, and that gender differences in computer use will be reduced when self-efficacy and utilitarian attitudes toward computers are controlled. As discussed in the data analysis section, most of the hypotheses are confirmed in this sample of college students. Males do use computers more than females when computer use is measured as hours per week spent using a computer. As expected, males have a higher level of self-efficacy with computers than females. However, the males and females in this sample have similar utilitarian attitudes toward computers. Self-efficacy and utilitarian attitudes have a significant positive relationship with computer use. Gender differences are slightly reduced when self-efficacy and utilitarian attitudes are controlled, but while self-efficacy is a significant predictor of computer use, utilitarian attitudes are not. This, however, may be due to the problem of multicollinearity between the two predictor variables. Finally, although gender differences are somewhat reduced when self-efficacy and utilitarian attitudes are controlled, gender remains as a significant predictor of computer use. This is true even when other variables, including number of classes requiring computer use, academic level, family income, and computer ownership, are held constant, although computer ownership and enrollment in classes requiring computer use are also significant predictors.

All of the hypotheses are consistent with the argument that computer self-efficacy and utilitarian attitudes toward computers have an impact on computer use. Therefore, even though the women in this sample are aware of the utilitarian value of computers, they have a lower level of computer self-efficacy than the men do and so tend to use computers less than the men do.

The relationship among college, gender, and computer use supports my argument concerning the effect of socialization into beliefs about what is gender-appropriate on computer use. The significant relationship between gender and college, and between college and computer use, suggests that if the selection of academic major or area of specialization is based on perceived gender-appropriateness, this may in turn affect computer use. That is, females may be concentrated in academic areas that require less computer use, which contributes to gender differences in computer use measured as hours per week spent on computer use. Therefore, although I controlled for this eventuality and still found gender differences in computer use in this sample, the selection of an academic major which is based on perceived gender-appropriateness should not be ruled out as a possible predictor of computer use.

A finding which supports the conclusion that computer use is affected by beliefs about self-efficacy and utilitarian attitudes toward computers is that when computer use is measured as hours per week spent on specific applications, statistically significant gender differences are greatly reduced. For instance, as shown in Table 3, although there are significant gender differences in mean hours spent playing games or using the internet, there are no other statistically significant gender differences on any other specific applications. Both males and females in this sample report spending less than one hour per week on statistics, chatting, spreadsheets, or database management, and although the mean amount of time spent is slightly less for females, the difference is not statistically significant. Furthermore, both males and females report spending about 2.5 hours per week using e-mail; time spent is slightly more for females but the difference is not statistically significant. Finally, both males and females report spending about 3 hours per week on word processing; again, time spent is slightly more for females but the difference is not statistically significant.

This finding may also have implications for the measurement of gender differences in computer use because, although females report using computers less than males in general, when specific applications are included the "gender gap" is reduced, in some cases even favoring females. This suggests that the perceived gender-appropriateness of specific applications may be what accounts for gender differences in computer use. That is, computer use in general may be seen as more male-appropriate, but specific applications may not be. This in turn may affect computer self-efficacy and/or utilitarian attitudes, leading to increased computer use by females in the case of some applications. Therefore, in order understand the gendered nature of computer use, perhaps researchers should focus on specific applications.

5.2 Implications For Theory and Research

Although the few studies which looked at computer use among college students found little evidence of a gender gap in computer use, I am aware of none that operationalized computer use as hours spent per week. Most researchers looked at attitudes toward computers as an explanation for an assumed gender gap without actually testing the impact of these attitudes on computer use in their samples (Francis, 1994; Wilder, Mackie, and Cooper 1985). Some researchers tried to make a connection between attitudes toward computers and computer use, but inferred computer use from other variables, such as prior experience with computers, rather than measuring it specifically as hours per week spent using computers (Fetler 1985). A number of theorists also attempted to explain the "technological gender gap" without empirical evidence of such a phenomenon (Hesse-Biber and Gilbert 1994; Griffiths 1988; Reisman 1990).

The implications for theory and research on gender differences in computer use are two-fold. First, if a causal connection is being sought, the existence of gender differences in computer use needs to be established in the sample or the findings on attitude differences cannot be used to explain gender differences in computer use. Using a liberal feminist and social learning theory approach, gender differences in computer use should be reduced as people accept the idea that computer use is equally important to both women and men, and that both women and men are equally capable of successful computer use. In order to find support for this argument, both attitudes and use must be studied together. Second, the usefulness of self-efficacy with computers for predicting computer use has been established by my study, but utilitarian attitudes may not a be good predictor because they are too highly correlated with self-efficacy.[3] Therefore, although attitudes toward computers provides only a partial explanation for gender differences in use, this relationship should be considered when attempting to discover a causal connection.

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[3]This relationship may also be spurious, and causal order is unclear because this was a cross-sectional study, so further research is necessary to explore this relationship more fully.

Another implication of my findings concerns the continued existence of gender differences in computer use at the college level. Although several studies found that gender differences in computer use, however they measured it, were not significant for college students as opposed to younger students, I still find a significant difference in my sample. This may be due to my improved measures of computer use, which take into account actual time spent on computer use in general and also on specific applications. Most other researchers confined their measurement of computer use to assumptions made based on measures of previous experience or preferred applications, which does not allow many conclusions to be drawn.

Finally, although gender differences in computer use can be partially explained by self-efficacy and the other variables I controlled for, some of the variance still remains unexplained. This suggests that there are other predictors of computer use besides the ones suggested by existing research, including my own, that should be considered in subsequent studies.

5.3 Limitations of This Study

The generalizability of the findings of this study is limited both by the nature of the sample and by the research design. As Francis (1994) has pointed out, the differences found in one sample of college students may not exist in another. My sample was a convenience sample, based on which professor would allow me to survey his/her class and who chose to attend class that day. Furthermore, since this was a cross-sectional study, causal order cannot be established. Also, although the reliability of my self-efficacy and utilitarian attitude scales was acceptable, the review of previous research has demonstrated that the results of such measures are inconsistent. Another shortcoming was my measurement of computer use. Reported usage was surprisingly low, and perhaps it was because the answer categories provided failed to represent all respondents' computer usage adequately.

A further limitation, although one over which I had less control, was the lack of literature on computer use among college students available for review. Since the majority of available research concentrated on gender differences in attitudes toward computers, it was difficult to establish a theoretical argument concerning gender differences in computer use. For instance, it was difficult to evaluate any changes in computer use behavior which may have taken place over time as a possible result of the increasing importance of computer use to both men and women in our society.

5.4 Conclusions

Most of the findings of this thesis were not unexpected. Despite women's progress toward social and economic equality with men, men continue to hold an advantage that is supported and perpetuated by the major institutions in our society. My research demonstrates that while college students may be aware of the importance of computers to academic and financial success, women still lag behind men in their utilization of this vital technology because they feel less competent about doing so. Furthermore, while it was beyond the scope of this study to establish empirically the source of this inequity, the relationship between gender-stereotyped socialization and individual behavior has been previously documented by research in many fields. For instance, statistics on the proportion of degress in higher education awarded to women in particular disciplines[4] demonstrates that although progress has been made toward more equality in formerly

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[4]See Table 9 in Appendix.

gender-specified areas of study and employment, the problem of inequities that can be attributed in part to gender-stereotyped socialization continues to be a viable one.

Suggestions for future research on gender differences in computer use include firmly establishing the structural sources of these gender differences so that they can be addressed. One way to accomplish this goal may be to study the relationships among other variables such as age, race, socioeconomic status, marital status, and employment that were not considered in this thesis, in terms of their relationship to computer use. Another research strategy might be to evaluate programs designed to alleviate gender differences in both attitudes about computers and use patterns using a longitudinal approach or an experimental model with a control group. My experience with trying to find empirical data on gender differences in computer use also suggests a need for more studies that actually document this phenomenon, because it is important to monitor any changes that may be occurring over time. Doing so would make it easier to establish what may contribute to those changes, so that potential solutions to the problems created by gender inequality can be assessed.

As stated at the beginning of this thesis, technological advances made in the name of improving human life have also resulted in the creation of increasingly serious threats to our well-being. If these problems are to be successfully addressed through the application of further technological innovation, the participation of the entire human race is necessary, not just 50% of it. Therefore, limiting women's access to the necessary tools for their full contribution to technological advancement, however it is accomplished, can only harm us all. Socially constructed gender inequality, in any area of life, is not just a "women's problem."

TABLES

Table 1: Descriptive Statistics For Variables in the Analysis

Categorical Variables - Percentage:		
Gender (N=242)		
Males	45.0	
Females	55.0	
Academic Level (N=241)		
Freshman	66.9	
Sophomore	24.8	
Junior	5.0	
Senior	2.9	
College (N=242)		
Agriculture/Life Sciences	2.1	
Architecture/Urban Studies	1.7	
Arts and Sciences	24.8	
Business	33.1	
Education	2.1	
Engineering	8.3	
Forestry/Wildlife	1.7	
Human Resources	14.9	
Unsure	11.6	
Access To A Computer (N=243)		
Own	71.6	
Friend's	21.4	
Lab in Dorm	1.2	
Lab on Campus	4.9	
Work	0.4	
Don't Know	0.4	

	Mean	S. D.
Hours Per Week Spent Using A Computer (N=241)	6.97	5.98
Number of Classes Taken Requiring Computer Use (N=241)	2.7	1.57
Family Income (N=226)	$68,982	26749
Computer Self-Efficacy Scale (N=243)	3.95	.88
Utilitarian Attitude Scale (N=243)	4.56	.47

Table 2: Factor Loadings and Correlations For Computer Self-Efficacy and Utilitarian Attitude Scales

Factor Loadings:

Item #	Factor 1 (Efficacy)	Factor 2 (Utility)
1	0.728	0.160
2	0.825	0.036
3	0.780	0.255
4	0.476	0.409
5	0.817	0.147
6	0.015	0.584
7	0.221	0.710
8	0.272	0.616
9	0.059	0.727
10	0.199	0.625

Correlations:

(N=242)	1	2	3	4	5
1	1.000				
2	0.425***	1.000			
3	0.497***	0.604***	1.000		
4	0.352***	0.281***	0.412***	1.000	
5	0.513***	0.614***	0.575***	0.365***	1.000

(N=243)	6	7	8	9	10
6	1.000				
7	0.216***	1.000			
8	0.159**	0.555***	1.000		
9	0.287***	0.390***	0.310***	1.000	
10	0.408***	0.309***	0.238***	0.358***	1.000

Note: Items 1-5 measure computer self-efficacy, and items 6-10 measure utilitarian attitudes.
** $p<.01$, *** $p<.001$

Table 3: Gender Differences In Computer Use, Computer Self-Efficacy, and Utilitarian Attitudes

Application (N=242)	Mean For Males	Mean For Females	Difference	F
Total Hours Per Week	8.57	5.71	2.86	14.400***
Games	2.85	0.99	1.86	19.125***
Internet	2.65	0.96	1.69	24.261***
E-Mail	2.29	2.45	-0.16	0.085
Statistics	0.81	0.55	0.26	1.435
Chatting	0.79	0.36	0.43	2.167
Word Processing	2.72	2.88	-0.16	0.188
Spreadsheets	0.52	0.42	0.10	0.565
Database	0.54	0.33	0.21	1.600
Other	1.73	0.73	1.00	8.055**

Multivariate F (10,229)=5.22, p<.001 Multivariate Effect Size=.19

Intervening Variables:	Mean For Males	Mean For Females	Difference	F
Self-Efficacy Scale (N=242)	4.13	3.82	0.31	7.461**
Utilitarian Attitude Scale (N=241)	4.61	4.51	0.10	2.852

**p<.01, ***p<.001

Table 4: Correlation Between Computer Self-Efficacy, Utilitarian Attitude, and Hours of Computer Use Per Week

(N=241)	COMPUTER USE	EFFICACY	UTIL. ATTITUDE
COMPUTER USE	1.000		
EFFICACY	0.475***	1.000	
UTIL. ATTITUDE	0.257***	0.436***	1.000

***$p \leq .001$

Table 5: Gender Differences In Computer Use When Controlling For Computer Self-Efficacy and Utilitarian Attitude Toward Computers

Application (N=240)	Mean For Males	Mean For Females	Difference	F
Total Hours Per Week	8.13	6.15	1.98	7.89**
Games	2.80	1.03	1.77	16.77***
Internet	2.52	1.09	1.43	18.11***
E-Mail	2.14	2.56	-0.42	0.88
Statistics	0.77	0.59	0.18	0.71
Chatting	0.80	0.35	0.45	2.33
Word Processing	2.59	3.01	-0.42	1.21
Spreadsheets	0.50	0.44	0.06	0.21
Database	0.53	0.34	0.19	1.26
Other	1.64	0.82	0.82	5.37*

Multivariate $F(10,227)=4.49$, $p<.001$ Multivariate Effect Size=.17

*$p<.05$, **$p<.01$, ***$p<.001$

Table 6: Results of Multiple Regression (Standardized Beta and T-Values) of Computer Use on Computer Self-Efficacy, Utilitarian Attitude, and Gender

(N=243)

	Beta	t	R Square
Equation 1			
Step 1	Beta	t	R Square
Gender	-.24	-3.80***	.06
(Constant)		15.33	
Total F (1,238)=14.34, p<.001			
Equation 2			
Step 1	Beta	t	R Square Change
Computer Self-Efficacy	.40	6.13***	.18
Utilitarian Attitude	.05	.711	
Step 2			
Gender	-.17	-2.81**	.03
(Constant)		-1.31	
Total F (3,236)=20.71, p<.001			

**p<.001, ***p<.001

Table 7: Results of Multiple Regression (Standardized Beta and T-Values) of Computer Use on All Control Variables

	Model 1 (N=243)			Model 2 (N=222)		
	Beta	t	R Square	Beta	t	R Square
Gender	-.17	-2.81**	.21	-.15	-2.44*	0.29
Computer Self-Efficacy	.36	5.73***		.27	4.04***	
Utilitarian Attitude	.04	.63		-.04	-.60	
Computer Ownership				.25	3.97***	
Academic Level				-.11	-1.75	
Family Income				-.06	-1.04	
Classes Requiring Computer Use				.15	2.32*	
(Constant)		.19			.19	
*p<.05, **p<.01, ***p.001	Total F (3,236)=20.71, p<.001			Total F (7,214)=12.33, p<.001		

Table 8: The Relationship Between Gender and College

College (N=241)	% Males	% Females
Agriculture	0.9 (1)	3.0 (2)
Architecture	3.7 (4)	0.0 (0)
Arts and Sciences	25.0 (27)	24.8 (33)
Business	40.7 (44)	27.1 (36)
Education	1.9 (2)	2.3 (3)
Engineering	12.0 (13)	4.5 (6)
Forestry/Wildlife	1.9 (2)	1.5 (2)
Human Resources	4.6 (5)	23.3 (31)
Unsure	9.3 (10)	13.3 (18)
Total	**100.0 (108)**	**100.0 (133)**

Chi-square (8)=28.76, p=.000

Table 9: Doctorates Earned, by Field: 1971 and 1992

Field of Study	*Number of Degrees Awarded* 1971	1992	*Female Recipients (%)* 1971	1992
Agriculture and Natural Resources	1086	1214	2.9	20.7
Area, Ethnic, and Cultural Studies	144	155	16.7	41.9
Biological Sciences/Life Sciences	3645	4243	16.3	38.3
Business	757	1242	2.8	23.3
Communications and Technologies	145	255	13.1	48.2
Computer and Information Sciences	128	772	2.3	13.3
Education	6041	6864	21	59.5
Engineering	3638	5499	0.6	9.6
English Language and Literature	1650	1273	28.8	57.8
Foreign Languages	988	850	34.6	55.5
Health Sciences	466	1661	16.5	58
Home Economics	123	293	61	75.8
Law and Legal Studies	20	68	(Z)	26.5
Liberal Arts and Sciences/Humanities	32	67	31.3	55.2
Library Science	39	50	28.2	68
Mathematics	1249	1082	7.6	21.3
Multi/Interdisciplinary Studies	59	231	6.8	37.7
Parks and Recreation	2	61	50	32.8
Philosophy, Religion, and Theology	866	1734	5.8	16.8
Physical Sciences/Technologies	4390	4391	5.6	21.9
Protective Services	1	24	0	45.8
Psychology	2144	3373	24	59.7
Public Administration/Services	174	432	24.1	52.8
Social Sciences	3660	3218	13.9	33.9
Visual and Performing Arts	621	906	22.2	44.4
Unclassified	3	569	(Z)	31.6
Total	**32107**	**40659**	**14.3**	**37.1**

(Z)=less than .05%
Source: Statistical Abstract of the U.S. 1995

APPENDIX: SURVEY

Informed Consent For Survey Participants

Title of Project: *Computer Use Among College Students*

Principal Investigator: Patricia J. Peterson

You are invited to participate in a study about computer use among college students. This study involves a survey for the purpose of collecting data from college students about their use of and attitudes towards computers. Participation is both voluntary and anonymous. This research project has been approved, as required, by the Institutional Review Board for projects involving human subjects at Virginia Polytechnic Institute and State University, and by the Department of Sociology.

Subject's Permission (you may tear this off and keep it):

I have read and understood the informed consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project. Should I have any questions about this research or its conduct, I will contact:

Patricia J. Peterson, Investigator	phone: 231-6455
Carol A. Bailey, Faculty Advisor	phone: 231-8976
Ernest R. Stout, Chair, IRB	phone: 231-9359

Computer Use Among College Students

In the first section, we would like to ask you some questions about your attitudes toward computers. Please select the answer that best fits your opinions and fill in the corresponding number on the op-scan sheet provided.

1. When I sit down at a computer, I know that I can accomplish what I set out to do.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

2. If I were sitting before a computer, I would not be sure how to use it.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

3. I could learn to use a new type of software I hadn't seen before.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

4. I can get my work done faster with a computer than without one.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

5. I feel incompetent when I try to use a computer.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

6. Knowing about computers will help me to get a job.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

7. Computers can eliminate a lot of tedious work for people.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

8. Computers are an efficient way of getting a job done.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

9. Knowing about computers gives you an advantage as a college student.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

10. Knowing how to use a computer is important for fulfilling my academic requirements.

    1. Agree
    2. Tend to agree
    3. Neither agree nor disagree
    4. Tend to disagree
    5. Disagree

In this section, we'd like to ask you some questions about your computer usage.

11. Including this semester, how many classes have you taken which required you to use a computer?

    1. 0
    2. 1
    3. 2
    4. 3
    5. 4
    6. 5 or more

12. Have you ever been required to use a computer as part of your employment?

    1. Yes
    2. No

13. Approximately how many hours **altogether** in a typical week do you spend using a computer?

    1. 0 hours
    2. 1 hour or less
    3. 2 to 4 hours
    4. 5 to 7 hours
    5. 8 to 10 hours
    6. 11 to 13
    7. 14 to 16
    8. 17 hours or more

Please indicate how many hours you spent in the past 7 days on each of the following applications:

	(0)	(1 or less)	(2-4)	(5-7)	(8-10)	(11-13)	(14-16)	(17+)
14. playing games	1	2	3	4	5	6	7	8
15. surfing the net (WWW)	1	2	3	4	5	6	7	8
16. e-mail	1	2	3	4	5	6	7	8
17. data analysis/statistics	1	2	3	4	5	6	7	8
18. chatting	1	2	3	4	5	6	7	8
19. word processing	1	2	3	4	5	6	7	8
20. spreadsheets	1	2	3	4	5	6	7	8
21. data base management	1	2	3	4	5	6	7	8
22. other	1	2	3	4	5	6	7	8

In this last section, we'd like to know a little more about you.

23. If you needed to use a computer, which of the following would you most likely use?
    1. One I own
    2. One owned by a friend
    3. One in a lab in my dorm
    4. One in a lab on campus
    5. One at work
    6. Other
    7. Don't know.

24. Are you male or female?
    1. Male
    2. Female

25. What is your academic level?
    1. Freshman
    2. Sophomore
    3. Junior
    4. Senior
    5. Graduate
    6. Other

26. What is your family's approximate yearly income?
    1. under $10,000
    2. $10,000 to $24,999
    3. $25,000 to $34,999
    4. $35,000 to $49,999
    5. $50,000 to $74,999
    6. $75,000 to $99,999
    7. $100,000 or more

27. What is your college?
    1. Agriculture and Life Sciences
    2. Architecture and Urban Studies
    3. Arts and Sciences
    4. Business
    5. Education
    6. Engineering
    7. Forestry and Wildlife Resources
    8. Human Resources
    9. Unsure (please write your academic major on the op-scan sheet)

Thank you for your help with this project!

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