AN ANALYSIS OF FACTORS THAT INFLUENCE COMMUNITY COLLEGE STUDENTS' ATTITUDES TOWARD TECHNOLOGY

A Dissertation

by

KATHLEEN LITERSKI FLEMING

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2005

Major Subject: Educational Human Resource Development

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Approved by:

Co-Chairs of Committee,	Walter Stenning
	Donald Seaman
Committee Members,	Kenneth E. Paprock
	Stephen Stark
Head of Department,	James Schenurich

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ABSTRACT

An Analysis of Factors That Influence

Community College Students' Attitudes

Toward Technology. (December 2005)

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Co-Chairs of Advisory Committee: Dr. Walter Stenning
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This study investigated the factors that influence community college students' attitudes toward technology, particularly in teaching and learning experiences. Studies on post-secondary students' attitudes reported in the literature are limited. Factors cited previously as having an effect on attitudes towards technology and toward computers included: gender; age; presence of a computer in the home; completion of a formal technology course; and comfort with technology.

The subjects in this study were 372 students in freshman level credit English classes in the five colleges of the North Harris Montgomery Community College District located in the greater metropolitan Houston area. Previous research instruments and studies to measure students' attitudes toward technology were reviewed. A modified version of the Secondary Students Attitudes' Toward Technology (SSATT) was developed for this study because of the content, reliability, and applicability to the post-secondary population. The instrument was administered in the spring of 2005.

The fact that 95.4% of the participants reported having a computer at home and that 70.2% reported having had a formal technology class provided insight into the integration of technology in the lives of this community college sample. A correlation matrix of all variables and analysis of variance were performed. Factor analyses were performed to identify subcomponents of the instrument. Eight factors were identified: (1) need for technology competence, (2) technology benefits, (3) negative aspects of technology, (4) technology and the workplace, (5) impact of increased use of technology, (6) video games, (7) technology and job creation, and (8) technology and safety.

A conclusion of the study was that neither age nor gender had a significant effect on the post-secondary students' attitudes toward technology, which differs from the findings in some of the previous studies. Females reported being as comfortable, if not more so, with technology in teaching and learning experiences as the males in the study. Exposure to technology, completion of a formal technology class, and the use of computers appeared to positively affect community college students' attitudes toward technology.

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INTRODUCTION

Society continues to experience increasing interactions with technology. All areas of life and the individual's interactions with their world are being impacted by the changes. With this evolution it becomes increasingly important to educational institutions that their students are prepared to use, understand, and mange technology in their lives and in their educational and work experiences. Individuals need to develop the skills and understanding about where and how to access information. They need to understand how to evaluate, organize, synthesize, use, and communicate the information (Texas Education Agency, 2002). The American Association of Community Colleges (AACC) lists technology along with teaching and learning in their strategic action areas. It points to the need for "educators to examine modes of communication that best fit a student's needs in an evolving society" (ACCC, 2001).

The Technology for All Americans Project (TFAAP) launched in 1994 by the International Technology Education Association (ITEA, 1996), the No Child Left Behind Act of 2001 (U.S. Department of Education, 2001), and the National Ed Tech Plan required by the No Child Left Behind Act to be submitted to Congress are testaments to the importance technology and technological literacy have for the future of students and society, and the attention it is receiving from government and education. As the integration of technology continues and technological literacy is developed, the

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This dissertation follows the style and format of *The Journal of Educational Research.*

attitudes of the students, teachers, parents, and institutions become important.

Students' attitudes toward technology have been researched for approximately twenty years and have been focused primarily at the elementary and secondary level. Attitude has not generally been recognized as directly related to action; however, it has been acknowledged that attitude is a factor and can influence behavior (Fishbein, 1967). Becker (1994) and Kim and Hunter (1993) indicated that attitudes have been tied to the use or avoidance of technology. The second of the six major standards in the *International Society for Technology Education (ITSE) National Educational Technology Standards for Students (NET-S)* addressed social, ethical, and human issues and stated as an objective that "students develop positive attitudes toward technology uses that support life long learning, collaboration, personal pursuits, and productivity" (International Society for Technology Education [ITEA], *National Educational Technology Standards for Students, 1996)*. Gaining understanding about students' attitudes toward technology and the factors that influence the attitudes has merit as education works toward meeting the needs and demands of the students and society.

Background of the Study

Attitude is a concept that has been considered in depth by the field of social psychology. The construct of attitude is complex and multi-dimensional. Allport (1935) pointed out that attitudes have a cognitive or mental component in his definition "a mental or neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (p.810).

Attitude is defined as “a learned predisposition to respond to an object or class of objects in a consistently favorable or unfavorable way” by Fishbein (1967). Debate continues in research as to the relationship between attitude and behavior as well as how it relates to beliefs, values, and emotions. What does emerge is that attitude is learned, affected by experience, and has an evaluative nature. It is the evaluative aspect that Shaw and Wright (1967) say distinguishes it from belief and motivation.

Research on students’ attitudes toward technology can be traced back to the studies by Raat and deVries in the middle 1980s with their studies on 13 year olds in the Netherlands. The Pupils’ Attitude Toward Technology instruments (PATT) were developed consisting of 85 items addressing a range of technology issues by Raat and de Vries (1985). Through factor analysis they identified 14 factors. British undergraduate students’ attitudes toward technology were researched by Fife-Schaw, Breakwell, Lee, and Spencer (1987).

The PATT was translated into English by Bame and Dugger (1989) who then identified the instrument as the PATT-USA. Five factors were identified by the administration of the PATT-USA in a study that involved students in seven states by Bame, Dugger, de Vries, and McBee (1993). The instrument was again used by Boser (1996) and Shafiee (1994) in their studies.

The Secondary Students’ Attitude Toward Technology (SSATT) was developed by Bolin (1992) after analysis of the earlier instruments and studies. Bolin’s factor analysis identified eight factors, the first of which was attitude toward technology. Shafiee (1994) administered a modified SSATT to students at a community college to “identify the factors underlying their attitudes toward working with and learning through computer technology” (p. 64). Nine factors were identified from the 32 item modified SSATT. Shafiee recommended, “that further research be conducted to confirm the results of the study with a different community college population” (p. 85).

Thompson and Householder (1995) reduced the length of some SSATT items, simplified others, and reduced the number of items to 30 to create the Technology Survey instrument for the grades 7 and 8. McHaney (1998) used the Technology Survey to study factors underlying secondary students’ attitudes toward technology for students in grades 7 through 12.

Each study has been successful in identifying factors that affected students’ attitudes toward technology and each added to the previous knowledge base. The factors affecting community college students’ attitudes toward technology in the twenty-first century have yet to have significant research.

Statement of the Problem

Students’ attitudes toward technology have seldom been researched at the post-secondary level in the past twenty years. Whereas a substantial amount of research and several survey instruments exist on students’ attitudes toward technology for grades 4 through 12, little is available for community college and university educators and administrators.

With enrollments in the 1,173 community colleges in the United States increasing to over 10.4 million students in the year 2000, and representing 44% of all undergraduates, according to the statistics from the “National Profile of Community

Colleges: Trends and Statistics" (American Association of Community Colleges [AACC], *Community College Fact Sheet*, 2000, p.1), research on the factors affecting this diverse student populations' attitudes toward technology is needed, particularly in both formal and informal teaching and learning experiences. Community colleges exist as centers for educational opportunity and provide courses for varying educational outcomes. They provide: (1) credit courses for individuals planning to transfer and seek degrees at four-year institutions; (2) training in various certificate programs requiring two years of less of instruction; and (3) professional and technical training and certification for individuals in the workforce. Community college students are the educators, administrators, technicians, and workforce of the next several decades and are living the transitions in technology.

Purpose of the Study

The purpose of this study was to identify the factors underlying community college students' attitudes toward technology in both formal and informal teaching and learning experiences. The objective of the study was to assess community college students' attitudes and to test the following hypotheses:

1. Male and female community college students will display similar attitudes toward technology.

2. Students with access to a computer at home will display similar attitudes toward technology.

3. Age will not affect students' attitudes toward technology.

4. Formal technology courses taken in high school will not affect students' attitudes toward technology.

5. The number and type of technology experiences will not affect students' attitudes toward technology.

Research Questions

The following research questions were the focus of this research:

1. To what degree does gender affect community college students' attitudes toward technology as reported by community college students in Houston, Texas?

2. To what degree does computer access in the home affect the students' attitudes toward technology as reported by community college students in Houston, Texas?

3. To what degree does age affect the students' attitudes toward technology as reported by community college students in Houston, Texas?

4. To what degree does taking a formal technology course in high school affect the students' attitudes toward technology as reported by community college students in Houston, Texas?

5. Do the number and type of technology experiences affect students' attitudes toward technology as reported by community college students in Houston, Texas?

6. What factors are identified by a factor analysis of the modified Secondary Students' Attitudes Toward Technology (SSATT) instrument used in this study of community college students in Houston, Texas?

Significance of the Study

This study is significant in that it provides information on community college student's attitude toward a critical element of their educational and work experience. As reported during the development of the Technology for All Americans Project, "Employers, policy makers, and educational leaders are starting to agree that all citizens need to be technologically literate in order to succeed in today's world" (Satchwell and Dugger, 1996). As it is argued that technological literacy is essential in the twenty-first century, its infiltration into curriculum and delivery methods abounds.

Acknowledging that attitude is "a learned predisposition to behave in a consistently favorable or unfavorable way with respect to a given object" (Schiffman and Kanuk, 1996) it becomes valuable to investigate students' attitudes toward technology. Daley, Watkins, Williams, Courtenay, Davis, and Dymock (2001) report in their study, *Exploring Learning in a Technology-Enhanced Environment*, "the findings of this study indicated that students' attitudes and perceptions towards technology [and the ways which technology foster the learning climate and structure the learning task] have a major impact on learning outcomes" (p. 136).

"At community colleges, people can continue to learn at any point in their lives. The fast pace of technological innovations and increasing frequency of job and career changes can create the potential for people to return to community colleges again and again" (American Association of Community Colleges [AACC], *National profile of community colleges: Trends & statistics*, 2000, p. 4). Little research can be found on post-secondary students' attitudes toward technology compared to the numerous studies on younger students. This study provides an assessment of community college students' attitudes toward technology. The institutions being sampled, though part of one district, have students of varying ages with different backgrounds and experiences.

As technology continues to explode and infiltrate all aspects of the students' lives and educational experiences there is value in identifying the factors that may be influencing their attitudes. Therefore, even a simple descriptive statistic like the availability of a computer in the home can help an instructor assist a student with the learning experience and environment.

Methodology

Population and Sample of the Study

The population sampled consisted of approximately 6,600 students enrolled in credit English courses during the spring of 2005 in the North Harris Montgomery Community College District in Houston, Texas. The district has a 1,400 square mile in-district service area serving 11 school districts: Aldine, Conroe, Cypress-Fairbanks, Humble, Klein, Magnolia, New Caney, Splendora, Spring, Tomball, and Willis. The district is comprised of five comprehensive community colleges: North Harris College in Houston, Texas (10,800 credit students); Kingwood College in Kingwood, Texas (6,500 credit students); Tomball College in Tomball, Texas (7,400 credit students); Montgomery College in The Woodlands, Texas (7,300 credit students); and Cy-Fair College in Cypress, Texas (8,600 credit students). After identifying all of the credit English classes offered throughout the district and creating a database by using a query of the computer system, a random sample of 30 credit English classes was drawn to participate in this study.

Procedure

The researcher had the approval of the Chancellor and the NHMCCD Executive Committee to conduct the research in the district. The Vice President of Educational Resources at each of the five colleges was contacted to discuss the scope and process of the research. A meeting was then scheduled with the dean having oversight of the English department to discuss the research and the administration of the instrument. The instruments were delivered to the instructor of each of the 30 randomly selected English classes sealed in an envelope along with a supply of number two pencils and instructions for the volunteer student administrator. The instruments were marked by the volunteers, collected by the volunteer administrator, sealed in an envelope, and returned to the researcher through the inter-campus mail.

Instrumentation

The instrument administered was a modified SSATT consisting of three parts (Shafiee, 1994). The top of the page requested the course information and the date of participation. Part I consisted of a listing item regarding those things the student considered major technologies that assist them in teaching and learning in both formal and information learning experiences. Part II consisted of 31 positive statements to be scored using a modified 10-point Likert scale. On the scale 1 represented “strongly disagree” and 10 represented “strongly agree”. Item 32 asked the student to rate his or her comfort level with computers and other technological equipment using a modified

10-point Likert scale with 1 representing “very uncomfortable” and 10 representing “very comfortable”. Part III consisted of demographic items on gender, age, college credits earned, computer usage, computer availability in the home, and whether or not the student took a formal technology class in high school.

Statistical Analysis

The SPSS statistical program version 13.0 for Windows was used to analyze the data obtained from the instrument. The descriptive statistics about the data were identified and noted. A correlation matrix was run for all of the attitudinal variables on the instrument. The Pearson Correlation Coefficient (r) and the coefficient of determination (r^2) were used to measure the strength of the relationship between the variables, to determine the portion of common variation in the variables, and used in the analysis of the research questions. Factor analysis using a varimax rotation was performed to check for homogeneity of the items and to group them. Analysis of Variance (ANOVA) was used to assess the impact of gender.

Limitations

Because the students were invited to volunteer for the study, it was possible that their willingness to participate could have had an effect on their attitude toward technology. Because the administration by the instructor could have had an influence on the students’ responses, a study administration sheet was included that requested that a student volunteer administer the instrument and seal the results to limit instructor participation. Though those precautions were taken in the study design it did not guarantee that there was no instructor influence. It was assumed that the students answered honestly and that the instrument provided a reliable picture of the students' attitudes toward technology.

Though the purpose of the study was to assess the factors that affected community college students' attitudes toward technology related teaching and learning in both formal and informal learning experiences, informal learning was not specifically examined.

Delimitations

The study was conducted on a random sample of students enrolled in credit English courses in the North Harris Montgomery Community College District in metropolitan Houston during the spring of 2005. The results of the study may be generalized to the population of students in the North Harris Montgomery Community College District only. Because the study was conducted on students in colleges whose demographic characteristics may not be representative of all areas of the United States, the results may not be generalizable to community college students in other geographic areas.

Definition of Terms

The following definitions were proposed for the purposes of this study. Further description on how these definitions were derived may be found in Chapter II.

Attitude: "A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (Allport, 1935, p.810).

Credit English class: an English class for which a student receives transferable college credit upon successful completion. In contrast are developmental English classes which are taken to build relevant skills necessary for success in college-level English courses (NHMCCD 2004-2005 Catalog, p.51).

Community college: In the state of Texas these two-year institutions were defined in the Education Code in section 61.003 as “public junior college means any junior college certified by the board in accordance with section 61.063 of this chapter (61).” Section 61.063 is the Listing and Certification of Junior Colleges and states that the commissioner of higher education shall file with the state auditor and the state comptroller on or before October 1 of each year a list of the public junior colleges in Texas.

Formal high school technology course: In Texas prior to 1998 these courses may have been in technology or industrial arts. Per chapter 126, titled Texas Essential Knowledge and Skills for Technology Applications, subchapter C titled High School, effective 9/1/98 the following section and courses are cited: 126.22 Computer Science I, 126.23 Computer Science II, 126.24 Desktop Publishing, 126.25 Digital Graphics/Annimation, 126.26 Multimedia, 126.27 Video Technology, and 126.28 Webmaster (Texas Education Code, Chapter 126, Texas Register 5203).

Technology: (1) is “human innovation in action that involves the generation of knowledge and process to develop systems that solve problems and extend human capabilities,” (2) is “the innovation, change, or modification of the natural environment to satisfy perceived human needs and wants,” (ITEA, *Technology for all Americans*, 1996). (3) is “the cumulative sum of man made means used to satisfy human needs and desires and to solve specific problems in any given discipline” (Shafiee, 1994).

CHAPTER II

REVIEW OF LITERATURE

Attitude is a concept that has been important to and investigated in many disciplines. The second of the six major standards in the *National Educational Technology Standards for Students (NET-S)* addresses social, ethical, and human issues and states as an objective that "students develop positive attitudes toward technology that support life long learning, collaboration, personal pursuits and productivity" (ITEA, 1996). The objective highlights not only the perceived importance of technology but also that of attitude toward technology.

To study community college students' attitudes toward technology, an extensive review of the literature in a number of disciplines was necessary to gain clarity about the concept of attitude and its measurement. Gaining a historical and developmental perspective of attitude, technology, and previous research was essential to the formulation of this study.

The areas covered in this review are: (1) the construct and definition of attitude, (2) the relationship between attitude and behavior, (3) the methods of measuring attitude, (4) the definition of technology, (5) the differentiation of studies on attitudes toward computers and those on attitudes toward technology, and (6) previous research on attitudes toward technology.

Construct and Definition of Attitude

Attitude has long been an important concept in social psychology. G.W. Allport (1954) stated that "This concept is probably the most distinctive and indispensable concept in contemporary American social psychology” (p.43). There have been, and continue to be, multiple definitions and models of attitude. Considerable research, discussion, and deliberation about the concept has occurred, particularly by social psychologists. Despite the debate and ongoing development of the concept, researchers in many different fields have continued to examine and investigate attitude and its implications.

Early definitions of attitude viewed it in terms of being a disposition that would explain action. At the beginning of the twentieth century Baldwin defined attitude as “readiness for attention or action of definite sort” (Baldwin, 1901, cited in Ajzen & Fishbein, 1980, p.13). In 1928, Louis Thurstone defined attitude as “the sum total of man’s inclinations and feelings, prejudice and bias, preconceived notions, ideas, fears, threats, and convictions about any specific topic” (Mueller, 1986, p.3). In 1931 Thurstone stated simply that “attitude is the affect for or against a psychological object” (Mueller, p.3). Allport (1935) reported on the many earlier definitions and on the assumptions that “attitudes determine for each individual what he will do” (p.806). He then defined attitude as “a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual’s response to all objects and situations with which it is related” (p.810). He was pointing out the complexity and comprehensiveness of the construct and introduced the concept that attitudes had a cognitive component. “Allport’s arguments concerning the complexity of attitudes were perhaps the first sign of what was later to become the predominant view of attitudes, namely, that attitudes are comprised not only of affect but also of cognition and conation” (Ajzen and Fishbein, 1980, p.17).

Affect is the feeling or emotion component expressed as “I feel”. It consists of the individual’s evaluation of, or emotional response to, an object or individual. The cognitive component is the belief, perception, and idea component expressed as “I believe”, or “I think”, or “I know”. The conative component is related to taking action, expressed as “I do” or “I intend to”. This conceptualization of attitude as three components was later labeled tripartite (Ajzen and Fishbein, 1980; Halloran, 1970; Mueller, 1986; Oskamp, 1977; Triandis, 1971).

Krech and Crutchfield (1948) stated, “An attitude can be defined as an enduring organization of motivational, emotional, perceptual, and cognitive processes with respect to some aspect of the individual’s world” (p.152). Psychologist D.T. Campbell (1950) proposed defining attitude in terms of the probability that a person will demonstrate a specific behavior in a specific situation. Since the 1950s social psychologists have shown much interest in the development of attitude theory highlighting its multidimensional aspects and questioning the aspects of its predictive nature. Popham (1994) proposed that affective behaviors are more suddenly transformed than cognitive behaviors.

Attitude was defined by Fishbein (1967) as “a learned predisposition to respond to an object or class of objects in a consistently favorable or unfavorable way” (p.477). Fishbein’s definition proposed that attitudes are learned and that they have direction. Halloran (1967) stated that “attitudes are not innate--they are learned, they develop and they are organized through experience" (p.14). Triandis (1971) explained the cognitive aspect by giving an example relating that if an individual had no prior knowledge or concept of an object that upon seeing it the individual would likely put it in an already known category and might have had an attitude toward it but not toward the new object. Therefore he held that cognition is a minimum prerequisite for having an attitude.

As the construct of attitude developed the ideas about the individual's process of evaluation and possession of positive or negative attitudes was highlighted. Attitudes vary in their direction, degree, and intensity (Halloran, 1967). Ostrom (1969) stated that attitude was:

> A learned predisposition to respond in a consistent evaluative manner toward an object or class of objects…The phrase 'consistent evaluative manner'refers to a dimension variously characterized as pro-con, favorable-unfavorable, positive-negative, supportive-hostile,or desirable-undesirable. (pp. 12-13)

Eagly and Chaiken (1993) defined attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p.1).

From the definitions and the decades of research and discussion there are a number of important elements about the construct of attitude to remember: (1) attitudes are learned and develop over time and with experience; (2) attitudes can be multidimensional and can have affective, cognitive, and conative components; (3) attitudes are directed toward something such as an object or individual; (4) attitudes have direction which might be expressed as: favorable/unfavorable, positive/negative, or agree/disagree; (5) attitudes can have degree and intensity; (6) attitudes can be situation specific; and (7) attitudes can change.

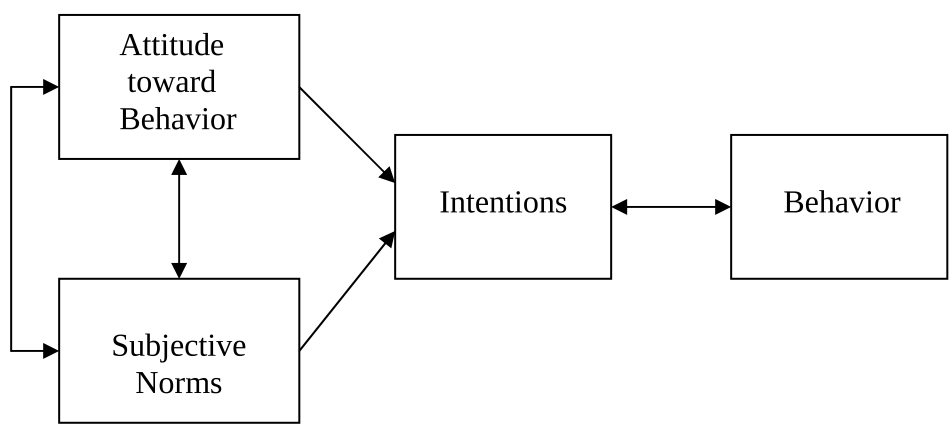
Relationship Between Attitude and Behavior

Throughout the development of the concept of attitude social psychologists, theorists, and researchers have suggested the link between attitude and behavior. That link is evident in the definitions presented. By the early 1970s researchers had not yet found strong evidence for Allport's theory that attitudes determined behavior, whether they were using the single component model which was primarily affective, or the tri-component model where all three components had an important role and potential to influence. Fishbein (1967) addressed the relationship of attitude and behavior by acknowledging that attitude was a learned behavior and went on to add:

> But once one has learned the attitude, he must also learn what response to make to it – that is, there is no innate relationship between attitude and behavior; one still has to learn a behavioral response. Two people may learn to hold the same attitude toward a given stimulus; clearly, however, they may also learn to make different responses to the same learned attitude. (p. 478)

It was acknowledged that the link between attitude and behavior was more complex than simply a response to a single stimulus. Attitude was likely only one of the factors that lead the individual take action. Fishbein and Ajzen (1975) introduced the theory of reasoned action (TRA) to address the other potential factors based on the premise that individuals are rational and that the behavior is under their volitional control. The theory provided a model that links the individual's beliefs, attitudes, intentions, and behavior (Fishbein, Middlestadt, Hitchcock, 1994). Fishbein and Ajzen introduced the concept that before behavior occurs there was an intention to take the action (illustrated in Figure 1). The theory acknowledged that the stronger the intention was the more the individual would attempt to perform the behavior. They proposed that intention was affected by two separate determinants: (1) the individual's attitude toward the behavior and (2) the subjective norm or social factor. The individual's attitude was based on the strength of their favorable or unfavorable evaluation of the behavior, reflecting a personal consideration. The individual's perception of the social pressures to perform or not perform the behavior constituted the subjective norm or social factor.

Figure 1. Fishbein and Ajzen (1975) Theory of Reasoned Action



The theory (TRA) was an attempt to understand and predict behavior. The relative weight the individual gave to each determinant varied from one individual to another. The theory did not however take into account other variables such as the individual's personality or demographic characteristics. In their later work Ajzen and Fishbein (1980) stated:

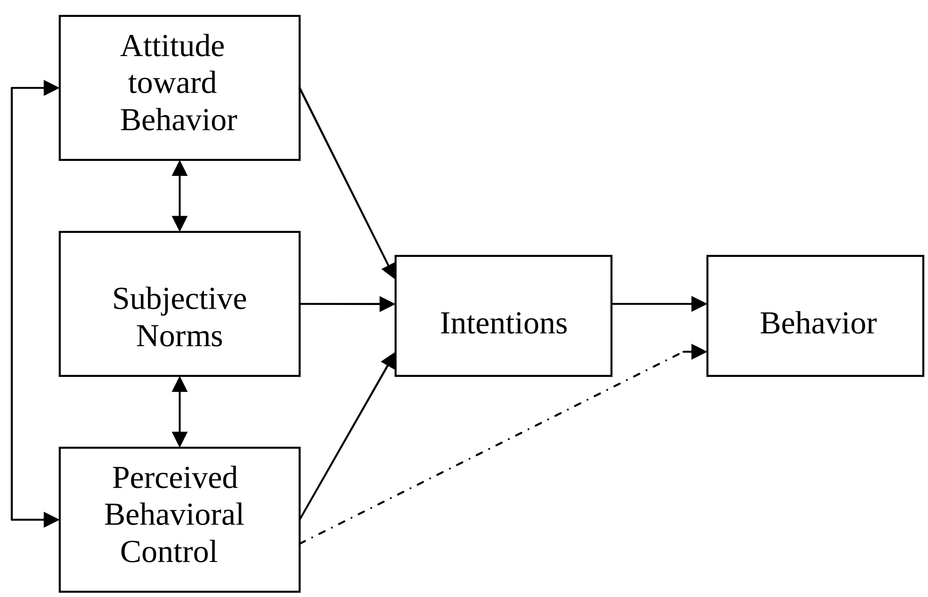
> Although we recognize the potential importance of such factors, they do not constitute an integral part of our theory but are instead considered

> to be external variables. From our point of view, external variables may influence the beliefs a person holds or the relative importance he attaches to attitudinal and normative considerations. (p.9)

In summary, the theory holds that consciously or subconsciously an individual goes through an evaluation similar to a cost/benefit analysis evaluating internal attitudes toward a behavior and subjective norms (normative beliefs) that determine the strength of their intention to perform the behavior.

The theory of reasoned action was helpful but clearly had shortcomings. It did not address the fact that no matter how strong an intention may be it may be thwarted by

Figure 2. Ajzen and Madden (1986) Theory of Planned Behavior



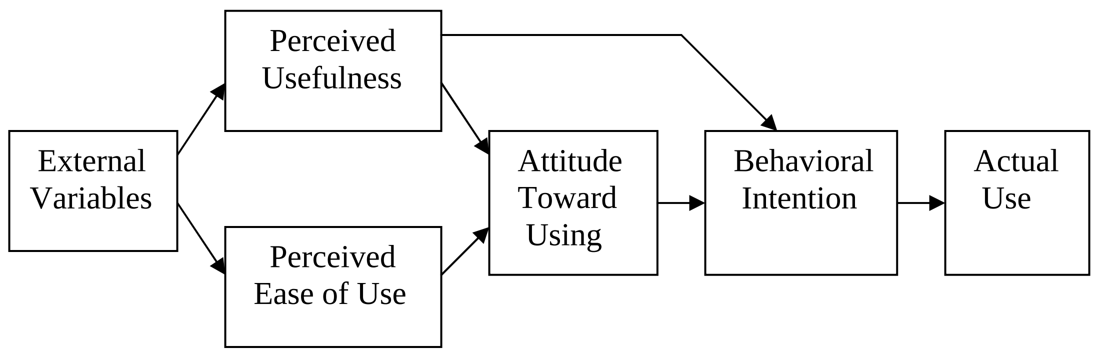
superseding conditions. Ajzen and Madden (1986) added perceived behavioral control to the theory of reasoned action after finding in their studies of individuals attempting to get good grades that their confidence or lack of confidence in their ability to attain their goal strongly influenced their intention to perform the behavior. The new model was called the theory of planned behavior (TPB).

Figure 2 illustrates the addition of the third determinant. The dashed line bypassing intentions indicates that individuals are not always able to control situations and are sometimes forced to act or not act in spite of their intentions.

There were mixed findings in some of the studies on the relationship between attitude and behavior. Ajzen and Fishbein argued “that study of the correspondence of target, action, context, and time between attitude and behavior provides the key to understanding the inconsistencies that have been reported” (Randolph, 2001. p. 8). The components were: (1) the target which was what was focused on; (2) the action which was what was going to occur; (3) the context which was associating the action with the outcome; and (4) the time which was the period over which the attitude is valid. It was also acknowledged that “the assignment of relative weights to the determinants of intention greatly increases the explanatory value of the theory” (Ajzen & Fishbein, 1980, p.6).

Both the theory of reasoned action and the theory of planned behavior were social psychology models attempting to examine beliefs, attitudes, intentions, and behaviors and continue to be regarded as hallmarks in behavioral research. Extending the basics of the theory of reasoned action Davis (1989) formulated the technology acceptance model (TAM) to explain or predict computer usage and computer information system adoption. The model (Figure 3) replaced many of the attitude measures with two acceptance measures: (1) perceived ease of use and (2) perceived usefulness. Perceived ease of use (PEOU) was defined as “the degree to which a user believes that using the system to be free of effort and the perceived usefulness (PU) was defined as the degree to which a user believes that using a specific application system will enhance his or her performance” (Davis, Bagozzi, and Warshaw,1989, p. 985).

Figure 3. Davis (1989), Davis, Bagozzi, and Warshaw (1989) The Technology Acceptance Model



Both the theory of reasoned action and the technology acceptance model encompassed strong behavioral elements and assumed that when the individual formed a behavioral intention to act the individual was be free to act without limitation.

Practically, that freedom may be affected by a number of constraints such as time constraints, limited ability, environmental or organizational limits, or unconscious habits. Bagozzi and Warshaw, (1992) further clarified the relationship of attitudes and the use of the technology by stating:

> Because new technologies such as personal computers are complex and an element of uncertainty exists in the minds of the decision makers with respect to the successful adoption of them, people form attitudes and intentions toward trying to learn to use the new technology prior to initiating efforts directed at using. Attitudes towards usage and intentions to use may be ill-formed or lacking in conviction or else may occur only after preliminary strivings to learn to use the technology evolve. Thus, actual usage may not be a direct or immediate consequence of such attitudes and intentions. (p. 115)

Venkatesh and Davis (2000) extended the technology acceptance model (TAM) to explain its factors of perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. The three social information processes added were: (1) subjective norm, (2) voluntariness, and (3) image. The four cognitive instrumental processes added were: (1) job relevance, (2) output quality, (3) result demonstrability, and (4) perceived ease of use. Experience was the final component added to what they then called TAM2 or the technology acceptance model two.

Subsequent research has tended to confirm the applicability of the technology acceptance model (TAM) and the model has found its use in management information systems research and in market research. Most of the other computer acceptance models that have been proposed continued to have their roots in the theory of reasoned action (TRA). Venkatesh, Morris, Davis, and Davis (2003) formulated the unified theory of acceptance and use of technology model (UTAUT) to integrate the main competing user acceptance models. It was developed with four core determinants of intention and usage and up to four moderators of key relationships. The four core determinants of intention and usage were: (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. The four moderators were: (1) gender, (2) age, (3) experience, and (4) voluntariness of use.

Researchers and theorists have continued to examine, explore, and attempt to explain the relationship between attitude and behavior throughout the past century. The models they have developed from the theory of reasoned action (TRA), the theory of planned behavior (TPB), the technology acceptance model (TAM), through to the unified theory of acceptance and use of technology model (UTAUT) have focused on the concepts of attitude and the determinants of behavior. Attitude may or may not directly affect behavior but it is accepted that it can influence it.

Methods of Measuring Attitudes

Agreement exists that attitude is a concept which generally can be studied in one of two ways. The first would be through the researcher’s direct observation of the subject’s behavior. The second would be through the data self-reported by the subject verbally or in written form. Challenges exist with both observation and with self-reporting. Direct observation can be difficult for three reasons: (1) it is difficult to determine exactly which behavior to observe and how to accurately record the behavior that is observed; (2) affective characteristics can be incorrectly inferred from the behaviors and from the observations; and (3) the behaviors observed can be misinterpreted (Dwyer, 1993). Though observation of a favorable or unfavorable attitude it may be possible its degree may be more difficult to determine. As Dwyer pointed out "Researchers generally have noted that the ability to determine the directionality of response through analysis of physiological reactions is extremely limited" (p. 6). Self-report methods can be difficult because the subjects may provide misinformation because: (1) they may try to please the researcher, (2) they may try to provide a socially acceptable response, and (3) they may agree with a question or statement when they are in fact unsure of their response (Anderson, 1981). Thurstone and Chave (1929) addressed the possibility of misinformation stating:

> All that we can do with an attitude scale is to measure the attitude expressed with the full realization that the subject may be consciously hiding his true attitude or that the social pressure of the situation made him really believe what he expresses….All we can do is minimize as far as possible the conditions that prevent our subjects from telling the truth, or else to adjust our interpretation accordingly. (p. 10)

In the literature four basic types of attitude measures are discussed: (1) equal-appearing intervals developed by Thurstone and Chave (1929), (2) Likert scales developed by Rensis Likert (1932), (3) Guttman scales developed by L. Guttman (1944), and (4) semantic differential technique introduced by Osgood, Suci, and Tannenbaum (1957). Each measure developed had positive features supporting its utilization and challenges that must be considered by the researcher when designing the study.

Thurstone and Chave (1929) developed a method of equal-appearing intervals for measuring attitudes that consisted of defining and identifying the object and then creating a pool of positive, negative, and neutral opinion statements. The pool of statements was then given to a number of judges for their evaluation with regard to the positive or negative view toward the attitude object. The judges assigned the statements to eleven categories ranging from the extreme positive to the extreme negative. If the judges disagreed on the assignment of the statement it was discarded. Statements that were considered ambiguous were also discarded. The remaining statements made up the questionnaire given to the subjects for their responses. The subjects were asked to indicate one of two responses - agreement or disagreement - with the statement. Scoring took in to account the various extremes of the statements as well as the fact that some expressed a favorable attitude and some an unfavorable attitude. A total score was computed which was to represent the measure of the subjects attitude toward the attitude object. Regarding the essential structure of the equal-appearing intervals Thurstone wrote, "… of evenly graduated opinions so arranged that equal steps or intervals on the scale seem to most people to represent equally noticeable shifts in attitude" (p. 554). Ajzen and Fishbein (1980) advised:

> The theory underlying Thurstone's scaling method has important implications, which have often been overlooked, for the relation between attitude and behavior. In Thurstone scaling, the attitude score represents a person's evaluation of an object implied by a set of his beliefs, intentions, or actions. (p.15)

Likert (1932) developed a summated ratings technique that was considered less complex and less time consuming than Thurstone's equally-appearing intervals. Likert's scale, in its original five-point form, allowed the following responses: (1) strongly disagree, (2) disagree, (3) undecided, (4) agree, and (5) strongly agree. The scale allowed for a broader range of responses which were scored from one to five and then totaled for a score that represented the subject's attitude. Likert's central concern was that the scales measure a one-dimensional construct. After the statements were written they were submitted to several judges to clarify whether each is positive, negative, or neutral in relation to the attitude object. Items not classified the same by the majority were to be eliminated from the final instrument. Following the administration of the instrument to a sample of the intended audience the data were analyzed to estimate the reliability and validity of the scale. A final scale was constructed from the conclusions drawn from the sample administration.

Determinations needed to be made on the total number of items to include in the instrument, the ratio of positive to negative statements to include, and the number response alternatives for each statement. Though Likert originally employed the five-response format, further development has occurred through the subsequent years. Response categories from two to seven were described by Anderson (1981) with the even numbered scales forcing a choice by eliminating the neutral response. The responses were weighted so that the highest weight was assigned to the most favorable response. Subsequently, the totals on the negative items would be reversed. Item scores were calculated and correlated with total scores. Researchers agreed that high correlations between an item score and a total test score suggested that the item represented the item being studied (Likert, 1932; Crano & Brewer, 1973; Anderson, 1981).

Guttman (1944) and Guttman and Suchman (1947) developed a procedure for evaluating a set of statements about an attitudinal object which became known as the Guttman scale. The instrument consisted of statements about an attitudinal object that: (1) have a common content, (2) are ordered along a continuum from least to most positive, and (3) the agreement with a given statement implies agreement with every other less positive statement (Crano & Brewer, 1973). Subjects were instructed to check all of the statements with which they agree. Each agreement received a score of one and each disagreement received a score of zero. The score was totaled for the individual and represented what was considered to be the subject's degree of favorability toward the object under study with further analysis performed to compute the coefficient of reproducibility (Guttman, 1944; Guttman and Suchman, 1947).

The adjective based semantic differential technique for measuring attitude was proposed by Osgood, Suci, and Tannenbaum (1957). It measured the subject's responses to pairs of bi-polar adjectives with meanings as opposite of each other as possible (Osgood, 1952). What was known as the semantic differential measured the direction and the intensity of the subject's reaction (Osgood & Suci, 1955). The attitudinal object was placed at the top of the scale followed by five or more emotional adjective pairs located at the end points of a seven equal segment continuum. The subject placed a check mark along the continuum to indicate their feeling about the object presented. A check mark in the center indicated a neutral feeling, where as, a check mark near either end indicated a positive or negative feeling. Values from one to seven were assigned to each option, with the weight of seven given to the most positive choice. The responses were totaled to obtain the subject's score. Correlations between each adjective pair and the total score were computed.

Self-report scales have been a popular research technique for measuring attitude. The researcher has the ability to choose the method best suited for the attitudinal issue under study taking into consideration the object and attitudes to be studied and the subject audience. Careful construction and testing of the items, adjectives, or questions, while remembering the potential for subject misinformation, can provide appropriate attitude research design. Oppenheimer (1966) suggested:

> If we wish to study attitude-patterning or explore theories of attitudes, then probably the Likert procedure will be the most relevant. If we wish to study attitude change, or the hierarchical structure of an attitude, then Guttman's method might be preferable. If we are studying group differences, then we'll probably elect to use the Thurstone procedure, … (p. 123)

Having reviewed the literature and the studies of Bolin (1992), Shafiee (1994), and Thompson and Householder (1995) the self-report modified Likert scale of the modified Secondary Students Attitudes toward Technology (SSATT) in the Shafiee (1994) research was used for this study. The items were ranked by the students on a scale of 1 to 10, where 1 represented "strongly disagree" and 10 represented "strongly agree." Demographic and descriptive items were added in new sections to the 32 statements to collect the additional data needed for this study.

Definition of Technology

To engage in a study of students' attitudes toward technology it was essential to have communicated a clear definition of technology. Challenges existed because of the multiple definitions of technology that existed and the need to differentiate the term technology in its broadest sense from terms such as technology education, instructional technology, and technological literacy. Satchwell and Dugger (1996) stated that:

> Technology as a core subject in our public school curriculum is a relatively new concept and …. because of its newness as a field of study, technology is often misunderstood and technology education

> is often confused with other areas of study such as educational technology. (p.6)

Johnson, Foster, and Satchwell (1989) recommended that technology should be described by the following characteristics: (1) technology is applied human knowledge and more than applied science; (2) technology extends human capability and enables humans to adapt and change their physical world; (3) technology is combining knowing, thinking and doing and therefore application based; and (4) technology exists in both social and physical domains demonstrated hard technologies such as tools and equipment and soft technologies such as software and the Internet. Subsequently, scholars provided numerous evolutionary definitions for consideration. Savage and Sterry (1990) defined technology as “a body of knowledge and systematic application of resources to produce outcomes in response to human needs and wants. (p. 7) Wright and Lauda (1993) viewed technology as:

> A body of knowledge and actions used by people to apply resources in designing, producing and using products, structures, and systems to extend the human potential for controlling and modifying the natural and human-made (modified) environments. (p. 3)

The *Technology for All Americans: Rationale and Structure for the Study of Technology* (ITEA, 1996) acknowledged that the concept of technology is complex but presented a brief and simplified working definition of technology as “human innovation in action” (p. 16). The document presented the derivation of the word as:

> From the Greek word *techne*, meaning art or artiface or craft, technology literally means the act of making or crafting, but generally it refers to the diverse collection of processes and knowledge that people use to extend human abilities and to satisfy human needs and wants. (p. 134)

The document made further clarification and addressed the "power and promise of technology" stating that:

> Technology is a fundamental aspect of human activity. The acceleration of technological change is a constant in everyone's life. The power and the promise of technology is based on the need for technological literacy – the ability to use, manage, and understand technology. Technological literacy is considered to be critical to the success of individuals, entire societies, and to the Earth's ecological balance. The promise of the future lines not in technology alone, but in people's ability to use, manage, and understand it. (p. 20)

Additional clarification and synthesis was provided by Satchwell and Dugger (1996) as they stated:

> Technology draws its domain along the dynamic continuum that starts with human wants and needs and ends in the satisfaction of those wants and needs. It includes such human capability as designing, inventing, innovating, practical-problem solving, producing, communicating, and transporting. Technology influences our society and culture by changing our lives and our environment. (p. 6)

Student's definitions or concepts of technology were often reported as being much narrower than the scholarly definitions. Various research studies have reported that the students' views of technology were often focused on devices such as computers, machines, and other electronic mechanisms. (Bame and Dugger, 1990; Boser, 1996; Shafiee, 1994; Thompson & Householder, 1995). These were what Satchwell and Dugger (1996) referred to as the "hard" technologies. Boser (1996) reported:

> Most students thought that technology involved computers, buildings, or machines. Student descriptions typically identified various components of technology and only a few students wrote descriptions that referenced the broad nature of technology. (p. 11)

Thompson and Householder (1995) reported an impact on students' perceptions and definition of technology. Primary school students in a school with a structured technology program identified technology as making (68%) and designing (25%), where as students without such program considered technology to be about things such as machines and radar (54%), or science related (28%).

Williams (2000) proposes that “students should perceive technology as a thoroughly integrated activity, not one which can be separated into content and process, or theory and practice” (p. 48). He concludes. “technology is such a broad area that a focus on any one process will not provide students with a broad concept of the nature of technology” (p. 57). Wright (2000) proposes that “a synthesis of definitions of technology indicates that it consists of knowledge, processes, and ingenuity that have enabled humans to conceive, design, and create tools and products as well as systems that support them” (p. 56).

Differentiation of Studies on Attitude Toward Computers and Toward Technology

There were a significantly larger number of studies reported in the literature on students’ attitudes toward computers and computer use than on students’ attitudes toward technology as a broad concept. The bulk of the studies reported were for primary and secondary students rather than for post-secondary students. However, the research on students’ attitudes toward computers held the potential for information on the models used and the factors identified that may have a relationship to students’ attitudes toward technology.

The factors affecting students’ attitudes toward computers that were worthy of consideration in preparing the design for the study of community college students’ attitudes toward technology were: (1) gender, (2) age, (3) access to a computer at home, and (4) amount of computer experience.

Gender was one of the most frequently reported variables in attitude studies. Early research on students' attitudes indicated that boys had a more positive attitude toward computers and technology than girls (Colley, Gale, & Harris, 1994; Collis, 1985; Kay, 1992; Levin & Gordon, 1989; Okebukaola, 1993). Kadijevich (2000) reported that males showed a more positive attitude than females in a study of computer attitude among ninth-grade students.

A number of reasons to address why males held a more positive attitude toward computers than females were reported. Dambrot, Watkins-Malek, Silling, Marshall, and Garber (1985) proposed that students associated computers with math and science and that girls often see themselves as lacking in the ability to succeed in those areas. A second reason proposed was the lack of access to computers by females (Lieberman, 1985; Kiesler, Sproull, and Eccles (1985); Marshall and Bannon (1986). Levin and Gordon (1989) reported that girls were more likely to use computers for word processing, while boys were more often programming computers. They found that boys had a more positive attitude toward computers and found them more enjoyable, important, and friendly than girls. It was reported by Mouzes (1995) that women "viewed the computer as an adversary" (p. 120). The gap between males and females' attitudes to computers has also been attributed to gender stereotyping by parents, peers, and teachers (Colley et al., 1994; Collis, 1985).

Research has however provided mixed results with regard to gender. Other studies found to the contrary that females had more positive attitudes and less anxiety toward computers than did males (Loyd, B. H., Loyd, D. E., Siann, G., and Macleod, J., 1987). McHaney (1998) found that males had a higher scores on the personal affect for technology and computers, but males and females scored alike with regard to the perception of the importance of technology and computers. Gattiker and Hlavka (1992) found no gender difference in the attitude of computer owners. King, Bond, et al. (2002) proposed:

> These results have led some to conclude that the gender gap in attitudes toward computers and their level of anxiety has now become negligible due to the ubiquitous nature of technology in daily life and the perception (by females) of the computer as a communication device. (p. 80)

Age, like gender, was a variable in most studies on students' attitudes toward computers but the results suggested little agreement on its definitive influence. Onwuebuzie and Jennings (2001) reported that age was a factor in their study of computer attitudes as the youngest group of students showed the least computer anxiety and highest level of confidence. They also reported that the oldest students scored higher in the perceived usefulness of computers and in their liking of computers. McHaney (1998) reported only that "seventh grade students had a more positive attitude toward technology than students in higher grades" (p. 76). In a 2003 study, Colley and Comber reported with regard to age that older girls held the least positive attitude toward computers.

Colley, Gale and Harris (1994) found that the “amount of experience on a home computer was associated with lower anxiety for both sexes, with greater confidence for males, and a greater liking for females” (p.133). McHaney (1998) reported that the scores on the factors identified in his study were higher for those students who reported having a computer in the home. It followed that access to a home computer would provide more opportunity for experience with a computer. Studies found that computer experience was positively correlated with attitudes toward computers (Koohang, 1989; Hunt & Bohlin, 1993). Williams, Ogletree, Woodburn, & Raffeld (1993) found that only past computer experience related to positive attitude scores.

Research has shown that gender, possibly age, access to a home computer, and the amount of computer experience are factors that can affect attitudes toward computers. The same factors would be worthy of inclusion in studies on students’ attitudes toward technology to assess their possible impact.

Research on Attitudes Toward Technology

Though students’ attitudes toward technology have been studied less frequently than students’ attitudes toward computers, Kim (2000) reported on 78 studies in 27 different countries in her meta-analysis. Two significant factors emerged from the analysis of 76 of the 78 studies of students’ attitudes toward technology: (1) only 18 of the 76 studies were conducted in the United States and (2) only 3 or 3.9% of the 76 involved college students.

Raat and de Vries (1985) developed a project and instrument titled Pupil’s Attitudes Toward Technology (PATT) involving 13-year-old students in the Netherlands to study their attitudes toward technology and their concepts of technology. The instrument was broad in nature and through factor analysis they identified 14 factors: (1) interest in technology; (2) girls and technology; (3) importance of technology; (4) creativity and technology; (5) difficulty of technology; (6) acquaintance with technology; (7) diversity of technology; (8) school and technology; (9) girls and repairing; (10) diversity of technology 2; (11) developing countries and technology; (12) importance of technology 2; (13) choice of technical profession; and (14) working with your hands in technology (Cited in Bolin, 1992).

From their PATT studies "Raat and de Vries concluded: (1) students had only a vague concept of technology, (2) the relationship of technology to physics was very obscure to students, and (3) girls were less interested in technology and see it as less important" (Boser, Palmer, and Daugherty, 1998, p. 3). De Klerk Wolters (1989b) stated:

> The PATT evolved into an international research project facilitated by Raat and de Vries (among others) at Eindhoven University of Technology in the Netherlands. The purpose of the initiative was to "integrate what pupils think of technology and to use the results of this research for the development of the new subject technology in primary and secondary school education". (p. 291)

PATT Conferences began to be held in 1984. The goals of the conferences were to: (1) bring together experiences in PATT research; (2) discuss developments in technology from an international perspective; and (3) discuss the relevance of PATT studies for development efforts (de Vries, 1992, p.246).

British undergraduate students' attitudes toward technology were researched by Fife-Schaw, Breakwell, Lee, and Spencer, (1987). They identified: (1) general benefits of technology; (2) acceptance of the inevitability of new technology; (3) anti-industrial values; (4) video games; and (5) green issues by their factor analysis.

The Pupils Attitudes' Toward Technology (PATT) was translated into English by Bame and Dugger (1990) who then identified the instrument as the PATT-USA. They designed the instrument in four parts. The first part asked the students for a short description of technology. The second part requested demographic data about the students. Section three required responses to statements using a modified Likert scale to assess the students' attitudes toward technology. The fourth part was structured for a description and understanding of the students' concept of technology (Bame & Dugger, 1990).

Five attitude factors were identified by the administration of the PATT-USA in a study involving students in seven states (Bame et al.,1993; Bame and Dugger, 1989). The factors were: (1) general interest in technology; (2) attitude toward technology; (3) consequences of technology; (4) technology is difficult; and (5) technology as an activity for girls and boys. Boser, Palmer, and Daugherty (1996) reported that:

> the results of the PATT-USA study indicated that: (a) students are interested in technology; (b) boys are more interested in technology than girls; (c) that students in the U.S. think that technology is a field for both boys and girls; (d) girls are more convinced that technology is a field for both genders; (e) there is a positive influence of a parents' technological profession on the students' attitude; (f) U.S. students concept of technology became more accurate with increasing age; (g) U.S. Students are strongly award of the importance of technology; (h) the U.S. has a rather low score on items measuring the concepts of technology compared to other industrialized countries; (i) students who had taken industrial arts/technology education classes had more positive attitudes on all sub-scales; and (j) the existence of technical toys in the home had a significantly positive impact on all attitude scales. (p. 3)

The PATT-USA was again used by Boser (1996) to:

> examine four instructional approaches typically used to deliver technology education content and to determine if various teaching approaches used by technology teachers affected the attitudes of middle school students toward technology. (p. 4)

The instructional methods examined in the study were: (1) traditional industrial arts; (2) self-paced modular technology education; (3) interdisciplinary technology education; and (4) problem centered technology education (Boser, 1996).

The Secondary Students' Attitude Toward Technology (SSATT) was developed by Bolin (1992) after analysis of the earlier instruments and studies. Modifications were made to the items and items were added so as to study students' attitudes toward school in general and additional subject areas. The factor analysis of the SSATT identified eight factors for the group of participating high school students: (1) attitude toward technology; (2) interest in technology; (3) applications of technology; (4) benefits of technology; (5) interest in science and technology; (6) interest in social studies and language arts; (7) interest in mathematics; and (8) effects of technology.

Shafiee (1994) administered a modified SSATT and modified PATT-USA to students in a community college to "identify the factors underlying their attitudes toward working with and learning through computer technology" (p. 4). The nine factors identified by Shafiee from the 32 item modified SSATT were: (1) benefits of technology, (2) positive influences of technology, (3) negative influences of technology, (4) learning by using computers, (5) technology as a tool for work and study, (6) inevitability of technology, (7) social isolation, (8) technology is safe, and (9) video games are bad.

Shafiee chose to eliminate nine of the 32 modified SSATT items to address inconsistencies in factor assignments and factor loading resulting in and instrument with 23 items. The result appeared to be an instrument that was more reliable. It was also found that the SSATT was more valid and reliable than the PATT-USA.

Shafiee (1994) found a factor formation difference for only the gender sub-sample after examining gender, age, and previously technology related courses. He recommended, “that further research be conducted to confirm the results of the study with different populations of community college students” (p. 85).

Thompson and Householder (1995) reduced the length of a number of SSATT items, simplified others, and reduced the total of survey items to 30 to create the Technology Survey instrument for grades 7 and 8. McHaney (1998) used the Technology Survey to study the factors underlying secondary students’ attitudes toward technology for students in grades 7 through 12.

Having reviewed the research on students’ attitudes toward technology and the instruments used in the studies from the PATT to the PATT-USA to the SSATT and the modified SSATT it was evident that there have been numerous studies on primary and secondary students’ attitudes toward technology but very little on post-secondary students. Each study had been successful in identifying factors that affected the students’ attitudes toward technology and each added to the previous knowledge base.

Summary of Review of Literature

Attitude is an important, but often complex, concept to study and measure. There are multiple definitions and models of attitude. Attitude is something that is not generally directly observable. It is acknowledged that attitudes are developed and modified through the individual's experiences and that continued exposure and experience with an object or category can lead the individual to develop positive attitudes, and thus seek the object or category, or to develop negative attitudes, and thus seek to avoid the object. The relationship of attitude to behavior is complex and studied in many disciplines. Its impact on behavior is often debated. Havice (1999) proposed:

> Educators must be sensitive to the idea that students' motivation to learn is influenced by attitudes (Fenneman, 1973; Lamb, 1987; Levy 1973; Simonson, 1979; Simonson & Bullard, 1978). According to Fleming and Levie (1978) attitudes help shape subsequent behaviors that determine our actions, such as attention to and acceptance of instructional messages. Furthermore, information is retained when it is consistent with attitude and disregarded when it is in conflict with attitude. (p. 2)

Initially, research on attitude focused on the affective or feeling component. It became clear with the passage of time and investigation that attitude was more complex and the tripartite concept that attitude was affective, cognitive, and conative evolved. It was also recognized that attitudes vary not only in direction, but also in degree and intensity, and that attitudes can change.

Several models to study and explain the relationship of attitude and behavior were developed and continued to evolve. The Technology Acceptance Model (Davis, 1989, Davis et al., 1989) specifically addresses attitude and behavior with regard to technology. It replaced the attitude measures with the two acceptance measures: (1) perceived ease of use and (2) perceived usefulness. The model has gained acceptance and has evolved into TAM2 (Venkatesh et al., 2003).

Four basic types of attitude measures discussed were; (1) equal-appearing intervals developed by Thurstone and Chave (1929); (2) Likert Scales (Likert, 1932); (3) Guttman scales (Guttman, 1944), and (4) semantic differential technique (Osgood et al., 1957). Each method had its strengths and weaknesses and its best applications. Likert scales were frequently used in the study of attitudes toward technology. Though Likert originally employed the five-response format, other response scales were often used including equal number response scales which eliminate the neutral response. A ten-point modified 10-point Likert scale was used by Shafiee (1994) in a modified SSATT administered to community college students. The same scale was used in this study.

To study a concept it is vital to have established a clear concept and definition of it. The definition " technology is the cumulative sum of man-made means used to satisfy human needs and desires and to solve specific problems in any given discipline" (Shafiee, 1994, p. 40) was chosen to be used on the instrument in this study.

Technology as a broad concept can mean many things. Rose, Gallup, Dugger, and Starkweather (2004) reported in *The Second Installment of the ITEA/Gallop Poll and What it reveals as to How Americans Think about Technology* that "the public, while surrounded on all sides by examples of technology at work, associates the word "technology" most closely with computers" (p. 2). Bame and Dugger (1990), Boser (1996), Shafiee (1994), and Thompson and Householder (1995) reported similarly that students described technology as tangibles such as computers, radar, and space vehicles.

It is therefore important that the cognitive aspect must be considered when defining, designing, and interpreting students' attitudes toward technology. "It is clearly difficult to measure a construct if it has not readily agreed upon boundaries" (Boser, et al., 1998).

More studies were reported on students' attitudes toward computers than on students' attitudes toward technology. From the computer attitude studies several factors reported such as gender, age, presence of a computer in the home, experience and comfort with technology were valuable to the study of attitudes toward technology. Bame & Dugger, 1990; Boser, 1996; Shafiee, 1994 and McHaney, 1998 found gender differences in their studies. Boser, 1996, Thompson and Householder, 1995 and Shafiee (1994) found that experience in technology-related courses affected students' attitudes. Further research is warranted to assess the factors that affect community college students' attitudes toward technology because as the "National Profile of Community Colleges: Trends & Statistics" pointed out, "the fast pace of technological innovations and increasing frequency of job and career changes can create the potential for people to return to community colleges again and again" (American Association of Community Colleges [AACC], *National profile of community colleges: Trends & statistics,* 2001, p. 12).

CHAPTER III

RESEARCH PROCEDURES

The procedures and techniques used in this study to accomplish its objectives are presented and detailed in this chapter. First, there is a general description of the subjects in this study. Second, the methodology of the study is discussed. Third, the development of the instrument used to collect the data is described. Fourth, the methods of data analysis are described and explained.

Population and Sample

The population for this study was all North Harris Montgomery Community College students enrolled in credit English classes offered in the spring of 2005. Per a query of the student data system 6,597 students were enrolled in credit English classes in the district.

North Harris Montgomery Community College District (NHMCCD) had an enrollment of 41,534 credit students served registered at its five colleges in the spring of 2005. The average age of the students was 25 years old and the gender ratio was 37.46 percent male students to 62.54 percent female students. The district currently has an in-district service area of approximately 1,400 square miles and is recognized as one of the largest community college districts in the state of Texas and one of the finest in the country. It serves Montgomery county and the northern geographic area of greater metropolitan Houston which is in Harris county.

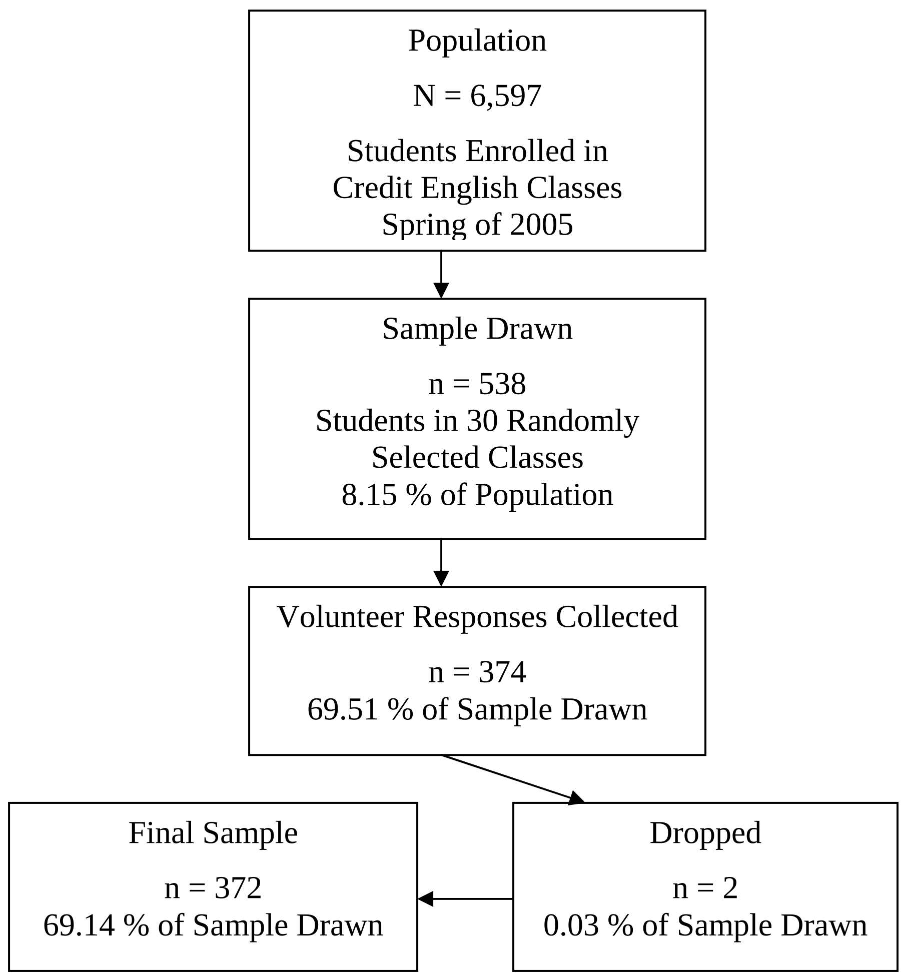
Six classes at each of the district's five colleges were randomly selected as the sample for this study. No distance learning classes were included. The approximate student enrollment in the 30 classes selected at the time of the administration of the instrument was 538 students. The North Harris College classes had a range of 9 to 21 students enrolled with a median of 14 students. The Kingwood College classes had a range of 14 to 21 students enrolled with a median of 19 students. The Tomball College classes had a range of 20 to 24 students enrolled with a median of 21 students. The Montgomery College classes had a range of 17 to 24 students enrolled with a median of 20 students. And the Cy-Fair College classes had a range of 19 to 24 students enrolled with a median of 20 students. In the spring of 2005, North Harris College offered 28.09 percent of the credit English classes, Kingwood College offered 12.71 percent, Tomball College offered 18.39 percent, Montgomery College offered 17.39 percent, and CyFair College offered 23.43 percent.

The course and section numbers of all of the credit English courses at North Harris College were entered into a random selection program and a random selection of six classes was generated. The procedure was repeated each for Kingwood College, Tomball College, Montgomery College, and Cy-Fair College to yield a total of 30 randomly selected courses.

The randomly selected classes were freshman level college credit courses. They were either English 1301 or English 1302. The description of these courses can be found in Appendix A.

The enrollment in the 30 randomly selected courses at the time the sample was drawn was 538 students. The total number of volunteer responses collected was 374 which was 69.51% of the sample drawn. These responses came from 27 of the 30 classes; three classes did not return any data. The population and sample summary data is displayed in Figure 4.

Figure 4. Study Population and Sample



Note. Techniques for sample size and selection from Isaac and Michael (1997)

Methodology

This section presents the research design, the methods of data collection, and data analysis. The discussion of the research design includes a description of the research questions and the details of the way the study was conducted. The process of selecting and developing the instrument is discussed, as are the methods to establish its validity and reliability. Finally, the rationale for using the correlation method and factor analysis is presented.

Research Design

The purpose of this study was to identify the factors underlying community college students' attitudes toward technology in both formal and informal teaching and learning experiences. It was to identify whether gender; access to a computer at home; age; and completion of a formal technology course in high school impacted the students' attitudes toward technology. Additionally, it was to determine if the quantity and type of technology experiences had an effect on students' attitudes toward technology. To study the impact of these variables and to identify the factors that might affect a students' attitude, an instrument was developed for a single administration to students who volunteered to participate. The goal was to capture a snapshot of the students' attitudes toward technology. Correlations and factor analysis were used to analyze the data, to test the hypotheses, and to attempt to identify factors that influence community college students' attitudes toward technology.

Research Methodology

Sealed envelopes containing 25–30 questionnaires with student information pages regarding the research study clipped to them were delivered or sent to the department head at each college. Also in the sealed packet were an instructional cover memo to the instructor; an instructional cover memo to a volunteer student administrator; 25-30 number two pencils and a return envelope addressed to the researcher to be sent via the inter-campus mail.

As the envelopes of student responses were received, each form was given a unique letter and number so that the results of the scanning process could be reviewed for accuracy. When all 27 of 30 course packets of student responses were received by the researcher, the 374 forms were aggregated and scanned in a single session. The scanned data were imported into a spreadsheet and every data field on the original marked form was compared to the scanned result to facilitate zero errors in the data that was statistically analyzed. Two forms were discarded from the sample because only the front side of the form had been completed leaving a sample population of 372.

Instrument Development

Previous research studies and instruments to assess the attitudes of students toward technology, beginning with Pupils Attitudes Toward Technology (PATT) developed in 1984 and used in a Dutch study conducted by Raat and deVries (1985), were reviewed to arrive at the content and form of the instrument for this study. Kim (2000) reported on 78 studies in 27 countries from 1984 through 2000. Whereas, the majority of the studies reviewed involved elementary and secondary school students;

few were designed for post-secondary students. Therefore, the specific questions and form were not appropriate for the population of community college students to be studied.

After reviewing the Secondary Students' Attitudes Toward Technology (SSATT) developed by Householder and Bolin (1993), Shafiee's (1994) modified SSATT and Computer Receptivity Scale (CRS), and McHaney's (1998) modified SSATT it was determined that a modified version of Shafiee's (1994) instrument would be used for this study. The same 32 items and 10-point Likert scale from Shafiee's study served as the base for a portion of the instrument for this study. Additional demographic data, technology perception data, and technology use data were collected and analyzed.

Shafiee's (1994) factor analysis of the 32 items for all 322 responses of the instrument administered in the spring of 1994 used a loading criterion of 0.30. The varimax rotation converged in 11 iterations. Shafiee identified 9 factors from the administration of the modified SSATT: (1) benefits of technology; (2) technology as a tool for work and study; (3) positive influences of technology; (4) negative influences of technology; (5) video games are bad; (6) inevitability of technology; (7) technology is safe; (8) social isolation; and (9) learning by using computers.

The instrument developed for this study and administered in the spring of 2005 was a double-sided single page document designed for optical scanning. The data collection was anonymous with no identifiers linking the individual student to the study. The students were asked to mark the circles indicating the course number, section number, and the date of the administration. An introductory text box was placed in the top left-hand corner of the front page of the instrument containing the following information:

> The purpose of this survey is to develop an understanding of students' attitudes towards technology so that student can experience improvements in their learning environments. Your participation is voluntary and all individual information will remain confidential. Please respond accurately.
>
> For the purposes of this study consider the broad definition, particularly related to teaching and learning in both formal and informal learning experiences: "technology is the cumulative sum of man-made means used to satisfy human needs and desires and to solve specific problems in any given discipline".

Including the purpose of the survey and attempting to clearly define technology as a broad concept just prior to asking what technologies assist them as students was a deliberate instrument design to try to move beyond the limited idea of technology as a computer.

The first part of the instrument presented a block with 15 blanks and requested the student to: "please list what you consider the major technologies that assist you in teaching and learning in both formal and informal learning experiences". This was designed to capture the students' concept of the technology they experience, and to consider their responses in light of similar responses in previous research studies. It was deliberately placed prior to requesting responses to the 31 positive statements to attempt to capture the students' initial and unaffected responses. There was however no way to ensure that the student read the information or strictly moved through the sections in order.

The second part of the instrument consisted of 31 positive statements to be scored using a modified 10-point Likert scale. On the scale 1 represented "strongly disagree" and 10 represented "strongly agree". The 31 items were exactly the same items in the same order as used by Shafiee in 1994 in his study of community college students' attitudes toward technology. Item 32 requested the student to rate his or her comfort level with computers and other technological equipment using a modified 10-point Likert scale with 1 representing "very uncomfortable" and 10 representing "very comfortable". Statements 1 -31 of the instrument administered in this study are reproduced in Table 1.

TABLE 1. Instrument Items 1 to 31 on Modified SSATT[1] Used to Assess Community College Students' Attitudes Toward Technology

1	Children should become familiar with technology as early as possible.
2	Increased automation will result in mass unemployment.
3	New technologies are improving working conditions.
4	People should have free access to all of their files held on computers by government agencies.
5	Information processing technologies will increase international trade.
6	Technology is scary.
7	Technology is part of all jobs.
8	Telecommunication is essential for world peace.
9	Nuclear power stations are safe.
10	Only a few Americans will benefit from the introduction of new technologies.
11	Technology education can broaden one's interests.
12	Video games disrupt family life.
13	I use technology in preparing materials for my school.
14	I use computers in my workplace.
15	Technology makes people more creative.
16	New technologies will create more jobs than they destroy.
17	Technology is too difficult for me.
18	Robots will eliminate monotonous, tedious jobs.
19	Social isolation may occur as more Americans work and shop from their homes.

TABLE 1. Continued

20	It is possible to learn about technology by oneself.
21	Everybody needs to be computer literate.
22	The use of computers to store personal information is an invasion of privacy.
23	America's international competitiveness depends upon technological development.
24	Technology is safe.
25	Technological advancements solve more problems than they create.
26	Video games are a waste of time.
27	Increased use of technology will lead to a rise in the standard of living for most Americans.
28	Technology increases the desire for comfort.
29	Technological understanding will be required for employment in the future.
30	I can learn better when I use computers.
31	I use technology in preparing my materials for my work.

Note[1]. Adapted from Secondary Students' Attitudes Toward Technology (Shafiee, 1994). n = 372

The third part of the instrument had of two sections. The first section consisted of demographic items 33 through 38 on gender; whether the student took a formal technology class in high school; whether the student had a computer at home; the students' age; college credits earned to date; and the number of hours in a typical week that the student used a computer. The second section consisted of items 39 through 50 and requested the student to mark the frequency of ten categories that applied to their computer use and provided them with blanks to indicate additional categories not listed.

The frequency choices were: (1) never, (2) monthly, (3) weekly, (4) daily, and (5) several times a day. Items 39 through 50 are reproduced in Table 2.

TABLE 2. Instrument Items 39 through 50 on Modified SSATT[1] Used to Assess Community College Students' Attitudes Toward Technology

	Item	Response Requested
33	Gender	Female / Male
34	Did you take a formal technology class in high school?	Uncertain / Yes / No
35	Do you have a computer at home?	Yes / No
36	Age (in years)	Bubble in Age
37	How many college credits have you earned to date?	Bubble in Credits
38	In a typical week how many hours in total do you use a computer? (Total of home, work and school usage)	Bubble in Hours
39	Communication[2] (friends, students, coworkers, relatives)	5 Choices*
40	Computations	
41	Computer programming	
42	Games	
43	Gathering information from the internet	
44	Media development	
45	Music	
46	Presentation development	
47	Shopping	
48	Word processing	
49	Others, please indicate	
50	Others, please indicate	

Note[1]. Adapted from Secondary Students' Attitudes Toward Technology (Shafiee, 1994). n = 372
Note[2]. For items 39 through 50 students were requested to mark their frequency for the categories of computer used that applied.
*The frequency choices were: never, monthly, weekly, daily, several times a day.

The positive statement items 1-31 were derived from previous instruments designed to study students' attitudes toward technology. Bolin (1992) had developed the Secondary Students' Attitudes Toward Technology (SSATT) from researching the earlier attitude toward technology instruments PATT and PATT-USA and stated:

> Careful analysis of the instruments developed by Raat and de Vries, Fife-Shaw et al., and Bame and Dugger indicated that those instruments would not meet the specific requirements of the current study. Instead, a measuring instrument was created for the study by modifying selected items from previous instruments and by developing items that were relevant within the context of the factors which had been identified by previous researchers. (p. 30)

Shafiee (1994) used the SSATT in a modified form to fit the community college student population and stated:

> The modified version of SSATT consisted of 32 items: 12 items from factor one (attitude toward technology), four items from factor two (interest in technology), four items from factor six (benefits of technology) six items from factor seven (application of technology), and four items from factor eight (effects of technology). Two items were added to address the respondents' comfort level with using computers and other means of information technology in an instructional setting. (p. 43)

Thompson and Householder (1995) and McHaney (1996) also used items from the SSATT in their research studies. Therefore, the items used in this study have survived intense evaluation and analysis. Additional demographic and computer use items were added to collect data for this study to better understand the attitudes toward and the uses of technology by community college students in the twenty-first century.

Statistical Analysis

Validity

The validity of a research instrument is critical in that it is an indication of how effectively it measures what it claims to measure. Isaac and Michael (1997) stated "validity information indicates the degree to which the test is capable of achieving certain aims" (p. 128). Borg and Gall (1989) provided that validity is "the degree to which a test measures what it purports to measure" (pp.249-250). Failure to assess and understand of the validity of an instrument could lead to errors in interpretation or the misapplication of the results.

Consideration of several types of validity was necessary. Borg and Gall (1989) stated that content validity is "the degree to which the sample of test items represents the content that the test is designed to measure" (pp.250-251). Isaac and Michael (1997) provided a content validity question: "How well does the content of the test sample the kinds of things about which the conclusions are to be drawn" (p. 125)? Numerous researchers have previously documented their development of the items used in this study. Raat and de Vries (1985) began with a broad range of items about various aspects of technology in developing their 80-item instrument. Bame and Dugger (1990), Bolin (1992), Shafiee (1994), Thompson and Householder (1995), and McHaney (1998) have all contributed their experience and expertise in their study of technology and statistical analysis to develop, refine, and validate the content of the items used in this study.

Isaac and Michael (1997) addressed construct validity:

> Construct validity is evaluated by investigating what qualities a test measures, that is by determining the degree to which certain explanatory

> concepts or constructs account for performance on the test…essentially, studies of construct validity check on the theory underlying the test. The procedure involves three steps. First, the investigator inquires: from this theory, what hypotheses may we make regarding the behavior of persons with high or low scores? Second, data are gathered to test the hypotheses. Third, in light of the evidence, an inference is made as to whether the theory is adequate to explain the data collected. (p. 129)

The question they propose is “to what extent do certain explanatory concepts or qualities account for the performance on the test” (p 125)? Borg and Gall (1989) offered that construct validity was “the extent to which a particular test can be shown to measure a hypothetical construct” (p.255).

Shafiee (1994) established the construct validity of the items used in this study by using both the “known-group” and “similar measure” methods. Dwyer (1993) indicated that factor analysis can be helpful in establishing construct validity. The work and analysis of Bolin (1992), Shafiee (1994), Thompson and Householder (1995), and McHaney (1998) have contributed support for this instruments’ construct validity.

Predictive validity was defined by Borg and Gall (1989) as “the degree to which the predictions made by a test are confirmed by the later behavior of the subjects” (p. 252). Shafiee (1994) found that an “index of predictive validity was .33 with a significance level of p = .001 for the modified version of the SSATT” (p.49). He used the number of non-required technology-related courses each student had taken per each subject’s transcripts as his study’s behavioral criterion. The 31 items in this study were the same as Shafiee’s therefore it is assumed that it has similar predictive validity; however, no criterion behavior was defined or observed in this study.

Reliability

Isaac and Michael (1997) stated “Reliability refers to the accuracy (consistency and stability) of measurement by a test” (p. 134). The reliability of a test indicated the trustworthiness of the scores (Dwyer, 1993). There are several methods for estimating the reliability of an instrument each involving computing a correlation between two or more scores on a test. The computation of this reliability coefficient indicated by a numerical value between 0 and 1.

The test-retest or pre-post test method involves administering the same instrument to the same subjects allowing for a period of time between administrations. Another method is the parallel-forms method which involves the administration of one test at one time, and the administration of an alternative test after a period of time has lapsed to the same group of subjects to control for the issue of learning affects which might be encountered with the test-retest method.

When a single administration of an instrument occurs, as in this study, there are several options to estimate reliability. The split-half method (or odd-even method) involves dividing the instrument in to two halves and calculating the score for each half (Isaac and Michael, 1997). A correlation of the scores for each half results in an estimate of reliability on tests having half the number of items as the original instrument. As length of the instrument can impact the computation of reliability “the reliability (consistency) coefficient for the entire test...may be estimated by the Spearman-Brown formula (involving certain generally reasonable assumptions)” (Isaac and Michael, 1997, p. 134). A potential shortcoming of the split-half method is that how the items were distributed in the instrument can produce different reliability coefficients (Borg & Gall, 1989).

Cronbach's Alpha is another method, and the one used in this study, which can be used to estimate reliability when there is a single administration of the instrument. It is a widely used method when using an instrument with interval scales. It yields an alpha coefficient that is the mean of all the coefficients obtained after splitting the items in half in all possible ways (Dwyer, 1993). It is not subject to the potential shortcoming of the split-half method because it overcomes the issue of the arrangement of the items in the instrument. It considers both the number of items and the intercorrelation of the items. A reliability coefficient of 0.7 means that 70% of the score is true variance and 30% is variance due to error (Nunnally, 1970). A coefficient of 0.7 or greater would be considered adequate for a hypothesized construct. The Cronbach's Alpha for the instrument in this study was .75; and .77 with the Cronbach's Alpha on standardized items.

Analysis of Variance

An analysis of variance (ANOVA) can be a useful inferential statistic. The key statistic is the F-test which tests to determine if the means of the groups formed by the independent variable values are different enough to not have occurred by chance. It provides the data for the differences in the sample means to determine if the differences are enough to decide that they do differ among two or more groups. The ANOVA is:

> Used to determine whether mean scores on one or more factors differ significantly from each other, and whether the various factors interact significantly with each other; also used to determine whether sample variances differ significantly from each other. (Borg and Gall, 1989, p. 356)

Isaac and Michael (1997) point out that "If a significant F ratio is obtained, the researcher only knows that somewhere in the data something other than chance is probably operating" (p. 190).

Factor Analysis

Factor analysis can be used to group variables with similar characteristics, thereby taking a larger number of variables and grouping them into to a smaller number of factors. It "is a statistical procedure that affords an explanation of how the variance common to several inter-correlated measures can be accounted for in terms of a smaller number of dimensions with which the variables are correlated" (Isaac and Michael, 1997, p. 212). Factor analysis has the ability to identify both the clusters and any outliers.

Factor analysis provides:

> An empirical basis for reducing the many variables to a few factors by combining variables that are moderately or highly correlated with each other. Each set of variables that is combined forms a factor, which is a mathematical expression to the common element that cuts across the combined variables. (Borg & Gall, 1989, p. 620)

In this study the first step in the factor analysis was the generation of a correlation matrix for all of the variables. The factors were extracted from the matrix based on the correlation coefficients of the variables and were rotated by varimax rotation to maximize the relationships. Varimax rotation is the most common rotation helping to identify each variable with a single factor. Isaac and Michael (1997) indicated that "As a rule, one can identify about one third as many dimensions as there are correlated variables" (p. 212).

Factor analysis was used in this study as it was in the development of the instruments used by Bolin (1992); Shafiee (1994); Thompson and Householder (1995); and McHaney (1998).

Statistical Treatment

To determine if there was a positive relationship of students' attitudes toward technology mean scores were calculated for each part of the instrument. Standard deviations were used to verify whether or not the scores overlapped between positive and negative responses. A mean score of 5.5 indicated support for the research questions since there was not an allowance for a neutral opinion on the instrument.

To determine if there was a correlation between attitudes and (1) gender, (2) computer access in the home, (3) age, and (4) a formal high school technology class, a correlation matrix for all variables was completed and analyzed, and the Pearson product-moment correlation was used.

A one-way analysis of variance (ANOVA) was used to determine if gender had any affect on the attitudes of students the attitudinal variables. F scores were used to evaluate and if the probabilities were 0.05 or less, the results were considered significant.

The 31 attitudinal variables in part II of the instrument were factor analyzed using a varimax rotation with a 0.40 minimum-loading criterion. The rotation converged in 19 iterations and 8 factors.

Analysis of Study Data

Data analysis was conducted using SPSS statistical program version 13.0 for Windows. All raw data were downloaded into an Excel spreadsheet and all of the data fields on each instrument was verified, and corrected if necessary, to ensure to most accurate data were analyzed in this study. Two instruments out of the 374 collected were missing data for items 25 through 50 and were eliminated from the study.

For the purposes of this study, four types of analysis were used from SPSS; the first was descriptive statistics to analyze instrument results regarding items 32 through 50; the demographics and computer use items. Second, a correlational analysis to respond to the research questions in this study. Third, a one-way ANOVA was used to analyze the survey results based on question, “to what degree does gender affect community college students’ attitudes toward technology”? Fourth, a factor analysis of the 31 attitudinal variables was performed using a varimax rotation with a 0.40 minimum-loading criterion to evaluate what factors that would affect the students’ attitudes toward technology could be identified.

CHAPTER IV

RESULTS

This study was designed to identify the factors underlying the community college students' attitudes toward technology in both formal and informal teaching and learning experiences. The research questions which were the focus of the study were:

1. To what degree does gender affect community college students' attitudes toward technology as reported by community college students in Houston, Texas?
2. To what degree does computer access in the home affect the students' attitudes toward technology as reported by community college students in Houston, Texas?
3. To what degree does age affect the students' attitudes toward technology as reported by community college students in Houston, Texas?
4. To what degree does taking a formal technology course in high school affect the students' attitudes toward technology as reported by community college students in Houston, Texas?
5. Do the number and type of technology experiences affect students' attitudes toward technology as reported by community college students in Houston, Texas?
6. What factors are identified by a factor analysis of the modified Secondary Students' Attitudes Toward Technology (SSATT) instrument used in this study of community college students in Houston, Texas.

The hypotheses were: (1) Male and female community college students will display similar attitudes toward technology, (2) students with access to a computer at home will display similar attitudes toward technology, (3) age will not affect students' attitudes toward technology, (4) formal technology courses taken in high school will not affect students' attitudes toward technology, and (5) the number and type of technology experiences will not affect students' attitudes toward technology.

This chapter includes the results of the calculation of the mean and standard deviation for each variable, the correlation matrix, the one-way analysis of variance (ANOVA), a factor analysis, and ancillary analysis of the data collected in this study. The reliability of the instrument and the test of the hypotheses are also included.

The instrument items were designed such that a low score of 1 or 2 indicated disagreement, while a high score of 9 or 10 indicated agreement toward the item being measured. By selecting a scale from 1 to 10 rather than 1 to 9, a neutral response was avoided. A score less than 5.5 indicated disagreement toward the item being measured, while a score in excess of 5.5 implied agreement toward the item.

Reliability of the Instrument

The reliability of the instrument used in this study was determined by using SPSS to generate Cronbach's Alpha. It was reported that it was .75; and .77 with Cronbach's Alpha on standardized items.

Demographics for Participants in Study

Selected demographics measured on a nominal scale in this study are displayed in Table 3 for gender, presence of a computer in the home, and completion of a high school technology class. There were 372 completed instruments analyzed in this study. More females than males completed the instrument, a ratio of 62.1% to 36.8%. That closely aligns with the gender percentages of the entire community college district of 41,534 students in the spring of 2005 which was 62.5% female and 37.46% male. Interestingly, 95.4% of the respondents indicated that there was a computer in the home. That would indicate alignment with the data in that 271 students listed a computer in part I of the instrument as a major technology that assisted them in formal and informal teaching and learning experiences. As 83 participants gave no response in part I, the 271 represented 93.7% of the 289 who responded.

TABLE 3. Selected Demographics (Nominal Scale) for Participants in Study of Community College Students' Attitudes Toward Technology

Variable		Frequency	Percent
Gender	Female	231	62.1
	Male	137	36.8
	No Response	4	1.1
	Total	372	100.0
Computer in the home	Yes	355	95.4
	No	7	1.9
	No Response	10	2.7
	Total	372	100.0
Formal technology class in high school	Yes	261	70.2
	No	82	22.0
	Uncertain	29	7.8
	Total	372	100.0

Note. Prior to 1998 a high school technology course was not required. Age range of participants was 16 to 49 years old. n = 372

The majority of the respondents, 70.2%, indicated that they had taken a formal technology class in high school. Taken in conjunction with the responses to a computer in the home it is observed that the community college students' who participated in this study had considerable exposure to technology.

TABLE 4. Selected Demographics (Interval Scale) for Participants in Study of Community College Students' Attitudes Toward Technology

Variable	Frequency	Mean	Standard Deviation
Age	366	21.7	5.73
College credits earned	348	18.8	15.84
Hours computer used in a typical week	362	19.1	19.81

Note. Age range was 16 to 49 years old.

Selected demographics measured on an interval scale are displayed in Table 4. The mean age for the district's entire spring 2005 credit student population was 25 years of age; for the participants in this study it was 21.7. The study participants ranged in age from 16 to 49 years old. The mean number of hours per week reported for their use of the computer for school, work, and leisure as 19.1 hours. The hours per week ranged from zero to 138, with only one response of zero hours. Less than one-third, or 31.2%, of the 362 respondents to item number 38 reported using the computer less than 10 hours per week and less than one-third, or 30.7%, reported using the computer between 10 and 19 hours per week. That indicated that 61.9% of the 362 respondents were below the reported study mean of 19.1 hours per week. The remaining 38.1% of the respondents reported 20 or more hours per week of computer use. The standard deviation of 19.81 hours per week demonstrated the possible variability in the hours reported.

To begin the evaluation of the data the mean scores and standard deviations were calculated for each of the 31 attitudinal variables in part II, and the overall mean score was tabulated for the entire group. Table 5 outlines the mean score, standard deviation, and frequency for each. The attitudinal items are abbreviated in the table; the full item can be found in Table 1 or in Appendix B.

The overall mean score of 6.32 for the population of 372 students indicates a modestly positive attitude by the students toward modern technology. If one considers one standard deviation of variance, the scores from 4.02 to 8.62 suggest that some students are within the boundary of 5.5 for a positive attitude toward technology, but others are not.

With no neutral response on the 10-point scale, a response of 5.5 or greater would indicate a positive response to the attitude variable. With a mean of 8.1, 8.5, and 8.2 respectively for items (1) children should become familiar with technology as early as possible; (13) I use technology in preparing materials for my school; and (29) technological understanding will be required for employment in the future; it would appear that the respondents in this study view technology as important.

TABLE 5. Descriptive Statistics for Items 1 through 31 of Modified Secondary Students' Attitudes Toward Technology (SSATT)[1]

	Attitude Variable	Mean	Standard Deviation	Frequency
Q1	FamiliarEarly	8.1	2.23	369
Q2	AutoUnemp	5.8	2.29	360
Q3	NewImprove	7.9	1.92	364
Q4	AccessPers	6.2	3.09	367
Q5	IntlTrade	7.0	2.00	363
Q6	Scary	4.0	2.98	367
Q7	PartAllJobs	7.8	2.19	369
Q8	TelePeace	6.0	2.55	363
Q9	NuclearSafe	4.0	2.11	359
Q10	FewBenefit	3.6	2.52	366
Q11	BroadenInterest	7.7	2.07	369
Q12	GamesInterupt	5.6	2.75	369
Q13	PrepForSchl	8.5	2.00	368
Q14	UseWorkplc	7.9	2.82	367
Q15	MoreCreative	6.5	2.72	366
Q16	CreateJobs/Ds	5.9	2.36	370
Q17	DifficultMe	3.1	2.44	366
Q18	RobotsElim	5.5	2.76	368
Q19	Socisolation	6.1	2.51	368
Q20	LearnAlone	6.4	2.52	368
Q21	AllNeedLiterat	7.8	2.34	369
Q22	StoreInvasion	4.8	2.51	368
Q23	AmerCompet	7.2	2.08	367
Q24	Safe	6.0	2.15	369
Q25	AdvanceSolve	6.3	1.96	367
Q26	GamesWaste	5.0	2.94	369
Q27	StdrdRise	6.7	1.95	368
Q28	DesireComfort	6.7	2.07	367
Q29	UnderReqEmp	8.2	1.98	369
Q30	LearnBetter	6.6	2.55	370
Q31	UsePrepWork	7.0	2.87	369

Note[1]. Adapted from Secondary Students' Attitudes Toward Technology (Shafiee, 1994). n = 372

Also worthy of note were the mean of 4.0, 3.6, and 3.1 respectively for items (6) technology is scary; (10) only a few Americans will benefit from the introduction of new technologies; and (17) technology is too difficult for me. These negative responses appeared to indicate that the respondents did not view technology as scary nor too difficult. Nor did they agree that only a few would benefit from new technologies.

Correlation Matrix

A correlation matrix was run for the 48 items in part II and part III on the modified Secondary Students' Attitudes Toward Technology (SSATT) used in this study. It included the 31 attitudinal variables utilizing the modified 10-point Likert scale that comprised part II, and the demographics and frequencies of use in part III. The resulting matrix was used in the analysis of several of the variables in this study. The Pearson correlation coefficient r measures the strength of relationship between the variables. The coefficient of determination r^2 measures the explanatory power that the independent variable has over the dependant variable. As a guiding rule, an r-value from zero to .20 may be considered to have no or only negligible correlation. An r of .20 to .40 may be considered as having a low degree of correlation. As will be shown on the tables in this study, the correlation coefficients were primarily below .40.

Correlation of Variables

The first question in this study considered was "To what degree does gender affect community college students' attitudes toward technology as reported by community college students in Houston, Texas?" Gender was one of the most often independent variables included in attitude studies of both technology and of computers.

Early studies indicated males were more positive than females, but more recent studies have produced mixed results. Therefore, gender in this study was looked at through both correlation and through an analysis of variance. Table 6 outlines the correlation of gender with the 31 attitudinal variables. Nine of the 31 attitudinal variables were statistically significant but had no practical significance. In the table only three of the Pearson correlation coefficients reach the .20 range suggesting that there is very little to no correlation between gender and the attitudinal variables. The items that had an r of .20 or greater were: (1) item 9, nuclear power stations are safe; (2) item 23, America's international competitiveness depends upon technological development; and (3) technology is safe. The largest coefficient of determination r^2 is only 0.07 for item 9. Only those items with a statistical significance of $p = .01$ have their full data displayed in the tables. Further analysis of gender was performed by doing an analysis of variance (ANOVA), and is detailed later in that part of the statistical analysis of the study.

Where it might have been anticipated that there would be a possible relationship between gender and the attitudinal variables, the correlation of the data in this study does not appear to indicate any degree of relationship for the community college students participating in the study. This seems to support the findings in other studies that males and females do not necessarily have different attitudes to the broad concept of technology.

The second question in this study was "To what degree does computer access in the home affect the students' attitudes toward technology as reported by community college students in Houston, Texas?" It had been reported that the presence of a

TABLE 6. Correlation of Gender with Attitudinal Variables for Community College Students in Houston, Texas

Attitudinal Variable		Response	r		r^2	p
1	FamiliarEarly	367	0.06			
2	AutoUnemp	358	-0.01			
3	NewImprove	362	0.00			
4	AccessPers	365	0.07			
5	IntlTrade	361	0.06			
6	Scary	365	-0.08			
7	PartAllJobs	367	-0.02			
8	TelePeace	362	0.00			
9	NuclearSafe	357	0.27	**	0.07	0.001
10	FewBenefit	364	0.02			
11	BroadenInter	367	-0.01			
12	GamesInterupt	367	-0.17	**	0.03	0.001
13	PrepForSchl	366	-0.14	**	0.02	0.007
14	UseWorplc	365	-0.07			
15	MoreCreative	364	-0.03			
16	CreateJobs/Ds	368	-0.03			
17	DifficultMe	364	-0.08			
18	RobotsElim	366	0.09			
19	Socisolation	366	-0.01			
20	LearnAlone	366	0.10			
21	AllNeedLiterat	367	-0.05			
22	StoreInvasion	366	0.04			
23	AmerCompet	365	0.22	**	0.05	0.001
24	Safe	367	0.20	**	0.04	0.001
25	AdvanceSolve	365	0.14	**	0.02	0.008
26	GamesWaste	367	-0.19	**	0.03	0.001
27	StdrdRise	366	0.15	**	0.02	0.005
28	DesireComfort	365	0.12	*	0.01	0.024
29	UnderReqEmp	367	-0.06			
30	LearnBetter	368	0.10			
31	UsePrepWork	367	-0.07			

Note. Significance $p = .05^{**}$, $p = .01^{*}$. Nine of the 31 attitudinal variables were statistically significant with regard to gender. n = 372.

computer in the home had a positive effect on students' attitudes toward technology. Table 7 presents the correlation data indicating that only three of the attitudinal variables were statistically significant, though not practically significant, with regard to the presence of a home computer at $p = .01$. The items with statistical significance were: (1) item 13, I use technology for preparing materials for my school; (2) item 14, I use computers in my work place; and (3) item 27, Increased use of technology will lead to a rise in the standard of living for most Americans. The Pearson correlation coefficients for all 31 attitudinal variables were all below the .20 mark suggesting that there is no correlation between the presence of a computer in the home and the attitudinal variables.

Recognizing that 95.4% of the 372 study respondents indicated that there was a computer in their home this study did not have two distinct or proportional groups to study. This study had 355 respondents reporting having a computer in the home, and seven reporting not having a computer in the home. Ten participants did not respond to the item. This study did not go into further detail as to the type of computer in the home, the uses of the computer, nor the amount of time spent on the computer at home. Further development of the home computer use would be beneficial in identifying any possible impact the use of the home computer has on community college students' attitudes toward technology. The question remains a valuable item to include in further studies particularly if the commonality of a computer in a home is more a norm in today's society and not simply a factor for the sample in this study.

TABLE 7. Correlation of Computer in the Home with Attitudinal Variables for Community College Students in Houston, Texas

Attitudinal Variable		Response	*r*		r^2	*p*
1	FamiliarEarly	361	-0.04			
2	AutoUnemp	353	-0.08			
3	NewImprove	357	-0.09			
4	AccessPers	360	0.05			
5	IntlTrade	355	0.01			
6	Scary	359	0.03			
7	PartAllJobs	362	0.03			
8	TelePeace	355	-0.01			
9	NuclearSafe	351	0.04			
10	FewBenefit	358	0.04			
11	BroadenInter	361	-0.06			
12	GamesInterupt	361	-0.05			
13	PrepForSchl	360	-0.14	**	0.02	0.009
14	UseWorplc	360	-0.12	*	0.02	0.026
15	MoreCreative	358	-0.04			
16	CreateJobs/Ds	362	0.06			
17	DifficultMe	358	-0.03			
18	RobotsElim	360	0.01			
19	Socisolation	360	-0.04			
20	LearnAlone	360	0.03			
21	AllNeedLiterat	361	-0.02			
22	StoreInvasion	360	0.02			
23	AmerCompet	359	-0.05			
24	Safe	361	0.01			
25	AdvanceSolve	359	-0.01			
26	GamesWaste	361	0.01			
27	StdrdRise	360	-0.11	*	0.02	0.045
28	DesireComfort	359	0.07			
29	UnderReqEmp	361	0.02			
30	LearnBetter	362	-0.01			
31	UsePrepWork	361	-0.04			

Note. Significance p = .05 **, p = .01 *. Three of the 31 attitudinal variables were statistically significant with regard to presence of a home computer.

The third question considered in this study was "To what degree does age affect the students' attitudes toward technology as reported by community college students in Houston, Texas?" The range of ages reported by the participants in the study was 16 to 49 years of age. The mean age in the study was 21.7 years. Table 8 outlines the correlation of age with the attitudinal variables and indicates that 10 of the attitudinal variables were statistically significant at $p = .01$ with regard to age. They did not however have practical significance. All Pearson correlation coefficients, with the exception of one, are below .20 indicating that there is no, or only negligible, correlation between age and the attitudinal variables. The exception was item 5, information processing technologies will increase international trade. As reported by many researchers studying the attitude of individuals toward technology, or computers, age does not often appear as a significant factor as it once did.

In this study 244 of the 366, or 66.66% participants that responded to item 36, age, were under 21 years old. Sixty-one participants, or 16.66%, reported being between 21 and 25 years of age. It appears that the participants in this study enrolled in transfer credit English classes were not far from their high school years, which may have had an affect on any differentiation in attitudes in this study. The remaining 16.66% of the participants were between 26 and 49 years old. The resulting observation was that the 21 to 25 year old group and the 26 to 49 year old group were equal in size.

The fourth question in this study was "To what degree does taking a formal technology course in high school affect the students' attitudes toward technology as reported by community college students in Houston, Texas?" It is important to note that

TABLE 8. Correlation of Age with Attitudinal Variables for Community College Students in Houston, Texas

Attitudinal Variable		Response	*r*		r^2	*p*
1	FamiliarEarly	365	0.03			
2	AutoUnemp	356	-0.11	*	0.01	0.037
3	NewImprove	360	0.00			
4	AccessPers	364	0.13	**	0.02	0.016
5	IntlTrade	360	0.20	**	0.04	0.001
6	Scary	363	0.00			
7	PartAllJobs	365	0.10			
8	TelePeace	360	0.16	**	0.03	0.003
9	NuclearSafe	356	-0.01			
10	FewBenefit	362	-0.07			
11	BroadenInter	365	-0.02			
12	GamesInterupt	365	0.13	**	0.02	0.015
13	PrepForSchl	364	0.09			
14	UseWorplc	363	0.11	*	0.01	0.037
15	MoreCreative	362	0.12	*	0.01	0.027
16	CreateJobs/Ds	366	0.07			
17	DifficultMe	363	-0.01			
18	RobotsElim	364	0.05			
19	Socisolation	364	0.02			
20	LearnAlone	364	0.07			
21	AllNeedLiterat	365	0.09			
22	StoreInvasion	364	0.09			
23	AmerCompet	363	0.12	*	0.01	0.023
24	Safe	365	0.04			
25	AdvanceSolve	363	0.11	*	0.01	0.029
26	GamesWaste	365	0.02			
27	StdrdRise	364	0.07			
28	DesireComfort	363	0.06			
29	UnderReqEmp	365	0.04			
30	LearnBetter	366	0.08			
31	UsePrepWork	365	0.16	**	0.02	0.003

Note. Significance $p = .05^{**}$, $p = .01^{*}$. Ten of the 31 attitudinal variables were statistically significant with regard to age.

of 1998 high school students in the state of Texas are required to take a technology course as part of their studies. Table 9 indicates that three of the attitudinal variables were statistically significant at $p = .01$ with values of 0.034, 0.020, and 0.033. However, the *r*-values for the items were 0.11, -0.12, and 0.11 respectively. The items were: (1) item 13, I use technology in preparing materials for my school; (2) item 17, technology is too difficult for me; and (3) item 29, technological understanding will be required for employment in the future. Again, the correlation coefficient values were below .20 and the coefficients of determination were 0.01, indicating that only 1% of the variance in the dependent variable was associated with the independent variable. Though the items were statistically significant they did not have practical significance.

In this study there appears to be no correlation of the variables of gender, computer access at home, age, nor a formal technology course with the attitudinal variable items of the modified SSATT used. The frequency data reported by the participants of the study with regard to a the commonality of a home computer and taking a high school technology course were of interest when considered against previous research studies on attitudes toward technology in the literature. It appears that for the larger portion of participants in this study that technology is integrated or at least common in their lives.

TABLE 9. Correlation of Formal High School Technology Class with Attitudinal Variables for Community College Students in Houston, Texas

Attitudinal Variable		Response	*r*		r^2	*p*
1	FamiliarEarly	369	-0.09			
2	AutoUnemp	360	-0.01			
3	NewImprove	364	-0.02			
4	AccessPers	367	0.06			
5	IntlTrade	363	0.07			
6	Scary	367	0.02			
7	PartAllJobs	369	0.04			
8	TelePeace	363	-0.02			
9	NuclearSafe	359	-0.06			
10	FewBenefit	366	0.01			
11	BroadenInter	369	0.01			
12	GamesInterupt	369	0.09			
13	PrepForSchl	368	0.11	*	0.01	0.034
14	UseWorplc	367	0.00			
15	MoreCreative	366	-0.08			
16	CreateJobs/Ds	370	-0.03			
17	DifficultMe	366	-0.12	*	0.01	0.020
18	RobotsElim	368	-0.06			
19	Socisolation	368	-0.01			
20	LearnAlone	368	0.04			
21	AllNeedLiterat	369	-0.03			
22	StoreInvasion	368	-0.06			
23	AmerCompet	367	0.07			
24	Safe	369	-0.02			
25	AdvanceSolve	367	-0.02			
26	GamesWaste	369	0.06			
27	StdrdRise	368	-0.03			
28	DesireComfort	367	0.03			
29	UnderReqEmp	369	0.11	*	0.01	0.033
30	LearnBetter	370	-0.08			
31	UsePrepWork	369	-0.04			

Note. Significance $p = .05$ **, $p = .01$ *. Three of the 31 attitudinal variables were statistically significant with regard to a formal high school technology class.

TABLE 10. Correlation of Comfort with Technology with Attitudinal Variables for Community College Students in Houston, Texas

Attitudinal Variable		Response	*r*		*r* ^{2}	*p*
1	FamiliarEarly	362	0.24	**	0.06	0.001
2	AutoUnemp	353	-0.06			
3	NewImprove	358	0.17	**	0.03	0.001
4	AccessPers	360	0.00			
5	IntlTrade	356	0.21	**	0.04	0.001
6	Scary	360	-0.26	**	0.07	0.001
7	PartAllJobs	362	0.18	**	0.03	0.001
8	TelePeace	356	0.15	**	0.02	0.005
9	NuclearSafe	352	0.10			
10	FewBenefit	359	-0.05			
11	BroadenInter	362	0.22	**	0.05	0.001
12	GamesInterupt	362	-0.13	**		
13	PrepForSchl	361	0.19	**	0.03	0.001
14	UseWorplc	360	0.19	**	0.04	0.001
15	MoreCreative	359	0.14	**	0.02	0.009
16	CreateJobs/Ds	363	0.01			
17	DifficultMe	359	-0.45		0.20	0.001
18	RobotsElim	361	0.15	**	0.02	0.003
19	Socisolation	361	0.05			
20	LearnAlone	361	0.32		0.10	0.001
21	AllNeedLiterat	362	0.15	**	0.02	0.004
22	StoreInvasion	361	-0.14	**	0.02	0.010
23	AmerCompet	360	0.12	**	0.02	0.020
24	Safe	362	0.30		0.09	0.001
25	AdvanceSolve	360	0.24	**	0.06	0.001
26	GamesWaste	362	-0.14			
27	StdrdRise	361	0.06			
28	DesireComfort	360	0.18	**	0.03	0.001
29	UnderReqEmp	362	0.12	**	0.02	0.018
30	LearnBetter	363	0.41		0.17	0.001
31	UsePrepWork	362	0.25		0.06	0.001

Note. Significance p = .05 **, p = .01 *. Twenty-two of the 31 attitudinal variables were statistically significant with regard to comfort with technology.

Table 10 outlines the correlation of the students' self-reported comfort with technology on a scale of 1 to 10, with 1 being "very uncomfortable" and 10 being "very comfortable" with the attitudinal variables. The data indicated that comfort with technology had a statistical significance at $p = .01$ in 22 of the 31 attitudinal variables. Though the statistical significance is not a practical significance the large number of correlated items would appear to indicate something about the students comfort with technology. Comfort had a correlation between .20 and .30 with five of the variables, and a correlation between .31 to .40 with four of the variables. Generally, a correlation of .25 to .30 indicates a fairly strong correlation. A correlation of .30 to .40 indicates a strong to very strong correlation. The four items with the .31 or greater correlation coefficient were: (1) item 17, technology is too difficult for me, with a negative correlation of -0.45; (2) item 20, it is possible to learn about technology by oneself; (3) item 24, technology is safe; and (4) item 30, I can learn better when I use computers.

Ten participants did not indicate a response to item 32 regarding their comfort with technology, however 154, or 42.54% of the individuals reported their comfort with technology as a value of 9 or 10. Importantly, 328 of the 362 respondents, or 90.60%, reported their comfort with technology as a value of 6 or greater. These frequencies combined with the correlation of comfort with technology with the attitudinal variables would indicate that the community college students participating in this study reported being comfortable with technology.

The fifth question in this study was "Do the number and type of technology experiences affect students' attitudes toward technology as reported by community

TABLE 11. Correlation of Hours per Week of Computer Use with Attitudinal Variables for Community College Students in Houston, Texas

	Attitudinal Variable	Response	*r*		r^2	*p*
1	FamiliarEarly	361	0.16	**	0.03	0.002
2	AutoUnemp	352	-0.12	*	0.01	0.024
3	NewImprove	357	0.09			
4	AccessPers	359	-0.05			
5	IntlTrade	355	0.12	*	0.01	0.025
6	Scary	359	-0.07			
7	PartAllJobs	361	0.10	*	0.01	0.057
8	TelePeace	356	0.14	**	0.02	0.007
9	NuclearSafe	352	0.10			
10	FewBenefit	358	-0.10		0.01	0.049
11	BroadenInter	362	0.12	**	0.02	0.019
12	GamesInterupt	361	-0.11		0.01	0.035
13	PrepForSchl	360	0.06			
14	UseWorplc	359	0.21	**	0.04	0.001
15	MoreCreative	359	0.13	**	0.02	0.011
16	CreateJobs/Ds	362	0.07			
17	DifficultMe	358	-0.19	**	0.04	0.001
18	RobotsElim	360	0.05			
19	Socisolation	360	-0.02			
20	LearnAlone	360	0.06			
21	AllNeedLiterat	362	0.05			
22	StoreInvasion	360	-0.03			
23	AmerCompet	359	0.07			
24	Safe	361	0.16	**	0.02	0.003
25	AdvanceSolve	359	0.11	*	0.01	0.030
26	GamesWaste	361	-0.09			
27	StdrdRise	360	0.12	*	0.01	0.024
28	DesireComfort	359	0.11	*	0.01	0.044
29	UnderReqEmp	361	0.08			
30	LearnBetter	362	0.21	**	0.04	0.001
31	UsePrepWork	362	0.14	**	0.02	0.007

Note. Significance $p = .05$ **, $p = .01$ *. Seventeen of the 31 attitudinal variables were statistically significant with regard to hours per week of computer use.

college students in Houston, Texas?" There were two parts to the question: (1) number of experiences and (2) type of experiences. The students were asked, "In a typical week how many hours in total do you use a computer (total of home, work, and school usage)?" The correlation of the hours per week of computer use with the attitudinal variables is displayed in Table 11. The hours per week of computer use was statistically, but not practically, significant with 17 of the 31 attitudinal variables at $p = .01$. The correlation coefficient r was greater than .20 with only two of the variables: item 14, I use computers in my work place, and item 30, I can learn better when I use computers. Ten individuals did not respond to item 38 on the number of hours of computer usage per week. The number of hours reported per week ranged from 187 to zero, with only one zero reported. There were 105 participants, or 29%, that reported their computer usage as being between 20 and 40 hours per week. There were 224 that indicated less than 20 hours of computer use per week, which was 61.87% of those responding. The mean reported was 19.1 hours per week indicating that the participants in this study used the computer for work, school, and home a considerable number of hours per week.

Table 12 displays the computer usage in aggregated categories reported by frequency for ten computer activities. It is noteworthy that over half of the respondents indicated that they used the Internet daily or several times a day. That was in contrast to the 7.7% that reported that they used the Internet monthly or never. It also bears noting that over half of the respondents reported that they used the computer for communication daily or several times a day. A rather large 64.8% of the community college students in this study reported using the computer for presentation development only monthly or never. Also of interest was the daily usage of the computer for music at 46.4% of the participants in this study.

TABLE 12. Computer Usage Reported by Frequency of Response for Items 39 through 48 on Modified Secondary Students' Attitudes Toward Technology (SSATT)

Computer Use	Daily or Several Times a Day	Never or Monthly
Internet	58.8 %	7.7 %
Communication	50.3 %	21.2 %
Music	46.4 %	32.6 %
Word Processing	40.2 %	19.4 %
Computations	26.1 %	47.8 %
Games	18.7 %	58.4 %
Media Development	16.0 %	57.3 %
Programming	10.9 %	79.9 %
Shopping	9.3 %	74.7 %
Presentation Development	9.1 %	64.8 %

Note. Individual responses for daily (4) and several times a day (5) were aggregated; never (1) or monthly (2) were aggregated. n = 372

ANOVA by Gender

An analysis of variance was used to investigate whether or not gender had any effect on the attitude of students toward technology. To determine if such relationships existed, a one-way ANOVA was used on the 31 attitudinal variables on the instrument. The results of the ANOVA for gender are listed in Table 13. The probabilities using the

TABLE 13. One-way ANOVA for Gender for Community College Students in Houston Texas

	Attitude Variable		n	m	sd	F	p
Q1	FamiliarEarly	F	230	8.0	2.31	1.51	0.220
		M	137	8.3	2.09		
Q2	AutoUnemp	F	222	5.8	2.21	0.07	0.793
		M	136	5.8	2.41		
Q3	NewImprove	F	228	8.0	1.85	0.00	0.996
		M	134	8.0	1.97		
Q4	AccessPers	F	229	6.2	3.08	1.81	0.180
		M	136	6.7	3.09		
Q5	IntlTrade	F	226	7.0	1.90	1.30	0.256
		M	135	7.2	2.18		
Q6	Scary	F	228	4.2	2.96	2.19	0.140
		M	137	3.7	2.98		
Q7	PartAllJobs	F	230	7.8	2.12	0.15	0.698
		M	137	7.7	2.30		
Q8	TelePeace	F	226	6.0	2.28	0.00	0.979
		M	136	6.0	2.97		
Q9	NuclearSafe	F	223	3.7	1.85	27.38	0.001
		M	134	4.8	2.31		
Q10	FewBenefit	F	228	3.6	2.57	0.15	0.692
		M	136	3.7	2.41		
Q11	BroadenInterest	F	231	7.7	1.96	0.02	0.885
		M	136	7.7	2.24		
Q12	GamesInterupt	F	230	5.9	2.64	10.87	0.001
		M	137	5.0	2.81		

TABLE 13. Continued

	Attitude Variable		n	m	Sd	F	p
Q13	PrepForSchl	F	230	8.7	1.90	7.45	0.007
		M	136	8.2	2.12		
Q14	UseWorkplc	F	229	8.1	2.79	1.82	0.179
		M	136	7.7	2.87		
Q15	MoreCreative	F	231	6.6	2.72	0.43	0.509
		M	133	6.4	2.72		
Q16	CreateJobs/Ds	F	231	5.9	2.31	0.42	0.518
		M	137	5.8	2.43		
Q17	DifficultMe	F	227	3.3	2.55	2.40	0.122
		M	137	2.9	2.25		
Q18	RobotsElim	F	231	5.3	2.71	3.26	0.072
		M	135	5.8	2.82		
Q19	Socisolation	F	230	6.1	2.47	0.05	0.831
		M	136	6.0	2.57		
Q20	LearnAlone	F	229	6.2	2.48	3.40	0.066
		M	137	6.7	2.52		
Q21	AllNeedLiterat	F	231	7.9	2.35	0.76	0.384
		M	136	7.6	2.32		
Q22	StoreInvasion	F	231	4.7	2.45	0.64	0.424
		M	135	4.9	2.63		
Q23	AmerCompet	F	229	6.9	2.05	17.79	0.001
		M	136	7.8	2.02		
Q24	Safe	F	231	5.7	1.97	15.64	0.001
		M	136	6.6	2.33		

TABLE 13. Continued

	Attitude Variable		n	m	sd	F	p
Q25	AdvanceSolve	F	229	6.1	1.88	7.19	0.008
		M	136	6.7	2.04		
Q26	GamesWaste	F	231	5.5	2.93	13.03	0.001
		M	136	4.4	2.81		
Q27	StdrdRise	F	230	6.5	1.97	8.17	0.005
		M	136	7.1	1.87		
Q28	DesireComfort	F	229	6.5	2.00	5.11	0.024
		M	136	7.1	2.16		
Q29	UnderReqEmp	F	231	8.3	1.98	1.31	0.252
		M	136	8.1	2.00		
Q30	LearnBetter	F	231	6.4	2.63	3.71	0.055
		M	137	7.0	2.40		
Q31	UsePrepWork	F	231	7.2	2.85	1.56	0.207
		M	136	6.8	2.89		

F-scores based on gender of $p = .05$ and $p = .01$ were overall not statistically significant. Two areas of attitude (1) safety and (2) games did appear to indicate some gender differences.

The first hypothesis of the study was that male and female college students will display similar attitudes toward technology. The results did not provide sufficient evidence to reject the hypothesis. The results of the study overall did not indicate differences in the attitudes of the students based on gender.

Factor Analysis

A factor analysis was done for the 31 attitudinal variables using a varimax rotation and a 0.40 minimum-loading criterion. The rotation converged in 19 iterations and clustered in eight factors accounting for a total of 52.77% of the variance. The factors identified were: (1) technology competence; (2) peace/creating; (3) negative influences of technology; (4) technology as a workplace tool; (5) increased technology impact; (6) video games are bad; (7) technology and job creation; and (8) technology and safety. Table 14 displays the factors with their factor loadings, Eigen values, and percent of variance accounted for.

Factor 1, technology competence, accounted for the largest portion of the variance at 18.21. It consisted of six of the 31 attitudinal variables in this study. In it were: (1) item 1, children should become familiar with technology as early as possible; (2) item 11, technology education can broaden one's interests; (3) item 21, everybody needs to be computer literate; (4) item 23, America's international competitiveness depends upon technological development; (5) item 28, technology increases the desire for comfort; and (6) item 29, technological understanding will be required for employment in the future.

Factor 2, peace/creating, accounted for 7.74% of the variance and consisted of just two of the attitudinal variables. They were: (1) item 8, telecommunication is essential for world peace; and (2) item 15, technology makes people more creative.

TABLE 14. Factor Analysis with Varimax Rotation for Items 1 through 31 of the Modified Secondary Students' Attitudes Toward Technology (SSATT) for the Participants in Study of Community College Students' Attitudes Toward Technology

		1	2	3	4	5	6	7	8
1	FamiliarEarly	.450							
2	AutoUnemp								
3	NewImprove			.672					
4	AccessPers								
5	IntlTrade								
6	Scary								
7	PartAllJobs								
8	TelePeace		.559						
9	NuclearSafe								.549
10	FewBenefit			.424					
11	BroadenInterest	.468							
12	GamesInterupt						.696		
13	PrepForSchl								
14	UseWorkplc				.508				
15	MoreCreative		.468						
16	CreateJobs/Ds							.567	
17	DifficultMe			.526					
18	RobotsElim					.439			
19	Socisolation					.556			
20	LearnAlone								
21	AllNeedLiterat	.475							
22	StoreInvasion			.414					
23	AmerCompet	.537							
24	Safe								.522
25	AdvanceSolve								
26	GamesWaste						.749		
27	StdrdRise					.452			
28	DesireComfort	.519							
29	UnderReqEmp	.622							
30	LearnBetter								
31	UsePrepWork				.834				
Eigen value		5.65	2.40	1.73	1.59	1.36	1.32	1.22	1.09
Variance (52.77 %)		18.21	7.74	5.59	5.13	4.39	4.26	3.94	3.51

Factor 3, negative influences of technology, accounted for 5.59% of the variance and consisted of four of the attitudinal variables. They were: (1) item 3, new technologies are improving working conditions; (2) item 10, only a few Americans will benefit from the introduction of new technologies; (3) item 17, technology is too difficult for me; and (4) item 22, the use of computers to store personal information is an invasion of privacy.

Factor 4, technology as a workplace tool, accounted for 5.13% of the variance. It consisted of the following 2 attitudinal variables: (1) item 14, I use computers in my workplace; and (2) item 31, I use technology in preparing materials for my work. Factors 5, 6, 7 and 8 each accounted for less than 5% of the total variance.

Determinations about the clusters of factors resulting from a factor analysis and the associations of the factors was reported in the literature as being subject to a certain degree of interpretation. The same held true for the factor analysis of this instrument based on the data collected in this study. Value is held in determining the total amount of variance accounted for by the resulting factors and examining the items in each factor.

Definition of Technology Responses

Studies of students' attitudes toward technology have frequently contained a component to capture the participants' perceptions of technology. In this study, the first item that the students were requested to respond to was their definition of technology by listing what he or she considered the major technologies that assisted in their teaching and learning in both formal and informal learning experiences. Their common responses and the frequency of those responses can be found in Table 15.

TABLE 15. Definition of Technology as Reported by Community College Students in Houston, Texas (Multiple Responses were Given)

Technology	Response Frequency	Technology	Response Frequency
Computer	253	Fax	8
Internet	110	CD	7
No response	83	Films and movies	7
Television	74	Satellite	7
Calculator	57	Scanner	7
DVD	33	Camera	6
Presentation software	33	Digital camera	6
Projector	32	Video	6
Cell phone	28	Video games	6
Books	24	Chalkboard	5
Projector - overhead	21	Database	5
Printer	19	Google or Yahoo	5
Computer, laptop	18	CD-Rom	4
Phone and telephone	18	Microwave	4
Radio	17	Newspaper	4
E-mail	16	Pen	4
Word processing	16	Pencil	4
Computer software	14	Spreadsheets	4
Automobile	13	Tape recorder	3
Library	13	Electricity	2
iPod	12	Flash drive	2
PDA	12	Floppy disc	2
VCR/VHS	11	Microfiche	2
Copier	10	Recorder	2
Overheads	10	Search engine	2
MP3	9	Websites	2

Note. Part I was a request to please list what you consider the major technologies that assist you in teaching and learning in both formal and informal learning experiences. n = 372

Eighty-three individuals chose to skip the item and gave no response; therefore, Table 15 represents the responses of 289 participants. The frequency of responses for computer, the Internet, and television stand out in the list of aggregated participant responses. They provide an interesting glimpse for educators with regard to the involvement with technology that the students have. As in previous studies the computer is the most often cited technology. It is also important to note that most commonly the hard technologies are cited. It is also evident that students do not have a singular or well-defined concept of technology, but are aware of the broad number and variety of technologies in their lives.

The fifth research question in this study was "do the number and type of technology experiences affects students' attitudes toward technology?" The data from: (1) the correlation matrix of all items, (2) the frequencies of use reported, and (3) the technologies listed that assisted the students in this study would indicate that attitude toward and comfort with technology increase with contact and experience with technology. Green (2000) proposed in his working paper:

> Information technology is now ubiquitous across and beyond higher education. It is not just the computers, the Internet, or the World Wide Web: it is the *aggregated presence* of these technologies in virtually all facets of daily life across so many sectors of the (American) economy that makes the difference. Higher educations clientele – students from 17 to 67 – now come to campus expecting to *learn about* and to *learn with* technology." (p.4)

The responses in this study appeared to mirror that picture of the student and their attitudes toward technology. Previous studies on students' attitudes toward technology when involved in technologically rich environments have shown some indications of the same value of experience.

Study Hypotheses

This study proposed five hypotheses in line with the research questions. The first with regard to gender was already addressed with both the correlation matrix and the one-way ANOVA. There appeared to be no significant gender differences in the students' attitudes toward technology in this study.

The second hypothesis was: Students with access to a computer at home will display similar attitudes toward technology. Because 95.4% of the students in this study reported having access to a computer in the home – an unexpected result – there was no adequate comparison to be made. Though this variable was used in past studies it would appear from this research study that it has lost some of its importance. It could however be an anomaly of this sample population of community college students.

The third hypothesis was: Age will not affect students' attitudes toward technology. The data collected in this study did not indicate that age had an affect on the students' attitudes toward technology therefore the null hypotheses cannot be rejected.

The fourth hypothesis was: Formal technology courses taken in high school will not affect students' attitudes toward technology. There was inadequate evidence to reject this hypothesis.

The fifth hypothesis was: The number and type of technology experiences will not affect students' attitudes toward technology. As the data is looked at cumulatively there was a tendency to think that the hypothesis could be rejected, however, the study design and data collected did not provide adequate data to accept or reject this hypothesis.

A correlation matrix, descriptive statistics, frequency tables, one-way ANOVA, and factor analysis were used to analyze the data obtained in this study. Few of the attitudinal variables showed significant correlation with gender, computer in the home, and age. Tables were constructed to display the data efficiently and indicate the attitudinal items showing some significance.

The high percentage of respondents reporting the availability of a computer in the home almost made it into a non-variable. The computer usage, both in time and activity, would indicate that the participants were comfortable with that technology and viewed it as important to their lives.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to examine community college students' attitudes toward technology in their teaching and learning in both formal and informal learning experiences. The purpose was accomplished by examining the degree of relationship between the variables in the study. The vehicle chosen to collect the data were a self-report method using a modified version of the Secondary Students' Attitudes Toward Technology (SSATT). The instrument had been used a in a number of previous studies for both secondary and post-secondary students and had been reported to be both valid and reliable. A modified 10-point Likert scale was chosen with 1 being "strongly disagree" and 10 being "strongly agree". Additional demographic information regarding gender, age, the presence of a computer in the home, and a formal technology class taken in high school were added to the instrument. Data were collected regarding the participants' definition of technology that assisted them in their teaching and learning in both formal and informal learning experiences and their uses and frequency of use of technology.

The concepts of attitude and technology were examined through a review of the literature and analysis of previous research studies. The instruments used previously to study attitudes toward technology and the evolution and development of the instruments, was examined to determine the fundamentals, variables, and design of the instrument used in this study. An examination of analysis of students' attitudes toward technology as a whole compared to students' attitudes toward computers specifically was done to clarify the broader issues in a study of attitudes toward technology.

The research was conducted during the spring of 2005 in a community college district in metropolitan Houston in Texas. The North Harris Montgomery Community College District (NHMCCD) was made up of five comprehensive colleges in a 1,400 square mile in-district service area serving 11 school districts. The district had an enrollment in its credit classes of 41,534 students in the spring of 2005.

The data for the study were collected using a modified Secondary Students' Attitudes Toward Technology (SSATT) instrument distributed to 30 randomly selected credit English classes. The approximate enrollment in the 30 classes at the time of the administration was approximately 597 students which was 8.15% of the 6,597 students enrolled in all of the districts' credit English classes. The instruments were delivered to the college English department and distributed to the randomly selected classes. The students were asked to volunteer to participate in the study and the instrument was administered by a volunteer student administrator. No individual identifying data were collected. A total of 374 instruments from 27 classes were returned to the researcher for analysis which represented 69.51% of the sample drawn.

In this study, six questions were considered:

1. To what degree does gender affect community college students' attitudes toward technology as reported by community college students in Houston, Texas?

2. To what degree does computer access in the home affect the students' attitudes toward technology as reported by community college students in Houston, Texas?

3. To what degree does age affect the students' attitudes toward technology as reported by community college students in Houston, Texas?

4. To what degree does taking a formal technology course in high school affect the students' attitudes toward technology as reported by community college students in Houston, Texas?

5. Do the number and type of technology experiences affect students' attitudes toward technology as reported by community college students in Houston, Texas?

6. What factors are identified by a factor analysis of the modified Secondary Students' Attitudes Toward Technology (SSATT) instrument used in this study of community college students in Houston, Texas?

A correlation matrix was performed on all the variables with tables indicating frequency, mean, standard deviation, and significance constructed for each of the variables considered in the study. A one-way ANOVA was done to test for the impact of gender on the attitudes toward technology. A factor analysis was done with a minimum loading criterion of .40. It resulted in 19 iterations and 8 factors accounting for 52.77% of the variance. Ancillary analyses were performed on the concept and use items reported by the participants in the study.

Conclusions

Several conclusions can be drawn from the data presented in Chapter IV of this study regarding community college students' attitudes toward technology. The conclusions were drawn by studying the data and the relationships of the variables in the study and are presented in relation to the six original research questions.

Research Question #1

The first research question was "To what degree does gender affect community college students' attitudes toward technology as reported by community college students in Houston, Texas?" Though the analysis of the correlation of gender with the 31 attitudinal variables found that nine were statistically significant at $p = .01$ there was no practical significance. The largest Pearson product moment correlation was only .27 indicating little or no relationship. The F values from the one-way ANOVA for gender at $p = .05$ and $p = .01$ were overall not statistically significant. Therefore, in this study there did not appear to be any degree of relationship between gender and the attitudinal variables in the study. The finding aligns with some of the more recent studies reported on attitude toward the computer or toward technology in the broader sense.

Research Question #2

The second research question was "To what degree does computer access in the home affect the students' attitudes toward technology as reported by community college students in Houston, Texas? Previous research studies had indicated that the presence of a computer in the home had a positive effect on students' attitudes toward technology. In this study 95.4% of the 372 respondents indicated that there was a computer in the home with only 1.9% of the participants (7 out of 372) reporting that they did not have a computer in the home. These frequencies suggested that the presence of a computer in the home was almost a non-variable but provided valuable information with regard to the computer becoming almost a "household staple". This finding could be unique to the population in this study. The study did not collect specific data on the students' use of the home computer which should be a consideration for future studies.

The analysis of the correlation data indicated that three of the attitudinal variables were statistically significant at p = .01 but not practically significant. All of the correlation coefficients were under .20 indicating no correlation between the presence of a computer in the home with the attitudinal variables.

The implications of the results of this finding for educators would be to encourage the students to use the computer technology available to them both at home and in the school learning centers for research, class assignments, and communication. Educators can assist and encourage students to develop their technological competencies through course objectives and assignments. Students might receive course information on disc or from a web site rather than via printed material if student access in their course mirrors the finding in this study.

Research Question #3

The third research question was, "To what degree does age affect the students' attitudes toward technology as reported by community college students in Houston, Texas?" The range of ages reported in this study was 16 to 49 with a mean age of 21.7. The correlation of age with the attitudinal variables indicated that 10 of them were statistically significant at p = .01 but had no practical significance. As all of the correlation coefficients were below .20 with the exception of item 5, information-processing technologies will increase international trade; there was no indication of correlation between age and the attitudinal variables.

Recognizing that 66.66% of the participants in this study were under 21 years of age and that if they had been enrolled in a Texas high school after 1998 they would have been required to take a formal technology course, the implications for educators would be that younger students have had exposure to technology in their formal studies. Another implication for educators from the findings of this study would be that age may not be a factor in community college students' attitudes toward technology.

Research Question #4

The fourth research question was "To what degree does taking a formal technology course in high school affect the students' attitudes toward technology as reported by community college students in Houston, Texas?" The fact that 70.2% of the students in this study reported having taken a formal technology course in high school indicates to educators that community college students graduating from high school after 1999 have been exposed to technology as part of their curriculum. Analysis of the correlation matrix showed that only 3 of the 31 attitudinal variables were statistically significant at $p = .01$ but did not have practical significance. The coefficients of determination were at 0.01, indicating that only 1% of the variance in the dependent variable was associated with the independent variable. Therefore, no significant relationship between a formal technology course in high school was indicated by the data reported and analyzed in this study.

The practical implications for educators would be to evaluate the inclusion of technology related courses in the community college certificate and degree programs to continue the students' exposure to technology and their development of the competencies needed for their future education and work. The question would be if formal technology courses are required in high school, should they be required in post-secondary education?

Research Question #5

The fifth research question was “Do the number and type of technology experiences affects students’ attitudes toward technology as reported by community college students in Houston, Texas?” This study looked at a correlation of the hours per week of computer use for school, work, and home as reported with the attitudinal variables. It also examined the frequency of ten computer uses: (1) internet, (2) communication, (3) music, (4) word processing, (5) computations, (6) games, (7) media development, (8) programming, (9) shopping, and (10) presentation development. It provided two spaces for students to add categories of their use in addition to the ten listed.

The correlation of the hours per week of computer use with attitudinal variables resulted in 17 of the 31 attitudinal variables showing statistical significance at $p = .01$. However, the Pearson correlation coefficients were all below .20, with the exception of item 14, I use computers in my workplace. As correlation coefficients at .20 or below indicate no or little correlation, a conclusion of this study was that the hours per week were not correlated with the attitudinal variables. The mean hours of computer use reported was 19.1 hours per week. The study found that 61.87% of the participants reported using the computer less than 20 hours per week; 29% reported usage between 20 and 40 hours per week. The practical implication is that these community college students did use the computer a significant number of hours per week but that there was a wide range of usage reported. Future studies might look more deeply into school use versus work and personal use to get a clearer picture of the students' computer use and its possible affect on attitudes toward technology in teaching and learning environments.

The computer usage reported by categories was reported by the choices: (1) never, (2) monthly, (3) weekly, (4) daily, and (5) several times a day. The analysis of the data grouped daily and several times a day together and never or monthly together to give better meaning to the data reported. It can be concluded from the analysis of the data that the 58.8% that reported Internet usage daily or several times a day, and the 50.3% that reported using the computer for communication daily or several times a day, that community college students use the computer on a regular basis to "stay connected". It was observed that 64.8% of the students reported using the computer for presentation development monthly or never. The practical implication for educators would be to address the development of the presentation development skill in their courses through class assignments.

Previous studies that found that students had a high positive attitude toward modern technology were supported in this study. If students were comfortable using technology, one would assume that their learning would reflect that positive response.

Research Question #6

The sixth research question was "What factors are identified by a factor analysis of the modified Secondary Students' Attitudes Toward Technology (SSATT) instrument used in this study of community college students in Houston, Texas?" The factor analysis with varimax rotation at a 0.40 minimum-loading criterion converged in 19 iterations and clustered in eight factors accounting for a total of 52.77% of the variance. Factor 1, technology competence, accounted for the largest portion of variance at 18.21 and consisted of six of the 31 attitudinal variables. Examining the factor analysis was useful in looking at how the instrument items clustered and the amount of variance that was accounted for by each factor. A conclusion from this study was that the factor analysis by itself had a minimal contribution in determining the factors that affect community college students' attitudes toward technology. It did provide insight into the instruments' individual items and guidance for future studies.

Comfort with Technology

Item 32 on the instrument used in this study requested the student to rate their comfort level with computers and other technological equipment used in their classes. The scale used was 10 indicated "very comfortable" and 1 indicated "very uncomfortable". The item was correlated with the 31 attitudinal variables resulting in 22 of the 31 being statistically significant at $p = .01$. Five of the variables had a correlation coefficient between .20 and .30; four of the variables had a correlation coefficient between .31 and 40. Because correlations of .30 to .40 are generally considered strong to very strong, and those between .25 and .30 indicate a fairly strong correlation, it was concluded that there was correlation between the students' comfort with technology and some of the attitudinal variables.

Because 42.54% of the participants reported their comfort with technology as 9 or 10, and 90.60% reported their comfort as 6 or greater, it was concluded that the students in this study were comfortable with technology in their classes. There appeared to be considerable exposure to technology, considerable use of technology, and finally comfort with technology as reported by the participants of the study. Practical implications for educators would be to foster the development of competencies and comfort with technology throughout the students' educational experiences.

Definition of Technology

The instrument used in this study requested the students to define technology by listing what the student considered the major technologies that assisted him or her in teaching and learning in both formal and informal environments. The majority of students continued to consider the "hard" technologies or equipment as technology. The same result has been reported in earlier studies. The computer was the most frequently cited technology followed by the Internet. The third most frequent response was no response to the item by 83 of the participants. A conclusion was that there is likely a more effective way to gather students' definitions of technology.

Examination of all the responses, their frequencies, and the terminology the students used gave a broad picture of the participants' technologies. A conclusion after reviewing the definitions was that a large percentage of these items were not common generally, and certainly not in educational environments, twenty years ago. That holds implications for a question about the availability of technologies in the future that are yet to be conceived and developed. A culminating conclusion is that the studies of technology and its impact on teaching and learning will continue to be valuable.

In summary, this study found that the students had a positive attitude toward technology and reported a considerable comfort and use. The presence of a computer in the home was so widely reported that it could have been assumed rather than being a variable. Finally, gender and age had no effect on students, attitudes toward technology in this study.

Recommendations

The analysis and examination of the data collected in this study lead to a number of conclusions by the researcher. The recommendations presented were based on the research and its results. It is hoped that further studies will test the conclusions and address the recommendations to verify and validate the findings and recommendations.

Recommendations Based on the Study

1. Gender and age should continue to be used as variables in studies on attitudes toward technology to validate the findings of this study and with the recognition that they may no longer be variables that affect attitude toward technology.
2. Instruments other than the Secondary Students' Attitudes Toward Technology (SSATT) may be better suited to identifying the factors that affect community college students' attitudes toward technology. The instruments may need to be developed and tested.
3. The findings of this study were that 95.4% of the students reported having a computer in the home but did not identify the frequency or use of the home computer specifically. Future research should identify the student's actual

educational use of the home computer to gain understanding of how it assists the student in learning and developing competencies.

4. Future studies should examine technology and informal learning rather than treating formal and informal learning together as was done in this study.
5. In this study it was not evident that the participants had a clear or concise definition of technology. Educators at all levels need to establish clarity for the term technology that is incorporated into the students learning experience early and at all educational levels. A panel at the local, state, and federal level should establish a definition of technology that is taught in high school.
6. This study collected data regarding whether or not the participants had taken a formal technology course in high school. It is recommended that future research investigate the formal technology course or courses taken in more depth, with regard to the skills or competencies the student perceived were gained from the course, and how it has assisted the student in understanding and in learning.
7. Finding ways to identify a student's definition of technology or understanding of what technology is should continue to be pursued in studies of attitudes toward technology, however, there may be more effective ways when examining the fact that approximately 22% of the participants in this study chose to give no response to the open listing item used in this study.
8. Asking students to rate or give feedback on their comfort with technology was useful to the overall analysis of the participants of the study. The item

should continue to be used. It is recommended that classroom educators use a similar assessment for their incoming students with regard to comfort and competencies so that they can direct the students learning experiences with technology appropriately.

9. Educators should continue to incorporate technology experiences and competencies into the student’s formal learning environment.
10. Caution is needed in interpreting the results of this study recognizing that the results can be generalized only to the students in the North Harris Montgomery Community College District.

Recommendations for Future Study

1. It is recommended that further research be conducted to confirm the results of this study with other populations of community college students in other locals.
2. This study should be replicated at the university and at the high school level to assess differences and verify results.
3. Based on the low correlation of the attitudinal items on the Secondary Students’ Attitudes Toward Technology (SSATT) instrument researchers studying students’ attitudes toward technology might develop and test new instruments to measure the attitude.
4. Research instruments that better measure the three components of attitude (affective, cognitive, and conative) should be developed and utilized to better understand each components role in attitudes toward technology.

5. Further research on the specific contributions of formal technology courses taken in high school and the students' use of the home computer would be helpful to educators by providing more in depth information on the results from this study.
6. There would be benefit to replicating this study with community college students in the developmental English classes to provide educators with any distinctions that would arise from a comparison with the data from this study.
7. Additional research on the effect of the utilization of instructional technologies should be performed in view of the comfort level with technology reported by the participants in this study.
8. Studies regarding community college students' attitudes toward technology using similar variables should be undertaken in community colleges that serve more rural rather than metropolitan students to examine access and usage of technology in educational experiences
9. Research studies that link community college students' attitudes and behaviors toward technology should be undertaken to further contribute to the understanding of the attitude-behavior link in educational experiences.

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APPENDIX A

ENGLISH COURSE DESCRIPTIONS

From the North Harris Montgomery Community College District 2004 – 2005 Catalog page 203:

English 1301 (ENGL 1301) – Composition and Rhetoric I (3 credits / 3 hrs. lecture)

A multi-paragraph composition course, including language study and the mechanics of writing, with examples from selected readings. Students may be required to achieve a departmentally approved score on a proficiency test before credit for the course is awarded. Prerequisite: Placement by testing or completion of ENGL 0307 or 0326 and ENGL 0305 or 0316.

English 1302 (ENGL 1302) – Composition and Rhetoric II (3 credits / 3 hrs. lecture)

A continuation of ENGL 1301 with an emphasis on critical papers, culminating in a term paper or papers. Readings in prose, poetry, and drama. Prerequisite: ENGL 1301.

APPENDIX B

INSTRUMENT ITEMS

Items 1 -32 requested responses on a 1 – 10 Likert Scale
1 being 'strongly disagree' and 10 being 'strongly agree'

Q#	Abbreviation	Full Statement
Q1	FamiliarEarly	Children should become familiar with technology as early as possible.
Q2	AutoUnemp	Increased automation will result in mass unemployment.
Q3	NewImprove	New technologies are improving working conditions.
Q4	AccessPers	People should have free access to all of their files held on computers by government agencies.
Q5	IntlTrade	Information processing technologies will increase international trade.
Q6	Scary	Technology is scary.
Q7	PartAllJobs	Technology is part of all jobs.
Q8	TelePeace	Telecommunication is essential for world peace.
Q9	NuclearSafe	Nuclear power stations are safe.
Q10	FewBenefit	Only a few Americans will benefit from the introduction of new technologies.
Q11	BroadenInterest	Technology education can broaden one's interests.
Q12	GamesInterupt	Video games disrupt family life.
Q13	PrepForSchl	I use technology in preparing materials for my school.
Q14	UseWorkplc	I use computers in my workplace.
Q15	MoreCreative	Technology makes people more creative.
Q16	CreateJobs/Ds	New technologies will create more jobs than they destroy.
Q17	DifficultMe	Technology is too difficult for me.
Q18	RobotsElim	Robots will eliminate monotonous, tedious jobs.
Q19	Socisolation	Social isolation may occur as more Americans work and shop from their homes.
Q20	LearnAlone	It is possible to learn about technology by oneself.
Q21	AllNeedLiterat	Everybody needs to be computer literate.
Q22	StoreInvasion	The use of computers to store personal information is an invasion of privacy.
Q23	AmerCompet	America's international competitiveness depends upon technological development.
Q24	Safe	Technology is safe.
Q25	AdvanceSolve	Technological advancements solve more problems than they create.
Q26	GamesWaste	Video games are a waste of time.

Q#	Abbreviation	Full Statement
Q27	StdrdRise	Increased use of technology will lead to a rise in the standard of living for most Americans.
Q28	DesireComfort	Technology increases the desire for comfort.
Q29	UnderReqEmp	Technological understanding will be required for employment in the future.
Q30	LearnBetter	I can learn better when I use computers.
Q31	UsePrepWork	I use technology in preparing my materials for my work.
Q32	RateComfort	I would rate my own comfort level with computers and other technological equipment used in my classes as:

Items 33 – 35 requested indicating gender #35, yes, no, or uncertain #36, and yes or no # 35.

Q33	Gender	Female or Male
Q34	HSClass	Did you take a formal technology class in high school?
Q35	HomeComp	Do you have a computer at home?

Items 36 – 38 requested filling in an actual number.

Q36	Age	
Q37	Credits	How many college credits have you earned to date?
Q38	HrsPerWeek	In a typical week how many hours in total do you use a computer?

Items 39 – 48 requested marking the frequency that applied to the individual's computer use as 'never', 'monthly', 'weekly', 'daily', or 'several times a day'.

Q39	Communicate
Q40	Computations
Q41	Programming
Q42	Games
Q43	Internet
Q44	MediaDevelop
Q45	Music
Q46	PresentDevelo
Q47	Shopping
Q48	WordProcess

Items 49 – 50 requested indicating other computer use and its frequency on the same scale as questions 39 – 48.

VITA

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Education

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M.B.A. Business Administration, Sam Houston State University, 1985
B.S. Dental Hygiene, Marquette University, 1970

Professional Experience

Director of Budgets, North Harris Montgomery Community College District
Director of Business Services, North Harris Montgomery Community College District
Business Manager, North Harris College
Instructor, Developmental Mathematics, North Harris College
Instructor, Management and Marketing, North Harris College
Instructor, Dental Assisting, North Harris College
Vice President and Operations Manager, Fleming Equipment Company, Inc.
President, Plants by Fleming, Inc.
Instructor, Dental Hygiene, Del Mar College

Professional Associations

American Association of University Women
American Association of Women in Community Colleges
Southern Association of College and University Business Officers
National Association of College and University Business Officers
Texas Association of Community College Business Officers