GIRLS' ENGAGEMENT WITH COMPUTERS WHILE CREATING WEB PAGES DURING MIDDLE CHILDHOOD

By

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(ABSTRACT)

The purpose of the research study was to describe girls' engagement with computers during middle childhood and to delineate the factors that initiated and sustained the engagement. The research questions were: 1) What patterns distinguish how girls engage in web page development during middle childhood? 2) What roles do environmental and personal factors play in the girls' engagement in the activity of web page development? 3) What are the perceived reasons for the girls' achievement in creating web pages?

The research design followed a qualitative case study approach with descriptive methods of data collection. Four participants were selected through nomination by their elementary school principal based on their computer attitude and aptitude. The data collected included interviews, observations, artifacts, and interviewer’s reflective notes. The data were analyzed through coding assisted by NUD*IST computer software. Overall, the access to computers, the relationships with powerful others, and the girls' perceptions of their ability to control influential factors, all worked together as antecedents for engagement with computers. The roles performed and the necessary social interaction sustained the engagement. The product, an educational web page, demonstrated successful achievement. The researcher provided recommendations for educators to create conditions for girls to achieve using computers, which impacts middle childhood girls' perceptions of future career options.

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Dedication

I dedicate this dissertation to my daughter, Amanda, who has been a constant source of inspiration to me. I admire the perseverance she displays in her life. She has been a role model for me by pursuing her own dreams. Throughout the process of completing my dissertation she has encouraged me with her words and deeds. Her pride in my accomplishments has spurred me on. I am extremely grateful to my husband, Charles, and my son, Bryan, who have endured the lapse of my time and energy. Their support in assuming household duties allowed me the freedom to research and write. I especially appreciate the music they add to my life. My parents, Elly and Ed Gunn, have instilled in me a deep respect for learning. I thank them for their unconditional love and support. May God continue to bless my family.

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CHAPTER I

Introduction

Shriram Krishnamurthi and Kathi Fisler (1998) of Rice University, Computer Science Department, encouraged countless other women when they said:

> We are computer scientists. We wake up every morning in love with what we do. We love computer science because it exercises both our creative and our logical sides. Unfortunately, people often misconceive computer science as a dry and impersonal area requiring only technical skills. We would like to offer a contrary, insider's view of our field. Computer science is not only about logical thinking. It is true that computer systems (both hardware and software) work according to precise rules. However, these systems consist of many, many pieces; the challenge lies in building and combining them. Some of the pieces already exist, but it takes creativity to put them together. The pieces that don't exist must be designed, which requires innovation. Assembling the whole system needs teamwork. The process is as creative and human as writing poetry or composing music. But computer scientists also develop products that have an immediate, direct, positive impact on people and society, which is deeply gratifying. We feel that few other disciplines require the same, unique blend of creativity and insight with problem-solving skills. That's why we are computer scientists, and there's nothing else that we'd rather be.

Statement of the Problem

Despite attempts over the years to recruit and retain more women in the world of computer science and other careers in information technology, they are still under-represented in these fields (Camp, 1997; Maxwell, 1998; Ordidge, 1997). A report by the American Association of University Women Educational Foundation (2000) indicated that women represent roughly 20% of information technology professionals. The United States Bureau of Labor Statistics (2000) reported that the United States will require 1.3 million new information technology workers between 1998 and 2008. The Bureau defined information technology jobs as including computer science, engineering, systems analysis and computer programming.

A study by the Educational Foundation of the American Association of University

Women (1998) found that, although there were critical shortages of women in the information technology field, some progress had been made. Still, a discouraging gap existed between the number of men and women emerging in the field of computer science. Evidence suggested that the gap would continue as few women entered the pipeline leading to careers in this field. Women were found to receive less than 20% of the computer science bachelor degrees. Computer Science is the only field in which women's participation has actually decreased over time (AAUWEF, 2000).

Underrepresentation of women in computer science is part of a larger problem of underrepresentation in related fields of science and engineering. Precursors of women's underrepresentation in the sciences and engineering were shown to begin during the early school years and continue throughout every educational level (Campbell, Hombo & Mazzeo, 2000; Nauta, Epperson, & Waggoner, 1999). When high school students were given the option of selecting their own courses, significantly fewer women than men elected to take advanced math and science course work. In addition, fewer women chose science, mathematics, and engineering majors when they entered college (Huang, Taddese & Walter, 2000).

The influence of gender differences on career development has been demonstrated in focus group interviews (McMahon & Patton, 1997). These interviews suggested that, as young girls compared themselves with others, they had few female role models who were actively engaged in career-related computer activities and technology to emulate. Bandura (1996) suggested that unless girls believe they can produce desired effects by their actions, they have little incentive to act.

Studies have shown that career choices were related to self-efficacy (McMahon & Patton, 1997; Solberg, 1998). Expectation for success was one of the best predictors of career choice (Betz, Voyten, & Klein, 1997). If females experienced success using computers at an early age it may follow that they would develop high positive self-efficacy in that area. Domain specific competence beliefs contributed to continued engagement in the activity in which one perceives one's self to be competent (Bandura 1993). Therefore, if young girls are afforded the opportunity to use computers and experience success, they will be likely to continue to do so. Their self-efficacy should continue to be positive in the domain specific areas of computer use and there should be continued expectancy for success (Eccles & Wigfield, 1995). Thus, since outcome

expectations influence career exploration and decision-making, developing girls' positive perceptions of their computer aptitude may lead them to explore computer rich careers.

The persistent underrepresentation of women in Science and Engineering education spurred researchers to scrutinize the gaps that occurred at the entry into and completion of science and engineering postsecondary programs (Bae, Choy, Geddes, Sable & Snyder (2000). Computer technology was shown to be an integral part of these programs. Entering into and completing these programs would be crucial for women to become professionals in the information technology labor market. The National Center for Education Statistics has identified three factors that are significant to entering the pipeline leading to information technology careers for women. The factors are family environment and support, student behavior such as attitudes and aspirations, and academic preparation (Huang, Taddese, & Walter, 2000).

Need for the Study

There is a need for educators to understand what conditions support and promote girls' computer aptitude and positive attitude towards computer use. Understanding this is imperative if we expect girls to be successful and to achieve in courses and in future careers using computer technology. This study will contribute to an understanding of why some girls seem prepared for entering the pipeline. By looking at factors thought to be related to girls' successful engagement with computers during middle childhood, we may better understand how to help more girls be able to tell stories like the previously quoted computer scientists.

Purpose of the Study

The purpose of this research study was to describe girls' engagement with computers during middle childhood, and to delineate the factors that initiated and sustained the engagement. The focus was to understand girls who made the choice to join a computer club to acquire the skills to develop a web page. The girls who participated in this study recounted stories regarding their initial engagement in using computers so this data could be analyzed.

Creating a web page is an example of successful acquisition of computer competency and thus, the study investigated girls in elementary school who had successfully created web pages. Complex factors contributed to motivating young girls to engage in technical activities using computers and the study focuses on developing an understanding of these factors. In this study, environmental factors included the degree of exposure to computers due to accessibility and the

impact of influences by other "powerful" people pertaining to computer use. Personal factors included a participant's perception of her own ability/skill and control over the other three factors.

Research Questions

The research questions that guided the study were: 1) What patterns distinguish how girls engage in web page development during middle childhood? 2) What roles do environmental and personal factors play in the girls' engagement in the activity of web page development? 3) What are the perceived reasons for the girls' achievement in creating web pages?

Perceived control is defined as the expectation that one can influence success through achievement that is contingent on one's own actions (Skinner, 1990). Weiner (1986) defined expectancy for success as the psychological consequence of the belief in one's control over environmental and personal factors. Thus, it is proposed that a girl's perception of her control over the environmental and personal motivating factors significantly contributes to her successful engagement with computer technology. This success was demonstrated by the achievement of creating a web page. The significance of this study was that one gained insight into the environmental and personal motivational aspects of girls who achieved success using computers.

Gilligan (1982) stated that the social-cognitive development of girls is affected by sex stereotyping. Sex stereotypes are the characteristics generally believed to be typical of men and women, and boys and girls. Eccles and colleagues (1998) found masculine cultural values and stereotypes incorporated into computer-based learning, work, and play. The study found that girls were passive observers in many computer settings because of the pervasive warlike or competitive sports metaphors in educational and recreational software. Girls saw computers as a means to an end. They were more concrete in their use of computers. They saw them as a social tool or a tool to use to display their knowledge. Due to the importance of attitude and ability demonstrated in predicting male and female use of computers (Shashaani, 1994), it was relevant to examine potential sex stereotypes associated with technology.

Qualitative analyses of children's drawings and interviews indicated gender differences and developmental trends in children's thinking about technology. Girls found value in computers differently than boys (Levin & Barry, 1997). Turkel and Papert's (1990) research

suggested two dimensions of computer use--concrete and personal styles. The web transformed cultural assumptions about the computer from a logical machine that involves technical, mathematical ability to the computer as an artistic tool that people use to write, design, and play with ideas and images. Users reacted to the web on a cognitive and social level (Swan, Bowman, Holmes et al., 1999). Physical characteristics such as age and gender affected these preferences.

Motivation was viewed as initiating and sustaining a goal directed activity (Pintrich & Schunk, 1996). Antecedent conditions contributed to the initiation of an activity. Environmental and personal factors were antecedent conditions in Weiner's (1986) attribution model. Environmental factors in this study included the degree of exposure to computers due to accessibility, and the impact of influences by other "powerful" people pertaining to computer use. Personal factors included a participant's perception of personal ability and control over the other factors. It was proposed that a girl's perception of her control over the environmental and personal motivating factors contributed to her initial engagement with computer technology. The psychological consequence, expectancy for success, contributed to sustaining an activity. With practice using the Internet, girls built their self-efficacy in the domain of computer use--as she worked on more challenging tasks, she became more skillful. An attribution of ability and effort became more stable and perceived internal control influenced future engagement (Skinner, 1990).

Significance of the Study

In the field of educational research, there was a gap in the literature regarding domain specific competence beliefs of girls during middle childhood. This study aimed to contribute to filling that gap, particularly regarding the social cognitive theory of motivation relating to engagement with computer technology, and specifically pertaining to the development of web pages. This educational research study contributed to the tradition of the development of social cognition in elementary school. It added to research addressing how girls' competence beliefs developed during middle childhood, the crucial time in which aptitude beliefs become established (Wigfield, Eccles, Yoon et al., 1997). The research also contributed to studies that interpret experiences depicting the person as a unique whole. It added to female beliefs regarding computer activities in gender-role stereotypic ways describing motivational experiences, not about what is, but about what is perceived.

Chapter II

Literature Review

This chapter reviews gender based engagement with computer technology, the middle childhood stage of development, and motivation theory with an emphasis on Weiner's (1986) attribution model--the lens through which this case study was conducted. It integrates theories of computer use, child development, and attribution. Environmental and personal factors explored in the study also are discussed.

Gender-Based Engagement with Computer Technology

Complex factors contribute to motivating young girls to engage in activities using computers. This study focussed on developing an understanding of them, because gender-based factors are strongly related to computer use. Researchers have demonstrated that girls use technology primarily for word processing, e-mail and Internet access, but when it came to computer fluency--to find innovative ways to use information technology or to adapt to new technologies as they emerged--girls and women were not in the forefront. They are estranged from it and opt out of acquiring skills that are key to computer careers (AAUWEF, 1998).

Research suggests that there is a difference between male and female use of technology. These differences are most profoundly seen in attitudes and aptitude of the genders. Janssen & Plomp (1997) carried out an extensive study of gender and educational computer use in a number of countries. They found that female students knew less about information technology, enjoyed using computers less than male students did, and perceived more problems with software.

Research has also shown gender differences in computer-based performance. For instance, Jackson and Kutnick (1996) reported that boys performed better than girls on computer based tasks. A meta-analysis of studies of gender differences in computer attitudes and behavior found that males had greater experience than women and girls, higher computer self-efficacy, and more positive attitudes toward computers than females (Whitley, 1997). He also found that men and boys exhibited greater sex-role stereotyping of computers. Due to the importance of attitude and ability found in predicting male and female use of computers (Shashaani, 1994), it is relevant to examine potential sex stereotypes associated with technology.

A study on the social interactions with computer use demonstrated that boys talk about computers more than girls. The context in which the males socialized using computers is during discussions while gaming (Orleans & Laney, 1998).

There are qualitative studies that gave an in-depth analysis of gender-based engagement with computer technology. In its inquiries into gender issues in computers and education, the AAUWEF (2000) report found that there is a concern about the passivity of girls' interactions with the computer. Girls rejected the violence, redundancy, and tedium of computer games. They disliked narrowly and technically focused programming classes. Too often, these concerns have been dismissed as symptoms of anxiety or incompetence that will diminish once girls "catch up" with the technology. The AAUWEF study confirms Turkel and Papert's research (1990), which stated that girls preferred concrete approaches to working with computers. The U.S Department of Education conducted case studies of nine sites that have used technology in ways that enhance a restructuring of the classroom around students' needs. Project-based activities formed the focus of the education reform program. These studies clearly indicated differences in masculine and feminine views toward computer technology. When using computers to complete a concrete project the girls engaged in the activity and became computer fluent (Keeler, 1996).

Haugland (1996) found connections between cultural assumptions, the contexts in which computers are used and girls' disinterest in computers. The findings suggested that clip art images in computer displays may reinforce the cultural stereotypes that computers are a male domain. A study by Keisler, Sproull, and Eccles (1995) found that masculine cultural values and stereotypes are incorporated into computer-based learning, work, and play. The study found that girls were passive observers in many computer settings because of the pervasive warlike or competitive sports metaphors in educational and recreational software.

Researchers found that the feminine attitude toward computer technology looked right through the machine to its social function, while the masculine view was more focused on the machine itself (Brunner & Bennett, 1997). Girls spent less time interacting socially while engaging in computer activities than boys (Orleans & Laney, 1998). Social interactions during engagement with computers consisted primarily of Internet searches together or e-mailing friends. Presenting technology as an end in itself was unappealing to most young women. Girls explored whether new technology solves a social problem, rather than celebrating speed or

power. A feminine view of computer technology as a more collaborative tool was thought to improve their attitudes toward computers (Morritt, 1997). Perhaps personal computers and the cultures in which they are used will be created by people who consider themselves to be Humanists as well as engineers (Papert, 1993), thus enhancing women's interest in this field.

One form of computer technology that has expanded dramatically in recent years is the Internet. Results of Yong's (1998) study of students' perceptions of the Web suggested that the Internet provided meaningful learning and flexible practice. Just as the social construct of gender is laced throughout society and carries stereotypes, these stereotypes became evident in patterns of communication in cyberspace (Mahoney & Knupfer, 1997). Girls enjoyed building relationships with their peers and communicating with others who shared their interests. Studies on gender attitudes about technology found females focussed on the social function of the web as seen as a medium to connect (Ferris, 1996). Although increasing numbers of women have been found to be using cyberspace actively, it remained male-dominated (Mahoney & Knupfer, 1997).

Much of the research done in the field of computer technology has consisted of quantitative studies that have focused on computer-related attitudes, aptitude, and use. In these studies most researchers have chosen a survey approach to examine differences between males and females. This has produced a wealth of conflicting descriptive data. For example, Hurley & Vosburg (1997) stated that there was no difference between gender attitudes about computers, while others stated that differences do exist (Shashaani, 1997; Whitley, 1997). Critiques of the methodology employed in short-term experimental applications suggested that the technology employed has led to misleading generalizations about computer effects (Krendl & Broihier, 1992). In general, the gender that had a more positive attitude toward computers, more aptitude in using computers, and a greater likelihood of using computers, depended on what attitudes one measured, what skills one assessed, and what use was being made of the computer (Morritt, 1997).

Many of the quantitative studies reviewed were narrow in scope. Limitations of the methodological approach to the study of computer effects in learning environments have been found (Krendl & Broihier, 1992). While reliable, valid descriptive data is critical for any comprehensive research endeavor, quantitative studies typically have not provided a coherent,

comprehensive understanding of why males and females have differed in their behavior toward computers (Kay, 1992).

The quality of the research, overall, has been poor, with inconsistencies found in the constructs. A meta-analysis was performed by Liao (1999) which pointed out only that gender differences of attitudes toward computers existed, but the question of what factors contributed to this was left unanswered. Interestingly, several studies revealed that there are fewer discrepancies in computer aptitude, attitude, and use among preschoolers and primary grade students, than among middle, secondary, and university students. This suggested that more disparities emerged as male and female students grew older (Kay, 1992; Webb, 1994).

Why are there contradictory research findings related to gender differences in quantitative research studies? Kay (1992) conducted a quantitative study of gender differences in computer attitudes, aptitude, and perceived control, which suggested an answer to this question. Although no significant differences between males and females in either affective or cognitive attitudes toward computers were found, males' perceived control over the computer was significantly higher. Kay (1992) indicated that differences in the relative importance of attitude and ability in predicting male and female use of computers suggested that males and females may view computers differently. There is a need for qualitative methodology to study the differences in reactions, thinking processes, and engagement with computer technology.

Middle Childhood Development

Middle childhood is defined as the concrete operational period encompassing grades four to eight. As children reach the age of 12, they have moved from the concrete to a more abstract thought process (Piaget, 1962). Recent interpretations of Piaget's work depicted children during middle childhood as little scientists, trying to understand the world largely on their own as builders of their individual intellectual structures (Singer & Revenson, 1996). Cognitive development in elementary school occurred when the child engaged in learning activities within social structures (Vygotsky, 1978). Children in grades four to eight are portrayed as living in the midst of other people who were eager to help them acquire the skills needed to live in their culture (Ebbeck, 1996).

In the school environment, the teacher assists with learning, but it is the learner who constructs the knowledge. For example, one type of assistance provided by people is scaffolding,

which can include helping children think about the task appropriately, modeling ways of solving problems, and giving hints to guide the child in useful directions. The activities of more competent people provide a temporary framework that encouraged children to think in more advanced ways than they otherwise could (Heyman & Dweck, 1998). Children replicated the activity structures, tools, socio-cultural rules, and community expectations while acting on some object of learning. Cultural tools include the entire range of objects and ideas that allow people to achieve their goals. These tools included machines such as calculators and computers. Tools alter the activity and, in turn, the tools are altered by the activity (Jonassen & Rohrer-Murphy, 1999).

Erikson (1963) spoke of elementary grades four to eight as the time when children either form a sense of industry or a sense of inferiority. During middle childhood, "social comparison" became the main factor in determining the value children placed on themselves. Children measured their own success by comparing themselves with others. They saw the roles men and women take in society and formed their opinions about what is culturally accepted (Serbin, Powlishta & Gulko, 1993). Nicholls (1990) found that there are developmental differences in children's concepts of ability, effort, difficulty, and luck. Before the age of six, children believe that people who try harder are smarter. From the ages of six through eight, children believed that people who try hard should have the same outcome, regardless of ability. The concepts of skill and luck were unclear. From ages 9 through 11, children began to realize that people who tried equally hard may not have the same outcome due to ability. The understanding of the relationships between ability and task difficulty or luck changed with age. Causal beliefs became more differentiated with age (Skinner, 1990). As they get older, children understand that success can be attributed to ability. However, they hold different perceptions of what ability means (Nicholls & Hazzard, 1993).

Cain and Dweck (1995) assessed the beliefs of first, third, and fifth graders about their abilities and achievement. The relationships between children's cognition about ability and achievement are related to their motivational responses. As children's knowledge about ability and achievement continue to grow, a sense of hopelessness or expectancy for success developed. Among children in fifth and higher grades, the helpless motivational pattern is associated with

the idea that intelligence is a fixed entity. Therefore, during middle childhood the motivational response of helplessness is formed if a child believes there is no control over their ability.

Eccles and colleagues (1993) examined the development of children's self- and task perceptions during elementary school years. It was found that children as young as first grade had differentiated self-beliefs for various activities. Young children's perceptions of competence and expectancy for success were more positive than the beliefs of the older children. Children's domain specific perceptions were important predictors of their activity choices. Engagement then is likely to occur when a child expects to have the ability to achieve success during the middle childhood years.

Skinner and colleagues (1998) demonstrated systematic age differences in analyses which suggested that the aspects of control changes with development. As children get older, the beliefs that regulate engagement shifted from perceived control over effort to perceived control over ability. During this developmental period, powerful others played an important role. This perception of control supported more engagement, resulting in better academic performance. Parents' sense of their child's academic efficacy and their aspirations for their children are considered to be linked to their children's scholastic achievement (Bandura, 1996).

Bandura (1986) hypothesized that self-efficacy affects an individual's choice of activities, effort, and persistence. People who had a low sense of efficacy for accomplishing a task may avoid it, while those who believed they were capable would be more likely to readily engage in it. Bandura also hypothesized that individuals who felt efficacious would work harder and persist longer when they encountered difficulties, than those who doubted their capabilities. Success raised efficacy and failure lowered it, but once a strong sense of efficacy is developed, the impact of failure may be greatly decreased. Bandura (1993) found that high outcome expectation, linked with high self-efficacy, produced high cognitive engagement. Bandura stated that children's beliefs in their efficacy to regulate their own learning and academic attainments influenced their scholastic achievement. Central to achievement are people's beliefs in their capabilities to exercise control over their level of functioning and environmental demands. Again, Bandura stated that, unless people believed they could produce desired effects by their actions, they have little incentive to act (Bandura, 1996).

In turn, as students worked on tasks and became more skillful, they maintained a sense of self-efficacy for performing well. A link was seen between motivation and learning in many studies. Schunk (1990) stated that motivation influences what, when, and how we learn. Students who are motivated to learn about a topic are more apt to engage in activities that they believe would help them learn. Skinner and colleagues (1998) found that perceived control influences academic performance by promoting or decreasing active engagement in learning. Thus, with high positive self-efficacy and a sense of control, continued engagement should lead to the achievement.

Motivation Theory

Motivation is defined as initiating and sustaining a goal directed activity. There has been a tremendous proliferation over the last 15 years in both the theories and the key constructs linked to a social cognitive perspective of motivation (Pintrich & Schunk, 1996). Attributions, or perceived causes of outcomes, are hypothesized to influence achievement behaviors, expectancies, and affects (Weiner, 1994). The motivation dimensions of attributions consist of antecedent conditions of the environmental and personal factors. Causal dimensions in Weiner's attribution model consisted of stability, internal or external locus, and control of ability, effort, difficulty of task, and powerful others. Causal dimensions provided psychological significance and meaning to simple attributions. The properties of a dimension, in terms of its stability, internality, or controllability, have implications for students' expectancy beliefs, implicating them in all types of motivated behaviors. Enhancement of motivation occurred when students perceived that they were making progress in learning (Pintrich & Schunk, 1996).

Weiner (1994) summarized the many correlational and experimental studies of these relations by concluding that the dimension of control is the most closely linked to future expectations for success. His model hypothesized that causal dimensions affect the psychological consequences of hopelessness or hopefulness. Hopefulness, in turn, affects persistent behavior and achievement.

An adaptation of Weiner's 1986 Attribution Model (see figure 2.1) forms the foundational construct of this study.

Antecedent Conditions	Perceived Causes	Causal Dimensions	Psychological Consequences	Behavior
Environmental Factors & Personal Factors	Ability & Powerful Others	Control & Stability	Expectancy for Success	Achievement

Figure 2.1. Motivational Dimensions of Attributions

Antecedent conditions leading to achievement consist of environmental factors and personal factors. In this study, environmental factors include access to computers and information regarding computer use as it pertains to significant people who may influence that use. Personal factors include the perception of one's ability and perceived control over other factors. As demonstrated, children made inferences about themselves based on their perceptions of social norms, access to information provided from feedback, and observing behaviors (Skinner & Belmont, 1993).

Perceived causes leading to achievement consist of ability and the influence of powerful others. The causal dimension of control over one's ability and over the influence of powerful others impact one's self-perception. In addition, Skinner and colleagues (1998) stated that children perceive their ability as both stable and unstable. The stable, non-controllable factor is the genetic intelligence demonstrated in problem solving and logical thinking. In this study, the unstable, controllable factor is the development of computer skills and increased knowledge about computer use. Optimal control occurs when there is an understanding that ability is unstable. Experimental and intervention studies have demonstrated that the relation between control beliefs and achievement is a reciprocal one (Skinner, Zimmer-Gembeck, & Connell, 1998). The more control one perceived to have over learning, the greater the achievement. The greater the achievement, the more control one had over learning.

With control over learning new skills and gaining information from parents, teachers, and siblings, the psychological consequence is proposed to be expectancy for success leading to engagement in the activity (Eccles & Wigfield, 1995). When children worked at a task and experienced early successes, they were apt to believe that they were becoming competent (i.e.,

acquiring knowledge and skill) and to develop a sense of efficacy for continued success (Schunk, 1984).

Achievement occurred when children developed patterns in their beliefs about their own success (Thorkildsen & Nicholls, 1998). Research on individual differences demonstrated that children's perceived control exerts a strong effect on their achievement (Skinner, Zimmer-Gembeck & Connell, 1998).

Weiner's (1994) attribution theory is similar to Bandura's (1993) and Schunk's (1991, 1997, 1998) self-efficacy theories, while also sharing similarities with Eccles and Wigfield's (1995) expectancy-value approach. The work by Heyman and Dweck (1998) has focused on helplessness as a result of studies by Nicholls (1990) and Nichols and Hazzard (1993) on the meaning of ability. Skinner's (1990) and Skinner et al.'s (1993, 1998) studies have employed general measures of control beliefs, while other motivational psychologists, Bandura (1996) and Eccles (1998), have argued that academic motivation is much more domain specific. All the approaches seek to explain engagement and performance, including the importance regarding the mediating role of self-beliefs between context and engagement/performance.

Skinner and colleagues (1998) assumed that a strong belief in one's control and a belief that ability is modifiable are optimal. A strong sense of personal efficacy, and beliefs in one's own ability to master challenging tasks, was also thought to be a psychological consequence within the motivational dimensions of attribution (Weiner, 1994). We need to consider the possibility that not all things are under our control and that some individual differences in aptitudes contain an element of stability that is very likely to influence final possible levels of competence (Heyman & Dweck, 1998).

As mentioned above, there were many similar theories linked to achievement and control beliefs. These constructs are derived from models that make similar predictions about the general influences on engagement and performance (Thorkildsen & Nicholls, 1998). Girls' beliefs about the causes of success and perceptions of expectations involve the coordination of personal values and contextual norms.

Based on the foundation provided in this section, the specific environmental and personal motivational factors to be assessed in this study will be elaborated upon.

Environmental Factors

Access to Computers

The computer has become an important tool in the home, classroom, and workplace. If girls have less access to a computer at home or at school, they could be at a disadvantage later in their educational careers or in the workplace. A 1999 study by the National Center for Education Statistics (NCES) found that females are just as likely as males to have access at home and at school. Between 1984 and 1996, the percentage of children in grades four to eight, and grade eleven who reported using computers at school at least once a week increased substantially (Bae et al., 2000). It is surmised that this access contributes to positive attitudes toward computer technology, as well as indicating a higher level of interest. The results were found to be due to parental influence and gender expectations (Sutton, 1991). For girls to have successfully completed web pages, they had to have access to information and equipment for Internet use. There must have been opportunities for practice and experiences to enable learning about computer use. A study by Downes and colleagues (1996) examined similarities and differences among children who regularly used computers at home. A factor that contributed to becoming confident, competent, and regular users of computers consisted of the number of computers in the home and the children's perceptions of their access to and use of computers (Haugland, 1996). While game playing remained the most common activity, many children regularly wrote, drew, and used information-based programs for leisure, as well as school-related work (Downes, Reddacliff & Moont, 1996). Furthermore, it has been shown that students in schools equipped with Internet access find computers to be excellent vehicles for bolstering their confidence with computer technologies overall (Quinn, 1998). Thus, both boys and girls who have easier access to computers will be more likely to use them and resultantly, to develop greater motivation to learn and develop the abilities that will heighten and continue that motivation. As the research sited above indicates, there is no gender difference in access to computers.

Powerful Others

Powerful others refer to parents, siblings, teachers, and peers. Development and learning occur continuously when children interact with people in their environment. Bandura (1996) found that parents' sense of their child's academic efficacy, and aspirations for their children, were linked to their child's achievement. Children who were encouraged to use computers for a

variety of purposes became comfortable moving between playing games and doing work on the computer. They interacted with parental computing experiences by ways of using the computer, ways of learning to use the computer, and who they perceive as owning the computer. Generally, children who displayed success with computers come from homes where other family members also used the computer for a variety of work-related and leisure activities (Downes et al., 1996).

In school, the teacher plays an important role in the child's development. Skinner and colleagues (1998) found that children in grades three through seven, who experienced teachers as warm and flexible, were more likely to develop optimal profiles of control. This supports greater motivation for engagement, resulting in better academic performance.

Personal Factors

Ability/Skills

Most social cognitive motivational theorists assume that a strong belief in one's control and a belief that ability is modifiable are optimal. A strong sense of personal efficacy and beliefs in one's own ability to master challenging tasks is a psychological consequence within the motivational dimensions of attribution. Studies by Eccles and colleagues (1989) and Skinner and Belmont (1993) have demonstrated the mediating role of self-beliefs between context and engagement.

With practice using the Internet, girls build their self-efficacy in the domain of computer use. As they work on more challenging tasks, they become more skillful. Ability and effort became more stable and perceived internal control influenced future expectancy for success (Nicholls, 1990; Nicholls & Miller, 1983, 1984). Cain and Dweck (1995) pointed out ways that these relationships between children's cognition about ability related to their motivational responses. Among children in fifth and higher grades, the helpless motivational pattern was associated with the idea that intelligence is a fixed entity. As children's knowledge about ability continued to grow, they understood that skill development was not fixed. Computer competencies demonstrated by the creation of web pages enhanced the girls' perceptions of their ability for using computer technology. Thus, it is proposed in this study that girls' expectancy for success using technology in middle childhood will lead to future engagement in technological activities.

Perceived Control

Bandura (1986) hypothesized that self-efficacy affects an individual's choice of activities, effort and persistence. That is, people who have a low sense of efficacy for accomplishing a task may avoid it, while those who believe they are capable should engage readily. Individuals who feel efficacious are hypothesized to work harder and persist longer when they encounter difficulties than those who doubt their capabilities. Success raised efficacy and failure lowered it, but once a strong sense of efficacy was developed, the impact of failure may may be greatly decreased (Bandura, 1993). High outcome expectation linked with high self-efficacy equaled high cognitive engagement. Central to achievement were people's beliefs in their capabilities to exercise control over their level of functioning and environmental demands. Research findings provided strong confirmation that both self-efficacy and outcome expectations impact an individual's affective and behavioral reactions to information technology (Compeau, Higgins & Hudd, 1999). Thus, girls' beliefs about their abilities should influence the amount of effort they will put into learning about computer technology.

Summary

The middle childhood years are the time to acquire computer skills so that girls can build on their success during the uncertain time of adolescence. Studies have shown that exposure to computers during early years or middle childhood increases self-confidence and positive attitudes about computers (Yelland, 1993). It is during this middle childhood developmental stage when children form either a sense of industry or a sense of inferiority (Erikson, 1963). During middle childhood, social comparison becomes the main factor in determining what value children place on themselves. Eccles and colleagues (1993) examined the development of children's self- and task perceptions during elementary school years. They found that young children's perceptions of competence and expectancy for success were more positive than the beliefs of the older children. Children's domain specific perceptions are important predictors of their activity choices. It has been shown that self-concept scores of girls declined significantly between grades five through eight (Klein & Zhems, 1996).

CHAPTER III

Methodology

This chapter describes the research methods used in the study. The chapter is organized in the following seven sections: the introduction, the setting for the study, the participants, the research design, the data collection process, the analysis of the data, and writing the narrative.

Introduction

The purpose of the research study was to describe girls' engagement with computers during middle childhood, and to delineate the factors that initiated and sustained the engagement. The researcher focused on understanding aspects of the girls who made the choice to join a computer club to acquire the skills necessary to develop a web page. Qualitative methodology was employed to describe complex factors that involved the experience of learning while engaging in computer activities. Creswell (1998) spoke metaphorically of qualitative research as an intricate fabric composed of minute threads, many colors, different textures, and various blends of material. Since this study was about complex factors in girls lives it seemed appropriate to choose qualitative methodology. Primarily, the researcher made sense of the complexity of learning by closely observing and listening to the learner. Fairbanks (1996) stated that, in qualitative research, meaning is conveyed through descriptive narratives.

The Setting

Bogdan and Bilken (1997) stated that the setting for an educational research study allows the researchers to gain salient information from observations. Understanding how girls use computers in elementary school was best accomplished by observing them engaging with the computers. The setting for this study was an after-school computer club called the Web Weavers Club. The Web Weavers Club consisted of a group of children from an elementary school in Northern Virginia, a suburb of Washington D.C. Three teams of students, four girls and eight boys, met in the computer lab of the school for fifteen weeks. They met once a week on Tuesday afternoons from 3:45 to 5:00 PM. The computer lab housed seventeen Macintosh computers, positioned around the perimeter of the room. There were four large tables arranged in a square in the middle of the room.

The purpose of the Web Weavers Club was to provide a computer learning environment. Members of the club participated in a "ThinkQuest Jr." contest to create

educational web pages. Andrea Papa (1999) from Advanced Network and Services, Inc., which manages the ThinkQuest web site, describes ThinkQuest as an educational initiative backed by major corporations and educational foundations committed to advancing learning through the use of computer and networking technology. The basic belief underlying the ThinkQuest programs is that the Internet and related technologies are powerful new learning tools that can be used by young people everywhere. It is an organization designed to encourage computer use. ThinkQuest also awards top winning team members with scholarships based on multiple categories (see Appendix A) and levels of achievement. There are five award categories: arts and literature, science and mathematics, social sciences, sports and health, and interdisciplinary (combining two or more categories).

Members of the Web Weavers Club worked in cooperative learning groups to research topics of interest. Fifth and sixth grade students were provided with applications to join the club by their homeroom teachers. Students could self-select to fill out the application. No prerequisite computer skills were required. The Web Weavers club provided an environment in which students could construct their own learning based on interest in a specific topic.

It was in computer lab that the researcher conducted the observations and informal conversations with the participants and the teachers. The researcher also conducted the taped conversations and interviews of the groups while they worked during the Web Weavers Club in the computer lab.

The setting for the individual interviews took place in the same elementary school prior to the meeting with the Web Weavers Club. The interviewer and participants used a classroom that was adjacent to the computer lab. The room was empty and quiet except for an occasional interruption regarding after-school announcements over the loud speaker. The interviews were conducted at a table with a tape recorder that was in a corner of the room.

Participants

The researcher began searching for the participants of this study by communicating with principals at elementary schools in the school system where she is employed. The criteria for selection were that the participants had to be females in elementary school who had demonstrated computer technology competencies. Several principals identified girls in their schools who met the criteria. One principal spoke of having an after-school computer club with

the purpose of creating educational web pages. The four girls who had self-selected to become members of this after-school club became the participants in the study. All agreed to the terms of informed consent (see Appendix B) and were forthright in obtaining the required signatures. They did not all possess the skills needed to create a web page but they had the desire to learn.

Creswell (1998) stated that the purposeful selection of participants represented a key decision point in qualitative study. Researchers designing qualitative studies need clear criteria for their decisions. The purposive sample in qualitative research is a small group of people, studied in their context. The participants of this research study were exemplars in computer competencies for their age since they were four young girls who were creating web pages.

Research Design

The case study tradition of inquiry was used in this study. The case was the participation of sixth grade girls in an after-school computer club called the Web Weavers Club. The case study followed Stake's (1995) approach, which considered the object of study in the context of the activity. It was during the club sessions that the researcher observed young girls engaging in the activity of creating a web page. The researcher studied the behaviors of the girls while engaging in the computer activities and interviewed the girls to understand what brought them to join the club.

The case study design provided the opportunity to study girls using computers in a natural educational setting. The qualitative approach was used to gather contextual material with a rich description of each participant's learning environment, patterns of behavior, and interactions within the environment (Yin, 1994).

Data Collection

Triangulation of data in qualitative research has been shown to use multiple and different sources of information to ensure accuracy of the information (Miles & Huberman, 1994; Patton, 1990). Several methods of data collection were used to ensure accuracy as stated above.

Data collection consisted of the following:

- individual interviews with each girl and the computer teacher
- informal conversations with the girls while they were engaged with the computer
- informal conversations with the two other teachers of the club
- observations

- taped conversations during the computer club with the girls and their groups (which consisted of peers and teachers)
- reviewing the finished product
- reflective notes

Individual Interviews

Rubin and Rubin (1995) recommended interviews using guided conversation to allow the researcher to capture the perspectives of participants. They explained that building a theory is based on exchanges in which the interviewees can talk back, clarify, and explain their points. In preparation for the study, the researcher conducted two pilot interviews. One was an individual interview and the other was a focus group. All the subjects were girls in elementary school who had created web pages. The subjects provided information that was considered important for the study. The information was regarding access to computers and the role that powerful others played in their lives by influencing them to use the computers. Based on these two pilot interview experiences, several interview questions were formulated (see Appendix C). During the course of the interviews, the researcher was mindful that she was talking to children. There was a need to provide them with opportunities to elaborate and to encourage them to be comfortable talking back, and clarifying their points. The researcher discovered that she was comfortable interviewing children, and that they were willing to speak openly for a time period of 30 to 45 minutes. Previous researchers found it to be a challenge for children to be in charge of their narratives when interacting with an authority figure (Lofland & Lofland, 1995). An important result of the pilot interviews was that the researcher learned to provide wait time for the girls as she conducted the interviews for the study.

The individual interviews for the case study were conducted in the school setting, lasting between 30 and 45 minutes each. The interview consisted of a Grand Tour question in the form of: "Tell me about yourself and your family." McCracken (1988) suggested that the interview format use a series of prompts designed to give structure to the interview. When the girls talked about their interests in and out of school, they were prompted to respond to when and why they use computers. These questions provided information about access to computers and people they interact with, that and who may have influenced their computer use. The most important aspect of the interviewer's approach concerned conveying the idea that the participant's information is

acceptable and valuable (Marshall & Rossman, 1989). A tape recorder was used to record the conversations. Purposefully, the recorder used was one typically found in an elementary school, so as not to distract the girls during the interviews.

The researcher interviewed the teacher who established, and maintained, the after-school computer club both formally and informally on several occasions. Dr. P., the computer teacher, was engaged in a 'teacher as researcher' project in which she videotaped and recorded the whole group interacting with the computers. Her emphasis was on the constructivist learning environment and how the teams of students collaborated in the process of creating web pages. She provided rich data for this study by sharing her insight on the girls' engagement with computer technology from an outside perspective.

Informal conversations

Informal conversations with the girls were conducted while they were engaged with the computer, working on their web pages. Questions were related to creating the web page. The researcher asked them to tell when and why they began creating the page, if it was an easy task, and who helped them when they had difficulty. A combination approach of open-ended questions and general questions was used. Patton (1990) suggested the use of interview probes. The researcher probed with questions related to family members and friends who may have been factors in motivating the girls to use computers at home. Again, these questions were phrased to avoid priming the participant's responses.

Informal conversations were conducted with all the teachers during the Web Weavers Club. While the teachers were acting as facilitators, they explained how they encouraged the girls to learn the computer skills needed while constructing their web pages. The direction the conversations took was dependent on what the girls were doing at the time.

Observations

Observing patterns of behavior brings an understanding of the engagement of girls with computer technology. The adult observer who attempts to understand a child's patterns of behaviors cannot pass unnoticed as a member of that group (Fine & Sandstrom, 1988). Being an outsider was difficult since the girls knew the researcher was a principal. Developing a sense of trust countered the need for the girls to consciously behave in a particular way to obtain approval. To develop that sense of trust, the researcher purposefully conducted the individual

interviews with each girl prior to observing them in the Web Weavers Club. There may have been an unconscious need for the girls to act in a manner that would gain my approval. Basic requirements of an observer include that one empathize emotionally, and not feel excessive personal anxiety about becoming close to those being studied (McAdams & West, 1997). Since the researcher is very comfortable with girls of this age she found that building trust was not as difficult a task as with someone not accustomed to working with children. The researcher understands children's patterns of behavior because she has "lived" with them as an elementary school teacher and principal for three decades.

The girls were observed interacting with their peers and teachers while they worked at the computers to design their web pages. The researcher engaged them in conversation using spontaneous questions & comments arising from the activity in which each girl was engaged. The researcher took field notes scripting what was said and how the girls interacted with the computer and the people in the club. She concentrated on taking notes focusing on one group at a time. The researcher used her training as an administrator in the teacher evaluation process to determine what were salient events and what was significant during observations at the after-school club. After each interview and observation, she took personal reflective notes, such as how she perceived the girls to be interacting with the computers. The purpose of the reflective notes was to assist in developing the narrative for telling the girls' stories.

Taped conversations

During the Web Weavers Club, the teachers taped the girls and their groups (which consisted of peers and teachers) as they engaged in the construction of their web pages. The teachers later analyzed the tapes to improve their teaching strategies.

Finished product

Three groups of students participated in collaborative learning activities to create web pages. One group produced "The Games Page," which focused on activities students can do such as learning gymnastics or playing the computer game, "Starcraft" (http://library.thinkquest.org/J002623). Another group produced "Sydney the Cat Explores Ancient Egypt." It was an historical fiction story (http://library.thinkquest.org/J002154). The third group produced "The Great Beyond," an informational web page about space exploration for the Science and Math category (http://library.thinkquest.org/J002651).

Reflective notes

After each individual interview and each observation, the researcher wrote notes in her journal. She noted the girls' affects and body language. The researcher brought her own perspective to what she had perceived were the salient points of the activity.

Data Analysis

It has been determined that judgments are generated by the linkages the participant makes between aspects of her life, as lived, and by the linkages the researcher makes between this understanding and interpretation (Josselson & Lieblich, 1995). The researcher made judgments as she conducted the observation of the girls. Data analysis was an ongoing part of data collection (Bogdan & Bilken, 1997). The analysis of the qualitative data collected involved studying notes and transcripts. It required organizing or coding interview and observation excerpts into interpretive categories, searching for patterns and connections among the excerpts, and reorganizing excerpts into new and different categories (Rubin & Rubin, 1995; Stake, 1995).

With the extensive amount of data, a careful, systematic process of analysis was conducted. After transcribing the tapes and notes as a Microsoft Word document, the documents were imported into a data analysis software package, Non -numerical Unstructured Data Indexing Searching and Theorizing (NUD*IST), which is a powerful tool for storing data, searching for themes, and diagramming. Creswell (1998) suggested using the "tree diagram" at the beginning of the coding process. A template can be created in accordance with the tradition of inquiry. The template created provided a framework for the initial a priori coding (see Figure 3.1).

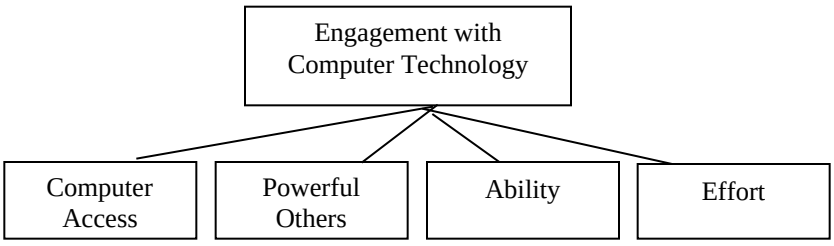

Figure 3.1. Index Tree

The first step of the analysis was to read the transcripts of the collected data in their entirety. The data was then disaggregated by assigning codes. The categories initially specified for this part of the analysis were access, powerful others, ability, and effort. Initial coding is concrete specification of emergent themes (Coffey & Atkinson, 1996). It was during this stage

that information could be put into several code categories. Instances of some codes occurred with such frequency and regularity that a file was developed with an enormous number of instances in it. Using NUD*IST, the researcher elaborated the code itself into families, to identify subdivisions. Due to that process, the tree diagram changed and expanded (see Figure 3.2).

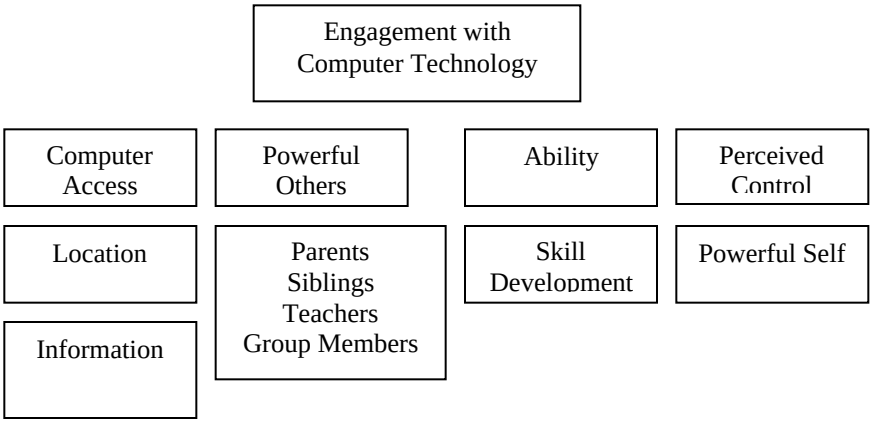

Figure 3.2. Expanded Index Tree

The categories were saturated and the researcher performed no further coding for them.

The second stage was focused coding. Codes served to summarize, synthesize, and sort observations. Once initial coding was achieved, the data had to be interrogated and systematically explored to generate meaning (see Appendix D). The move from coding to interpretation is a crucial one, as Wolcott (1995) suggested. Quality, in case study research, is based on intuitive judgment. By providing the pivotal link between data collection and its conceptualization, coding became the fundamental means of developing the analysis (Lofland & Lofland, 1995).

The index tree in NUD*IST is a succinct visual presentation of the relationships among parts of similar themes. The index tree diagramming function was a strategy that the researcher used to manipulate the data throughout the analysis process. In social science research, diagrams have been defined as "visual representations of relationships between concepts" (Strauss & Corbin, 1990). Conclusions were drawn from interpreting the visual displays, noting patterns and themes that emerged. NUD*IST allowed interpretations to be made, based on the powerful sorting and cross-themes reports it generated.

Writing the Narrative

The process of narrative research is "writing it down," which is the more objective recording of events, and "writing it up," which is the more subjective interpretation of the events (Fairbanks, 1996). It is like solving a puzzle for the reader to go through the layers of coherence and examine reality (Fairbanks, 1996). The researcher's experience, lived as an elementary school teacher and principal over the past thirty years, allowed insights into the lives of the participants. Having raised a daughter and a son, the researcher also understood the complexities of middle childhood and gender development. Based on these experiences, the interpretations of the data reflect personal perspectives of the stories of these unique girls.

The researcher bears the responsibility for portraying the participants with empathy and consideration. There are no risks associated with, or that could result from, the research. The work that was done was not to be graded. It is acknowledged that biases of the researcher were brought to the interpretive stage of the research study. The researcher remained committed to attending to the rigors of data collection and analysis throughout this study. Reports of the descriptions of girls' engagement with computer technology were based on empirical materials that have been carefully interpreted for the reader in the following chapters.

CHAPTER IV

Findings

The purpose of the research study was to describe girls' engagement with computers during middle childhood, and to delineate the factors that initiated and sustained the engagement. Understanding girls who made the choice to join a computer club to acquire the skills necessary to develop a web page was the specific focus of this study.

This chapter, as suggested by Stake (1995), opens with a vignette so that the reader can develop a feel for the time and place of the study. The findings are presented in three sections. The first section of this chapter consists of demographics and sketches of the girls as gleaned from interviews with the girls themselves and with the teachers of the computer club. The second section consists of data from observations conducted during the Web Weavers Club. The third section consists of data presented by answering the research questions.

Vignette

The four sixth grade girls were sitting close together, hovering around Linda, who was typing at one of the Macintosh computers in the school's lab. The Web Weavers Club was over. The girls were asked by the club's sponsor to create a web page to share their experiences of their participation in the club. The sponsor wanted to post the web page on the elementary school's web site to advertise and attract students to become the next year's participants. This was the first time the girls worked together as a whole group. For the past fifteen weeks they were in mixed gender groups, working in the computer lab to create educational web pages for a ThinkQuest Jr. Contest.

The computer lab in which the girls were working consisted of 16 Macintosh computers, situated around the perimeter of the room. There were several large rectangular tables placed together to make a square in the middle of the room. This table was the gathering place. Today, the sponsor and the researcher treated the girls to breakfast. We discussed the Web Weavers Club. Although the girls began their task of creating a web page at individual computers, they quickly moved to the computer where Linda sat. Brenda began making suggestions about background colors and graphics. Tina joined in with some ideas. Kara was discussing the mints she had brought. Tina realized links had to be made and asked the teacher to help her do so. She moved back to her original computer and began linking this new web site to the web pages the

groups had created for the ThinkQuest Jr. Contest. Kara moved back to her original computer and pulled up an unrelated site--one that she had created in her homeroom class--to show the others. The teacher left the girls to work on their own.

Demographics and Thumbnail Sketches

My name is Kara and I am twelve. While in Web Weavers I learned how to work Mac computers and different programs on them. For example, I learned how to use Claris Homepage 3.0 to make web pages. I used ClarisWorks Paint with GifBuilder to make animated gifs. The best part of being in the Computer Club called Web Weavers was seeing the final product on the Internet. The hardest part of being in the club was getting my team members to listen to me because I was the only girl in my group. I think the boys wouldn't listen to my ideas because I was just a girl (maybe I was smarter than they are and they didn't want to admit it!).

Kara lives with her mom and dad and two sisters. She is a middle child, which she said is unfair. "My younger sister gets her way as the baby and the older one gets to do things I can't do." During her interview, Kara smiled and often giggled. She responded to all questions, sometimes needing prompting to elaborate. Her favorite subject in school is mathematics and at home she enjoys cross-stitch. It was noticeable to me that during our interview she did not talk at all about friends. Much of her spare time is spent playing softball, an interest shared by her sisters. Her mom is the coach and they all spend after-school time and weekends engaged in softball activities. The first time Kara used the computer she said she was pretty little. She remembers playing a kid game like Reader Rabbit. It was an older computer, unlike the PC she has now. She plays computer games once or twice a week, depending on homework. She also uses it for typing assignments. She plays computer games when she's bored or to get out of going to sleep right away. Sometimes she plays with her little sister because she is just learning to work the computer. Otherwise, she will play by herself. Kara has a computer in her room with software selected by her parents. The games on the computer she received as gifts. There is no Internet access. Her dad lets her use his laptop that has Internet access for school projects. She didn't know how to build a web page before she joined the club. The reason she joined the Web Weavers Club is because her mom said it would be good for her so she decided to try it. "My mom told me there's going to be certain categories like math and science which I'm good in."

As a participant of the Web Weavers Club, Kara was a member of the team consisting of one girl and four boys. They developed
"The Great Beyond," an information web page about Space Exploration for the Science and Math category (http://library.thinkquest.org/J002651). Kara complained that she was the only girl in the group. She said they did work together on the home page although she had to control the boys so they would not fool around. Her mother helped her get the information that she wrote about the food pyramid. She said she likes teasing the boys and they usually went along with what she wanted to do. However, sometimes they needed guidance from the teachers to keep from getting off task.

The teacher noted that, except for the development of their quiz, it appeared that Kara did not confer with the others. However, she was willing to read and comment on the way pages looked or how the text was worded. Foods astronauts eat in space, history of rockets, effects of gravity, how to calculate weight in space, and how to become an astronaut were individually researched and written about by the space team members. These categories then became incorporated into the overall web page theme of life in space as an astronaut. Once the individual pages were written, the teachers observed that Kara and the other space team members invited one another to review the pages and that members of other teams also read the pages with interest. Most of the revision and editing ideas came from the coaches, although students did share related Internet web sites where students could gather additional information.

> **Hi, my name is Tina. I am eleven, going on twelve. I joined the Web Weavers Club because I love computers and I love to make Web pages in school. So, I thought joining the club would be fun. I thought, why not join? My brother was in the club last year and I heard a lot of good things about it so I could not wait to get into sixth grade to join Web Weavers. The hardest thing that I did was getting the backgrounds set on the web pages because every time I put in a background I never saved it right. I had to do it ten times before I got it right! The best thing about the club was making the whole Web page and seeing it on the Internet. It was all so fun.**

Tina grew up with her mom, her grandparents, and her brother, who is 13. Her parents were divorced when she was two and she does not see her dad. Tina was sitting with two boys at the table in the computer lab, sharing a snack and talking. She was wearing metallic blue nail polish. Tina came to the interview room and talked freely and comfortably until the tape was turned on. She became self-conscious at first but then after practicing a few times she said she was ready for the interview. Tina said she really loves math. She and her brother and friends play football in front of her house or play with her two dogs. She likes pets and goes to gymnastics once a week. When she is with the babysitter, she plays inside on the Internet or watches TV.

At home, Tina's mom monitors the time spent watching TV and using the computer. Her mom got a computer a few years ago for her work and she doesn't want the children to use it when she is not home. The computer has games, puzzle-making software, and the Internet. She usually plays computer games together with her brother. She also uses the Internet with her brother, taking turns checking their e-mail. When she watches the Disney Channel sometimes they say to go to www.Disney.com. She'll go online and play the games there. The games are crossword puzzles or word matching games. She doesn't use the Internet every day but when she is really bored she can go on it for two hours. She is usually not on it that much because her brother will fight over it if she gets one more minute than he does.

Tina's brother joined the Web Weavers Club last year and he "really, really liked it." She wanted to learn to make a web page so that she could do it at home, too, and so she and her brother could make their own web site. There is a schedule her mom set up for Tina and her brother to share the computer. Tina uses the computer almost every day but not for more than 30 minutes. Tina and her brother make time to watch movies together and "just chat." They often do things on and off the computer together. Tina's brother told her to join the Web Weavers Club. "The first day he was in the club last year he came home and told me I really have to join this club. I said, 'I intend to', and I did."

As a participant in the Web Weavers Club, Tina was on a team consisting of one girl and three boys. They produced "The Games Page," which focused on activities students can do such as learning gymnastics or playing the computer game, "Starcraft" (http://library.thinkquest.org/J002623). Tina did not mind working as the only girl in the group. She said, "Where I live, there are not many girls and I am with my brother a lot, so I am like one

of the guys." At the same time, she said she could not control the game selections of the boys in her group. She did her own real sports page writing about gymnastics, although the rest of the group did virtual games for the page. She remarked that she was not as happy with the page because it really didn't "mix very well." It seems Tina went along with the boys and did not take control of making the page more cohesive.

The teacher reported that, in the beginning of the club, Tina was unfocused. It took several club meetings before she engaged in an activity using the computer. Once she initially engaged with the activity, she remained engaged. By the end of the project she engaged in all aspects of building the web page. She added text, gifs, and tinkered to make all the links work. With teacher direction she was able to learn the skills needed to complete the web page.

> **My name is Linda and I am eleven. I was in Web Weavers, too, but in a group of two girls and three boys (although two boys left the club earlier in the year due to after-school scheduling conflicts). I learned how to use a Mac computer and create hyperlinks, text, graphics, and backgrounds. The hardest thing to do was to get used to using a Mac. At home I use a P.C. and have different programs and shortcut keys. The easiest thing to do was to (unlike Kara) get my opinion heard. In my group I was the leader so I always got my say. Another reason it was easy to make decisions was because after the two boys left the one who was still in the club, Will, didn't want the rest of us girls to gang up on him.**

Linda lives with her mom during the weekdays and with her dad on the weekends. Her mom is a high school English teacher and her dad works for a computer company. She has a brother who is 13. When Linda came into the interview room she began talking about herself right away. Linda says she has a lot of friends and is not very shy. She likes to read and write "a lot." Her favorite activities are going to the movies and playing on the computer.

She first started to use the computer at age seven or eight and got a book all about computers. The reason she got the book was because she wanted to learn graphics. Her dad was spending time with her brother on the computer and she wanted her dad's attention too. She uses the computer to play games, e-mail to her friends, and create hyperstudio slide shows and videos. She has computers both at her mom's house and her dad's. Since she shares the computer with

her brother, she doesn't use it as much as she would like because he uses it all the time. She uses the computer for an hour each day, "maybe two hours if I'm lucky. It all depends on if my brother is bothering me to get off." To alleviate the sharing problem, Linda and her brother wrote a "computer constitution" so everyone gets equal time. "It's not true, maybe when we first got it, it was equal time, but not now." At her dad's house, she says her brother uses the computer there and she uses her dad's laptop. Linda is in competition with her brother over the use of the computer, "He is really, really into the computer. He bothers me to get off. I'm always in competition with my brother." Linda joined the Web Weavers Club because her teacher told the class all about it and it sounded like fun.

As a participant in the Web Weavers Club, Linda was in a group that consisted of two girls and one boy. They developed an historical fiction web page entitled, "Sydney the Cat Explores Ancient Egypt" (http://library.thinkquest.org/J002154). In collaborating on the creation of the web page, Linda said it was democratic and easy to come to agreements. "We all talk together and decide on the things we need to do." Linda was selected as the leader and she said that was one reason their group worked so well together. She acknowledged the need to seek consensus when making decisions. She controlled the information included in the web page as she researched and wrote much of the text.

The teacher noted that Linda, from the first week, envisioned and articulated to her group what she saw as the big picture of the web page. Linda was an enthusiastic writer of the text from the beginning to the end of the activity. Members of the Ancient Egyptian team divided the researching tasks into the categories of architecture, games, social pyramid, gods, mummies, hieroglyphics, and schooling. They did most of their research at home using the Internet, a social studies textbook, and trade books. The teacher said the other students gave their research notes to Linda, the team leader, who was responsible for taking the information and incorporating it into the fictional story she was writing for the web page. As Linda wrote the story, she often had questions about content. To help her with typing the story, Linda used an AlphaSmart keyboard at home. At the beginning of the club she downloaded the text from the AlphaSmart to the web page and revised the story with input from other members of her team, often obtaining their opinions and ideas. The teacher said that Linda was a strong leader, checking with team members during the school week to ask them how they were coming with their research.

My name is Brenda and I'm twelve. I was in a group with Linda and Will. I joined Web Weavers because I thought that it would be fun and interesting. I found out that it was fun. In fact, it was more fun than I had thought. I think I had a really good team. We all got along together really well, and didn't really fight. The hardest part for me was getting used to saving and putting the animations in the right folder because I would usually put it in the wrong folder. I'm very glad I joined Web Weavers and I think that all the kids should try it because you really learn a lot and have a lot of fun.

Brenda lives at "my mom's house" during the week and on the weekends she goes to her dad's. She has two brothers and three sisters. Her sisters, who are 3, 10, and 14, and brother, who is 1, live with her mom. Her other brother, who lives with her dad, is 4. Brenda was willing to participate in the interview yet she did not elaborate at all as she responded to questions. She is a serious girl and at times appeared uncomfortable talking about her family. Brenda said she likes to hang out with her friends, to go places and to play games like basketball and hockey. Her favorite subject at school is writing. After school she watches her younger siblings and does her homework. She sometimes watches TV.

Brenda says she uses the computer for about an hour on Saturday mornings when she wakes up. She has the responsibility of watching her younger siblings after school and on weekends. She uses the computer for about an hour on weekends to e-mail friends and play some games, like "Brainquest." The computer in her mom's house is located in the TV room and is shared by the whole family. She said her mom was trying to get another one. She did not talk about her dad and using computers with him at all. For a school project Brenda's teacher taught her to do animation on the computer. Brenda shared that she had taught her classmates to do animation after she had learned it in school. When the teacher told her about the Web Weavers Club, she decided to join so she could create a web page. She was "into animation" and she wanted to learn more about it.

As a participant in the Web Weavers Club, Brenda was in the same group that consisted of two girls and one boy, as Linda. The team developed an historical fiction web page entitled, "Sydney the Cat Explores Ancient Egypt" (http://library.thinkquest.org/J002154). Brenda agreed with Linda that they all talk together and decide on the things they need to do.

The teacher said that Brenda spent a large portion of her time designing the animation and graphics, and making the pages cohesive, as a whole. Brenda spent the first few weeks totally engaged in creating an animated figure of a cat to go along with the group's page. It wasn't until the last two weeks that she shared tasks with the other members of her group. The Ancient Egyptian team worked very closely to make sure the content was correct on the web pages as well as to create the quiz for their web page. The teacher stated, “I was most impressed with their resolve to figure out why links were broken and how to design the quiz so that correct answers would take the user to the next question and incorrect answers would take the user back to the question to try again.” Team members even came into school early and stayed a few days after school to work on the linking issues, showing a determined attitude to "get it right." The team demonstrated organizational skills right from the beginning of the program. Brenda was very focused on creating the animated cat. “I truly acted as a facilitator,” as Brenda was independent and persistent in her activity.

During the interviews the girls spoke mostly about their parents and siblings. Although the questions were not directly asking about school experiences, the girls did share ways in which they used the computers at school. The two themes that they discussed were computer access and powerful others.

Computer Access at School

All girls had access to computers and information regarding computer use. In school, each of the girls' classrooms was equipped with four Macintosh computers that had Internet access. The girls were able to use the computers to work on assignments. Classroom teachers integrated computer technology within all curriculum areas. Computers were used as tools to gather and impart information. The girls also had access to computers and information on the use of the computers in the school’s computer lab. The computer teacher, Dr. P., taught computer skills as she worked with students on a weekly basis in the computer lab.

Powerful Others at School

At school, teachers are the powerful others who provide computer access. Teachers provided time for computer use, instruction on how to use the computers and a constructivist learning environment in which the girls could create their web pages. The constructivist learning environment is one in which there is a goal directed, open-ended, problem-based activity

(Jonassen & Rohrer-Murphy, 1999). The team members were also powerful others, influencing the achievement of the girls.

Teachers played a role in all aspects of the girls' engagement with computers. Information was provided to the girls through feedback from the teachers and observation of their behaviors. The girls saw their teachers who, except for one, were all women, using computers on a daily basis.

The classroom teachers taught the girls to use the software in the classroom and Dr. P, the computer teacher, was mentioned throughout the interviews as being the most knowledgeable about computer technology. She taught the girls skills during their regularly scheduled computer lab time each school day. Dr. P. organized the Web Weavers Club and the classroom teachers distributed the application forms and encouraged the girls to join the club.

The narratives of the girls suggest the home access and support from parents and siblings, along with the school access and support as described by the girls in their interviews set up an expectancy for success. The girls joined the Web Weavers Club initiating the engagement with computers for the purpose of completing a web page.

Observations and Taped Sessions during Web Weavers Club

For the first fifteen minutes of each club meeting, the students gathered at a table in the middle of the lab and had a snack. The girls and boys talked about a variety of topics related to school and home. After ten minutes, the teacher directed the conversation to the tasks the students would be performing for the next hour. She asked the students to tell her what assistance they might need for creating their part of the web page. The children then went to an individual computer and engaged in an activity to work towards achieving the completion of a web page. The teachers acted as facilitators, assisting when asked and providing guidance when needed. The teachers called students together in pairs or small groups when choices needed to be made affecting the cohesiveness of the overall theme of the web page. Negotiations were required regarding who did what. Only on a few occasions did the teachers needed to redirect the girls' attention to remain on task.

During the observations of the Web Weavers Club, two themes emerged. The two themes were Ability and Control. Ability refers to the computer aptitude or skills the girls developed.

Control refers to the expectation that one can influence success through achievement that is contingent on one's own actions.

Ability

As the girls created the web pages, they engaged with the computer in various ways. The tasks changed throughout the construction of the web pages. They chose to learn how to use Hot Potatoes, a Half-Baked software freeware program developed by the University of Victoria's Language Centre to create a quiz for their web page. First, the students learned to create a quiz and save the quiz as an HTML document. Then they planned the questions and the possible response choices for each question.

When creating content web pages, the girls were more often involved in researching, typing, and designing graphics than troubleshooting glitches. At one time during my observations of the Web Weavers Club the researcher noticed each of the girls engaging in the following activities:

- Making image maps (invisible links on an image that take the user to another page)
- Scanning student drawn pictures to create gifs
- Learning how to create animated gifs
- Searching the Web to find audio sound bytes to add to the web page
- Creating the quiz page (using Hot Potatoes)
- Researching information on the Web for the text
- Forming the image maps so they would not overlap one another
- Finding graphics for the web pages from the Internet or shareware programs
- Creating backgrounds
- Finding related web pages that would give more information for the development of the text
- Surfing the Internet to find related web sites that would give additional information.

Although the girls did perform tasks as stated above, during the observations they engaged in one task more frequently than any other. They also chose the tasks they wanted to engage in most frequently.

Kara spent the majority of her time drawing and typing a food pyramid. When it was completed, she engaged in tying what she built visually into the rest of the Space theme. She

talked most often with other members of the club about non-computer related topics. I observed Kara off task on three occasions. She began the task of writing text for her food pyramid or quiz answers. Talking with a boy in her group or calling up an unrelated Internet site distracted her. She fluctuated from becoming disengaged and then reengaged in the computer activities.

Tina spent the majority of her time adding text, gifs, and tinkering to make all the links work. She often asked the teacher or her teammates for assistance with her task. Although she started the activity with minimal computer skills, by the end of the project she needed little assistance.

Linda spent the majority of her time typing text from the research she had done on the Internet. She tied the web pages together with a coherent story line that wove through the pages. She continually talked to members of her team, asking for information or their opinions. She offered her own opinions regularly and sought approval for what she was writing.

Brenda spent the majority of her time engaged in creating an animated figure of a cat to go along with the group's page. It was not until the last observation that she spent most of her time with the other members of her group. Brenda worked primarily on creating gifs.

Control

The girls controlled joining the computer club by filling out the applications and attending the club sessions. During the computer club the girls controlled the tasks and the amount of time spent on the task. They also controlled the attention of the teachers and other group members.

Kara's perception of her control at school was inflated. She perceived she had control of the boys in the group. It was interesting that Tina agreed with this perception. The teacher facilitators were the powerful others in control of the groups' progress. Kara worked on building her own portion of the web page. She drew a food pyramid and spent little time with the others in her group. The teacher did not see Kara organizing any of the group when they completed their individual pages.

Tina depended on the teacher to initiate engagement with the computer. She had no single predominant role in her group. She perceived herself as powerless in controlling the thematic content of the group's page. She resigned herself to the fact that there was little continuity to the separate sections of the web page. She did not perceive herself as having control

of the situation. At times, she was not on task, requiring the teachers to assist her. Once engaged, she learned to make links, created images and backgrounds and controlled the development of her computer skills.

Linda perceived her control over the group as its leader. She demonstrated leadership skills through consensus building. Her role as organizer was evidence of the control she did have over the successful completion of the web page. She collected the research done by the other members and wove a story with an overall theme and design. The teacher remarked that this group worked closely together to make sure the content was correct and the design of the quiz was user friendly. Linda demonstrated a determination to "get it right" by spending time focused on her own task and in collaboration with the other members of the group.

Brenda was in control of the amount of time spent creating an animated cat during the computer club sessions. She controlled the teacher of the computer club by asking for assistance with this one specific task. She wanted to learn the skills to create and revise the animated figures on the web page. She controlled the development of her computer skills, by persistently working on her ability to create animated gifs. When needed however, she responded to Linda's consensus building requests for creating a cohesive web page with her group.

Interpretation of the Findings

The following research questions guided data collection in the study:

1) What patterns distinguish how the girls engage in web page development during middle childhood?

2) What environmental and personal factors influenced the girls' engagement in the activity of web page development?

3) What were the girls' perceived reasons for their achievement in creating web pages?

Question One. What patterns distinguish how girls engage in web page development during middle childhood?

Behaviors pertinent to the girls' engagement with computers fell into two patterns. One pattern that emerged was the performance of roles observed as the girls participated in the Web Weavers Club. The second pattern was the socialization that occurred while engaging with computers.

Roles

During the construction of the web page, the girls took on various activity roles. The roles were interchangeable, allowing them to perform based on their skill levels and the needs of the group. The researcher identified four roles of engagement: Architect, Builder, Designer, and Unengaged.

The Architect is a visionary, the one who sees the big picture. She structures the pages of the web site so it flows and is connected. She keeps the content accurate by finding information and typing text for the group's web pages. She plans the number of pages in a stack. She coordinates the different people in the group to see that there is congruence. She decides on the text content and the visual content of the page so as to impart the information to the reader. Although learning to scan pictures, taking digital images of team members, and surfing the Internet for audio files were all valuable skills to learn, the Architect pulled it all together, creating a cohesive theme. Linda demonstrated herself to be an Architect from the first week. She envisioned and articulated to her group what she saw as the big picture of the web page. Tina took on the role of Architect for her group only after beginning the project as a disengaged member.

The Builder does the work of creating the content of the web page and tinkering to make it functional. She writes the text, imports graphics and animation, and creates buttons and links. It is the role of the Builder to methodically put the pieces together. All the girls were Builders at some time during the activity of creating a web page. Brenda spent the first few weeks totally engaged in creating an animated figure of a cat to go along with the group's page. In addition to being an Architect, Linda was an enthusiastic Builder of the text from the beginning to the end of the activity. She tied the web pages together with a coherent story line that wove through the pages. Tina started the activity with minimal building skills. By the end of the project she engaged in all aspects of building the web page. She added text, gifs, and tinkered to make all the links work. Kara spent the majority of her time as a builder. She created a food pyramid and focused on this one task. As Tina learned skills from the coaches, she became a Builder and towards the end, with the help of the teacher, tried to pull the page together.

The Designer concentrates on the visual aesthetics of the page. She creates the backgrounds, considering texture and color. The necessary skills for the Designer are the ability

to create animated gifs and scan student drawn pictures to create gifs. The Designer spends time searching the Web to find audio sound bytes to add to the web page and locating graphics for the web pages from the Internet or shareware programs. The Designer positions the text and graphics, matching the animation and sound with the overall theme of the page. All the girls designed portions of the group's web page as it related to their personal topic of the overall theme. Brenda and Linda, however, spent a large portion of their time designing the animation and graphics, making the pages cohesive, as a whole. It wasn't until the last two weeks that Brenda shared the role of Designer with the other members of her group. Brenda worked primarily on creating gifs. The teacher remarked, "Because of her drive and independence, I truly served as a facilitator, helping only when technical difficulties arose or a skill had to be taught." Kara and Tina designed their pages without connecting with the other members of their team until the very end of the project. Once the food pyramid was completed, Kara engaged in the role of Designer, tying what she built visually into the rest of the space theme.

At times, the girls were Unengaged. It was purposeful behavior, demonstrated when a student did not understand how to do something, decide what to do, or wanted to watch how something was done. Rarely was it because they were not interested. The teacher reported that, in the early meetings of the club, Tina was lost. She was interested in her topic but it took several club meetings before she engaged in an activity using the computer. Once she initially engaged with the activity she remained engaged most often as a Builder. Kara fluctuated from becoming disengaged and then reengaged in the activity. Since her participation in the club was due to her mother's strong urging, this activity may not have been something she would have done on her own. She appeared most comfortable in the role of a Builder, although she didn't know how to build a web page before she joined the club. Towards the last few club sessions, Kara and Tina took on the role of Designer.

The teacher felt there was no Architect for Kara's space and Tina's games teams. The group members were not very organized and motivated at the beginning of the program. This may have been due to the lack of a strong student group leader on each team at the beginning of the program and team members wanting to "explore" and "tinker" with the computer programs and peripheral devices rather than research and write about their topics. However, as time for posting web pages to the ThinkQuest Jr. server drew near, all team members appeared to become

much more focused and began working together to help one another. Creating the quiz for each web page seemed to be the one activity that brought them together to collaborate and review the web pages as a whole.

Socialization

The second pattern that emerged was the social interaction that occurred as the girls engaged with computers. Computer oriented behaviors and socialization were demonstrated in the context of the family at home and the groups at school.

At Home. Three of the four girls came from homes where the parents were divorced. The one girl who did have her father living at home did not spend time socializing with her while interacting with the computer. The other three girls had supportive mothers but they were not active computer users. The girls did not mention socializing with their mothers in relation to computers. Two of the girls had older brothers who they did socialize with in relation to computers on a regular basis.

The computer was in Kara's room and she did not have to share it with anyone. Kara only used it when she was bored or for homework. Occasionally, she played games with her younger sister. The socialization around computer use only occurred when she needed help from her parents on a particular task. In the Web Weaver's Club, Kara socialized while unengaged with the computer. She worked on her own page individually as the other members of the group did. There was not much social interaction until the end when they worked collaboratively to bring together visually what they had done on their separate topics. Although she socialized with other members of the group regularly, it was often while she was not engaged with the computer. Kara's computer use was an isolated activity.

Kara, who lived with both parents, had a dad who supported her use of the computer by loading software and helping with Internet use. He was not as socially involved with Kara as her mother was. Kara spoke most often about her mother. Social activities were non-computer related activities. They revolved around softball in which Kara's sisters and mother actively participated. Kara did not mention her friends.

Interaction with the computer was one of the many ways Tina socialized with her brother. They shared an older computer, with use restricted by her mom. Sometimes she and her brother played games together, and she used the computer for homework assignments and e-mailing

friends. Tina, like Linda, used the computer on a regular basis. They both competed with their brothers over access as well as enjoyed interacting with their brothers and the computer. Tina, however, socialized more frequently with her brother and was much less competitive than Linda. Tina attributed her success with getting along with the boys in her group to the fact that she spends so much time with her brother and enjoys being "one of the boys." Tina was highly influenced by her brother to join the Web Weavers Club. He was a member the previous year and they planned to create a web page at home together.

Linda's socialization with her father was on weekends. She did use the computer with him and competed with her brother so she could get her father's attention. She specifically learned skills so she could spend more time with her father doing activities on the computer. Linda used the computer to keep in touch with friends. She even coached them on how to establish e-mail accounts so they could write regularly.

Brenda's interaction with computers at home was similar to Kara's. She used it for playing games and doing homework assignments. Brenda did have to share the computer with the rest of the family, as it was located in the family room. There was little socialization other than occasionally teaching her younger sister something or playing a game with her. In the club, Brenda's primary role was the Builder. She did work as a team member by offering ideas and asking the group's opinion. She remained focused on the animation of the page. She learned her computer skills at school, not at home. Although Brenda spent weekends with her father, she did not speak about using the computer with him. She did not mention her mother's use of the computer either. Brenda mentioned that she e-mailed her friends.

At School. The cooperative learning groups were purposefully arranged by the teachers. The intent of the ThinkQuest Jr. contest was to have students work cooperatively to problem solve and research information. Evidence of the collaboration can be found in the structure of the three websites created by the teams. The games and space sites consisted of separate topics and each page was independent of the other. The Egypt site consisted of a cohesive theme. The nature of the Ancient Egyptian web page required that each page flow into the next, creating the historical fiction story. This may have been why the Ancient Egyptian team members collaborated more on the content of each page than did the other team members. The Ancient Egyptian team worked very closely to make sure the content was correct on the web pages, and

created the quiz for their web page. The Ancient Egyptian team seemed to be highly organized and self-motivated right from the beginning of the program. Due to the structure of the site, collaboration was a must.

Question Two. What environmental and personal factors influenced the girls' engagement in the activity of web page development?

Computer Access

At home, all girls had access to computers and information regarding computer use. Three of the four girls came from homes where parents were divorced. There were computers at each parent's house. One of the girls lived in the home with both parents.

In school, each of the girls' classrooms was equipped with four Macintosh computers each having Internet access. The computer lab in which the Web Weavers Club met contained 16 Macintosh computers.

Access to computers and information regarding the use of computers were antecedent conditions for expectancy for success. The girls engaged with the computers at home prior to coming to school. The prior knowledge of computers was a foundation as the girls learned computer skills. Learning takes place when a teacher builds upon a student's prior knowledge. This access increased the probability that the girls could engage with computers enough to become capable of using them to create a web page.

Powerful Others

In this study, powerful others refer to parents, siblings, teachers, and team members in the club. Powerful others provide access to and information about computers at home and at school. Information is provided by feedback and observing behaviors. During the middle childhood developmental stage the girls make references about themselves from observing their own behavior and in relation to others (Bandura, 1986).

At home, three of the four families of the girls provided models of computer use. Parents provided guidance and information for developing computer skills. Older brothers played a significant role in two of the girls' lives. Since learning occurs by observing others, spending so much time with brothers who are heavy users of computers affected the two girls' use of computers. Since the girls socialized with their brothers often, they had opportunities for collaboration using the computers. Although there was competition with their brothers over the

amount of time the girls were able to spend using the computers, the time spent collaboratively using the computer was beneficial. Kara was the only girl whose mother influenced her to join the Web Weavers Club. This influence was verbal encouragement not within the context of modeling by behavior. The mother was not a role model as a computer user. Although there was a father figure in the home on a regular basis, his influence on Kara's computer use was not as strong as her mother's.

At school, teachers provided time for computer use, instruction on how to use the computers, and a constructivist learning environment in which the girls could create their web pages. The constructivist learning environment is one in which there is a goal directed, open-ended, problem-based activity (Jonassen & Rohrer-Murphy, 1999).

Teachers played a role in all the girls' engagement with computers. Of all the girls, Brenda was most influenced by her teachers to use the computer. For a school project, Brenda's teacher taught her to do animation on the computer. Brenda shared that she had taught her classmates to do animation after she had learned to do it in school. When the teacher told her about the Web Weavers Club, she decided to join so she could create a web page. She was "into animation" and she wanted to learn more about it.

The team members were also powerful others, influencing the achievement of the girls. Having boys in the club sometimes provided a hindrance as they all mentioned their need to control what the boys did. Either the boys actually bothered the girls or they did not participate as much with the group as the girls would have liked. The cooperative learning groups consisting of boys and girls did provide an opportunity for collaboration. Since most of what we learn comes through interaction with others (Brandt, 1998), the team members in the groups were influential powerful others in this study.

Ability

Skinner and colleagues (1998) state that children perceive their ability as both stable and unstable. Ability that is stable refers to the cognitive intelligence such as that measured by IQ tests. Ability that is unstable is knowledge learned by performance or training. Computer aptitude is ability that is unstable and can be modified. In this study, ability refers to the computer skills the girls acquired for creating a web page. This includes skills learned at home as well as skills learned in school.

Skills Learned At Home. Kara learned to use word processing for typing assignments. She played computer games and sometimes taught her little sister to work the computer. Her dad let her use his laptop with Internet access for school projects. She didn't know how to build a web page before she joined the club. She did not acquire technical skills at home.

Tina learned many of her computer skills from her brother. Together they used puzzle-making software, played various computer games and went on the Internet to visit sites and check their e-mail. She watched her brother create web pages at home. He was in the Web Weavers Club the year prior to her being in the club. She did know how a web page was constructed but had not acquired the technical skills to do so herself.

Linda first started to use the computer at age seven or eight. She got a book all about computers to learn graphics. She uses the computer to play games, send e-mail to her friends, and create hyperstudio slide shows and videos. Linda loves to write and has taught herself to type quickly. She and her brother create animated characters and import music from the Internet to make up stories. The stories are turned into videos and hyperstudio slide shows. She described her characters and has ongoing episodes that relate to her own life experiences. She would like to use the computer two hours a day but has to compete with her brother for the access. Although she had not had the experience of building a web page, she had acquired the technical skills to do so.

Brenda talked about using the computer at home to play computer games and word process school assignments. She did not use the computer to build a web page or watch anyone else in her family do so. She had not acquired the technical skills at home.

Skills Learned At School. Some of the skills needed for creating a web page were learned at home or at school prior to joining the after-school club. However, most skills were developed during the computer club activities. At the beginning of the school year, none of the students had any substantial experience with web page authoring, although Tina did indicate that she had watched her brother create web pages. All the girls increased the level of their computer aptitude during the study. The teacher taught the students how to use the web authoring and gif building software.

Control

In this study, control is the expectation that one can influence success through achievement that is contingent on one's own actions. By belief in their control over the other three factors, the girls demonstrated expectancy for success by joining the Web Weavers Club.

The girls were able to control the time they spent using the computer at home to some degree. Two of the girls had to share much of their computer time with their older brothers. One girl had the control of her computer use as it was in her room. The fourth girl had little control of the time she used the computer because it was located in a family room and several other people had access to it. One parent did control the time by setting up restrictions for specific times when the computer could be turned on and how much time per day was allowed for its use.

Kara had limited control over her engagement with computers. Kara's mother and father both contributed to her use of computers at home. They provided her with the software and computer games to play. Her interaction with the computer at home was very different from the other girls because it was not self motivated. Kara received software and information from her parents. Kara was "told" by her mother to join the Web Weavers Club. At home, Kara perceived she had little control. She talked about how unfair it was being the middle child. She lived with both mom and dad, who took control of the games she played on the computer. Kara's powerful others, her mother in particular, initiated the interaction with computers for Kara.

Tina has not yet become aware of her control. She depended on her powerful others, both at home and at school, to interact with the computer. Tina's computer use at home is closely tied to the relationship with her brother. If she is using the computer independently, she is usually communicating with friends, using e-mail. The socialization factor with her brother and her friends drives Tina's use of the computer at home.

Linda's control was evident when she described that she was angry that her father was paying so much attention to her brother while interacting with the computer. She perceived she controlled this situation by learning "fun graphics" and showing them to her dad. He then spent more time interacting with her and the computer. She controlled her ability to develop computer skills by reading a book in second grade to teach her more computer skills. Learning these skills enabled her to interact with the computer at a level that would please her father. Linda liked to use the computer at home. "I use the computer each day, two hours if I'm lucky. I can't use it that much because my brother is on it all the time." Linda controlled her brother's computer use by

creating a "computer constitution" to equally divide the time spent on the computer. Although she said it was still not totally fair, she did increase her access to the computer.

Linda perceived she had control over her father's attention when she said, "I felt left out because my dad was confiding in my brother about the computer. So I learned graphics and stuff. My dad thought it was cool." As the result of doing something better than her brother on the computer, she was able to get her dad's attention, as she expected she would.

Linda has well developed computer skills. She has created several hyperstudio presentations about a character named "Cheesey." She was proud of her accomplishment. "I still do graphics, I think better than my brother now." Because she took control over her ability to develop her own computer skills, she was able to achieve hyperstudio presentations. Linda was proud of the fact that she could teach computer skills to her mom better than her brother could. She had learned much of her computer skills at home prior to joining the club.

Brenda's control was strong. Her home was the least supportive of computer interaction. Teachers at school were the powerful others who influenced her interaction with computers. She learned animation in her classroom and her desire to improve her skill in that area motivated her to join the Web Weavers Club. Her persistence at learning animation was evident in all of my observations. Like Linda and Tina, she was not influenced by her parents to join the Web Weavers Club.

Question Three. What were the girls' primary perceived reasons for their achievement in creating web pages?

Kara perceived that she was smart and thus, had a high degree of expectancy for success. She complained that she was the only girl with four other boys in the group, yet she felt she had control over them and they usually went along with what she wanted to do. She spent most of her time working on her part of the page individually. At the end of the club session, the group did work together to address the needs of the web site as a whole. Kara felt the group membership affected the successful achievement of creating the web page. "The hardest part was getting my team members to listen to me because I was the only girl in my group. I think the boys wouldn't listen to my ideas because I was just a girl (maybe I was smarter than they are and they didn't want to admit it!)."

The computer teacher noted that, except for the development of their quiz, it appeared that members of Kara's space team did not confer with one another. However, they were willing to read and comment on the way pages looked or how the text was worded. Once the individual pages were written, the teachers observed that the space team members invited one another to review the pages, and members of other teams also read the pages with interest. Most of the revision and editing ideas came from the coaches, although students did share related Internet web sites where students could gather additional information.

Tina perceived she was “one of the boys” and did not mind working as the only girl in the group. At the same time, she could not control the topic selections of the boys in her group. The boys did virtual games while she did her page writing about a real sport, gymnastics. She remarked that she was not as happy with the page because it really didn't "mix very well." The hardest thing for Tina was getting the backgrounds set on the web pages. Every time she put in the background she never saved it properly. The best thing about the club was making the whole web page and seeing it on the Internet. She felt the computer coaches, especially Dr. P., helped her achieve success.

The computer teacher noted that Tina asked her to explain something before engaging in a task. Tina worked individually and was persistent once she became engaged. She was social with the boys in her group. It wasn't until the end of the club sessions however that she interacted with her other team members to complete the quiz section of the group's web page.

Linda perceived herself as possessing the computer skills needed to be the leader of the group. Things got done because people listened to her. She felt that another reason it was easy to make decisions was because, after two boys left the original group due to conflicting schedules, the one who was still in the club did not want the girls to gang up on him. Linda perceived she had control over the group as the declared leader. Although she was the leader, she sought group consensus frequently. She controlled the information included in the web page as she wrote much of the text. Linda felt she could not control the amount of work done by Will, the only boy in her group. Therefore she had to do more work at home.

The computer teacher noted that Linda, from the first week, envisioned and articulated to her group what she saw as the big picture of the web page. Linda was an enthusiastic Builder of the text from the beginning to the end of the activity. Members of her Ancient Egyptian team

divided the researching tasks into the categories of architecture, games, social pyramid, gods, mummies, hieroglyphics, and schooling. They did most of their research at home using the Internet, a social studies textbook, and trade books. They gave their research notes to Linda, the team leader, who was responsible for taking the information and incorporating it into the fictional story she was writing for the web page. As Linda wrote the story, she often had questions about content. To help her with typing the story, Linda used an AlphaSmart keyboard at home. At the beginning of the club she downloaded the text from the AlphaSmart to the web page and revised the story with input from other members of her team, often obtaining their opinions and ideas. Linda was a strong leader, checking with team members during the school week to ask them how they were coming with their research.

Brenda thought she had a really good team. "We all got along together really well, and didn't really fight." The hardest part for her was getting used to saving and putting the animations in the right folder because she would usually put them in the wrong folder. She felt she really learned a lot from the teachers and group and had a lot of fun. Brenda agreed with Linda that they all talked together and decided on the things they needed to do. Brenda spent a large portion of her time designing the animation and graphics, making the pages cohesive, as a whole.

The computer teacher noted that once she assisted Brenda with explaining how to create the animation for the web page she interacted very little with Brenda. Brenda was totally engaged with the activity of creating and refining an animated cat. The teacher stated that Brenda was so intent on her task she did not interact with any other team member.

Summary

The Web Weavers Club, an after-school computer club, was the setting for the case studied. Observations and interviews of four girls and their teachers in elementary school were conducted between January, 2000 and March, 2000. The girls who participated in the study had various stories to tell of their home environments and computer use. At school, the environment for all of the girls was similar yet their roles changed as they engaged with the computer. The girls' perceptions of their successful achievement in creating a web page varied.

This chapter answered the questions posed by the researcher.

1) What patterns distinguish how the girls engage in web page development during middle childhood?

The two patterns that distinguished how the girls engaged with the computers were the roles the girls performed while creating the web page and the socialization that occurred while using computers. Four roles of engagement were identified: Architect, Builder, Designer, and Unengaged. The socialization that occurred was demonstrated by the interaction with parents, siblings and group members.

2) What environmental and personal factors influenced the girls' engagement in the activity of web page development?

The environmental factors influencing the girl’s engagement in web page development were computer access and powerful others. The personal factors were ability and control.

3) What were the perceived reasons for the girls' achievement in creating web pages?

The girls perceived they had the ability to create web pages and self selected to join the club and the interest group. They felt the teachers would assist them in developing the computer skills to do so. The girls perceived they had control over the creation of a web page by collaborating with others.

CHAPTER V

Recommendations and Conclusions

This chapter is presented in three sections. The first section is a discussion of the findings delineating the factors explored in the study. The second gives recommendations for future research. The third section provides recommendations for educators.

Discussion

Schools have a message to communicate about the future of work. Technological careers will increasingly draw on "people skills" as well as humanities and social sciences. It is important for girls to understand career options in information technology as well as the impact of new technologies on more traditional fields (NCES, 1999).

The standard for computer use necessary for preparing students for the workplace has changed over the years. Computer ability requires more than using the computer as a tool for word processing or use of the Internet and e-mail. Computer ability demands the use of abstract reasoning to apply information technology in innovative ways to solve problems. It necessitates the ability to interpret vast amounts of information with analytic skill to understand basic principles of programming and other computer science fundamentals. Computer ability means to continually adapt and learn new technologies as they emerge in the future (AAUWEF, 2000). It is the job of educators to ensure that girls are just as competent and prepared as their male peers to enter the pipeline towards careers in information technology.

There are environmental and personal factors that influence girls' initial engagement with computers. Early exposure to computers enables computer literacy to develop (Downes et al., 1996). Access to computers at home and at school affords girls the opportunity to retrieve information, manipulate data, and produce results in innovative ways. Engagement with computers occurs when there is an expectancy for success. Expectancy for success is the consequence of the belief in one's control over environmental and personal factors (Weiner, 1986).

The environment both at home and at school allowed the girls in this study to access computers. This access increased the probability that the girls could engage with computers enough to become capable of using them to create a web page. Access to information regarding computer use was provided to the girls prior to coming to school. This prior knowledge allowed

scaffolding to occur. Scaffolding using the computer is an interactive process in which the teacher assists the learner to build a structure to contain and frame new computer information (Bull, Shuler & Overton et al., 1999). The girls were ready to learn new computer skills since they had already acquired some skills at home. When the girls came to school they had already developed expectancy for success using computers.

Another factor influencing the initial engagement with computers was powerful others who provided computer access. Powerful others refer to parents, siblings, teachers, and team members in the club. At home, the families of the girls provided access to computers and to information on developing computer skills. The one girl who lived with both her mother and father was most influenced by her parent to join the Web Weaver's Club. The other three girls were primarily encouraged by a brother or a teacher. This demonstrates that, although parents are powerful others in control of access to the computer, because they are the ones who purchase the computer and provide software and information, girls can get involved with a computer club without the girls perceiving direct encouragement or influence by parents. The team members were also powerful others, influencing the achievement of one another. Powerful others impacted the girls' achievement by affording them adequate access to computers or providing motivation or instruction sufficient to engage with the computers. At school, teachers provided time for computer use, instruction on how to use the computers, and a learning environment in which the girls could construct their web pages.

The constructivist mode of learning promotes the theory developed by Piaget (1970) that knowledge is invented and reinvented. The constuctivist learning environment is one in which the learner builds knowledge while engaging in an activity (Jonassen & Rohrer-Murphy, 1999). The girls' role in the Web Weaver's club was to be actively involved creating a web page with a group of students. The teachers' role was to facilitate and work alongside the students as they learned computer skills such as using the Internet to locate information and web page authoring. The girls constructed their own knowledge through discovery and participation.

A major factor in two of the girls' initial engagement with computers was the relationship they had with older brothers. Since children learn by observing the actions of others (Bandura, 1986) having brothers who use the computer daily influenced the girls engagement with the computer. Social activities involving the computer with older brothers increased the computer

use by the girls. This influenced how the girls interacted with the boys in the teams at school. Computer use while socializing with boys was more comfortable for the girls with older brothers (McHale, Crouter & Tucker, 1999).

It is interesting to note that one of the girls used the computer to engage socially with her father. The father did not live at home with the family. When the girl went to his house on weekends, the computer became a focus of social interaction. There was competition with her brother over gaining the attention of her father. This influenced the amount of computer skills the girl learned. The girl purposely increased her ability to gain the attention of her father in competition with her brother.

In this study, ability refers to the computer aptitude of the girls. It includes skills learned at home as well as skills learned in school. These skills helped them to create a web page. Skinner and colleagues (1998) state that children perceive their ability as both stable and unstable. Ability that is stable refers to the cognitive intelligence that is inherited. It is demonstrated by an innate ability to work with and understand computer technology. Ability that is unstable is knowledge learned by performance or training. Computer aptitude is ability that can be modified. The girls demonstrated behaviors as builders and designers modifying their ability as their roles changed. Finally, the girls perceived they had control over their ability to learn computer skills.

Control is the belief that one can influence success through achievement that is contingent on one's own actions (Skinner, 1990). Believing they had control over the other factors, the girls were better able to successfully create a web page. The girls perceived they had control over their ability to learn computer skills. The access to computers at home was somewhat restricted by parents and siblings however the girls did have some degree of control over computer use and computer information. The control over powerful others at home and at school was demonstrated in the manipulation of the time and attention of parents, siblings and teachers as it related to computer use. The constructivist learning environment of the Web Weavers Club enabled the girls to learn by controlling when and how they used the computers.

The girls' belief that they had control over the outcome initiated and sustained their engagement with computers even though initially, they were influenced by a parent, sibling or teacher to join the Web Weavers Club. The successful creation of the web pages stemmed from

their belief that the girls had the ability to develop their unstable computer aptitude. The girls attributed their success to the teachers who provided them access and information to learn the computer skills. Two of the girls attributed their success to the fact they had older brothers who encouraged them. The girls believed that their control over the behaviors of the boys on their team affected the final product. Those that felt they did control the boys had more pride in the finished product than the girls who did not feel they had control of the boys' behavior.

Overall, the access to computers, the relationships with powerful others, and the girls perceptions of their ability to control influential factors, all worked together as antecedents for engagement with computers. The roles performed and the necessary social interaction sustained the engagement. The product, an educational web page, demonstrated successful achievement

The findings from this study support Weiner's Attribution Model (1986). The girls' achievement of creating a web page was a behavior resulting from their expectancy for success. The psychological consequence of expectancy for success was a result of the girls' control over their environments (computer access and powerful others) and their own aptitude and skills. My findings show that the girls self selected to join the computer club and perceived they had control over parents, siblings, group members, teachers, and their own computer aptitude.

Behaviors pertinent to the girls' sustaining engagement with computers were demonstrated in the changing roles they played while constructing web pages. The combination of roles that the girls tended to adopt to successfully create a web page within their group led to their achievement. The researcher has identified four roles of engagement: Architect, Builder, Designer, and Unengaged. The Architect was a visionary, the one who saw the big picture. She structured the pages of the web site so it flowed and was connected. The Builder created the content of the web page and tinkered to make it functional. The Designer concentrated on the visual aesthetics of the page. She created the backgrounds, considering texture and color. The girls blended creativity and insight with problem solving skills as they took on their various roles. As the girls performed various roles they learned new skills. The activity of creating the web page enabled the construction of new knowledge (Jonassen, Peck & Wilson, 1999).

Social interactions sustained the girls' engagement with computers. Within the social context of the family, the girls were able to use computers at home. However, there were restrictions on the use--either they needed to share the computer with other family members or

they were limited to a certain amount of time on the computer. In addition, they often interacted with siblings or parents while using the computer--playing with them, learning from them or instructing them. There was also social interaction during school related time on the computer. The collaborative learning environment engaged the girls socially with their peers. Negotiations were required regarding who did what and who had the most control over what was being produced.

Three of the four participants in this study were from homes whose parents were divorced, with the mother as the primary parental figure. The social configuration of the family unit did not necessarily reflect the need for a father to be present in the home to initiate computer use by girls. This supports research that states that in less traditional families, social learning processes may lead sisters and brothers to be more similar and to exhibit fewer sex-typed differences (McHale, Crouter & Tucker, 1999). Brothers serve as role models and girls value their brother's computer aptitude. In addition to their direct involvement, the brothers played an important role in the girls' sex role socialization when they served as sources of social comparison. Perceiving minimal sex-typed differences the girls with brothers were comfortable working with the computers in the family setting.

The girls who joined the Web Weavers Club did so with an expectancy for success using computers. When girls achieve success using the computer as they did in this study they have formed a sense of industry leading to self-efficacy in the domain of computer use (Eccles et al., 1998). If, as Weiner (1994) suggests, girls engagement in an activity is due to their expectancy for success the implications of these findings suggest that the success girls achieve will result in continued engagement with computers. Since, as Jonassen, Peck, and Wilson (1999) state, there is a reciprocal effect in regard to computer use and computer aptitude, the more girls use the computer during middle childhood the more competent they will become. The more competent they become, the more likely they will be to envision themselves as lifelong users of computer technology. It has been suggested that unless girls believe they can produce desired effects by their actions, they have little incentive to act (Bandura, 1996). The girls in this study did believe they could produce the desired effect of completing a web page. And they did.

In the specific domain of computer use, achievement using computers increased positive self-efficacy (Eccles & Wigfield, 1995). Specific to computer use this self-efficacy then will

translate into future expectancy for successful computer use. Studies showed that career choices were related to self-efficacy (McMahon & Patton, 1997; Solberg, 1998). One study indicated that expectation for success was one of the best predictors of career choice (Betz, Voyten & Klein, 1997). The implications of this study would lead us to believe that girls having a high degree of computer self-efficacy may make career choices that would lead to occupations where they could continue using computer technology.

Girls appear to value computers depending on the required social and performance roles. The findings suggested that when girls value the task, as demonstrated by selecting interest groups, they are likely to remain engaged in the task (Eccles et al., 1993). By valuing a task and having a goal directed activity, as these girls did, there was evidence of flow. The girls expressed an interest in the activity, and as research done by Csikszentmihalyim (1997) suggested, given the appropriate environment, a person will continue to explore that activity of interest. The flow state is reached when a person engaging in an activity loses track of time and sustains the activity. As a result of flow, skills improve and consequently self-efficacy for the activity is strengthened. Bandura (1986) hypothesized that individuals who feel efficacious would work harder and persist longer when they encountered difficulties, than those who doubt their capabilities. The present findings support this hypothesis.

Recommendations for Future Research

Research on computer use and aptitude of girls during middle childhood enables educators to conceptualize complex factors representing each person as a unique whole. Future studies need to be conducted to illustrate individual girl's experiences within educational contexts, coordinating concerns with social systems and individual identities. There needs to be more research asking questions about why girls use the computer. Qualitative studies examining what factors prompt girls' engagement in computer use will add to information on beliefs and valuing of computer activities in gender-role stereotypic ways (Kay, 1994).

There is a need for more middle childhood research. In the field of educational research on achievement motivation, there is value in exploring students' motivational experiences as outlined in Nicholls & Hazzard (1993). Nicholls' research examining students' experiences and their perceptions of ability indicated that ability is not easily understood by children. Although differentiated from effort and luck, ability is unlikely to mean the same thing to everyone.

Researchers studying motivation have discussed how children's achievement-related beliefs become established. Middle childhood is a crucial period. The computer-related beliefs and task values, as they relate to computer use, become established during this developmental period. More research during the middle childhood developmental period is needed to explain individuals' experience in their social context, their control beliefs, their engagement, and performance. Success raised efficacy, and failure lowered it, but once a strong sense of efficacy was developed, a failure might not have much impact. Bandura (1993) found that high outcome expectation, linked with high self-efficacy, produced high cognitive engagement.

Recommendations for Educators

"Powerful Learning", as described by Brandt (1998), occurs in an environment that supports the intended learning. People learn when they feel in control and use what they already know as they construct new knowledge. This study hopes to guide educators by providing an understanding of the conditions for girls' learning using computers.

The case study of an after-school computer club confirms the value of a constructivist learning environment. At the beginning of the study, the computer aptitudes of the girls were at different levels of development. Kara and Brenda had developed computer skills learned from playing computer games, word processing and e-mailing. Tina and Linda who had older brothers developed more technical skills. Linda had the most advanced computer aptitude having created video and hyperstudio shows. Despite the various skill levels, the girls believed their computer aptitude was modifiable and within the constructivist environment they had control of their learning. Regardless of where they began, they all progressed as a result of learning new skills needed to build a web page. The girls manipulated the computer as they performed various roles. They constructed meaning on the basis of their interpretation of data received from the computer.

Learners control their learning. The search for meaning takes a different route for each learner. Each student constructs her own unique meaning through her own cognitive processes. As educators we have great control over what we teach, but far less control over what students learn. This is the heart of the constructivist approach to education.

Educators should provide girls during the middle childhood developmental stage, numerous opportunities for discovery learning. The girls’ interactions with the computer can lead to changes in how they think about computer use. The constructivist learning environment

enables girls to take on various roles while increasing their computer aptitude. While providing the girls with discovery learning opportunities the teachers cast the girls in an active role. The teachers act as facilitators to encourage the construction of knowledge based on prior knowledge.

Educators should provide girls during the middle childhood developmental stage, with computer opportunities for social interaction in a positive emotional climate. Caine and Caine (1997) stated that the brain is a social brain, so most learning involves other people. Cooperative learning involves students working in small groups collaborating while engaged in a social activity. Knowledge and understanding occur during social activities through dialogue with others. As Vygotsky's (1978) theory suggested, children learn first through person to person interactions and then individually through an internalization process. The interactive environment should be set up to provide children with the social process of idea making using computers. In this setting, the teacher should act as a facilitator by asking questions that guide the social interactions.

In this study the girls who felt their product was not as cohesive as they would have liked, attributed this to their lack of control over the boys' collaboration. Educators should consider providing single sex cooperative learning groups using computers. Educators should consider providing girls with opportunities to self select their topics of interest. The purpose for using the computer should be based on what they feel they need to learn and what they feel is personally meaningful.

The Web Weavers Club was structured by self-selection. The girls opted into the club regardless of their computer ability, based on various factors mentioned previously. The constructivist learning environment, with cooperative social activities, enabled the girls to have control of their learning. Educators set up conditions for powerful learning, providing a choice of topics based on interest, and a choice of roles in the group. The girls lived up to the high expectations of the teachers. Powerful learning occurs when girls can learn in their own way, have choices and feel in control (Brandt, 1998)

As was done in the Web Weavers Club, teachers should design learning that empowers girls to make meaning through the mindful manipulation of the computer input. Teachers need to be architects who blend interactive settings, differentiated instruction, inquiry, experimentation, and investigation. To enhance girls' control, the teacher should assist girls to set their own

challenging yet achievable goals using computers. As the girls engage in activities to achieve their goal, educators should provide feedback in a positive emotional climate (Schunk, 1997). More qualitative research focused on why girls chose to engage with computer technology will assist educators to provide powerful computer learning opportunities.

Conclusion

The implications of the findings suggest that by age eleven girls can develop their computer aptitude to the degree that they are able to envision and create an educational web page. The environments in which the girls access computers at home and at school affect the girls' initial engagement with computers. Girls choose to engage in computer activities using the technology for various reasons. When provided the support to develop skills by powerful others, expectancy for success occurs and engagement with computers is sustained.

Girls' competence beliefs in domain specific tasks leads to expectancy for success (Eccles et al., 1998). During the middle childhood developmental stage, competency beliefs are high. Providing opportunities for learning computer skills will sustain expectancy for success. Powerful learning occurs when the girls learn in their own way, have choices, and feel in control.

In general, when asking if females have an aptitude for using computers, the answer is yes. When researchers study girls' aptitude using computers, results will depend on what skills are assessed, and what use is being made of the computer (Morritt, 1997). Girls can accept the computer not only as a tool for word processing or for use of the Internet and e-mail. They can broaden their computer ability to become "power users," understanding basic principles of programming and other computer science fundamentals. It is imperative to ensure that girls are just as competent as their male peers in being prepared to enter the pipeline towards careers in information technology.

References

American Association of University Women Educational Foundation. (1998). *Gender gaps: Where schools still fail our children.* Washington, D.C.

American Association of University Women Educational Foundation. (2000). *Tech-savvy: Educating girls in the new computer age.* Washington, DC.

Bae, Y., Choy, S., Geddes, C., Sable, J., & Snyder, T. (2000). *Trends in educational equity of girls and women*. Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1993). Perceived efficacy, cognitive development and functioning. *Educational Psychologist, 28*, 117–148.

Bandura**,** A. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development, 67*(3), 1206–1222.

Betz, N. E., Voyten, K., & Klein. (1997). Efficacy and outcome expectations influence career exploration and decidedness. *Career Development Quarterly, 46*(2), 179-89.

Bogdan, R. C., & Bilken, S. K. (1997). *Qualitative research for education* (3rd ed.). Boston: Allyn and Bacon.

Brandt, R. (1998). *Powerful learning*. Alexandria, VA: Association for Supervision and Curriculum Development.

Brunner, C., & Bennett, D. (1997). Technology and gender: Differences in masculine and feminine views. *NASSP Bulletin, 81*(592), 46–51.

Bull, K., Shuler, P., Overton, R., Kimball, S., Boykin, C., & Griffin, J. (1999). *Process for developing scaffolding in a computer mediated learning environment.* Paper presented at the American Council on Rural Special Education, Albuquerque, New Mexico.

Butler, R. (1999). Information seeking and achievement motivation in middle childhood and adolescence: The role of conceptions of ability. *Developmental Psychology, 35*(1), 146-63.

Cain, K. M., & Dweck, C. S. (1995). The relation between motivational patterns and achievement cognitions through the elementary school years. *Merrill-Palmer Quarterly, 41*(1), 25–52.

Caine, R. R., & Caine, G. (1997). *Education on the edge of possibility.* Alexandria, VA: Association for Supervision and Curriculum Development.

Camp, T. (1997). The incredible shrinking pipeline. *Communications of the ACM, 40*(10), 103–110.

Campbell, J., Hombo, C., & Mazzeo, J. (2000). *Trends in academic progress: Three decades of student performance* (NCES 20000469). Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Educational Statistics.

Carlson, E. A., Sroufe, L. A., Collins, W. A., Jimerson, S., Weinfield, N., Henninghausen, K., Egeland, B., Hyson, D. M., Anderson, F., & Meyer, S. E. (1999). Early environmental support and elementary school adjustment as predictors of school adjustment in middle adolescence. *Journal of Adolescent Research, 14*(1), 72-94.

Coffey, A., & Atkinson, P. (1996). *Making sense of qualitative data.* Thousand Oaks, CA: Sage.

Compeau, D., Higgins, C., & Hudd, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS Quarterly, 23*(2), 145-59.

Creswell, J. W. (1998). *Qualitative inquiry and research design*. Thousand Oaks: Sage.

Csikszentmihalyi, M. (1997). Flow and education. *NAMTA Journal, 22*(2), 2-35.

Denzin, N., & Lincoln, Y. (1994). *Handbook of qualitative research*. Thousand Oaks, CA: Sage.

Downes, T., Reddacliff, C., & Moont, S. (1996). *Children's use of electronic technologies in the home.* Sidney, Australia.

Ebbeck, M. (1996). Children constructing their own knowledge. *International Journal of Early Years Education 4*(2), 5-27.

Eccles, J., Wigfield, A., Flanagan, C., Miller, C., Reuman, D., & Yee, D. (1989). Self-concepts, domain values, and self-esteem: Relations and changes at early adolescence. *Journal of Personality, 57*, 283–310.

Eccles**,** J., Wigfield, A., Harold, R., & Blumenfeld, P. (1993). Age and gender differences in children's self and task perceptions during elementary school. *Child Development, 64*, 830–847.

Eccles, J., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21,* 215-225.

Eccles, J. (1998). Perceived control and the development of academic motivation. *Monographs of the Society for Research in Child Development, 63*(2-3), 221-231.

Eccles, J. S., Barber, B., & Jozefowicz, D. (1998). Linking gender to educational, occupational, and recreational choices: Applying the Eccles et al. model of achievement-related choices. In W. B. Swann, Jr. & J. H. Langlois (Eds.), *Sexism and stereotypes in modern society: The gender science of Janet Taylor Spence* (pp. 153–192). Washington, DC: American Psychological Association.

Erikson, E. (1963). *Childhood and society*. (2nd ed.). New York: Norton.

Fairbanks, C. (1996). Telling stories: Reading and writing research narratives. *Journal of Curiculum and Supervision, 11,* 320-340.

Ferris, S. P. (1996). Women on-line: Cultural and relational aspects of women's communication in on-line discussion groups. *Interpersonal Computing and Technology 4*(3-4), 29-40.

Fine, G. S., Kent. (1988). *Knowing children: Participant observation with minors*. Thousand Oaks, CA: Sage.

Gilligan, C. (1982). *In a different voice*. Cambridge, MA: Harvard University Press.

Glasser, W. (1996). Then and now: The theory of choice. *Learning, 25*(3), 20-22.

Haugland, S. (1996). Enhancing children's sense of self and community through utilizing computers. *Early Childhood Education Journal, 23*(4), 227-30.

He, P. W., & Jacobson, T. E. (1996). What are they doing with the internet? A study of user information seeking. *Internet Reference Services Quarterly, 1*(1), 31-51.

Heyman, G. D., & Dweck, C. S. (1998). Children's thinking about traits: Implications for judgements of the self and others. *Child Development, 69*(2), 391–403.

Huang, G., Taddese, N., & Walter, E. (2000). *Entry and persistence of women and minorities in college science and engineering education* . Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Hurley, N. P., & Vosburg, J. D. (1997). *Modern technology: The relationship between*

student attitudes toward technology and their attitudes toward learning using modern technology in an everyday setting. (143). Ontario, Canada.

Jackson, A., & Kutnick, P. (1996). Group work and computers: Task type and children's performance. *Journal of Computer Assisted Learning, 12*, 162-171.

Janssen, R., & Plomp, T. (1997). Information technology and gender equality: A contradiction in terms. *Computers and Education, 28*, 65-78.

Joiner, R., & Messer, D. (1998). The effects of gender, expectations of success and social comparison on children's performance on a computer based task. *Educational Psychology, 18*(3), 319-327.

Jonassen, D. H., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing consructivist learning environments. *Educational Technology Research and Development, 47*(1), 61-79.

Jonassen, D. H., Peck, K., & Wilson, B. G. (1999). *Learning with technology: A constructivist perspective*. Upper Saddle River, NJ: Merrill, Prentice Hall.

Josselson, R., & Lieblich, A. (Eds.). (1995). *Interpreting experience: The narrative study of lives*. Thousand Oaks, CA: Sage Publications.

Kay, R. (1992). Understanding gender differences in computer attitudes, aptitude, and use: An invitation to build theory. *Journal of Research on Computing in Education, 25*(2), 159-171.

Kay, R. (1994). Understanding and evaluating measures of computer ability: Making a case for an alternative metric. *Journal of Research on Computing in Education, 26*(2), 270-284.

Keeler, C. M. (1996). Networked instructional computers in the elementary classroom and their effect on the learning environment: A qualitative evaluation. *Journal of Research on Computing in Education, 28*(3), 329-345.

Keisler, S., Sproull, L., & Eccles, J. (1995). Poolhalls, chips, and war games: Women in the culture of computing. *Psychology of Women Quarterly 9*, 451-462.

Klein, A. Z., & Zhems, D. (1996). Self concept and gifted girls: A cross sectional study of intellectually gifted females in grades 3, 5, and 8. *Roeper Review, 19*(1), 30–33.

Krendl, K. A., & Broihier, M. (1992). Student responses to computers: A longitudinal study. *Journal of Educational Computing Research, 8*(2), 215-227.

Krishnamurthi, S., & Fisler, K. (1998). Rice University, Computer Science Department. [http://www.witi.com]

Levin, B., & Barry, S. (1997). Children's views of technology: The role of age, gender and school setting. *Journal of Computing in Childhood Education, 8*(4), 267–290.

Liao, Y. (1999). *Gender differences on attitudes toward computers: A meta-analysis* . San Antonio, TX: Society for Information Technology & Teacher Education International Conference.

Lofland, J., & Lofland, L. (1995). *Analyzing Social Settings*. Belmont, CA: Wadsworth Publishing Company.

Mahoney, J. E., & Knupfer, N. (1997). *Language, gender and cyberspace: Pulling the old stereotypes into new territory*. Albuquerque, NM: Association for Educational Communications and Technology.

Marshall, C., & Rossman, R. B. (1989). *Designing Qualitative Research*. Newbury Park: Sage.

Maxwell, T. (1998) *The information technology workforce crisis: Planning for the next environment*. State Univ. of New York, Albany.

McAdams, D., & West, S. (1997). Introduction: Personality psychology and the case study. *Journal of Personality, 65*, 757-783.

McCracken, G. (1988). *The long interview*. Newbury Park, CA: Sage.

McHale, S., Crouter, A., & Tucker, C. (1999). Family context and gender role socialization in middle childhood: Comparing girls to boys and sisters to brothers. *Child Development, 70*(4), 990-1004.

McMahon, M., & Patton, W. (1997). Gender differences in children and adolescents' perceptions of influences on their career development. *School Counselor, 44*(5), 368-376.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: A sourcebook of new methods*. Thousand Oaks, CA: Sage.

Morritt, H. (1997). *Women and computer based technologies: A feminist perspective*. Lanham, MD: University Press of America, Inc.

Nauta, M., Epperson, D., & Waggoner, K. (1999). Perceived causes of success and failure: Are women's attributions related to persistence in engineering majors? *Journal of*

Research in Science Teaching, 36(6), 663-76.

Nicholls, J., & Miller, A. (1983). Differentiation of the concepts of difficulty and ability. *Child Development, 54*(4), 951-59.

Nicholls, J., & Miller, A. (1984). Reasoning about the ability of self and others: A developmental study. *Child Development, 55*, 1990-1999.

Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review, 91*(3), 328-46.

Nicholls, J. (1990). What is ability and why are we mindful of it? A developmental perspective. In S. Kolligian (Ed.), *Competence considered* (pp. 11–40). New Haven, CT: Yale University Press.

Nicholls, J., & Hazzard, S. (1993). *Education as adventure: Lessons from the second grade*. NY: Teachers College Press.

Ordidge, I. (1997). IT's for girls—or is it? *Education and training, 39*(1), 30–35.

Orleans, M., & Laney, M. C. (1998). *Early adolescent social networks and computer use.* Paper presented at the Proceedings of the Families, Technology, and Education Conference, Chicago, IL.

Papa, A. (1999). *ThinkQuest Background Information* . (http://www.thinkquest.org/news/overview.shtml)

Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer*. NY: Basic Books.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. Newbury Park, CA: Sage.

Piaget, J. (1962). *Play, dreams, and imitation*. NY: Norton.

Piaget, J. (1970). Piaget's theory. In P. Mussen (Ed.), *Carmichael's manual of child psychology*. NY: Wiley.

Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Quinn, S. M. (1998). Electronic recess: Observations of E-Mail and Internet surfing by K-12 students. *T.H.E. Journal, 26*(1), 60.

Rubin, H. J., & Rubin, I. S., (1995). *Qualitative interviewing: The art of hearing data.* Thousand Oaks, CA: Sage.

Sattler, C., Kirshstein, R., Rowe, E., deFur, E., Kleimann, K., & Haag, P. (1998). *Gender gaps: Where schools still fail our children*. Washington, DC: American Association of University Women Educational Foundation.

Schunk, D. (1984). Sequential attributional feedback and children's achievement behaviors. *Journal of Educational Psychology, 76*, 1159-1169.

Schunk, D. (1990). Introduction to the special section on motivation and efficacy. *Journal of Educational Psychology, 82*, 3-6.

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*, 207-231.

Schunk, D. H. S., Carl W. (1991). *Process goals and progress feedback: Effects on children's self-efficacy and skills.* . Chicago, IL: American Educational Research Association.

Schunk, D. H. (1997). *Self-Monitoring as a motivator during Instruction with elementary school students.* . Chicago, IL: Annual Meeting of the American Educational Research Association.

Schunk, D. H. (1998). Goal and self-evaluative influences during children's cognitive skill learning. *American Educational Research Journal, 33*(2), 359-82.

Serbin, L., Powlishta, K., & Gulko, J. (1993). The development of sex typing in middle childhood. *Monographs of the Society for Research in Child Development, 58*(2), 1-95.

Shashaani, L. (1994). Gender differences in computer experience and its influence on computer attitudes. *Journal of Educational Computing Research, 11*(4), 347–67.

Shashaani, L. (1997). Gender differences in computer attitudes and use among college students. *Journal of Educational Computing Research, 16*(1), 37–51.

Singer, D., & Revenson, T. (1996). *A Piaget primer: How a child thinks.* NY: International Universities Press, Inc.

Skinner, E. A. (1990). Age differences in the dimensions of perceived control during middle childhood: Implications for developmental conceptualizations and research. *Child Development, 61*(6), 1882-90.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571–581.

Skinner, E. A., Zimmer-Gembeck, M., & Connell, J. (1998). Individual differences and the development of perceived control. *Monographs of the Society for Research in Child Development, 63*(23), 12–19.

Solberg, V. S. (1998). Assessing career search self-efficacy: Construct evidence and developmental antecedents. *Journal of Career Assessment, 6*(2), 181-93.

Stake, R. (1995). *The art of case study research.* Thousand Oaks, CA: Sage.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Sutton, R. E. (1991). Equity and computers in school: A decade of research. *Review of Educational Research, 61,* 475–503.

Swan, K., Bowman, J., Holmes, A., Schweig, S., & Vargas, J. (1999). Reading the web: Making sense of the information superhighway. *Educational Technology Systems, 27*(2), 95-104.

Thorkildsen, T. & Nicholls, J. (1998). Fifth graders' achievement orientations and beliefs: Individual and classroom differences. *Journal of Educational Psychology 902,* 179-201.

Turkel, S., & Papert, S. (1990). Epistemological pluralism: Style and voices within the computer culture. *Journal of Women in Culture and Society, 16*(1), 128–157.

Turkel, S., & Papert, S. (1993). Styles and voices. *For the learning of mathematics, 13*(1), 49–52.

United States Bureau of Labor Statistics. (2000). *Occupational outlook handbook*. Washington, DC. (http://stats.bls.gov/blshome.htm)

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Webb, M. E. (1994). Beginning computer-based modeling in primary schools. *Computer Education, 22,* 129–144.

Weiner, B. (1986). *An attributional theory of motivation and emotion.* NY: Springer-Verlag.

Weiner, B. (1994). Integrating social and personal theories of achievement striving. *Review of Educational Research, 64*(4), 557-573.

Whitley, B. E., Jr. (1997). Gender differences in computer-related attitudes and behavior: A meta-analysis. *Computers in Human Behavior, 13*(1), 122.

Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbreton, A.J.A., Freedman-Doan, C., & Blumenfeld, P. (1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-Year Study. *Journal of Educational Psychology, 89*(3), 451–469.

Wolcott, H. (1995). *The art of fieldwork*. Walnut Creek, CA: Alta Mira Press.

Yelland, N. (1993). Young children's attitudes of computers and computing. *Australian Journal of Early Childhood, 20*(2), 20–25.

Yin, R. (1994). *Case study research: Design and methods (2nd ed.)*. Thousand Oaks, CA: Sage.

Yong, Y. (1998). Learners' perceptions on learning through the Web. *Journal of Instruction Delivery Systems, 12*(1), 23–26.

Zuga, K. F. (1999). Addressing women's ways of knowing to improve the technology education environment for all students. *Journal of Technology Education, 10*(2), 57-71.

APPENDIX A

ThinkQuest Jr. Judging Rubric

The four judging criteria, weighted as indicated below will be used for all category awards.

1. **(50 points) - Educational Value**

   In order to encourage teams to create entries that have significant educational value, the Judges will evaluate:

   a. The importance of the educational objectives of the entry;

   b. The extent to which the entry meets these educational objectives in (a) above; and

   c. The originality, innovation and artistic presentation of the entry and its material.

2. **(25 points) - Entry Quality**

   In order to encourage students to create high-quality entries, the Judges will evaluate:

   a. The technical quality of the entry, including its reliability, ease-of-use, internal consistency, robustness, and its ability to perform quality checks on data submitted, and to work efficiently as the increasing numbers of students and schools use the entry, and

   b. The quality of the content of the entry, including the accuracy and completeness of information (formulae, propositions, text, illustrations, etc.), the expressiveness and clarity in communication of ideas, and the appropriateness of the attribution(s) of the work of others.

3. **(15 points) - Internet Style of Learning**

   In order to encourage each team to create an entry which uses computers and the Internet to enhance the users' learning experiences, the Judges will evaluate the extent to which an entry:

   a. Allows for active participation by others.

   b. Encourages others to share data, ideas, and materials that can enrich the overall value of the entry, and that help to create a "learning community" around the entry, and

   c. Fosters interactive, participatory, collaborative "Internet style" learning that encourages users to explore the Internet's timely resources and to create new relationships that broaden the community in which they live.

In the entry form, each team should describe how its team members believe the entry will allow, encourage and foster these activities and how these activities will enrich the value of the entry.

4. **(10 points) - Entry Usage**

   The Judges will determine whether an entry has been, and is likely to be, highly used by others. This evaluation will be based on:

   a. The valid frequency of use of an entry, the nature of its use and users, and the comments of other users about the entry.

   b. The expectation that other students will heavily use the entry.

   Consequently, factors students should consider as they build an entry include:

   - the entry's appealing nature
   - its breadth of potential users
   - its educational effectiveness
   - its originality, appropriateness, and clarity
   - the number of languages used, and
   - its ability to work on a variety of platforms and browsers.

APPENDIX B

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Informed Consent for Participants
Of Investigative Projects

Title of Project Girls Engagement With Computer Technology During Middle Childhood
Investigator Denise Chase

I. The Purpose of this Research

The purpose of the study is to describe the causal dimensions that attributed to the successful creation of web pages by girls in the middle childhood developmental stage. By gaining an understanding of the motivating factors in acquiring computer skills to enable the creation of web pages educators can set up conditions for future technology learning.

II. Procedures

A qualitative interview approach with descriptive method of data collection will be employed in this project. Data in this study will be primarily generated through interviews with elementary school aged girls, informal conversations with their teacher, observations and interviewer's reflective notes. The criterion for selection was the creation of a web page. Five girls were selected based on their principal's recommendation.

Participants in this study will be asked to do the following:

1) Be interviewed two times for no more than thirty minutes each. The first interview will be with the teacher in the classroom or other room in the school. The interview will consist of questions asking to describe the use of computers at home and in school. The teacher will be asked to describe the interaction of the girl with computers in the classroom. The second interview will be in school with the interviewer asking questions about interests in and out of school, people that

are admired, beliefs about ability and control over learning. A tape recorder will be used to tape the conversations.

2) Be observed for twenty minutes while working on the web page explaining what is being done and why. A tape recorder will be used to tape the conversations.

The data will be coded and analyzed using NUD*IST software. Categories will be created based on themes, ideas, related terms and processes the girls share. Validity and reliability of findings will be addressed through triangulation of multiple data and data collection methods.

III. Risks

There are no risks to the students or the teachers as a result of the research. Names will not be used in any reports and none of the students' work will be graded. The participants will have an opportunity to read what is written and names will be withheld. Teachers' remarks will be confidential. The teacher and a student's parent must make the request for a final copy of the report in writing.

IV. Benefits of this Project

There is a dearth of women in technology rich careers. Expectancy for success in these fields motivates women to develop technology skills. Engagement in the activity of creating web pages demonstrates an aptitude in using technology. There is little known of girls in the middle childhood stage of development who have successfully achieved such technology competence. The benefits of this project are for educators to understand what conditions can be set up to motivate girls to engage in web page development. Findings from this study will add to the knowledge of middle childhood development and the motivation dimensions of attributions.

V. Extent of Anonymity

Individuals in this study will not be identified. Names of the subjects and their teachers will be coded as case numbers. The coded information will be in the investigator's computer. The audiotapes will be secured in the investigator's home office desk. The investigator will be the

sole individual transcribing the tapes to text. The tapes will be destroyed five years after publication of the dissertation.

VI. Compensation

There is no compensation earned for participation in this study.

VII. Freedom to Withdraw

Subjects are free to withdraw with no penalty at any time. Subjects are free not to answer any question or respond to situations that they choose without penalty.

VIII. Approval of Research

This research project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University and by the principal of the Elementary School in Fairfax County Public School.

IX. Subject's Responsibility

I voluntarily agree to participate in this study. I have the following responsibilities:

Answer questions about my interests and ability.

Answer questions about my use of computers.

Describe my engagement in the activity of creating a web page.

X. Subject's Permission

I have read and understand the Informed Consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project.

If I participate, I may withdraw at any time without penalty. I agree to abide by the rules of this project.

_____

Signature **Date**

If I participate, I may withdraw at any time without penalty. I agree to abide by the rules of this project.

_____

Signature **Date**

_____

Parent's Signature **Date**

Should I have any questions about this research or its conduct, I may contact:

Denise Chase _____

Investigator Phone

Dr. Marilyn Lichtman _____

Faculty Advisor Phone

Dr. Cline _____

Chair IRB

Research Division Phone

December 13, 1999

Dear Parent/Guardian of ,

I am currently conducting research for my dissertation. I am in the Ph.D. program at Virginia Tech in the Department of Educational Research and Evaluation. My study is what motivates girls in elementary school to create their own web site. I have attached the Informed Consent form, which explains the purpose and procedures for this study.

Your daughter was selected by her principal as a possible participant in my study. I would be very interested in interviewing her and discussing her web page. The interviews would be conducted in school and would relate to her learning.

Please read the attached information and discuss the study with your daughter. If you and she are interested and willing to participate, please sign the two forms and return them to the principal, Lynn Pope.

I appreciate your kind attention to this matter.

Sincerely,

Denise Chase
Principal
Poplar Tree Elementary School

Permission to Tape Record

Name of Student/Teacher_____

I give permission for Denise Chase to tape record an interview, which will be used for research for a doctoral dissertation. My identity and school name will be coded and known only to the researcher. The researcher will eliminate all names and indicators on by identity from the tape prior to it becoming transcribed into text. I am guaranteed that neither my name nor the school's name will be used in the written dissertation report.

_____

Signature of Student/Teacher

_____

Parent's Signature

APPENDIX C

Individual Interview Questions

- Tell me about yourself and your family.
- What are your interests in school/outside of school?
- Describe your computer use.
- Tell me when you began using the computer.
- When do you use it?
- Who do you use it with?

Informal Conversations During the Club

- Show me your web page. When did you begin creating it?
- What did you learn creating the web page in the club?
- Was it easy to do?
- Who helped you?

APPENDIX D

Field Notes using NUD*IST

Storing and organizing files

I practiced moving the pilot interview document from Word to NUDIST

Creating a Template

I created an a priori template

Storing and organizing files

After each interview I transcribed the text from tape to Word. After three of the interviews I imported the Word document to NUDIST. I had the individual interviews in separate project files at first. I later imported them into one project called dissertation. At first I did not pay attention to the text units, but later found by deliberately creating meaningful text units I could code the text more effectively.

It was difficult at first to remember the nuances of the software package. Every time I would get away from it I would need to take extra time to remember the specifics needed in opening up the files and importing it from Word.

I created a very basic template for my Prospectus, which I think now, was premature. I should have looked at the transcripts in a more holistic manner. After transcribing the interviews and observations I created another broader template as suggested by Creswell in his book. A positive to creating a theme template first is when coding the text I initially had a common place to put the initial categories for searching for themes.

Storing and organizing files

I continued to put word documents into NUDIST in the Dissertation Project file
It became easier to do so.

I coded the files and made nodes

I started with 4 nodes, which grew, to 8

Searching for themes

I added categories under the initial theme creating "children" or sub categories. I tagged segments of text from all of the documents that related to a single idea

I queried the database for all information pertaining to a single theme. I used the tree diagram to help me visualize the data and analyze the meaning of the text.

Crossing themes.

I ran reports and read my memos to discover

Diagramming

While categorizing the information into nodes, I continually used the tree diagram to make a visual picture of my thinking.

Create a template

I realize after reviewing Creswell's book and use of NUDIST my original template was only a Theme section of the whole Tree Diagram. I expanded the tree diagram to make nodes on Case context. I added information about the girls, their family and the club.

At this time my themes section contains 8 nodes with several "children"

The template allows me to illustrate developing a visual model for analysis of the data to frame the analysis within a case study tradition of inquiry.

I created more nodes with working "titles" and continually revised it

I created a "Quotes" node including salient quotable material .I intend to begin and end with a vignette and I will search these quotes for the vignette I will use.

I used the matrix feature of program to compare categories of information.

I created a node for metaphors with children of different types of metaphors. I found text in which metaphors were presented and grouped into categories.

Searching for themes

I learned to code using an easier process. You can add codes from the palette and press select. The Index Tree diagram comes up and you add the coding right there. I used to have to look at a printout of the tree diagram

I printed a report noting margin codings for the first time.

Re-searching for themes

I made an outline. The construct of the attribution theory was the framework for description. I realized the findings were supporting the theory and fitting into the construct. I was able to write within that framework easily. I saw the relationship to the literature and made the connection in my mind. It was finally coming together. As I went back to develop the themes I needed to search in NUD*IST to reconfirm and find quotes to support my interpretations.

I examined my text database to determine where I can select text that conveys a description of the individual, specific events, my own personal interpretation of events, and implications for the reader.

Mistakes

I deleted all my coding. It was horrifying at first but then as I recorded the interviews I realize I am either reconfirming my original thinking or changing my mind as I look at it again

I learned to delete the code easily and change from one node to another.

Advantages of the software:

Conceptual network builders and Look at data base line by line

Data is not fixed or set once it is in the category first put in

Locate material whether the material is an idea, a statement, a phrase or a word

Disadvantages of the software:

Learning the computer program is time consuming

Need to read the material first to get a sense of the whole

Program is an adjunctive procedure in the analysis process

Vita

Denise Chase was born on August 12, 1948. She attended Catholic elementary and middle schools and public high school in Long Island, New York. She graduated from Valley Stream South High School in 1966. She earned a Bachelor of Arts degree in Education from the State University College at Potsdam in 1970. She completed her Masters in Education from State University College at Stony Brook in 1976. In addition, she earned an Administrative Endorsement from Virginia Polytechnic Institute and State University in 1986.

Mrs. Chase has taught fourth grade and sixth grade for the Sachem District in Long Island and third grade, gifted and talented fourth and sixth grade, in Fairfax County Public Schools in Virginia. She was the assistant principal at Centreville Elementary School and White Oaks Elementary School. Mrs. Chase was the principal of West Springfield Elementary School for six years. She currently leads the instructional program at Poplar Tree Elementary School, with 800 students in grades K-6. Besides the regular education program, the school includes a Head Start class, five classes of autism, and three classes of moderately to severely disabled special education students.

Mrs. Chase was the recipient of the Virginia State School Bell Award given to principals who have contributed to the field of education and have demonstrated high achievement. In the field of research, she has presented at the National Conference of the Community of Caring, which is affiliated with the Kennedy Foundation. Her professional affiliations include: Fairfax, Virginia State, and National Associations of Elementary School Principals, Phi Delta Kappa, and the Association for Supervision and Curriculum Development.

_____

Denise Chase