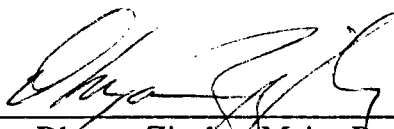


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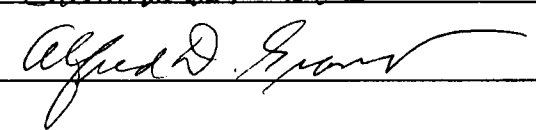
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Jennifer S. Wolfkill
July 19, 1995

**AN ANALYSIS OF GENDER BIAS
IN CD-ROM EDUCATIONAL SOFTWARE**

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Jennifer S. Wolfkill
August 1995

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DEDICATION

This research is dedicated to my parents, Jay and Sharon Kieseewetter. They have always instilled in me the importance and value of education. Most importantly, they have always believed in me, supported me in my endeavors, and encouraged me to be my best. Their love and support are instrumental in enabling me to reach this point in my education.

This research is also dedicated to my wonderful husband, Jason. His love and encouragement have kept me afloat throughout this enormous project. His interest in my graduate work coupled with his belief in my abilities gave me the motivation necessary to complete this degree. His encouragement and support have always given me the confidence I need to achieve my goals. To him, thank you.

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ABSTRACT

This research examined the extent of gender bias in educational CD-ROM software targeted to children aged three to eight. The study was designed to augment past research that may already be outdated due to the changing nature of computer technology and to discover questions for further research. The research method for this study was content analysis. Four coders content analyzed ten randomly selected pieces of software produced and distributed by three major companies. The coders examined the character portrayals and program elements in each CD-ROM program. In examining these areas, coders categorized each character that they observed and recorded their overall interpretations of the program elements. The research found that male characters appeared more often than female characters in the software studied and that male characters were more likely to assume active roles than were female characters. Also, the research found that the program elements in the software studied were not targeted to primarily male or female users; instead, each program incorporated elements that would appeal to both male and female users. Finally, the research suggested that male users and female users may perceive character portrayals, character roles, and program elements differently.

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CHAPTER ONE

Introduction

In the past few years, the use of educational technology has increased rapidly. In 1988-89, only 3% of schools had CD-ROM technology. In 1993-94, 43% of schools had CD-ROM technology (Berger & Kinnell, 1994, p. 26). In 1992-93 alone, CD-ROM use in schools increased by 93%. Also, in that same school year, video laserdisc use in schools increased by 80% ("Multimedia . . .," 1993). These growth trends are indicative of the pervasiveness of technology in our society. Children today will need to have an extensive working knowledge of technology and its many applications in order to pursue future educational and career goals.

Recent research indicates, however, that all children are not gaining this knowledge equally.

While girls and boys show similar appreciation of the significance computers have for their personal futures, boys are more likely to take more computer courses in schools than girls, to report using computers in extracurricular settings more often than girls, and to report more frequent home use of computers than girls. (Lockheed, 1985, p. 117)

Large differences in male and female computer use also exist. For instance, girls are underrepresented in programming courses, game playing, and extracurricular computing activities whereas they are overrepresented in word processing courses (Sutton, 1991, p. 482). Also, although there is usually equal access to computers in schools, research indicates that girls tend to access computers significantly less than boys (Brady & Slesnick, 1985; Sanders, 1985). Additionally, research suggests that one possible reason for less female access of computers could be male aggression.

"Sometimes, the enthusiasm of boys to get to the computer [results] in verbal and physical aggressive behavior, which [discourages] girls from gaining access" (Sutton, 1991, p. 485). Thus, recent research suggests "that computer use during the 1980s did not bring education closer to equal educational opportunity. Rather, it maintained and exaggerated existing inequities in education" (Sutton, 1991, p. 494).

Differences in male and female computer use not only affect children's school performance but also could affect children's future careers.

Beginning with the preschool years, males consistently spend more time than females in computing activities. For males, such concentrated involvement translates into higher achievement scores than females in computer-based technology in both academic and career settings. For women, the outcome is lower technological skill levels than males. This discrepancy, if allowed to continue, could impair our nation's ability to compete in a technological world market since women constitute almost half of the work force in the United States. (Nelson & Watson, 1991, p. 346)

Research to date has indicated that a gender gap exists in the use of educational technology. Some research has explored possible reasons for this gender gap, but much more research is needed in order to understand fully the underlying causes. One possible contributing factor is computer software content is oriented towards males more than females. Some research has explored gender bias in graphics, pictures, and text in other curricular materials.

Sex-role stereotyping, discriminatory presentations of women, as well as the marginalizations of girls and women in textbooks not only portray an inaccurate view of society, but also play powerful roles in the socializations of both male and female students. (Biraimah, 1993, p. 285)

This gender bias may be present not only in more traditional educational materials but also in newer curricular materials such as computer software. Some research has focused on determining what kinds of program elements appeal to each sex. For example, males prefer "games with a shooting or propelling object through space fantasy, scoring, graphic-oriented feedback, absence of verbal feedback, and a format with action and aggression" (Cooper, Hall, & Huff, 1990, p. 421). Females prefer "a format without aggression and shooting action, word-oriented tasks, verbal feedback, completion tasks, cooperation, purposeful or practical tasks, and music" (Cooper et al., 1990, p. 421).

In the past, much educational software has emphasized the elements with primarily male appeal. For instance, research has indicated that some of the most popular educational computer programs have "had a predominantly male orientation, using symbols such as guns, space missiles, or warships. Action, competition, and aggression have been the preferred designs" (Cooper et al., 1990, p. 420). The male orientation of software not only deters girls from computer use but reinforces stereotypical perceptions that computers are primarily for male use (Rosenthal & Demetrulias, 1988, p. 154). Research also indicates that "the majority of girls do not respond positively to software programs that require aggression and competition to solve problems; neither do they respond positively to programs that use traditional male symbols for motivation and reinforcement" (Rosenthal & Demetrulias, 1988, p. 154). For these reasons, "there's very little [software] for girls that stimulates the same kind of software infatuation that is currently drawing boys into the world of computers" (Brady & Slesnick, 1985, p. 23).

Software developers can rectify gender bias by creating truly gender-neutral software that "holds equal appeal for girls and boys primarily because it is flexible

enough to be adapted to whatever interests girls or boys bring to it" (Brady & Slesnick, 1985, p. 24). Before this can effectively be accomplished, more research is needed to investigate the effects of the incorporation of biased elements on boys and girls. However, it must first be determined to what extent these elements are incorporated in various types of educational software currently used in schools. This determination will serve as an important step in defining the gender bias problem in software as well as a starting point for the development of solutions.

Statement of the Problem

Today, public schools increasingly are relying on technology to supplement curricula and to broaden students' learning opportunities. As technology advances and the cost decreases, computer applications in the educational field will multiply. Already evidence of this growing trend exists. For example, "according to Denver-based market research firm Quality Education Data (QED), use of CD-ROM in schools increased nationally by 93 percent" ("Multimedia . . .," 1993) during the 1992-93 school year. As of 1994, 43% of schools used CD-ROM. In other words, 15 million public school students had access to CD-ROM technology (Berger & Kinnell, 1994, p. 26). Educational use of interactive video laserdiscs has also increased. During the 1992-93 school year, use of video laserdiscs increased 80%. Also, between September 1991 and December 1992, over 850 new education/training laserdisc titles were released ("Multimedia . . .," 1993).

These figures are astounding; however, this research, in many cases, suggests that this technology is being used blindly. Little research which examines gender bias in software content has been conducted. Therefore, much software is being

incorporated into schools' curricula without thought to the possibility of gender bias. The small amount of research that has focused on gender roles in software, even if conducted in recent years, has already been outdated by the pace of technology. Therefore, there is a need for additional research.

Purpose of the Study

The purpose of this study is to analyze gender bias in educational software primarily intended for ages three through eight and designed for CD-ROM technology, which is currently used in American public schools. There are several research questions:

1. How many male and female characters are presented in each computer program? What type of role does each character assume?
2. Does the structure of the individual software programs contain elements (e.g., audio, feedback, scoring) that appeal to male users or to female users; or is the appeal gender-neutral?
3. Is there a relationship between the software program's subject matter and the appeal of the elements and the characters of the program structure?

Significance of the Study

Since the growth of educational software is increasing rapidly, it is necessary to continue evaluating the programs for gender bias. If gender bias in software exists and continues to go unchecked, negative stereotypes of females already common in society will be reinforced in children's minds. Gender bias in software can also turn girls away from technology and the software itself. If software content primarily appeals to males, females will not find programs interesting and will interact with technology less than males. Less interaction with technology could cause poorer computer competencies among females, thus hindering girls' future educational opportunities and future career opportunities in a world where computer technology is pervasive. This study plans to determine the current status of gender bias in educational software while providing information and questions that can be addressed in future research on this topic.

Definitions of Terms

Gender Bias: A leaning toward the interests of one gender or the other. Since most software studied to date has been more male-oriented than female-oriented, gender bias in this study will refer to software content that appeals more to males than to females.

Gender-Neutral Software: "The kinds of tool programs that provide open-ended frameworks within which people can work in individual ways to accomplish individual

goals. Such software holds equal appeal for girls and boys primarily because it is flexible enough to be adapted to whatever interests girls or boys bring to it" (Brady & Slesnick, 1985, p. 24). For example, programs that allow children to create their own games or to measure their own vital signs (Brady & Slesnick, 1985, p. 26).

Stereotype: A standardized conception or image invested with special meaning and held in common by members of a group. In this study, the term *stereotype* will refer to negative and incorrect conceptions of males and females.

"Girl" Software: Computer programs that are intended to attract females by appealing to their interests but end up reinforcing negative female stereotypes by focusing on such topics as shopping or housework, or stereotypical perceptions, such as girls like spelling but hate math.

Characters: Representations of humans or animals that take on human qualities in computer programs.

Elements: A component part of the software's content. In this study, elements refer to component parts such as graphics, scenes, audio, objects, feedback, and colors.

Structure: The manner in which elements of a computer program are arranged, organized, or interrelated.

Compact Disc-Read Only Memory (CD-ROM): A technology utilizing optical discs to store large amounts of data, such as audio, video, graphics, and text, for interactive use with personal computers.

Video Laserdisc: An interactive multimedia delivery system which uses specially formatted optical discs with a dedicated player and a television set.

Organization of Chapters

Presented in five chapters, this research analyzed the content of twelve educational CD-ROM programs primarily intended for children ages three through eight, determined the number of female and males characters in each program along with their corresponding roles, and examined specific elements in each program to determine gender perceptions of that program.

Chapter One serves as an introduction to some of the issues involving the growth of technology in schools, children's attitudes toward and use of computers, and gender-biased elements apparent in some instructional materials. The purpose and significance of the study are included along with the three research questions guiding the research. Definitions of key terms used throughout the manuscript are also defined in the chapter.

Chapter Two contains a review of related literature on children's attitudes toward and use of computers; children, social interaction and computers; curriculum content and socialization; educational computer software; gender preferences in computer graphics and program structure; and implications for software design.

Chapter Three details the methods used to conduct the content analyses of the twelve computer programs. Research parameters are also included.

Chapter Four presents the research findings which are divided into four sections. Sections One and Two report results relating to character portrayal. Section Three reports results relating to program elements. Section Four examines the data from the first three sections in light of the subject matter of each program.

Chapter Five contains Summary, Conclusions, Limitations, and Recommendations for further research.

CHAPTER TWO

Review of Literature

Children's Attitudes Toward and Use of Computers

Children develop their attitudes toward any task or situation primarily through the influence of external factors.

Children's attitudes are shaped first by social expectations and then by their abilities, talents, and interests. Children, through interaction with parents, relatives, peers, and teachers, select activities which determine both the quality of their school experiences and their subsequent careers. (Nelson & Watson, 1991, p.348).

Thus, "student attitudes toward computers may affect the development of skills they will need in the future" (Griffin, Gillis, & Brown, 1986, p. 246). However, children's attitudes toward computers depends on their use of computers, as attitudes and use seem to serve as interdependent factors in determining students' long-term perceptions of computers. Research indicates that the more a child uses a computer, the more positive that child's attitude will be regarding his/her experience (Nelson & Watson, 1991, p.348). Much of the research to date has indicated, however, that boys generally use computers significantly more than girls (Hess & Miura, 1985; Levin & Gordon, 1989; Nelson & Watson, 1991) and that boys generally have more positive attitudes toward computers than girls (Chen, 1986; Fetler, 1985; Griffin et al., 1986).

Research conducted in the 1970s and early 1980s suggested that differences in computer use and attitudes between males and females were directly related to mathematics anxiety (Nelson & Watson, 1991, p. 347). Researchers suggested this

relationship for two reasons: the types of computer courses taught at the time, which focused on programming and math, and the primary placement of computers in math departments (Nelson & Watson, 1991, 347). In determining gender differences in math alone, researchers examined math enrollment and achievement. For instance, research reports from the 1970s indicated that math enrollment heavily favored males in high school and college. Recent re-evaluation of that research, however, indicated that the enrollment differences were not as great as originally reported. Enrollment in lower-level math courses, like algebra and geometry, were approximately equal while larger differences favoring males occurred in advanced courses, like trigonometry and calculus (Chen, 1986, p. 266). Regarding mathematics achievement, differences attributed to gender have not been widely reported for the elementary grades. In junior and early senior high school, achievement in math courses was approximately equal for males and females (Chen, 1986, p. 266). However, in upper high school and college, sizeable gender differences in math achievement have been reported, with the most significant differences in SAT math scores. For example, research indicates that average male scores are approximately 40 to 50 points higher than average female scores. In the high-achieving scorers group, those students who score above 700 on the math section of the SAT, males outnumber females four to one (Chen, 1986, pp. 266-267). Since computer courses in the 1970s and early 1980s dealt heavily with math content, it seemed to be logical to draw a correlation between gender differences in math and gender differences in computers. Research in the mid-1980s, however, rejected math anxiety as a major correlate for two reasons: (1) the wide variety of computer programs available to students in different subject areas, and (2) word processing (Nelson & Watson, 1991, pp. 348, 350). Also, research during the mid-1980s indicated that "females were spending as much time as males in classes which

used computers" (Nelson & Watson, 1991, p. 348). However, research has indicated that gender differences in attitudes towards and use of computers still exist (Nelson & Watson, 1991, p. 348).

Research conducted to date indicated that boys and girls have equal computer abilities and similar appreciation for the importance of computers as tools in today's society (Brady & Slesnick, 1985; Lockheed, 1985). This research also indicated that, for the most part, boys and girls have equal access to computers in schools (Brady & Slesnick, 1985; Sutton, 1991). Equal computer abilities and equal access were apparent in one of the most thorough computer literacy studies conducted. In 1979, the Minnesota Educational Computing Consortium (MECC) conducted a literacy study among adolescents in the eighth and eleventh grades. In this study, MECC found that "girls and boys were roughly equal in overall computer literacy as well as programming test scores" (Chen, 1986, p. 269). In fact, "girls outscored boys for items presented as word problems" (Chen, 1986, p. 269). MECC attributed the equality of achievement to the excellent computer program in Minnesota, "where equal access to computers for all students has been mandated" (Chen, 1986, p. 269). The researchers speculated, however, that in school districts where computer resources are scarce, girls may lose motivation if boys show more initiative in obtaining computer workstations (Chen, 1986, p. 269).

Research in the 1980s did indicate that significant differences were apparent in voluntary computer use (Brady & Slesnick, 1985; Lockheed, 1985; Sutton, 1991). For instance, boys outnumber girls three to one in computer camp attendance (Lockheed, 1985; Sutton, 1991). Hess and Miura (1985) found that female attendance of computer camps decreased with age and difficulty of the computer course. For example, "the proportion of females was 30% in primary grades, 26% in the middle school grades,

and 24% in high school" (Hess & Miura, 1985, p. 197). Also, there was 28% female enrollment in beginning and intermediate courses, 14% female enrollment in advanced programming courses, and only 5% female enrollment in assembly language courses (Hess & Miura, 1985, p. 197). Hess and Miura also found that the male-female ratio greatly increased as computer camps increased in price. The researchers speculated that "parents seem more willing to invest in this type of training for their sons than for their daughters" (Hess & Miura, 1985, p. 201).

Boys are also more likely to take elective computer courses in school. For example, according to the National Longitudinal Study of 1980 - 1982, boys outnumbered girls three to two in high school elective programming courses (Lockheed, 1985, p. 117). Chen (1986) found that a higher percentage of boys took programming classes both before and during high school, that males took more higher-level programming courses than females, and that the gender differences in enrollments increase with the level of the programming class (p. 271). Chen also reported that "while a higher proportion of males enrolled in computer programming classes, males and females reported similar levels of performance on one measure of programming skill" (Chen, 1986, p. 271). Chen's study revealed that when students reported their most recent programming grade, boys only did slightly better than girls (Chen, 1986, pp. 271-272). However, Chen did not specify whether the student grades were from the same level programming class. The only high school computer course in which girls were overrepresented was word processing (Sutton, 1991, p. 482). Schubert (1986) also found that girls preferred word processing classes over programming classes.

Interest among females in using computers seems to heighten when females use the computer for word processing or data processing. Females enjoy

creating stories and using programs for music and art. Females were more positive than males on items related to pleasure in writing stories, essays, and compositions on the computer. Many females seem to value the computer as a means to an end. (Schubert, 1986, p. 271)

In school computer centers open for voluntary use, research reported ratios of boy users to girl users ranging from 20:1 to 3:2 (Lockheed, 1985, p. 118). Sanders (1985) suggests some reasons why girls do not take advantage of school computer centers more often. First of all, "girls consider computers unfeminine because they see mostly boys using them" (Sanders, 1985, p. 37). Second, "girls stay out of the computer room because their girlfriends aren't there - an important social dynamic at the middle school age" (Sanders, 1985, p. 37). Finally, since many schools make computers centers available on a "first-come, first-served basis," that "boys, in their enthusiasm for the machines, aggressively capture the opportunities" (Sanders, 1985, p. 37).

A large difference between boys and girls in access to home computers was also reported in the 1980s. "Regional and national studies found that families of male students were more likely to own a computer than families of female students" (Sutton, 1991, p. 481). A 1984 survey published in USA Today reported that, in households owning computers, 70% of home users were male (Lockheed, 1985, p. 118). In one study, Chen (1986) found that 23.7% of high school males in the Silicon Valley area had home computers as compared to 18.1% of high school females (p. 273). Chen notes that although more high school students owned computers in this technologically aware area than the national average, a larger percent of males still had access to home computers than females (Chen, 1986, pp. 271-272). Chen also found that "boys used their home computers an average of 6.1 hours per week, while girls had an average

weekly use of 3.6 hours" (Chen, 1986, p. 273). Levin and Gordon (1989) found that while 60% of boys had home computers, only 18% of girls did. Also, these researchers found that while 64% of boys understood how to use computers, only 28% of girls understood how (Levin & Gordon, 1989, p. 77). Swadener and Jarrett (1986) also found that more boys than girls had access to a home computer. However, two-thirds of the girls who had a home computer also had a female role model in using that computer (Swadener & Jarrett, 1986, p. 46).

Gender differences in home computer access are important since research indicates that home use influences computer competence. For instance, according to a National Assessment of Educational Progress (NAEP) study conducted in 1985-86, "school instruction in computer skills was important in gaining proficiency, but accounted for less variation in computer competence than did extracurricular access to computers, especially access at home" (Martinez, 1994, p. 396).

Research has indicated that from about the ages of three or four, males have more computer experience than girls (Nelson & Watson, 1991, p. 348). Some researchers, such as Nelson and Watson (1991), have suggested that parental influence may cause this discrepancy (p. 348). First of all, parents tend to buy computers for boys more often than for girls. Also, at home, the father usually assumes the role of the computer teacher whereas the son assumes the role of the computer student (Nelson & Watson, 1991, p. 350). As previously mentioned, parents send males to computer camps more often than females (Hess & Miura, 1985; Nelson & Watson, 1991). Additionally, parents tend to purchase computer games for boys more often than girls (Nelson & Watson, 1991, p. 350), and research indicates that boys play computer games much more frequently than girls (Nelson & Watson, 1991; Swadener & Jarrett, 1986). Research also indicates that "parents tend not to motivate their female children

to be involved with computer-based technology" (Nelson & Watson, 1991, p. 350) or that parents more closely structure their daughters' time than their sons' (Sanders, 1985, p. 37). Sanders (1985) suggests that "parents might structure their daughters' free time more closely than their sons' time, either to protect them or to make sure they have time for household chores. The result is that many girls have fewer chances for informal, after-school computer use" (Sanders, 1985, p. 37). Sanders also suggests that some parents "accept the stereotypical notion that computers are more suitable for boys than for girls and convey that message to children" (Sanders, 1985, p. 37). Nelson and Watson suggest that positive parental influence may encourage girls to become more active in computer use. "Positive parental expectations can serve to motivate females to achieve more when exposed to computer-based experiences" (Nelson & Watson, 1991, p. 350).

Although boys and girls have equal access to school computers, research indicated that boys tended to monopolize computer workstations. "Sometimes, the enthusiasm of boys to get to the computer resulted in verbal and physical aggressive behavior, which discouraged girls from gaining access" (Sutton, 1991, p. 485). In a study of preschoolers, King and Alloway (1992) reported that although girls were equally competent as boys in computer skills, girls did not access computers as often as boys. Some preschool girls in this study said that much of the time they were "physically unable to secure a turn" (King & Alloway, 1992, p. 462). The girls, however, neglected to say that it was the boys who dominated the computer, although this male domination was evident in the researchers' observations (King & Alloway, 1992, p. 462).

Interview data strongly indicate that girls may have felt overwhelmed by the sheer eagerness of the boys to secure a turn. While girls regularly reported that

they were interested in accessing the computer, these equally competent computer users were unwilling or unable to assert their right to an equitable allocation of time at the activity. (King & Alloway, 1992, p. 464)

Other research has also indicated that male aggression in obtaining computer workstations appears at young ages. "Whether in a structured or unstructured setting, boys as young as four to five years of age have been observed to monopolize computers through displaying aggressive behaviors instead of practicing turn-taking" (Nelson & Watson, 1991, p. 348). Turkle, the author of The Second Self: Computers and the Human Spirit (Nelson & Watson, 1991, p. 353) suggested some reasons for girls' passive behavior and boys' aggressive behavior.

[G]irls were taught the characteristics of "soft mastery" such as negotiation, compromise, and give and take. Conversely, [Turtle] pointed out that boys learned decisiveness and the imposition of will. [Turtle] found that this training translates into a male view of the computer as a separate, objective mechanism. For girls, [Turtle] maintained that interaction with the computer was viewed as a communication vehicle, producing a style which included negotiation and interaction with and around the machine. (Nelson & Watson, 1991, pp. 348-349)

Research indicates that boys believe computers to be in the male domain; girls do not hold a similar belief (Sutton, 1991, p. 494). Swadener and Jarrett (1986) found that "middle grade girls perceive women as computer users more frequently than do boys" (p. 47). Levin and Gordon (1989) cited similar results in a study of sex differences in attitudes at the junior and senior high level (pp. 71, 85). According to Levin and Gordon, "girls viewed the computer as being usable by a wider range of people than did boys; boys typically held more stereotypical views" (Levin & Gordon,

1989, p. 85). Although many girls believe that "women and girls can be as skilled with computers as men and boys" (Chen, 1986, p. 273), many girls have a more difficult time believing that they are individually competent in computer use. "This ambivalence concerning females' strong beliefs in social equality but diminished personal interest and confidence has been described as a 'We can but I can't' attitude" (Chen, 1986, p. 274). Some research has indicated that stereotypical attitudes toward computer use are not apparent at the junior high level; instead, stereotypical views seem to manifest only in the higher grades (Swadener & Hannafin, 1987, p. 39). However, other research has suggested that stereotyped attitudes "emerge among boys but not girls at the junior high and senior high level" (Levin & Gordon, 1989, p. 85). Finally, some research suggests that "the association of computers with mathematics, as well as teacher behaviors which often defer computer handling to male students, suggests to female students that they are neither needed nor wanted within the computer's domain" (Biraimah, 1993, p. 285).

Many researchers have indicated that gender-related attitudes toward computer use develop and are established by certain ages. For instance, except for male aggression in obtaining computer stations, no significant "gender differences [are] found for computer use in preschool and early elementary school aged children" (King & Alloway, 1992; Nelson & Watson, 1991). However, research indicates that girls' attitudes toward computers begin to change in the third and fourth grades (Nelson & Watson, 1991; Swadener & Jarrett, 1986). "By the third or fourth grade, however, disparities in attitudes and performance scores between girls and boys show that girls seem less technologically motivated and, thus, less interested in future computing experiences" (Nelson & Watson, 1991, p. 347). Research also indicates that by the eighth grade, gender differences in attitudes are established (Schubert, 1986, p. 271).

Therefore, some research has suggested that "grades four through eight are critical for the involvement of girls in computing" (Swadener & Jarrett, 1986, p. 42). For instance, one longitudinal study conducted by Krendl and Broihier (1992) indicates that girls' attitudes toward computers do change during fourth through tenth grades. The researchers measured student responses to questionnaires over a period of three years. Three hundred thirty-nine students in grades four through ten participated in this study. At each point of measurement over the three years, some significant results emerged: girls enjoyed computers less than boys; girls found computers to be more difficult than boys; and girls believed that computers were educationally less effective than boys (Krendl & Broihier, 1992, pp. 218, 223-225). Smith (1986) also found that computer confidence in females decreased with age (p. 343). In high school, gender differences in attitudes toward computer use become even more pronounced (Nelson & Watson, 1991, p. 347). "By adolescence, girls are reported to develop an ardent dislike for computers while boys' enjoyment and skill level increase" (Nelson & Watson, 1991, p. 347).

Children, Social Interaction and Computers

Research indicates that children primarily interact socially with members of their own gender (Legault, 1993, p. 2). Social interaction of this kind can affect children's exposure to or participation in certain activities. For instance, "high school boys more often reported having [male] friends who were knowledgeable about and encouraged computer use" than girls (Chen, 1986, p. 278). Since male and females tend to associate with same-sex peers more frequently, this research finding suggests that "males are sharing knowledge and encouragement concerning computers more often with other males than females" (Chen, 1986, p. 278).

Society's expectations may largely contribute to the above-mentioned research finding that boys primarily help each other with computer tasks. Research indicates that boys tend to see success with computers as "a source of respect from peers and parents" (Chen, 1986, p. 279). "The development of skill with computers is more socially approved and offers more social incentives in the culture of adolescent males than females. These stronger male bonds surrounding computer use may also act to develop and reinforce males' greater self-confidence with the technology" (Chen, 1986, p. 279). Society also encourages boys' use of and confidence with computers by providing positive male role models in the media (Levin & Gordon, 1989, p. 86). "This male-directed socialization process might contribute to a self-fulfilling prophecy among boys: they receive a greater amount of positive reinforcement to work with computers, and are provided with greater computer exposure, which gives them greater confidence in their ability to succeed with this new machine" (Levin & Gordon, 1989, p. 86).

On the other hand, girls do not get the same societal encouragement in using computers as boys. For instance, girls need social interaction more so than boys. "One student to each computer - the usual school arrangement - does not meet adolescent girls' needs for social interaction" (Sanders, 1985, p. 37). Adolescent girls are very social and prefer to interact with other people instead of inanimate objects. To them, computers are "solitary activities and non-human" (Sanders, 1984, p. 32). "A computer environment that emphasizes paired work at a single machine or encourages discussion among students at several machines should indeed be more effective in encouraging girls' computer use than one in which students are isolated from each other" (Sanders, 1985, p. 27). Also, the Center for Educational Equity at the American Institute for Research (AIR) found that

female students often feel conflict between the desire to socialize with friends and the desire to learn more about computers. Although students of both sexes experience pressure from peers, females interested in computers seem to be called 'nerds' more often than males, and consequently participate less in computer experience. (Schubert, 1986, p. 272).

It seems to be acceptable if girls give up on learning about computers because of peer influences or societal influences, because "socially approved helplessness is at its strongest at puberty" (Sanders, 1984, p. 32).

Research has also suggested that overall children interact more with one another when working with computers and that children identify other students as experts when working with computers (Hawkins, Sheingold, Gearhart, & Berger, 1982, pp. 362-363). For instance, these researchers found that "more task-related interaction occurred among children when they were working with computers than during other non-teacher-directed classroom tasks. (e.g., math activities, language activities, map making)" (Hawkins et al., 1982, p. 371). This research also suggests that "the presence of microcomputers may provide a new opportunity for peers to serve as resources for each other, and for children to perceive each other's competence" (Hawkins et al., 1982, p. 372). Additionally, children in this study identified other students as experts in the computer field, those they could turn to for help, and identified other students as helpers, those with similar computer skills as themselves with whom they would enjoy working. Interestingly, girls were not often chosen by their peers as computer experts. When girls were chosen as a helper, it was always by another female. However, girls did identify boys as computer experts. "While teachers identified several girls as knowledgeable about computers, these girls were not often selected by their peers" (Hawkins et al., 1982, p. 371).

Curriculum Content and Socialization

Recent research has indicated that visuals and text in educational materials, such as textbooks and software, can have a serious impact on children's socialization.

Curriculum content conveys society's values and role models to students. When content is controlled by a society's dominant group, such as white males in America, inequities and stereotypes are perpetuated. "Many of the curriculum materials such as textbooks, readers, and biographies that students use also introduce society's gender biases into the school structure" (Grossman & Grossman, 1994, pp. 73-74). Bias in school materials could impact children considering students spend ninety percent of their learning time with educational materials, such as textbooks, workbooks, filmstrips, and computer software (Hulme, 1988; Scott & Schau, 1985). When biased materials are used in an educational setting, they "tend to exclude from full intellectual participation those children who do not readily identify with the dominant culture," such as females and minorities (Biraimah, 1993, p. 284). For instance, lack of female characters in software may tend to lead females to believe that "they are less important and less significant in our society than are majority males" (Biraimah, 1993, p. 285).

Gender-biased, or sex-biased, materials "are those in which (1) females appear as main characters and in illustrations far less frequently than males; (2) females and males are overwhelmingly portrayed in sex-stereotypical roles; (3) females appear more often than males in derogatory roles; and/or (4) male generic language is used" (Scott & Schau, 1985, p. 219). Research studies conducted during the 1970s indicated that, for the most part, female characters were portrayed as "passive, concerned about their looks and getting dirty, fearful, and lacking creative interaction with others and with their environment" (Hulme, 1988, p. 191) while male characters "tended to be heroic,

physically strong, clever, and seemingly able to control the environment" (Hulme, 1988, p. 191). Also, the portrayal of adults indicated that men had a variety of professional options available to them whereas women primarily chose the role of wife or mother in lieu of a career outside of the home. Of those female characters who did in fact work outside of the home, they were usually depicted in low-paying traditional female roles, such as a secretary, teacher, or nurse (Hulme, 1988, pp. 191-192). Men, on the other hand, "were depicted as workers without opportunities for emotional expression or family interaction" (Hulme, 1988, p. 192).

Educational materials are not as sexist now as they were in the 1960s and 1970s. For instance, the difference in the number of pictures of males and females has been largely reduced. Also, working females are now portrayed in a variety of occupations, not just traditional female roles. Furthermore, the number of males portrayed in basal readers has been reduced by replacing the male characters with gender-neutral characters, such as talking trees or animals (Grossman & Grossman, 1994, p. 74). Although some sexist problems in educational materials have been corrected, problems still exist. For instance, "authors and publishers still use male pronouns to describe individuals whose gender is unknown and *man* for all people" (Grossman & Grossman, 1994, p. 74). Also, although the use of gender-neutral characters in basal readers avoids the appearance of gender bias, it does not increase the number of stories involving female characters. "In fact, stories about males still greatly outnumber stories about females in some students' readers in the higher grades and in the biographies found in school libraries" (Grossman & Grossman, 1994, p. 74). Additionally, in most educational materials, fathers work outside of the home while mothers stay home. When at home, mothers participate in domestic chores and child rearing while fathers fix and build things. Outside of the home, males and females are

still portrayed in stereotypical jobs, but to a lesser degree than in the 1960s and 1970s (Grossman & Grossman, 1994, p. 74). "Males are engaged in three times as many different occupations as females, and it is fathers who are the executives, professionals, scientists, firefighters, and police officers" (Grossman & Grossman, 1994, p. 74). In many educational materials today, "females are described as overemotional, dependent, concerned about their appearance, and observers rather than participants. Males are actively involved in solving problems and doing adventurous things. Females are still portrayed as receiving help and males as providing help" (Grossman & Grossman, 1994, p. 74). Also, in science books, male characters primarily portray the scientists; in math books, "boys learn to count by driving cars, flying planes, and engineering trains, while girls learn to count by jumping rope, measuring cloth, and following cooking recipes" (Grossman & Grossman, 1994, p. 74). Although there is not much difference between the number of pictures of males and females in history books, only five percent of the text is devoted to females' experiences. "The disparity between the percentage of the total copy devoted to women and the visuals that depict women suggests cosmetic changes distorting the extent to which women have been incorporated" (Grossman & Grossman, 1994, p. 74). In the five percent of the text dealing with females' experiences in history, authors and publishers tend to focus on traditional female roles "almost to the exclusion of feminists or those who were involved in feminist issues" (Grossman & Grossman, 1994, pp. 74-75).

Research indicates that gender characteristics found in educational materials' content does affect students (Scott & Schau, 1985, p. 225). For instance, "reading about successful women has been found to cause girls to have higher expectations of female success, an important component of achievement, as is knowing that there is a historical perspective to achieving women" (Hulme, 1988, p. 190). In fact, research

has indicated that both boys and girls spend more time on their studies after learning about a member of their own sex succeeding (Hulme, 1988, p. 190). However,

when sex-biased language is used, pupils gain a distorted view of the world, one that assumes males are dominant in human culture and that females are not important enough to be visible in language. Stereotyped portrayals of females and males in instructional materials restrict pupils' attitudes about who can and who should engage in a wide variety of human activities. (Scott & Schau, 1985, p. 225)

Gender bias in software also affects socialization by creating situational stress. Situational stress is "a state of unpleasant psychological tension aroused by interacting with environmental stimuli that are threatening and are perceived to be beyond a person's competence and resources" (Cooper et al., 1990, p. 420). In 1990, Cooper et al. reported research indicating that software oriented toward males produced situational stress in females whereas software oriented toward females produced situational stress in males. However, situational stress only resulted when the software was used in a public setting. When the software was used in a private setting, gender-oriented software did not produce situational stress (Cooper et al., 1990, p. 425). Additionally, in public situations, girls working at male tasks attributed higher ability to male opponents. "In contrast, if performance is more private, the task is less ego involving, and attention can focus on improvement and less on comparison with others" (Cooper et al., 1990, p. 426).

Educational Computer Software

Most educational software programs emphasize traditional male interests, such as war and sports, for motivation and reinforcement (Rosenthal & Demetrulias, 1988;

Wilder, Mackie, & Cooper, 1985).

The most popular software for teaching math, spelling, language, and other subjects has a predominantly male orientation, using symbols such as guns, space missiles, or warships. Action, competition, and aggression have been the preferred designs. (Cooper et al., 1990, p. 420)

Such male-oriented topics may not appeal to most girls (Canada & Brusca, 1991; Lockheed, 1985; Rosenthal & Demetrulias, 1988). When girls do use male-oriented software, they are exposed to subtle, biased messages within the programs. "The messages are that males are active, competent, and in control, whereas females are passive, helpless, and in need of male assistance" (Canada & Brusca, 1991, p. 48). Not only do these messages deter girls from computer use, they also "reinforce the view of computer technology as masculine and primarily for use by boys and men" (Rosenthal & Demetrulias, 1988, p. 154).

Realizing that most educational software primarily appealed to boys, program designers attempted to rectify this gender imbalance by creating "girl" software. "Ideally, this software would tap into girls' interests and would be designed to complement the way that girls (as opposed to boys) like to learn" (Brady & Slesnick, 1985, p. 23). Two such programs, Jenny of the Prairie and Cave Girl Clair, found success with female students. These programs focused on "two independent female protagonists who must use their wits, courage and intelligence to survive" (Brady & Slesnick, 1985, p. 23). However, most "girl" software fails because it falls into a trap of reinforcing sexist stereotypes (Brady & Slesnick, 1985, p. 24). For instance, some "girl" software revolves around shopping, interior decorating, dating, or housework (Sutton, 1991, p. 485) whereas other programs incorporate stereotypes such as females

prefer spelling over math. These programs initially appeal to girls but limit their educational experiences (Brady & Slesnick, 1985, p. 24).

Instead of creating software specifically for one gender, program designers should focus on creating gender-neutral software, which appeals to both males and females. More specifically, gender-neutral software refers to

the kinds of tool programs that provide open-ended frameworks within which people can work in individual ways to accomplish individual goals. Such software holds equal appeal for girls and boys primarily because it is flexible enough to be adapted to whatever interests girls or boys bring to it. (Brady & Slesnick, 1985, p. 24)

Software programs that allow children to create their own games or measure their own vital signs are examples of gender-neutral software (Brady & Slesnick, 1985, p. 26).

Forsyth and Lancy (1989) studied the effects of gender-neutral software on children's ability to learn as well as their interest in the program. The researchers randomly sampled fourth and fifth graders at a Utah elementary school to study their reactions to Lowe and Walt Disney's Winnie the Pooh in the Hundred Acre Wood. Not only did the software appeal to both boys and girls, but the children also equally learned geography skills from the program (Forsyth & Lancy, 1989, pp. 53-55). Forsyth and Lancy believe the program had equal appeal because of its construction. The program is "nonviolent, is only mildly competitive, includes 'hummable tunes' rather than bangs and crashes, and stars a cast of characters balanced among male, female, and neuter (Eeyore? Roo?)" (Forsyth & Lancy, 1989, p. 55).

Gender-neutral software takes a step in the right direction, but it will not cure educational software of its gender bias. This type of software can fall into the same trap as "girl" software. For instance, gender-neutral software may initially appeal to

females' interests, but it "makes no attempt to expand those interests in nonstereotypical ways" (Brady & Slesnick, 1985, p. 26). An example of a program that does accomplish this goal is the video laserdisc program, Voyage of the Mimi. Not only does this program appeal to girls' interests, but it also encourages the development of math and science skills, which are traditionally male-dominated disciplines (Brady & Slesnick, 1985, p. 26).

What we actually want is to create an environment in which any youngster - male or female - feels free to explore his or her interests without being influenced by stereotypical notions of "girls' activities" and "boys' activities." We want to be sure that boys and girls have equal opportunities - and similar *enticements* - to become involved with technology. (Brady & Slesnick, 1985, p. 23)

Gender Preferences of Computer Graphics and Program Structure

Computer graphics may play an integral role in the instructional process by increasing learner interest, motivation, curiosity, and concentration (Jakobsdottir & Krey, 1993, p. 3). Research has indicated that males and females prefer different types of graphics. For instance, boys prefer images of active figures, vehicles, and male characters (Jakobsdottir & Krey, 1993, p. 6). Girls prefer large, detailed, and colorful images of people, plants and animals; female characters; and peaceful, "friendly" scenes (Jakobsdottir & Krey, 1993, p. 6).

Boys and girls also differ in preferred program structure. For instance, boys prefer: "opportunity to move (or animate) objects, or implying movement of objects" (Jakobsdottir & Krey, 1993, p. 6); "elements of suspense and danger" (Jakobsdottir & Krey, 1993, p. 6); emphasis on scoring; graphic as opposed to verbal feedback; and

active, aggressive formats (Cooper et al., 1990, p. 421). Girls prefer: "a format without aggression and shooting action; word-oriented tasks; verbal feedback; completion tasks; cooperation; purposeful or practical tasks; and music" (Cooper et al., 1990, p. 421).

Implications for Software Design

Huff and Cooper (1987) concluded that educational software is largely designed for boys, "without consideration of the effect on girls' motivation to use them or on girls' educational profit from them" (p. 530). As one computer designer said, "Computer software is designed for boys, about boys, by boys" (Campbell, 1984, p. 5). While much research has been done on the type of activities in educational software, not much critical analysis of its content has been conducted (Biraimah, 1993, p. 285).

Software designers incorporate their expectations in their programs. The benefits children receive from educational software are influenced by the program's design and approach to the user. "The logical outcome of this line of reasoning is that it is not the computer, or even the software, that is at the root of the sex bias in software, but the expectations and stereotypes of the designers of the software" (Huff & Cooper, 1987, pp. 520-21).

For example, Huff and Cooper (1987) chose 34 female and nine male educators, with computer design experience, to create software that taught grammar for seventh graders. Even though most designers were women who "expressed concern regarding the sex bias in educational software," most programs appealed primarily to boys (Huff & Cooper, 1987, pp. 521-522, 529). Huff and Cooper concluded that the designers in this experiment "may have assumed that *their* users would be male and

intentionally set out to please the male majority" (Huff & Cooper, 1987, p. 529). A limitation of this study, however, is that it did not explore how software should be designed in order to eliminate gender bias (Huff & Cooper, 1987, p. 530).

Today's technology opens many doors to software designers. Interactive, automated delivery systems allow designers to consider individual learners' needs and adapt the technology to achieve educational individualization (Ross, Sullivan, & Tennyson, 1992, p. 6).

Designers of CBI [computer-based instruction] can play a vital role in narrowing the technological gender gap by increasing the appeal of entertainment software and electronic games for females, incorporating information about the female-machine interface into product design, and reducing sexist stereotyping of characters. (Canada & Brusca, 1991, p. 49)

Educators can also help to eliminate children's exposure to bias in software by evaluating computer programs before using them in the classroom. However, many software evaluation forms are vague in their determination of gender bias. "Most software review forms, if they address the issue of bias and discrimination, do so with only a single question, which for the untrained reviewer will not address the subtle issues which are the most pervasive in instructional materials" (Rose, 1984, p. 51). On the other hand, some review forms do target gender bias in software with some depth. For instance, they may contain questions dealing with "language, proportional representation, and roles of females" (Schubert, 1986, p. 270). Although these forms seem to take a step in the right direction in attempting to eliminate gender bias in software, they do not address more subtle gender-related issues, such as feedback, music and scoring (Schubert, 1986; Cooper et al., 1990). Teachers and administrators

need to educate themselves on the messages delivered through computer software and the effects those messages may have on children.

The greatest obstacle to selecting and using software that does not contain [gender bias] is lack of awareness. Through increased awareness, educators can put pressure on developers and publishers to stop producing instructional materials that do not recognize computers as learning tools for all students.

(Schubert, 1896, p. 270)

CHAPTER THREE

Methodology

The purpose of this study is to gather information on the current status of educational software to assess gender bias. The research method for this study is a content analysis. There are several research questions.

1. How many male and female characters are presented in each computer program? What type of role does each character assume?
2. Does the structure of the individual software programs contain elements (e.g., audio, feedback, scoring) that appeal to male users or to female users; or is the appeal gender-neutral?
3. Is there a relationship between the software program's subject matter and the appeal of the elements and the characters of the program structure?

"Content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communication" (Berelson, 1952, p. 18). Not only does this research method descriptively identify elements in the programs but it also counts those elements' occurrences. This quantitative approach converts all necessary information to numbers, such as percentages, which enables the researcher to make clear comparisons of the software programs' content. Because this

method quantifies certain elements of the programs' content, it allows the researcher to assess the extent of gender bias in each educational program.

Sample Selection

A chart of the top twenty educational software publishers as determined by PC Data, which was printed in Eric Brown's That's Edutainment!, was used as the basis in determining which software companies would be selected for the study (Brown, 1995, p. 85). The ranking of the software companies was based on the total percentage of educational software sales for the first half of 1994 (Brown, 1995, p. 85). The researcher focused on the first ten companies on the list, and then contacted those companies with requests for their most current catalogs. Broderbund (number 3 on the list) was excluded since the catalog was not sent until after the sample was selected, despite several requests. The researcher then chose three companies that offered the most CD-ROM educational software for children aged three to eight. Where a program was listed as appropriate for an age range which partially exceeded but mostly overlapped or was wholly included in the three to eight range, it was considered appropriate for selection. For example, a program targeted to children aged four to ten was considered appropriate for selection, as was a program targeted to children aged three to six. The Learning Company (number one on the list), Davidson & Associates (number four on the list), and Living Books (number seven on the list) were selected. According to PC Data and based on educational software sales from the first half of 1994, The Learning Company received 13.59% of total sales, Davidson & Associates received 8.29% of total sales, and Living Books received 3.70% of total sales (Brown, 1995, p. 85).

Since the educational CD-ROM population for the three companies was small, the researcher used the lottery method to choose four CD-ROM titles from each of the three companies' catalog for a total of twelve titles. "The lottery method is a kind of random sample in which every element is given a number and every element has an equal chance of being selected" (Singletary, 1994, p. 61). This random sample method works best when dealing with small population numbers (Singletary, 1994, p. 61). The twelve software titles randomly selected for this research are: Reader Rabbit 1 - Deluxe, Reader Rabbit 3 - Deluxe, Math Rabbit - Deluxe, and Treasure MathStorm! produced by The Learning Company; 3 Balloons (SWeDE), McGee School Days (Lawrence), My Favorite Monster (Simon and Schuster Interactive), and The Little Turtle (Computer Curriculum Corporation) produced by the companies denoted in parentheses and distributed by Davidson & Associates; and Harry and the Haunted House, Little Monster at School, Just Grandma and Me, and Arthur's Birthday produced by Living Books. After the twelve CD-ROM titles were drawn, the researcher used the lottery method again to draw two titles from the twelve for the pre-test. Arthur's Birthday produced by Living Books and Math Rabbit - Deluxe produced by The Learning Company were chosen for the pre-test in which intercoder reliability was determined. The researcher also timed each piece of software for its general length. Specific lengths of the programs could not be determined since the programs are interactive. The program length, therefore, can be determined by the user as it may take anywhere from approximately fifteen minutes to over an hour per program, depending on the user's interactive choices.

During the study, the coders examined the character portrayals and program elements in each CD-ROM program. In examining these areas, coders categorized

each character that they observed and recorded their overall interpretations of the program elements.

Four students from the College of Education were selected to serve as coders. Each coder is currently working on his/her Master's degree in Curriculum and Instruction and each has had teaching experience. Each coder content analyzed twelve pieces of educational software targeted to children aged three to eight. All four coders analyzed two pieces of software during the pre-test and ten pieces of software for the study. The coders will be given a copy of the study and its results.

The Coding Instrument

The researcher based the design of the coding instrument on past research of character portrayals in different types of educational media, such as textbooks and computer software, and on past research of gender preferences of program elements, such as scoring and feedback. For instance, past research indicates that in traditional educational materials, such as textbooks, male characters outnumber female characters (Grossman & Grossman, 1994, p. 74-75). Also, past research indicates that a disproportionate number of male characters in computer software may tend to lead females to believe that "they are less important and less significant in our society than are majority males" (Biraimah, 1993, p. 285). Further, one study acknowledges the presence of sex-neutral characters in educational software programs (Forsyth & Lancy, 1989, p. 55). Thus, the researcher designed the coding instrument to allow each coder to record the number of male and female characters as well as sex-neutral characters.

Additionally, past research indicates that male characters in textbooks and computer software programs tend to assume active roles whereas female characters tend to assume passive roles (Canada & Brusca, 1991; Grossman & Grossman, 1994; Hulme, 1988). For instance, past research indicates that male characters are often portrayed as "active, competent, and in control whereas [female characters] are passive, helpless, and in need of male assistance" (Canada & Brusca, 1991, p. 48). Thus, the researcher designed the coding instrument to allow each coder to record each character's role as aggressive, active, passive, or submissive.

Past research also indicates that male and female computer users prefer different types of program elements in computer software, such as graphical representations, audio, feedback, scoring, and format (Cooper et al., 1990; Jakobsdottir & Krey, 1993). For instance, past research suggests that boys place a higher emphasis on scoring than do girls, and girls prefer verbal feedback whereas boys prefer graphical feedback (Cooper et al., 1990, p. 421). Thus, the researcher designed the coding instrument to allow each coder to record his or her overall interpretation of feedback, audio, scoring, and format in each program as well as the overall orientation of each program, either education or entertainment.

Pre-Test

The researcher trained each coder in the method of content analysis and in the use of the coding sheet. Each coder was also given a coder instruction book containing specific directions for the coding sheet as well as definitions of certain terms, such as "aggressive," "passive," "feedback," and "completion task format" (See Appendix B

for a sample of the coder instruction book). During the training session, the researcher explained the general purpose of the study to the coders but did not specify the research questions.

The researcher conducted a pre-test in order to test the coding instrument and to measure intercoder reliability. The pre-test was conducted in the Humanities computer lab on the University of Tennessee campus. All four coders participated in the pre-test in two sessions. Two coders completed the pre-test in one session, and the other two coders completed the pre-test in a second session. Since two coders participated in the pre-test in each session, the researcher gave them specific instructions not to speak to each other about the software or coding decisions during the study. Each coder evaluated Arthur's Birthday and Math Rabbit - Deluxe for the pre-test.

The researcher did not stay in the room with the coders during the pre-test or any other part of the study. The researcher did, however, start each program and change CD-ROMs for the coders when notified since the coders were unfamiliar with this process on the computer system. The researcher did not discuss the coding process with the coders at this time. After the two pieces of software were analyzed by the coders, the researcher conducted a debriefing session with the coders in order to identify any major problems with the coding sheet or the coding process. The pre-test was helpful in clarifying certain terms and definitions in the coder instruction book. Also, an additional choice was added to two categories on the coding sheet. "Storytelling format" was added to the overall format category, and "N/A" was added to the feedback category.

The pre-test also helped the researcher assess intercoder reliability by providing data necessary to calculate agreement between the coders in each category. Two commonly used statistical measures of reliability are Scott's Pi and Holsti's formula

(Singletary, 1994, pp. 295-296). In 1955, William A. Scott of the University of Michigan reported the development of Scott's Pi, a mathematical expression that calculates intercoder reliability. Scott's Pi corrects the reliability figure for chance agreements between coders (Scott, 1955, pp. 321, 323). In most cases, Scott's Pi gives a more accurate reliability index because it corrects for chance agreement (Budd, Thorp, & Donohew, 1967; Singletary, 1994). However, Scott's Pi skews toward zero when responses are clustered in only a few of several categories (Scott, 1955, p. 323). In this study, the coders' responses were often concentrated in one or two categories, with no responses in other categories. For instance, most characters were coded as "active" with fewer responses in the "passive" and "aggressive" categories and almost no responses in the "submissive" category. Although coder agreement seemed to be high, the application of Scott's Pi produced deceptively low reliability figures because of this clustering of coding decisions. In this particular study, most coding decisions were clustered, and the coders agreed on a majority of the responses. Because Scott's Pi does not reflect the level of agreement in clustered answers (Scott, 1955, pp. 323-324), the researcher used a measure of intercoder reliability that would more accurately reflect the agreement between coders in this particular study.

A second widely used measure of intercoder reliability has come to be known as Holsti's Formula (Holsti, 1969; Singletary, 1994). Although this formula does not account for the possibility of chance agreement, it is not influenced by the distribution of responses among categories, i.e., clustering of responses (Holsti, 1969, p. 140). Holsti's Formula was chosen as the reliability measure for this study, because it yields "the ratio of coding agreements to the total number of coding decisions" (Holsti, 1969, p. 140).

For the purpose of determining intercoder reliability as well as reporting the results for this study, the researcher randomly assigned coders to two teams - Team A and Team B. Using Holsti's Formula, overall intercoder reliability was calculated for each coding category: .670 for coding in the character portrayal category and .873 for coding in the program elements category. More specifically, the intercoder reliability for Team A was .705 for coding in the character portrayal category and .800 for coding in the program elements category. The intercoder reliability for Team B was .635 for coding in the character portrayal category and .945 for coding in the program elements category.

The lower reliability figures in the character portrayal category are a result of the interactivity of the CD-ROM programs. Because of this interactivity, there was no guarantee that all coders saw all characters in each program. Holsti recognized that the nature of the data analyzed may influence the reliability of a study but that this is usually beyond the researcher's control (Holsti, 1969, p. 135). The observed content of CD-ROM software is to some extent determined by the user's interaction with the program in selecting options the program presents. Therefore, CD-ROM users who choose different options may observe different aspects of the program, e.g., different characters. Holsti noted "that high reliability can be achieved for simple forms of content analysis, in which coding is essentially a mechanical task" (Holsti, 1969, p. 142). However, Holsti also noted that "as categories and units of analysis become more complex, they may yield results that are both more useful and less reliable" (Holsti, 1969, p. 142). Given the inherent difficulty of coding interactive CD-ROM programs, the researcher "may be forced to strike some balance between reliability and relevance of categories and units; the coefficient of reliability cannot be the sole criterion for making such decisions" (Holsti, 1969, p. 142). Thus, although the

intercoder reliability figures are low for the character portrayal category, they are acceptable due to the interactivity of the programs analyzed.

Parameters

This study included only CD-ROM software listed by the manufacturers as appropriate for children aged three to eight, which normally encompasses pre-school through third grade. Where a program was listed as appropriate for an age range which partially exceeded but mostly overlapped or was wholly included in the three to eight range, it was considered appropriate for selection. For example, a program targeted to children aged four to ten was considered appropriate for selection, as was a program targeted to children aged three to six.

CHAPTER FOUR

Results

By analyzing the content of a sample of educational CD-ROM software, this study gathered data to determine the extent to which the character portrayal and use of program elements in such software is gender biased. It also examined the relationship between the subject matter of each program and the extent of any gender bias.

The results are divided into four sections. Section One reports data concerning the frequency of female, male, and sex-neutral characters in each program. Section Two reports data concerning the frequency of character roles assumed by female, male, and sex-neutral characters. Section Three reports data reflecting the incorporation of different types of program elements: feedback, audio, scoring, program type, and overall format. For the first three sections, results are given first for the content analysis by all coders and then for Team A and Team B. Next, results are given for the content analysis by male coders and female coders. In Section Four, the data from the first three sections are examined in light of the subject matter of each program. Due to the interactivity of CD-ROM software, the coders could observe different numbers of characters in each program; thus, the tables in Sections One and Two present the average figures. The percentages reported were then calculated from these averages.

Section One: Frequency of Female, Male, and Sex-Neutral Characters

Table 1 indicates the average number and percentage of female, male, and sex-neutral characters in each program observed by all coders. Table 1 also reports the

Table 1
AVERAGE NUMBER AND PERCENTAGE OF FEMALE, MALE,
AND SEX-NEUTRAL CHARACTERS OBSERVED BY ALL CODERS

Software Titles	n females	% females	n males	% males	n sex-neutral	% sex-neutral	n characters
3 Balloons	2.25	17.65	7.75	60.78	2.75	21.57	12.75
Harry and the Haunted House	1.75	24.14	3.75	51.72	1.75	24.14	7.25
Just Grandma and Me	7.75	36.90	6.00	28.57	7.25	34.52	21.00
Little Monster at School	8.00	42.11	8.25	43.42	2.75	14.47	19.00
The Little Turtle	1.25	50.00	1.25	50.00	—	—	2.50
McGee School Days	2.00	50.00	2.00	50.00	—	—	4.00
My Favorite Monster	1.25	26.32	1.00	21.05	2.50	56.23	4.75
Reader Rabbit 1	1.25	23.81	2.75	52.38	1.25	23.81	5.25
Reader Rabbit 3	2.25	31.03	4.00	55.17	1.00	13.79	7.25
Treasure MathStorm!	2.50	43.48	1.50	26.09	1.75	30.43	5.75

TOTALS	30.25	33.80	38.25	42.74	21.00	23.46	89.50
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Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.68.

average total number of characters per program as observed by all coders as well as the total number and percentage of female, male, and sex-neutral characters in all ten programs.

Overall, Table 1 indicates that the coders observed more male characters in the CD-ROM programs than female or sex-neutral characters. On average, coders observed a total of 42.74% male characters, 33.80% female characters, and 23.46% sex-neutral characters. Five programs -- 3 Balloons, Harry and the Haunted House, Little Monster at School, Reader Rabbit 1, and Reader Rabbit 3 -- contained more male characters than either female or sex-neutral characters. In four of these five programs -- 3 Balloons, Harry and the Haunted House, Reader Rabbit 1, and Reader Rabbit 3 -- more than 50% of the characters were identified as male.

Two programs, The Little Turtle and McGee School Days, had an equal number of male and female characters, with no sex-neutral characters observed. Two other programs, Just Grandma and Me and Treasure MathStorm!, contained more female characters than male or sex-neutral characters. No programs contained more than 50% female characters. One program, My Favorite Monster, contained more sex-neutral characters than male or female characters. In this same program, more than 50% of the characters were identified as sex-neutral. This research suggests that male characters appear more frequently than either female or sex-neutral characters. The intercoder reliability for Table 1 was 0.68. Either the interactivity of the programs, which could have influenced the number of characters each coder observed, or differences in the coders' perceptions of what is female, male, or sex-neutral could account for a lower reliability figure.

Table 2 reports the average number and percentage of female, male, and sex-neutral characters observed by Team A. On average, coders in Team A observed a

Table 2
AVERAGE NUMBER AND PERCENTAGE OF FEMALE, MALE,
AND SEX-NEUTRAL CHARACTERS OBSERVED BY TEAM A

Software Titles	n females	% females	n males	% males	n sex-neutral	% sex-neutral	n characters
3 Balloons	2.50	17.24	8.50	58.62	3.50	24.14	14.50
Harry and the Haunted House	1.50	27.27	3.50	63.64	0.50	9.09	5.50
Just Grandma and Me	10.00	43.48	7.50	32.61	5.50	23.91	23.00
Little Monster at School	7.50	40.54	7.00	37.84	4.00	21.62	18.50
The Little Turtle	1.00	50.00	1.00	50.00	—	—	2.00
McGee School Days	2.00	50.00	2.00	50.00	—	—	4.00
My Favorite Monster	0.50	16.67	0.50	16.67	2.00	66.67	3.00
Reader Rabbit 1	1.00	28.57	1.50	42.86	1.00	28.57	3.50
Reader Rabbit 3	3.00	40.00	3.50	46.67	1.00	13.33	7.50
Treasure MathStorm!	2.50	35.71	1.50	21.43	3.00	42.86	7.00

TOTALS	31.50	35.59	36.50	41.24	20.50	23.16	88.50
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Notes: Categories may not equal 100% due to rounding.
Intercooder reliability: 0.73.

total of 41.24% male characters, 35.59% female characters, and 23.16% sex-neutral characters. These figures closely follow the figures for all coders presented in Table 1, with only slight variations. Four programs -- 3 Balloons, Harry and the Haunted House, Reader Rabbit 1, and Reader Rabbit 3 -- contained more male characters than female or sex-neutral characters. Team A reported only two programs, Three Balloons and Harry and the Haunted House, as having more than 50% male characters. Unlike the results in Table 1, Team A reported more female characters than male or sex-neutral characters in Little Monster at School. Two programs, My Favorite Monster and Treasure MathStorm!, contained more sex-neutral characters than male or female characters. The intercoder reliability for Table 2 was 0.73. This research suggests that the coders in Team A either could have observed more of the same characters or that their perceptions of what is female, male, or sex-neutral could have been more alike; either of these factors could account for the higher intercoder reliability for this team.

Table 3 reports the average number and percentage of female, male, and sex-neutral characters observed by Team B. On average, coders in Team B observed a total of 44.20% male characters, 32.04% female characters, and 23.76% sex-neutral characters. These figures also closely follow the figures for all coders presented in Table 1, with only slight variations. Three programs -- Three Balloons, Reader Rabbit 1, and Reader Rabbit 3 -- contained more than 50% male characters. Team B observed more female characters than male or sex-neutral characters in one program, Treasure MathStorm!. This program also contained more than 50% female characters. Two programs, Just Grandma and Me and My Favorite Monster, contained more sex-neutral characters than male or female characters. No programs contained more than 50% sex-neutral characters. The intercoder reliability for Table 3 was 0.63. This research suggests that the coders in Team B either could have seen fewer of the same characters

Table 3
AVERAGE NUMBER AND PERCENTAGE OF FEMALE, MALE,
AND SEX-NEUTRAL CHARACTERS OBSERVED BY TEAM B

Software Titles	n females	% females	n males	% males	n sex-neutral	% sex-neutral	n characters
3 Balloons	2.00	18.18	7.00	63.64	2.00	18.18	11.00
Harry and the Haunted House	2.00	22.22	4.00	44.44	3.00	33.33	9.00
Just Grandma and Me	5.50	28.95	4.50	23.68	9.00	47.37	19.00
Little Monster at School	8.50	43.59	9.50	48.72	1.50	7.69	19.50
The Little Turtle	1.50	50.00	1.50	50.00	—	—	3.00
McGee School Days	2.00	50.00	2.00	50.00	—	—	4.00
My Favorite Monster	2.00	30.77	1.50	23.08	3.00	46.15	6.50
Reader Rabbit 1	1.50	21.43	4.00	57.14	1.50	21.43	7.00
Reader Rabbit 3	1.50	21.43	4.50	64.29	1.00	14.29	7.00
Treasure MathStorm!	2.50	55.56	1.50	33.33	0.50	11.11	4.50

TOTALS	29.00	32.04	40.00	44.20	21.50	23.76	90.50
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Notes: Categories may not equal 100% due to rounding.
Intercoeder reliability: 0.63.

or that their perceptions of what is female, male, or sex-neutral could have been different; either of these factors could account for the lower intercoder reliability for this team.

Table 4 reports the total average number and percentage of female, male, and sex-neutral characters observed in all ten programs by male coders versus female coders. On average, male coders identified a total of 85.5 characters, of which 39.77% were male, 32.75% were female, and 27.49% were sex-neutral. On the other hand, female coders identified an average total of 93.0 characters, of which 45.16% were male, 34.95% were female, and 19.89% were sex-neutral. The most notable difference in these figures is the percentage of characters classified as sex-neutral: 27.49% by male coders and 19.89% by female coders. This research suggests that female coders are more likely to categorize characters as either male or female than are male coders. These results suggest that female coders perceive gender portrayal differently than male coders. For Table 4, the intercoder reliability for male coders was 0.70, and the intercoder reliability for female coders was 0.73. These figures are slightly higher than the overall intercoder reliability figure for Table 1; this suggests that female perceptions of what is female, male, or sex-neutral are more alike and male perceptions of what is female, male, or sex-neutral are more alike. Again, the interactivity of the programs could have influenced the number of characters observed by each coder, thus lowering the intercoder reliability.

Section Two: Frequency of Character Roles

Table 5 indicates the average number and percentage of roles of female, male, and sex-neutral characters in each program observed by all coders. Overall, Table 5 indicates that the coders observed more active characters (over 80%) in the CD-ROM

Table 4
OVERALL AVERAGE NUMBER AND PERCENTAGE OF
FEMALE, MALE, AND SEX-NEUTRAL CHARACTERS
OBSERVED BY MALE CODERS VS. FEMALE CODERS

	n females	% females	n males	% males	n sex- neutral	% sex- neutral	n charac- ters
Male Coders	28.00	32.75	34.00	39.77	23.50	27.49	85.50
Female Coders	32.50	34.95	42.00	45.16	18.50	19.89	93.00

Notes: Categories may not equal 100% due to rounding.

Intercoder reliability: male coders - 0.70; female coders - 0.73.

Table 5
AVERAGE NUMBER AND PERCENTAGE OF ROLES OF
FEMALE, MALE, AND SEX-NEUTRAL CHARACTERS
OBSERVED BY ALL CODERS

		Aggressive		Active		Passive		Submissive	
Software Titles	Gender	n	%	n	%	n	%	n	%
3 Balloons	females	—	—	2.25	17.65	—	—	—	—
	males	—	—	7.75	60.78	—	—	—	—
	sex-neutral	—	—	2.75	21.57	—	—	—	—
Harry and the Haunted House	females	0.25	3.45	1.25	17.24	0.25	3.45	—	—
	males	0.50	6.90	3.25	44.83	—	—	—	—
	sex-neutral	—	—	1.75	24.14	—	—	—	—
Just Grandma and Me	females	—	—	3.75	17.86	4.00	19.05	—	—
	males	—	—	2.50	11.91	3.50	16.67	—	—
	sex-neutral	—	—	4.00	19.05	3.25	15.48	—	—
Little Monster at School	females	—	—	7.00	36.84	1.00	5.26	—	—
	males	0.50	2.63	7.25	38.16	0.50	2.63	—	—
	sex-neutral	—	—	2.25	11.84	0.50	2.63	—	—
The Little Turtle	females	—	—	1.00	40.00	0.25	10.00	—	—
	males	—	—	1.00	40.00	0.25	10.00	—	—
	sex-neutral	—	—	—	—	—	—	—	—

Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.61.

Table 5 (continued)

		Aggressive		Active		Passive		Submissive	
Software Titles	Gender	n	%	n	%	n	%	n	%
McGee School Days	females	—	—	2.00	50.00	—	—	—	—
	males	—	—	2.00	50.00	—	—	—	—
	sex-neutral	—	—	—	—	—	—	—	—
My Favorite Monster	females	—	—	1.00	21.05	0.25	5.26	—	—
	males	—	—	0.75	15.79	0.25	5.26	—	—
	sex-neutral	—	—	2.25	47.37	0.25	5.26	—	—
Reader Rabbit 1	females	—	—	1.00	19.05	0.25	4.76	—	—
	males	—	—	2.00	38.10	0.75	14.29	—	—
	sex-neutral	—	—	0.50	9.52	0.75	14.29	—	—
Reader Rabbit 3	females	—	—	2.25	31.03	—	—	—	—
	males	—	—	4.00	55.17	—	—	—	—
	sex-neutral	—	—	1.00	13.79	—	—	—	—
Treasure MathStorm!	females	—	—	2.50	43.48	—	—	—	—
	males	—	—	1.50	26.09	—	—	—	—
	sex-neutral	—	—	1.75	30.43	—	—	—	—
TOTALS	females	0.25	0.28	24.00	26.82	6.00	6.70	—	—
	males	1.00	1.12	32.00	35.75	5.25	5.87	—	—
	sex-neutral	—	—	16.25	18.16	4.75	5.31	—	—

Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.61.

programs than any other category. Of all characters observed, 35.75% were categorized as active male characters, 26.82% as active female characters, and 18.16% as active sex-neutral characters. Almost 18% of all characters were categorized as passive. Of all characters observed, coders identified 6.70% as passive female characters, 5.87% as passive male characters, and 5.31% as passive sex-neutral characters. Less than 2% of all characters were identified as aggressive, with aggressive males totaling 1.12% of all characters and aggressive females totaling 0.28% of all characters. No sex-neutral characters were identified as aggressive. No characters of any gender were identified as submissive.

Active male characters were the most common character type observed in five programs -- 3 Balloons, Harry and the Haunted House, Little Monster at School, Reader Rabbit 1, and Reader Rabbit 3. Two programs, 3 Balloons and Reader Rabbit 3, contained more than 50% active male characters. Two programs, The Little Turtle and McGee School Days, had an equal number of active male and active female characters, with no sex-neutral characters observed. One program, Treasure MathStorm!, had more active females than any other type of character. Two programs, Just Grandma and Me and My Favorite Monster, have more active sex-neutral characters than any other type. No programs contained more than 50% active female or active sex-neutral characters.

In three programs -- Harry and the Haunted House, Just Grandma and Me, and Little Monster at School -- coders observed more passive female characters than passive male or passive sex-neutral characters. Two programs, The Little Turtle and My Favorite Monster, had an equal number of passive male characters and female characters, with My Favorite Monster having an equal number of passive sex-neutral characters as well. One program, Reader Rabbit 1, had an equal number of passive

male and passive sex-neutral characters, with both outnumbering passive female characters. Coders identified no passive characters in the remaining programs.

Coders identified aggressive characters in only two programs, Harry and the Haunted House and Little Monster at School. In Harry and the Haunted House, coders identified more aggressive male characters than aggressive female characters and no aggressive sex-neutral characters. In Little Monster at School, the only characters identified as aggressive were male. Generally, the data presented in Table 5 suggest that most characters are categorized as active, with active male characters outnumbering active female and active sex-neutral characters. The intercoder reliability for Table 5 was 0.61. Either the interactivity of the programs, which could have influenced the number of characters each coder observed, or differences in the coders' perceptions of characters' roles could account for a lower reliability figure.

Table 6 indicates the overall role distribution within gender categories. Of all female characters identified, 79.34% were active, 19.84% were passive, and 0.83% were aggressive. Of all male characters identified, 83.66% were active, 13.73% were passive, and 2.61% were aggressive. Of all sex-neutral characters identified, 77.38% were active and 22.62% were passive. No characters were identified as submissive in any gender category. The data suggest that female characters are slightly more likely to be categorized as passive than male characters; sex-neutral characters are the most likely to be categorized as passive. The intercoder reliability for Table 6 was 0.61. As noted in the preceding paragraph, the interactivity of the programs or the differences in the coders' perceptions could account for a lower reliability figure.

Table 7 reports the average number and percentage of roles of female, male, and sex-neutral characters observed by Team A. These figures closely follow the

Table 6
OVERALL AVERAGE ROLE DISTRIBUTION WITHIN GENDER
CATEGORIES

	% Aggressive	% Active	% Passive	% Submissive
Female n=30.25	0.83	79.34	19.84	—
Male n=38.25	2.61	83.66	13.73	—
Sex-neutral n=21.00	—	77.38	22.62	—

Notes: Categories may not equal 100% due to rounding.
 Intercoder reliability: 0.61.

Table 7
AVERAGE NUMBER AND PERCENTAGE OF ROLES OF
FEMALE, MALE, AND SEX-NEUTRAL CHARACTERS
OBSERVED BY TEAM A

Software Titles	Gender	Aggressive		Active		Passive		Submissive	
		n	%	n	%	n	%	n	%
3 Balloons	females	—	—	2.50	17.24	—	—	—	—
	males	—	—	8.50	58.62	—	—	—	—
	sex-neutral	—	—	3.50	24.14	—	—	—	—
Harry and the Haunted House	females	0.50	9.09	1.00	18.18	—	—	—	—
	males	1.00	18.18	2.50	45.46	—	—	—	—
	sex-neutral	—	—	0.50	9.09	—	—	—	—
Just Grandma and Me	females	—	—	5.00	21.74	5.00	21.74	—	—
	males	—	—	2.00	8.70	5.50	23.91	—	—
	sex-neutral	—	—	3.50	15.22	2.00	8.70	—	—
Little Monster at School	females	—	—	6.00	32.43	1.50	8.11	—	—
	males	0.50	2.70	6.00	32.43	0.50	2.70	—	—
	sex-neutral	—	—	3.00	16.22	1.00	5.41	—	—
The Little Turtle	females	—	—	1.00	50.00	—	—	—	—
	males	—	—	1.00	50.00	—	—	—	—
	sex-neutral	—	—	—	—	—	—	—	—

Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.70.

Table 7 (continued)

		Aggressive		Active		Passive		Submissive	
Software Titles	Gender	n	%	n	%	n	%	n	%
McGee School Days	females	—	—	2.00	50.00	—	—	—	—
	males	—	—	2.00	50.00	—	—	—	—
	sex-neutral	—	—	—	—	—	—	—	—
My Favorite Monster	females	—	—	0.50	16.67	—	—	—	—
	males	—	—	0.50	16.67	—	—	—	—
	sex-neutral	—	—	2.00	66.67	—	—	—	—
Reader Rabbit 1	females	—	—	1.00	28.57	—	—	—	—
	males	—	—	1.50	42.86	—	—	—	—
	sex-neutral	—	—	0.50	14.29	0.50	14.29	—	—
Reader Rabbit 3	females	—	—	3.00	40.00	—	—	—	—
	males	—	—	3.50	46.67	—	—	—	—
	sex-neutral	—	—	1.00	13.33	—	—	—	—
Treasure MathStorm!	females	—	—	2.50	35.71	—	—	—	—
	males	—	—	1.50	21.43	—	—	—	—
	sex-neutral	—	—	3.00	42.86	—	—	—	—
TOTALS	females	0.50	0.56	24.50	27.68	6.50	7.34	—	—
	males	1.50	1.69	29.00	32.77	6.00	6.78	—	—
	sex-neutral	—	—	17.00	19.21	3.50	3.95	—	—

Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.70.

figures for all coders presented in Table 5 with only slight variations. Team A reported only one program, 3 Balloons, with more than 50% active male characters. Unlike the results in Table 5, Little Monster at School had equal numbers of active male and active female characters, with fewer active sex-neutral characters. Team A reported only one program, Just Grandma and Me, with more active female characters than any other type. Two programs, My Favorite Monster and Treasure MathStorm!, had more active sex-neutral characters than any other type. My Favorite Monster contained more than 50% active sex-neutral characters.

In Table 7, only one program, Little Monster at School, had more passive female characters than passive male or passive sex-neutral characters. In Just Grandma and Me, Team A observed more passive male characters than passive female or passive sex-neutral characters. Team A observed only sex-neutral characters in the passive category in Reader Rabbit 1. The intercoder reliability for Table 7 was 0.70. This research suggests that the coders in Team A either could have observed more of the same characters or that their perceptions of characters' roles could have been more alike; either of these factors could account for the higher intercoder reliability for this team.

Table 8 presents the average number and percentage of roles of female, male, and sex-neutral characters observed by Team B. These figures closely follow the figures for all coders presented in Table 5 with only slight variations. Team B identified over 50% of the characters in Treasure MathStorm! as active females. Only one program, Harry and the Haunted House, had only female characters in the passive category. Little Monster at School, The Little Turtle, and My Favorite Monster each had an equal number of passive male and passive female characters, with no passive sex-neutral characters identified. Just Grandma and Me had more passive sex-neutral

Table 8
AVERAGE NUMBER AND PERCENTAGE OF ROLES OF
FEMALE, MALE, AND SEX-NEUTRAL CHARACTERS
OBSERVED BY TEAM B

Software Titles	Gender	Aggressive		Active		Passive		Submissive	
		n	%	n	%	n	%	n	%
3 Balloons	females	—	—	2.00	18.18	—	—	—	—
	males	—	—	7.00	63.64	—	—	—	—
	sex-neutral	—	—	2.00	18.18	—	—	—	—
Harry and the Haunted House	females	—	—	1.50	16.67	0.50	5.56	—	—
	males	—	—	4.00	44.44	—	—	—	—
	sex-neutral	—	—	3.00	33.33	—	—	—	—
Just Grandma and Me	females	—	—	2.50	13.16	3.00	15.79	—	—
	males	—	—	3.00	15.79	1.50	7.90	—	—
	sex-neutral	—	—	4.50	23.68	4.50	23.68	—	—
Little Monster at School	females	—	—	8.00	41.03	0.50	2.56	—	—
	males	0.50	2.56	8.50	43.59	0.50	2.56	—	—
	sex-neutral	—	—	1.50	7.69	—	—	—	—
The Little Turtle	females	—	—	1.00	33.33	0.50	16.67	—	—
	males	—	—	1.00	33.33	0.50	16.67	—	—
	sex-neutral	—	—	—	—	—	—	—	—

Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.51.

Table 8 (continued)

Software Titles	Gender	Aggressive		Active		Passive		Submissive	
		n	%	n	%	n	%	n	%
McGee School Days	females	—	—	2.00	50.00	—	—	—	—
	males	—	—	2.00	50.00	—	—	—	—
	sex-neutral	—	—	—	—	—	—	—	—
My Favorite Monster	females	—	—	1.50	23.08	0.50	7.69	—	—
	males	—	—	1.00	15.38	0.50	7.69	—	—
	sex-neutral	—	—	3.00	46.15	—	—	—	—
Reader Rabbit 1	females	—	—	1.00	14.29	0.50	7.14	—	—
	males	—	—	2.50	35.71	1.50	21.43	—	—
	sex-neutral	—	—	0.50	7.14	1.00	14.29	—	—
Reader Rabbit 3	females	—	—	1.50	21.43	—	—	—	—
	males	—	—	4.50	64.29	—	—	—	—
	sex-neutral	—	—	1.00	14.29	—	—	—	—
Treasure MathStorm!	females	—	—	2.50	55.56	—	—	—	—
	males	—	—	1.50	33.33	—	—	—	—
	sex-neutral	—	—	0.50	11.11	—	—	—	—
TOTALS	females	—	—	23.50	25.97	5.50	6.08	—	—
	males	0.50	0.55	35.00	38.67	4.50	4.97	—	—
	sex-neutral	—	—	16.00	17.68	5.50	6.07	—	—

Notes: Categories may not equal 100% due to rounding.
Intercoder reliability: 0.51.

characters than passive male or passive female characters. In Reader Rabbit 1, Team B identified more passive male characters than passive female or passive sex-neutral characters. In Little Monster at School, the only program containing aggressive characters, only male characters were identified as aggressive. The intercoder reliability for Table 8 was 0.51. This research suggests that the coders in Team B either could have seen fewer of the same characters or that their perceptions of characters' roles could have been different; either of these factors could account for the lower intercoder reliability for this team.

Table 9 reports the overall average number and percentage of roles of female, male, and sex-neutral characters observed by male coders versus female coders. Overall, male coders categorized 74.27% of all characters as active and 25.73% as passive. Female coders categorized 87.17% of all characters as active, 10.16% as passive, and 2.68% as aggressive. Both male and female coders identified active male characters as the most common; males categorized 32.16% of all characters as active males while female coders categorized 39.04% of all characters as active males. Male coders categorized 22.81% of all characters as active females, whereas female coders categorized 30.48% as active females. Male coders categorized 9.94% of all characters as passive female characters, 8.19% as passive sex-neutral characters, and 7.60% as passive male characters. Female coders categorized 4.28% of all characters as passive male characters, 3.74% as passive female characters, and 2.14% as passive sex-neutral characters. The data suggest that female coders are more likely to categorize characters as active than are male coders and that female coders identified aggressive characters where male coders identified no aggressive characters. For Table 9, the intercoder reliability for male coders was 0.63, and the intercoder reliability for female coders was 0.67. These figures are slightly higher than the overall intercoder

Table 9
OVERALL AVERAGE NUMBER AND PERCENTAGE OF ROLES
OF FEMALE, MALE, AND SEX-NEUTRAL CHARACTERS
OBSERVED BY MALE CODERS VS. FEMALE CODERS

		Aggressive		Active		Passive		Submissive	
	Gender	n	%	n	%	n	%	n	%
Male Coders	females	—	—	19.50	22.81	8.50	9.94	—	—
	males	—	—	27.50	32.16	6.50	7.60	—	—
	sex-neutral	—	—	16.50	19.30	7.00	8.19	—	—
Female Coders	females	0.50	0.54	28.50	30.48	3.50	3.74	—	—
	males	2.00	2.14	36.50	39.04	4.00	4.28	—	—
	sex-neutral	—	—	16.50	17.65	2.00	2.14	—	—

Note: Categories may not equal 100% due to rounding.

Intercoder reliability: male coders - 0.63; female coders - 0.67.

reliability figure for Table 5; this suggests that female perceptions of characters' roles are more alike and male perceptions of characters' roles are more alike. Again, the interactivity of the programs could have influenced the number of characters observed by each coder, thus lowering the intercoder reliability.

Section Three: Program Elements

Table 10 indicates the coders' identification of the feedback and audio program elements for each CD-ROM title. The percentages reflect the total number of coders that categorized the feedback component as graphical, verbal/text, both, other, or N/A and the audio component as musical, crashes/bangs/explosions/special effects, both, or other. The percentages for each category may equal more than 100% because the coders could choose more than one response under feedback and audio.

For the most part, coders agreed that feedback was present in seven of the ten titles. In five of these seven -- 3 Balloons, The Little Turtle, Reader Rabbit 1, Reader Rabbit 3, and Treasure MathStorm! -- the coders unanimously agreed that both graphical and verbal/text feedback were present. The coders unanimously agreed that no feedback was present in Harry and the Haunted House, Just Grandma and Me, and Little Monster at School.

In eight of the ten titles -- 3 Balloons, Harry and the Haunted House, Just Grandma and Me, Little Monster at School, McGee School Days, My Favorite Monster, Reader Rabbit 1, and Reader Rabbit 3 -- the coders unanimously agreed that both musical and crashes/bangs/explosions/special effects audio elements were present. In the remaining two titles, The Little Turtle and Treasure MathStorm!, a majority of coders agreed that both of these audio elements were present. Also, a majority of coders agreed that other types of audio, such as animal sounds, were present in most

Table 10
PERCENTAGE OF ALL CODERS IDENTIFYING PROGRAM
ELEMENTS: FEEDBACK AND AUDIO COMPONENTS

Software Titles	Feedback					Audio			
	graphi- cal	verbal/ text	both	other	N/A	musical	crashes/ bangs/ etc.	both	other
3 Balloons	—	—	100	25	—	—	—	100	50
Harry and the Haunted House	—	—	—	—	100	—	—	100	100
Just Grandma and Me	—	—	—	—	100	—	—	100	75
Little Monster at School	—	—	—	—	100	—	—	100	100
The Little Turtle	—	—	100	—	—	25	—	75	50
McGee School Days	—	50	50	75	—	—	—	100	75
My Favorite Monster	—	50	25	25	25	—	—	100	75
Reader Rabbit 1	—	—	100	75	—	—	—	100	75
Reader Rabbit 3	—	—	100	75	—	—	—	100	100
Treasure MathStorm!	—	—	100	—	—	25	—	75	100

Notes: Categories may total more than 100% because coders could choose more than one response.

Intercoder reliability: 0.83.

titles. This research indicates that most of these programs incorporate feedback and audio elements that past research has shown to appeal to both male and female users. The intercoder reliability for Table 10 was 0.83. Although the interactivity of the programs could have influenced the reliability figure, this research suggests that coders' perceptions of program elements could have had more influence on intercoder reliability.

Table 11 indicates the coders' identification of the scoring, program type, and overall format components of each program. The percentages reflect the total number of coders that categorized the scoring component as scored or not scored, the program type as entertainment-oriented or education-oriented, and the overall format of the program as arcade game, completion task, storytelling, or other.

A majority of coders categorized six programs -- Harry and the Haunted House, Just Grandma and Me, Little Monster at School, The Little Turtle, McGee School Days, and Reader Rabbit 1 -- as not scored. A majority of coders categorized three programs -- 3 Balloons, Reader Rabbit 3, and Treasure MathStorm! -- as scored. Coders were evenly divided between scored and not scored for My Favorite Monster. These results suggest that since most of the programs in this study are not scored, they would appeal more to female users as indicated by past research.

The coders unanimously identified six programs -- 3 Balloons, The Little Turtle, McGee School Days, Reader Rabbit 1, Reader Rabbit 3, and Treasure MathStorm! -- as education-oriented. A majority of coders identified four programs -- Harry and the Haunted House, Just Grandma and Me, Little Monster at School, and My Favorite Monster -- as entertainment-oriented.

The coders unanimously identified four programs -- 3 Balloons, Reader Rabbit 1, Reader Rabbit 3, and Treasure MathStorm! -- and a majority of coders identified

Table 11
PERCENTAGE OF ALL CODERS IDENTIFYING PROGRAM
ELEMENTS: SCORING, PROGRAM TYPE, AND OVERALL
FORMAT COMPONENTS

Software Titles	Scoring		Program Type		Overall Format			
	scored	not scored	entertainment oriented	education oriented	arcade game	completion task	story-telling	other
3 Balloons	100	—	—	100	—	100	—	—
Harry and the Haunted House	—	100	75	25	—	—	100	—
Just Grandma and Me	—	100	75	25	—	—	100	—
Little Monster at School	—	100	75	25	—	—	100	—
The Little Turtle	25	75	—	100	—	25	50	25
McGee School Days	—	100	—	100	—	75	—	25
My Favorite Monster	50	50	75	25	—	25	25	50
Reader Rabbit 1	—	100	—	100	—	100	—	—
Reader Rabbit 3	75	25	—	100	—	100	—	—
Treasure MathStorm!	100	—	—	100	—	100	—	—

Note: Inter-coder reliability: 0.79.

McGee School Days as having a completion task format. The coders unanimously agreed that three programs -- Harry and the Haunted House, Just Grandma and Me, and Little Monster at School -- had a storytelling format. The coders were divided as to the format of the remaining titles. No programs were categorized as having an arcade game format. The data suggest that, according to past research, the format of many of these programs would appeal to female users. The intercoder reliability for Table 11 was 0.79. As in Table 10, the interactivity of the programs could have influenced the intercoder reliability, but the research suggests that coders' perceptions of program elements had more influence on the reliability figure.

Table 12 reports Team A's identification of the feedback and audio program elements for each CD-ROM title. The intercoder reliability for Table 12 was 0.73. Table 13 reports Team A's identification of the scoring, program type, and overall format components of each program. The intercoder reliability for Table 13 was 0.70. The data in each of these tables closely follow the overall data presented in Tables 10 and 11, with no notable differences. Although the interactivity of the programs could have influenced the reliability figures, the research suggests that coders in Team A perceived program elements somewhat differently.

Table 14 reports Team B's identification of the feedback and audio program elements for each CD-ROM title. The intercoder reliability for Table 14 was 0.92. Table 15 reports Team B's identification of the scoring, program type, and overall format components of each program. The intercoder reliability for Table 15 was 0.87. The data in each of these tables closely follow the overall data presented in Tables 10 and 11, with no notable differences. Although the interactivity of the programs could have influenced the reliability figures, the research suggests that coders in Team B perceived program elements more similarly.

Table 12
PERCENTAGE OF CODERS IN TEAM A IDENTIFYING
PROGRAM ELEMENTS: FEEDBACK AND AUDIO
COMPONENTS

Software Titles	Feedback					Audio			
	graphi- cal	verbal/ text	both	other	N/A	musical	crashes/ bangs/ etc.	both	other
3 Balloons	—	—	100	—	—	—	—	100	50
Harry and the Haunted House	—	—	—	—	100	—	—	100	100
Just Grandma and Me	—	—	—	—	100	—	—	100	50
Little Monster at School	—	—	—	—	100	—	—	100	100
The Little Turtle	—	—	100	—	—	50	—	50	50
McGee School Days	—	—	100	100	—	—	—	100	50
My Favorite Monster	—	50	—	—	50	—	—	100	50
Reader Rabbit 1	—	—	100	50	—	—	—	100	50
Reader Rabbit 3	—	—	100	50	—	—	—	100	100
Treasure MathStorm!	—	—	100	—	—	50	—	50	100

Notes: Categories may total more than 100% because coders could choose more than one response.

Intercoder reliability: 0.73.

Table 13
PERCENTAGE OF CODERS IN TEAM A IDENTIFYING
PROGRAM ELEMENTS: SCORING, PROGRAM TYPE, AND
OVERALL FORMAT COMPONENTS

Software Titles	Scoring		Program Type		Overall Format			
	scored	not scored	entertainment oriented	education oriented	arcade game	completion task	story-telling	other
3 Balloons	100	—	—	100	—	100	—	—
Harry and the Haunted House	—	100	50	50	—	—	100	—
Just Grandma and Me	—	100	50	50	—	—	100	—
Little Monster at School	—	100	50	50	—	—	100	—
The Little Turtle	50	50	—	100	—	50	50	—
McGee School Days	—	100	—	100	—	100	—	—
My Favorite Monster	50	50	50	50	—	50	—	50
Reader Rabbit 1	—	100	—	100	—	100	—	—
Reader Rabbit 3	50	50	—	100	—	100	—	—
Treasure MathStorm!	100	—	—	100	—	100	—	—

Note: Intercoder reliability: 0.70.

Table 14
PERCENTAGE OF CODERS IN TEAM B IDENTIFYING
PROGRAM ELEMENTS: FEEDBACK AND AUDIO
COMPONENTS

Software Titles	Feedback					Audio			
	graphi- cal	verbal/ text	both	other	N/A	musical	crashes/ bangs/ etc.	both	other
3 Balloons	—	—	100	50	—	—	—	100	50
Harry and the Haunted House	—	—	—	—	100	—	—	100	100
Just Grandma and Me	—	—	—	—	100	—	—	100	100
Little Monster at School	—	—	—	—	100	—	—	100	100
The Little Turtle	—	—	100	—	—	—	—	100	50
McGee School Days	—	100	—	50	—	—	—	100	100
My Favorite Monster	—	50	50	50	—	—	—	100	100
Reader Rabbit 1	—	—	100	100	—	—	—	100	100
Reader Rabbit 3	—	—	100	100	—	—	—	100	100
Treasure MathStorm!	—	—	100	—	—	—	—	100	100

Notes: Categories may total more than 100% because coders could choose more than one response.

Intercoder reliability: 0.92.

Table 15
PERCENTAGE OF CODERS IN TEAM B IDENTIFYING
PROGRAM ELEMENTS: SCORING, PROGRAM TYPE, AND
OVERALL FORMAT COMPONENTS

Software Titles	Scoring		Program Type		Overall Format			
	scored	not scored	entertainment oriented	education oriented	arcade game	completion task	story-telling	other
3 Balloons	100	—	—	100	—	100	—	—
Harry and the Haunted House	—	100	100	—	—	—	100	—
Just Grandma and Me	—	100	100	—	—	—	100	—
Little Monster at School	—	100	100	—	—	—	100	—
The Little Turtle	—	100	—	100	—	—	50	50
McGee School Days	—	100	—	100	—	50	—	50
My Favorite Monster	50	50	100	—	—	—	50	50
Reader Rabbit 1	—	100	—	100	—	100	—	—
Reader Rabbit 3	100	—	—	100	—	100	—	—
Treasure MathStorm!	100	—	—	100	—	100	—	—

Note: Inter-coder reliability: 0.87.

Table 16 reports male coders' identification of the feedback and audio program elements for each CD-ROM title; the intercoder reliability for Table 16 was 0.72. Table 17 indicates male coders' identification of the scoring, program type, and overall format components of each program; the intercoder reliability for Table 17 was 0.77. Table 18 reports female coders' identification of the feedback and audio program elements for each CD-ROM title; the intercoder reliability for Table 18 was 0.93. Table 19 indicates female coders' identification of the scoring, program type, and overall format components of each program; the intercoder reliability for Table 19 was 0.90. These reliability figures suggest that females' perceptions of program elements are more similar to each other's than are males' perceptions of program elements.

The data from these tables indicate two notable differences between male coders' and female coders' identification of program elements. First, female coders identified the presence of "other" audio elements significantly more often than did male coders. Second, female coders indicated more often that programs were scored than did male coders. This research suggests that female coders perceived some program elements differently than male coders.

Section Four: Gender Bias and Program Subject Matter

For this section, the researcher categorized each program under a subject heading: reading, interdisciplinary, and mathematics. The categorization was based on the manufacturer's classification of each program. Six programs fell into the reading category: Harry and the Haunted House, Just Grandma and Me, Little Monster at School, The Little Turtle, Reader Rabbit 1, and Reader Rabbit 3. Three programs fell into the interdisciplinary category: 3 Balloons, McGee School Days, and My Favorite Monster. One program fell into the mathematics category: Treasure MathStorm!.

Table 16
PERCENTAGE OF MALE CODERS IDENTIFYING PROGRAM
ELEMENTS: FEEDBACK AND AUDIO COMPONENTS

Software Titles	Feedback					Audio			
	graphi- cal	verbal/ text	both	other	N/A	musical	crashes/ bangs/ etc.	both	other
3 Balloons	—	—	100	50	—	—	—	100	—
Harry and the Haunted House	—	—	—	—	100	—	—	100	100
Just Grandma and Me	—	—	—	—	100	—	—	100	50
Little Monster at School	—	—	—	—	100	—	—	100	100
The Little Turtle	—	—	100	—	—	50	—	50	—
McGee School Days	—	50	50	50	—	—	—	100	50
My Favorite Monster	—	—	—	50	50	—	—	100	50
Reader Rabbit 1	—	—	100	50	—	—	—	100	100
Reader Rabbit 3	—	—	100	50	—	—	—	100	100
Treasure MathStorm!	—	—	100	—	—	—	—	50	100

Note: Categories may total more than 100% because coders could choose more than one response.

Intercoder reliability: 0.72.

Table 17
PERCENTAGE OF MALE CODERS IDENTIFYING PROGRAM
ELEMENTS: SCORING, PROGRAM TYPE, AND OVERALL
FORMAT COMPONENTS

Software Titles	Scoring		Program Type		Overall Format			
	scored	not scored	entertainment oriented	education oriented	arcade game	completion task	story-telling	other
3 Balloons	100	—	—	100	—	100	—	—
Harry and the Haunted House	—	100	50	50	—	—	100	—
Just Grandma and Me	—	100	50	50	—	—	100	—
Little Monster at School	—	100	50	50	—	—	100	—
The Little Turtle	—	100	—	100	—	—	50	50
McGee School Days	—	100	—	100	—	100	—	—
My Favorite Monster	—	100	50	50	—	—	50	50
Reader Rabbit 1	—	100	—	100	—	100	—	—
Reader Rabbit 3	50	50	—	100	—	100	—	—
Treasure MathStorm!	100	—	—	100	—	100	—	—

Note: Inter-coder reliability: 0.77.

Table 18
PERCENTAGE OF FEMALE CODERS IDENTIFYING PROGRAM
ELEMENTS: FEEDBACK AND AUDIO COMPONENTS

Software Titles	Feedback					Audio			
	graphi- cal	verbal/ text	both	other	N/A	musical	crashes/ bangs/ etc.	both	other
3 Balloons	—	—	100	—	—	—	—	100	100
Harry and the Haunted House	—	—	—	—	100	—	—	100	100
Just Grandma and Me	—	—	—	—	100	—	—	100	100
Little Monster at School	—	—	—	—	100	—	—	100	100
The Little Turtle	—	—	100	—	—	—	—	100	100
McGee School Days	—	50	50	100	—	—	—	100	100
My Favorite Monster	—	50	50	—	—	—	—	100	100
Reader Rabbit 1	—	—	100	100	—	—	—	100	50
Reader Rabbit 3	—	—	100	100	—	—	—	100	100
Treasure MathStorm!	—	—	100	—	—	—	—	100	100

Note: Categories may total more than 100% because coders could choose more than one response.

Intercoder reliability: 0.93.

Table 19
PERCENTAGE OF FEMALE CODERS IDENTIFYING PROGRAM
ELEMENTS: SCORING, PROGRAM TYPE, AND OVERALL
FORMAT COMPONENTS

Software Titles	Scoring		Program Type		Overall Format			
	scored	not scored	entertainment oriented	education oriented	arcade game	completion task	story-telling	other
3 Balloons	100	—	—	100	—	100	—	—
Harry and the Haunted House	—	100	100	—	—	—	100	—
Just Grandma and Me	—	100	100	—	—	—	100	—
Little Monster at School	—	100	100	—	—	—	100	—
The Little Turtle	50	50	—	100	—	50	50	—
McGee School Days	—	100	—	100	—	50	—	50
My Favorite Monster	100	—	100	—	—	50	—	50
Reader Rabbit 1	—	100	—	100	—	100	—	—
Reader Rabbit 3	100	—	—	100	—	100	—	—
Treasure MathStorm!	100	—	—	100	—	100	—	—

Notes: Intercoder reliability: 0.90.

Of the six reading programs, the research indicates that no one program presented both male-oriented character portrayals and male-oriented program elements. However, three reading programs -- Harry and the Haunted House, Reader Rabbit 1, and Reader Rabbit 3 -- presented mostly male-oriented character portrayals. Each of these also contained some program elements that past research indicates appeal to female users. For instance, Harry and the Haunted House and Reader Rabbit 1 were not scored. Reader Rabbit 1 and Reader Rabbit 3 had a completion task format. All three of these programs also contained audio elements, such as music and crashes/bangs/explosions/sound effects, that past research indicates appeal to both male and female users. Reader Rabbit 1 and Reader Rabbit 3 each contained graphical and verbal/text feedback, which past research indicates appeal to both male and female users.

Of the remaining three programs in the reading category, those data indicate that two, Little Monster at School and The Little Turtle, presented character portrayals that were nearly balanced between male and female characters. However, the third program, Just Grandma and Me, presented more female characters than male characters. All three programs contained audio elements that appeal to both male and female users. Further, all three programs were not scored, a characteristic which research indicates appeals to female users. Feedback was present in only one of these three programs; The Little Turtle contained graphical and verbal/text feedback, which past research indicates appeal to both male and female users.

Of the three titles in the interdisciplinary category, the data indicate that one program, 3 Balloons, presented more male characters than female characters; one program, McGee School Days, presented an even number of male and female characters; and one program, My Favorite Monster, presented more sex-neutral

characters than either male or female characters. All three programs contained audio elements that past research indicates appeal to both male and female users.

Additionally, 3 Balloons contained graphical and verbal/text feedback, which past research indicates appeal to both male and female users. In the scored/not scored category, McGee School Days was not scored whereas 3 Balloons was scored.

Further, the research indicates that both 3 Balloons and McGee School Days had a completion task format, which past research indicates appeals to female users.

In the mathematics category, research indicates that Treasure MathStorm! presented significantly more female characters than male characters. However, Treasure MathStorm! contained feedback and audio components that past research indicates appeal to both male and female users. The data indicate that this program was scored, a characteristic that primarily appeals to male users. On the other hand, the data indicate that Treasure MathStorm! had a completion task format, a characteristic that primarily appeals to female users.

The research indicates that no one program in any subject category presented both male-oriented character portrayals and male-oriented program elements. While many programs presented male-oriented character portrayals, all programs contained at least some program elements that appeal to both male and female users or primarily to female users. The data suggest that the programs within the subject matter categories do not tend to incorporate character portrayals and program elements that are distinctly male-oriented or female-oriented.

CHAPTER FIVE

Summary, Conclusions, Limitations, and Recommendations

The purpose of this study was to analyze gender bias in educational CD-ROM software primarily intended for ages three through eight. Using content analysis, this study attempted to assess the current status of gender bias in ten randomly selected pieces of CD-ROM software by focusing on character portrayal and program elements. By analyzing ten pieces of software produced or distributed by three top software companies, this study was able to determine that, overall, the programs are gender biased in their character portrayals but not in their program elements.

Three research questions were developed to guide the research. The results yielded by the research form the basis for the answers to these questions.

- Research question 1: How many male and female characters are presented in each computer program? What type of role does each character assume? The data from this study suggest that male characters are found in educational computer programs more often than female or sex-neutral characters. In some programs, male characters outnumber female characters by a ratio of two to one. Although female characters outnumber male characters in a few programs, the data indicate that overall there are almost ten percent more male characters than female characters present in the studied software.

The data also indicate that male characters are more likely to assume active roles than are female characters. However, the margin of difference in the number of characters of each gender assuming an active role is slight. The data further indicate that female characters are more likely to assume passive roles than are male characters.

Again, the margin is slight. Also, of the small number of characters identified in an aggressive role, most were male characters. Finally, the data suggest submissive characters of either gender are uncommon, as coders did not identify any character as assuming a submissive role.

- Research question 2: Does the structure of the individual software programs contain elements (e.g., audio, feedback, scoring) that appeal to male users or to female users; or is the appeal gender-neutral? The data indicate that all of the educational software programs studied incorporated program elements that appeal to male users and to female users. For instance, most of the programs that contained feedback presented forms that appeal to male users and to female users. Also, every program studied contained audio elements that appeal to both males and females.

However, most of the programs studied were not scored. Generally, scoring can be reflected in numbers or graphical representations of achievement or prizes. Past research suggests that female users are more attracted to a program format without scoring whereas male users prefer some type of scoring (Cooper et al., 1990, p. 421). Interestingly, the data indicate that no program studied had an arcade game format; past research suggests that this format primarily appeals to male users (Cooper et al., 1990, p. 420). On the other hand, half of the programs studied had a completion task format; past research suggests that this format primarily appeals to female users (Cooper et al., 1990, p. 421).

Brady and Slesnick (1985) defined gender-neutral software as tool programs that allow users to set and accomplish individual goals in individual ways, such as programs that allow users to create their own games or to measure their own vital signs (pp. 24, 26). The data suggest that no program analyzed in this study fits this definition. The programs all contain some elements that appeal to male users and some elements that

appeal to female users, but none with complete gender-neutral appeal. However, the data suggest that some of the programs studied are similar to Winnie the Pooh and the Hundred Acre Wood, which Forsyth and Lancy (1989) found to hold both boys' and girls' interest while successfully teaching all students geography (pp. 53-55). Forsyth and Lancy attributed this program's success to its construction, which took a more gender-neutral approach by incorporating elements that appealed to both males and females (Forsyth & Lancy, 1989, p. 59).

- Research question 3: Is there a relationship between the software program's subject matter and the appeal of the elements and the characters of the program structure? The data from this study suggest that there is no relationship between the program's subject matter and gender bias present in character portrayal or program elements. For instance, most programs in the reading subject category contained more male characters than female characters. However, these same pieces of software contained program elements that past research suggests appeal to female users. The data suggest that within a subject category, programs may be gender biased in one respect but not in another. Therefore, the data does not indicate any relationship between subject matter and gender bias.

Conclusions

In the 1960s, Melvin DeFleur proposed his "cultural norms theory," which states that the repetition of fictional scenes in entertainment influences the viewers' perception of normality (Singletary, 1994, p. 288). Later, George Gerbner proposed his "cultivation theory," which states that television influences viewers' perception of

reality by instilling in them an exaggerated view of the world based on what they have seen on television (Singletary, 1994, p. 288). Both of these theories attempt to predict the effects of mass entertainment, namely television, on viewers. However, because of similarities in the television medium and the computer medium, these theories may also apply to educational computer software.

Computer software users could gain distorted perceptions of reality from exposure to gender bias in educational software, especially as the use of this software continues to grow. For instance, the software programs in this study presented more male characters than female characters. Further, more male characters in the software programs assumed active roles than did female characters. This unbalanced character portrayal could slant both girls' and boys' perceptions of reality. This effect could be heightened for girls or for boys, since the data suggest that females and males perceive character portrayals differently. Exposure to this kind of gender bias in educational software could lead both girls and boys to believe that it is more acceptable for males to assume active roles in society. Also, the software programs in this study present more female characters than male characters in passive roles. Again, this gender bias may lead children to believe that it is more acceptable for women to assume passive roles in society.

Another effect of gender biased character portrayals in educational software is that girls are discouraged from computer use. Past research has suggests that girls prefer female characters in software programs whereas boys prefer male characters in software programs (Jakobsdottir & Krey, 1993, p. 6). Constant exposure to male characters in educational software may cause girls to lose interest in computer use. Past research indicates that girls are already using computers less than boys, especially in extracurricular activities (Hess & Miura, 1985; Levin & Gordon, 1989; Nelson &

Watson, 1991). Unless gender biased character portrayals are corrected, boys will continue to use computers more often than girls. This trend may ultimately decrease girls' ability to compete in the modern computer-oriented workplace as adults.

Program elements that primarily appeal to boys can also discourage girls from using computers. For instance, past research suggests the most commonly used educational software programs appeal primarily to male interests by incorporating arcade game-like elements, using symbols such as spaceships and guns or focusing on aggressive formats (Cooper et al., 1990, p. 420). Such male-oriented software may not appeal to most girls (Canada & Brusca, 1991; Lockheed, 1985; Rosenthal & Demetrulias, 1988). However, the data from this study indicate that no program analyzed had an arcade game format. This finding is encouraging, because it may suggest that software designers are moving away from strongly male-oriented formats.

In fact, the data from this study suggest that, overall, software designers are incorporating program elements that appeal to both male and female users. For instance, several of the programs studied contained graphical feedback, which past research suggests appeals to boys, as well as verbal or text feedback, which past research suggests appeals to girls (Cooper et al., 1990, p. 421). By incorporating program elements that appeal to both boys and girls, program designers are taking a step in the right direction by minimizing gender bias. However, software designers should continue to move toward gender-neutral software by constantly seeking to incorporate elements that appeal to boys and girls equally. As they attempt to do so, software designers should also bear in mind that females and males may perceive program elements differently, as suggested by this study.

Software designers should also seek to eliminate gender bias from their products by monitoring character portrayal. Bearing in mind the influence that educational

software content can have on users, designers should strive to present a more accurate distribution of males and females as well as a more accurate portrayal of male and female roles. However, software designers are not solely responsible for implementing these changes. Teachers, administrators, and parents should evaluate and monitor educational software for their students or children. By making themselves aware of gender bias in educational software, teachers, administrators, and parents can select software that more accurately portrays male and female characters. As more informed choices are made, software producers and designers will respond to a demand for gender-neutral software.

Limitations of the Study

One limitation of this study is that it includes only software compatible with the Apple Macintosh computer system. It excludes programs designed for use only with IBM-compatible computer systems, because only Apple Macintosh computers were available to the researcher. Since the University of Tennessee campus was the most convenient location for the coders to complete this study, the researcher was limited to the facilities available there. The only computers owned by the University of Tennessee that met the hardware requirements of the CD-ROM programs were Apple Macintoshes.

A second limitation of this study is that it was conducted under time constraints. Due to the limited time allotted for this study, coders only analyzed about 20 minutes of each program. Therefore, the coders did not have time to explore all interactive possibilities within each program. It is possible that each coder pursued different

interactive possibilities within the allotted time; as a result, each coder may have encountered different characters and elements within each program.

A third limitation of this study deals with another aspect of the interactivity of the CD-ROM programs studied. Since the programs are interactive in nature, many of the characters in each program assumed a passive role until the user selected that character. Many times, the selected character assumed a different role by becoming active or aggressive. In other instances, when the user clicked on what appeared to be an inanimate object, such as a kitchen appliance or a doll, the inanimate object became animate. In many cases, the selected inanimate objects assumed human characteristics, thus making them characters. Because the coders did not have time to explore all interactive possibilities within the software, it is possible that they did not see all characters in the programs or see accurate roles of those characters.

Recommendations for Further Research

More research concentrating on educational software for all age groups, pre-school through college, would provide a better understanding of the existence of gender bias in educational software. An exhaustive content analysis, which would enable coders to explore all interactive possibilities within each program, would provide a more complete understanding of the presence of gender bias in such software. Such a study would overcome some limitations caused by interactivity encountered in this research.

Also, focus group research would provide insight into educational software users' perceptions of character portrayals and program elements. For instance, in

educational software targeted toward preschoolers, characters are often animals or cartoon creatures that may not have obvious male or female characteristics. Software users may interpret these characters as either male or female based on their personal perceptions or experiences. In other words, the computer users may interpret an ambiguous character as male or female when the software designer did not intend for that character to have a specific gender identity. Such research may also provide insight into the differences in males' perceptions and females' perceptions of character portrayals and program elements.

More specifically, future research could examine differences in perceptions among various groups of computer users. For instance, this research could examine children's perceptions of character portrayals and program elements by using children as coders. This may provide insight into children's perceptions of characters' gender and roles or children's interpretations of program elements. Also, future research could examine differences in perception among people in various disciplines. By using coders from different disciplines -- such as graphic arts, music, sociology, communications, or education -- future research could provide insight into how professional training may affect perception.

Another possibility for future research may be interviewing or surveying software designers to gain insight into their awareness of gender bias issues in educational computer software. Such a study could also examine whether software designers and distributors monitor their products for gender bias and if so, how this is accomplished. Understanding the attitudes of software producers toward gender bias issues could be helpful in minimizing gender bias in future software products.

Also, future research could explore the relationship between software design and children's attitudes toward computers. Such research could provide insight into

how software designers can create computer software programs that encourage computer use among all children equally. The creation of such software could result in an overall improvement of children's attitudes toward computer use, especially among females.

Finally, further research could examine children's, teachers', and administrators' attitudes toward and perceptions of gender bias issues in educational software. This research could consist of focus groups, surveys, or interviews. A longitudinal study of children and their attitudes toward and perceptions of gender bias issues in educational software also may provide a better understanding of how these issues influence children at different ages. Such research would be helpful in guiding teachers' and administrators' educational software choices for their school or district. Also, such research could enable teachers and administrators to minimize the effects of gender bias on students.

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APPENDICES

APPENDIX A

Sample Coding Form

Coder name: _____

Computer program title: _____

Computer program's subject matter: _____

CODER: COMPLETE EACH OF THE FOLLOWING SECTIONS.

I. CHARACTER PORTRAYAL:

a. Male

1 ----- aggressive active passive submissive

Explanation:

2 ----- aggressive active passive submissive

Explanation:

3 ----- aggressive active passive submissive

Explanation:

4 ----- aggressive active passive submissive

Explanation:

5 ----- aggressive active passive submissive

Explanation:

6 ----- aggressive active passive submissive

Explanation:

7 ----- aggressive active passive submissive

Explanation:

8 ----- aggressive active passive submissive

Explanation:

9 ----- aggressive active passive submissive

Explanation:

10 ----- aggressive active passive submissive

Explanation:

b. Female

1 ----- aggressive active passive submissive

Explanation:

2 ----- aggressive active passive submissive

Explanation:

3 ----- aggressive active passive submissive

Explanation:

4 ----- aggressive active passive submissive

Explanation:

5 ----- aggressive active passive submissive

Explanation:

6 ----- aggressive active passive submissive

Explanation:

7 ----- aggressive active passive submissive

Explanation:

8 ----- aggressive active passive submissive

Explanation:

9 ----- aggressive active passive submissive

Explanation:

10 ----- aggressive active passive submissive

Explanation:

c. Sex-neutral

1 ----- aggressive active passive submissive

Explanation:

2 ----- aggressive active passive submissive

Explanation:

3 ----- aggressive active passive submissive

Explanation:

4 ----- aggressive active passive submissive

Explanation:

5 ----- aggressive active passive submissive

Explanation:

6 ----- aggressive active passive submissive

Explanation:

7 ----- aggressive active passive submissive

Explanation:

8 ----- aggressive active passive submissive

Explanation:

9 ----- aggressive active passive submissive

Explanation:

10 ----- aggressive active passive submissive

Explanation:

d. No characters present

II. PROGRAM ELEMENTS:

A. Feedback:

graphical: (explanation)

verbal/text: (explanation)

both: (explanation)

other: (explanation)

N/A

B. Audio:

musical: (description)

crashes/bangs/explosions/special effects: (description)

both: (description)

other sounds (e.g., animal, birds, non-descriptive sounds): (description)

C. Scoring:

scored

not scored

D. Type of Program:

Entertainment-oriented: (explanation)

Education-oriented: (explanation)

E. Overall format of computer program:

arcade game format: (explanation)

completion task format: (explanation)

storytelling format: (explanation)

other: (explanation)

APPENDIX B

Coder Instruction Book

I. Character Portrayal

- For each character in the program, identify it as male or female. For instance, when the first male character appears, circle "1" under **Male**; when the second male character appears, circle "2" under **Male**; and so forth.
- If the character does not have identifying male or female traits, identify that character as sex-neutral.
- If no characters are present in the program, choose (d) - "No characters present."
- For each character in the program, circle the term that most closely describes that character's role.

Aggressive: "vigorously energetic, especially in the use of initiative and forcefulness; boldly assertive" (Stein, 1984, p. 26).

Active: "constantly engaged in action; busy" (Stein, 1984, p. 14).

Passive: "not participating actively; inactive" (Stein, 1984, p. 972).
E.g., an observer, bystander.

Submissive: "unresistingly or humbly obedient" (Stein, 1984, p. 1309).
E.g., follower as opposed to leader.

- Give a brief explanation of why you classified each character as male, female or sex-neutral; for instance, note clothing or other physical characteristics that helped you identify that character's sex or sex-neutral status. Also note why you chose one of the four terms to describe that character's role; for instance, note specific actions or attitudes that those characters exhibit or possess.

II. Program Elements

- A. *Feedback:* when the program or a character in the program provides positive or negative reinforcement for answers or task completions. Feedback is not a

character's or object's response to the user (e.g., inanimate objects becoming human-like characters when clicked on).

Choose the term - "graphical" or "verbal/text" - that best describes the type of feedback in the program.

- If both "graphical" and "verbal/text" feedback occur, then choose "both."
- If some type of feedback occurs that does not fall into the above categories, then choose "other."
- If no feedback is given in a program, then simply mark that question as N/A.
- Then give a brief explanation of your choice; for example, describe one instance of feedback.

(NOTE: It is possible to choose more than one category in this section; for instance, you may choose "graphical" as well as "other.")

B. Choose the term - "musical" or "crashes/bangs/explosions/special effects" - that best describes the type of audio found in the program.

- If both "musical" or "crashes/bangs/explosions/special effects" audio occur, then choose "both."
- If some type of audio is found in the program that does not fall into the above categories, then choose "other."
- Then give a brief explanation of your choice; for example, describe one element of audio.

(NOTE: It is possible to choose more than one category in this section; for instance, you may choose "musical" as well as "other.")

C. Indicate whether scoring was evident in the program or not. Scoring can be reflected in numbers or graphical representations of achievement or prizes.

D. Indicate whether the overall program is "entertainment-oriented" or "education-oriented."

Entertainment-oriented: simply for entertainment; while there may be some educational value, the program is overall intended for amusement.

Education-oriented: has educational value; concentrates on educational skills; while there may be some entertainment, the program is overall intended to teach an academic skill.

-- Briefly explain your answer.

- E. Indicate whether the overall program format is an "arcade game format," a "completion task format," "storytelling format," or "other."

Arcade game format: game-oriented; the object is to succeed at the game.

Completion task format: task-oriented; the object is to complete a goal or task.

Storytelling format: narrative-oriented; the object is to follow along as a story is told.

-- Briefly explain your answer.

***** BE SURE TO FILL OUT ALL QUESTIONS; DO NOT SKIP ANY PARTS.**

APPENDIX C

List of Educational CD-ROM Titles Studied

CD-ROM Titles Used in Pre-Test:

1. Arthur's Birthday: produced and distributed by Living Books
Subject: reading
2. Math Rabbit - Deluxe!: produced and distributed by The Learning Company
Subject: mathematics

CD-ROM Titles Used in Study:

1. 3 Balloons: produced by SWeDE; distributed by Davidson and Associates
Subject: interdisciplinary
2. Harry and the Haunted House: produced and distributed by Living Books
Subject: reading
3. Just Grandma and Me: produced and distributed by Living Books
Subject: reading
4. Little Monster at School: produced and distributed by Living Books
Subject: reading
5. The Little Turtle: produced by Computer Curriculum Corporation; distributed by Davidson and Associates
Subject: reading
6. McGee School Days: produced by Lawrence Productions; distributed by Davidson and Associates
Subject: interdisciplinary
7. My Favorite Monster: produced by Simon & Schuster Interactive; distributed by Davidson and Associates
Subject: interdisciplinary

8. Reader Rabbit 1 - Deluxe!: produced and distributed by The Learning Company
Subject: reading
9. Reader Rabbit 3 - Deluxe!: produced and distributed by The Learning Company
Subject: reading
10. Treasure MathStorm!: produced and distributed by The Learning Company
Subject: mathematics

APPENDIX D

Coder Information

Team A:

1. Jesse Horton

Received a Bachelor of Arts degree in History from the University of Tennessee in May 1994. Currently working on a Master of Science degree in Curriculum and Instruction with a focus on secondary education at the University of Tennessee. Completed field experience at Bearden Middle School and Clinton High School during the 1994 spring semester. Completed internship at Farragut Middle School in June 1995.

2. Melissa Kirk

Received a Bachelor of Science degree in Education from the University of Tennessee in 1990. Received her elementary education certification from the University of Tennessee in 1991. Currently working on a Master of Science degree in Curriculum and Instruction with a focus on primary education. Worked as a teacher in the Oak Ridge City Schools from 1990-1991 and at Cedar Bluff Intermediate School from 1991-1993. Currently working at Ridgedale Elementary School where she teaches third or fifth grade.

Team B:

1. Calvin Cupp

Received a Bachelor of Science degree with a major in mathematics and a minor in education from the University of Tennessee in 1994. Currently working on a Master of Science degree in Curriculum and Instruction and a focus on secondary education. Completed field experience at Carter High School and South Doyle Middle School. Completed internship at Heritage High School.

2. Christen Nuckolls

Received a Bachelor of Arts in Human Learning and Behavior with a minor in Elementary Education from the University of Tennessee in May 1995. Currently working on a Master of Science degree in Curriculum and Instruction with a focus on primary education. Completed field experience at Alcoa Professional Development School. Has worked as a substitute teacher in Bolivar, Tennessee. Will be interning at Rockford Elementary School in Blount County during the fall and spring semesters of 1995-1996.

VITA

Born in San Bernardino, California, Jennifer Wolfkill received her initial education in St. Louis, Missouri, and Germantown, Tennessee. She earned her Bachelor of Science in Telecommunication with a minor in English from the University of Florida in 1992.

Her experience in the field includes interning in the WREG-TV news department in Memphis, Tennessee; interning in the WUFT-TV promotions department in Gainesville, Florida; working as a student production assistant at WUFT-TV; and working as a student production assistant at Center for Telecommunications and Video in Knoxville, Tennessee. Her other experience includes working as a personal banker at National Bank of Commerce in Memphis, Tennessee.