FLASHING INTO A CHILD'S MIND: THE EDUCATIONAL IMPACT OF CHILDREN'S MULTIMEDIA ON LEARNER SATISFACTION

by

CARLA PASCHKE

B.S., Technical Communication, Mercer University

JENNIFER PASCHKE

B.S., Technical Communication, Mercer University

An Engineering Honors Project Report Submitted to the

Mercer University School of Engineering

MACON, GA

2005

FLASHING INTO A CHILD'S MIND: THE EDUCATIONAL IMPACT OF

CHILDREN'S MULTIMEDIA ON LEARNER SATISFACTION

by

CARLA PASCHKE

JENNIFER PASCHKE

Approved:

____ Date ______________________

Project Advisor

____ Date ______________________

M. Dayne Aldridge, Dean, School of Engineering

TABLE OF CONTENTS

APPENDICES

ACKNOWLEDGEMENTS

Reflecting over the past three years, we would like to thank each person who has assisted us in the Mercer University School of Engineering Honors Program and specifically with our study of children's multimedia and its affects on learner satisfaction rates. We would particularly like to acknowledge the teachers and students at Montessori of Macon for their willingness to participate in our study. Additionally, we would like to recognize Dr. Helen Grady and Dean M. Dayne Aldridge for providing continual support and assistance throughout each stage of this project.

LIST OF TABLES

page

TABLES

LIST OF FIGURES

page

FIGURES

ABSTRACT

CARLA PASCHKE
JENNIFER PASCHKE
Flashing into a Child's Mind: The Educational Impact of Children's Multimedia on Learner Satisfaction
(Under the direction of HELEN GRADY)

This study explores the relationship between the learner satisfaction rates of elementary school children and the medium by which they learn. Twenty-two children between the ages of six and nine who attend Montessori of Macon participated in the study evaluating the impact the use of technology has on overall experience satisfaction rates. These participants were chosen through a convenience sampling method. The data was collected using a four-point Likert scale. The results were then found by assessing each participant's satisfaction score for use of a worksheet and of an educational game. The results of the study show a positive correlation between the use of educational multimedia in the classroom and the increase of learner satisfaction rates. The meanings and implications of these results are discussed.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

The activities in which children participate during their lower elementary years play a significant role in shaping the ways children perceive learning and respond to stimuli. These years are marked by considerable cognitive and social development and form a foundation for children's future tendencies and attitudes toward learning. Thus, positive learning experiences as young children tend to result in positive learning experiences in upper primary, secondary, and postsecondary institutions [1].

However, positive learning experiences are quickly being replaced by disinterest in the classroom, leaving educators the task of generating interest in studies among an unreceptive audience. Current studies have revealed efforts to reinvigorate high school students' desires to learn by incorporating technology into the curriculums. Less, though, has been done to combat the source of the problem—a lack on interest in learning within early elementary classrooms.

Therefore, it is necessary to explore how to raise interest levels early in a child's educational experience and more specifically how to motivate children to want to learn. By increasing children's satisfaction rates regarding learning, the likelihood children will want to participate in future learning activities will increase as well. Given the technological savvy of young children, technology poses as a possible motivator. We hypothesize that children's satisfaction rates following completion of an educational computer game will be higher than those of children completing a worksheet, a more traditional medium.

The following report presents our research regarding the satisfaction rates of learning experiences when children interact with technology compared with those resulting from experiences with traditional learning methods. A literature review introduces current research and the subsequent need for our study. A summary of the project follows including our project goal and objectives. The "Methods" section details the development of our testing products and procedures. Finally, we discuss our results and their implications on children's preferred method of learning.

1.2 Literature Review

1.2.1 Problem: Disinterest in Learning

Upon entering school, children's interest levels in learning significantly decrease. Children no longer ask questions nor do they exhibit the unquenchable thirst for knowledge present during their preschool years. Disinterest in learning increases as students age and as the environments in which they learn change [2]. This disinterest is evidenced by the number of students dropping out of school before graduation. Among persons 16-24 years old, 10.7% drop out before graduating from high school [3]. Equally significant is the number of students physically present in the classroom who "fail to invest themselves fully in the experience of learning" [2].

Disinterest in learning has resulted in poor performance in classrooms as well as on national tests. "Since the 1970s, assessments of U.S. students have indicated that their mathematical proficiency is well below what is needed to remain competitive in a global economy" [4]. Studies conducted in reading and writing produce similar results. A 1994

National Assessment for Educational Progress revealed that nearly three quarters of the nation's fourth graders cannot meet the criteria for proficiency in reading set for their grade [1]. The results from 2003 of the same assessment found no significant difference [5]. Such studies have resulted in a growing awareness of the need to restructure learning strategies. Of particular note are strategies targeting children early in their school experiences. A 1996 *Report of the Carnegie Task Force on Learning in the Primary Grades* identifies the years from three to ten as the time period that will have the greatest impact on a child's long-term learning capacity and development. The study further attests to the lack of interest in learning in United States elementary schools and the subsequent general level of underachievement present.

1.2.2 Combating Disinterest Within the Classroom Through Motivation

To understand how to combat disinterest in the classroom, motivators of learning must be examined. According to motivational theory research, motivation to learn increases when students are given control over aspects of their learning. Control over a task leads students to experience positive feelings toward that task, thereby increasing their desire to repeat the task and facilitating learning through repetition [6]. Learner control is present when students are able to "[exercise] choice and discretion over the sequence, pace, and amount of information they can process" [6]. Such individualized control is difficult to achieve in large classrooms when using traditional learning strategies; however, the benefits of learner control demand alternative learning strategies be examined. Students given control over aspects of their learning experience not only show greater interest in the subject matter, but they also demonstrate more trust in other people, higher self-esteem, and greater persistence [6]. Control, therefore, fosters positive performances in the classroom as well as positive traits within students.

While control increases enjoyment by student learners, the level of fun children associate with specific tasks also contributes to students' motivation to learn. Educators have long recognized the need for students to have positive attitudes about learning, and such attitudes are achieved when students enjoy the tasks in which they engage [7]. Learning outcomes can be improved by discovering tasks children enjoy and embedding learning in those scenarios [8]. Thus, a strong correlation exists between the enjoyment of learning and effectiveness of learning.

1.2.3. Computer Games Foster Motivation to Learn

Computer games are a possible solution to combating disinterest in the classroom as the use of games increases the level of interactivity within learning materials. Interactivity stimulates users' engagement while meeting an increasing demand for opportunities to apply knowledge within a virtual world [8]. Furthermore, interactive technology combines practicality, flexibility, and excitement to give students greater control over their learning—control previously lacking in traditional learning materials [9]. In a study sponsored by the Centre for British Teachers (CfBT), primary school students were interviewed about their perceptions about interactivity and in particular interactive whiteboards (IWBs). Students were very enthusiastic about the presence of IWBs in the classrooms, especially the devices' versatility, multimedia capabilities, and the fun and enjoyment they brought to learning [10]. Thus, interactivity registers positively with students, providing them with greater motivation to learn.

Computer games further fit into a paradigm of fun children possess. Within this context, games transform otherwise undesirable tasks into enjoyable experiences. For example, a computer game DiaBetNet was created to motivate children suffering from diabetes to keep better track of their blood sugar. The software, which is installed on handheld computers, challenges users to predict their glucose levels. Points are awarded when their predictions are correct. Researchers found children increased the number of times they checked their blood sugar when playing the game, thereby decreasing the number of episodes of hyperglycemia (excess blood sugar) [11]. Similarly, technology can be used to increase the frequency with which children expose themselves to undesirable subjects in school and the enjoyment levels they possess during the activities.

1.2.4. Current Research Gap

While research has been conducted supporting the use of technology for older students in primary and secondary school systems, very little research exists on the effectiveness of computer applications and technology-supported practices for younger students in early elementary school or preschool. However, children in early elementary school and preschool represent a critical audience of technology. If disinterest in learning can be combated when children are young, a greater propensity for learning may develop within young people, therefore leading to greater successes in secondary education and an overall achievement increase among future generations. To determine whether young children respond to technological stimuli better than they do traditional learning materials, research on the satisfaction levels of learning of students early in their primary education must be conducted, particularly comparative research between traditional and nontraditional learning materials.

CHAPTER 2

PROJECT BACKGROUND

2.1 Mercer University School of Engineering Honors Program

The Mercer University School of Engineering (MUSE) four-year Honors Program is designed to stimulate excellence in learning among all selected participants. Throughout their freshman year, these students collaborate to design and construct autonomous robots. In their sophomore year, however, honors students develop a three-year personal project plan on which they will work until graduation. These project plans encourage cross-disciplinary work and allow students to narrow their focus to an engineering-related area of particular interest. While faculty advisors from both MUSE and other Mercer departments oversee their progress, students are responsible for their own projects from conception to completion and thus gain an exceptional level of intellectual independence. "Flashing into a Child's Mind: The Educational Impact of Children's Multimedia on Learner Satisfaction" presents the work that we accomplished as MUSE honors students over the three-year period while we completed our personal project plan.

2.2 Project Goal

The purpose of this project was to examine the role that multimedia plays in the learner satisfaction rates of second-grade elementary school children. In particular, the project compared the satisfaction rates produced by multimedia to those produced by traditional worksheets in the context of a classroom setting. The learner satisfaction rate was defined as the enjoyment level that a child experienced upon completion of a school activity. The project included the creation of equivalent computer and worksheet learning tools as well as the testing of these materials on our target audience.

2.3 Project Objectives

The following objectives guided the course of this project:

- Identify key principles for effective multimedia design for children
- Identify key theories regarding the way that children learn
- Develop an educational computer game that tests second-grade math skills and follows accepted guidelines for effective children-based multimedia
- Develop a worksheet with math problems corresponding with the created computer game
- Gain certification from the Institutional Review Board to perform research using children as test subjects.
- Use the developed materials to test learner satisfaction rates of students at an elementary school
- Analyze the difference between the satisfaction of students using each method of learning

CHAPTER 3

METHODS

3.1 Creation of Testing Materials

3.1.1 Creation of an Educational Computer Game

The educational computer game, “Matheopolis,” transports children to a medieval castle where an evil math wizard has taken over the kingdom. In order to defeat the wizard and thus save the kingdom, players must successfully disarm the magical shields guarding each doorway and navigate through the castle. To do so, children must solve a mathematical challenge in each room of the castle until discovering the wizard. This edition of Matheopolis requires the exploration of four rooms, and each mathematical challenge consists of four addition problems, for a total of sixteen math problems in the game. In addition to solving problems, players also collect valuable treasures in each room. Players then choose the treasure from these items they wish to use to defeat the wizard. These items include a magic wand, a potion, a sword, and a spell.

The creation of “Matheopolis” required the application of both the technological skills and the theoretical knowledge surrounding children’s multimedia. Macromedia Flash MX was chosen as the primary building tool for the game due to the program’s accessibility and capacity for adding animation and interactivity. To learn Flash, we enrolled in courses at Mercer such as TCO325 Multimedia as well as developed our proficiencies through books and on-line tutorials. We enhanced our Flash abilities with work in Adobe Photoshop to create realistic graphics. Actual construction of the game lasted approximately six months.

The content of the game resulted from principles learned through researching children's multimedia. Prior to game development and construction, we devoted four months to reviewing current research in this area and then identified key elements to incorporate into the design of our own game. The following principles guided development of our game.

First, interactivity registers very positively with children. Interactivity allows children to "leave their footprints," to feel like they are important [12]. Interactivity builds on the natural tendencies of children to be curious and creative, engaging them in a variety of ways [13]. Not only does Matheopolis allow children to type answers into the math problems, but it also gives them the power to control the fate of the make-believe kingdom Matheopolis. The most evident example is the user's ability to choose which of the collected treasures to use to defeat the wizard. Each treasure performs a different function; thereby allowing children to experiment and find their favorite method. As *Figure 1: Using the Magic Spell Transforms the Wizard into a Flower* displays, the interactivity allows the user to adopt a positive, proactive role within the game.

Figure 1: Using the magic spell transforms the wizard into a flower.

Animation and sound effects are also positive design elements when developing multimedia for children. These elements attract children's initial attention and motivate them to continue using a site/ product [14]. Animation significantly enhances the element of fun within multimedia if it is done well; however, too much animation will distract and disorient children [13]. Therefore, multimedia requires a balance of animated and unanimated features to be effective. In addition to the finale transformations when the wizard is defeated, "Matheopolis" uses small animations in each of the castle's rooms such as paintings winking or dog tails wagging. Additionally, the boxes surrounding the math problems make noises, change sizes, and change colors as does the swirling shields that guard the doorways.

Geographic navigation metaphors also work well. Children enjoy "pictures of rooms, villages, 3D maps, or other simulated environments that [serve] as an overview and entry point to various site or subsite features" [14]. For this reason, we chose a castle as the backdrop for our game. The castle provides an adventurous front while the floorplans, rooms, and doorways through which users must travel mimic real-life environments. Each doorway serves as an entry point into the next level of the game.

Unlike adult audiences, children are much more likely than adults to stop and read directions. Therefore, thorough yet easy-to-understand instructions should be used when designing children's games. Additionally, a "Help" button should be placed on each page to assist children experiencing difficulty [15]. At the beginning of our game, children are presented with the instructions. At the bottom of the screen is a question mark that serves as a help feature, which is explained to users in the instructions.

Placement on the screen is crucial as most young children do not understand page scrolling. Accordingly, the most important information should be visible without scrolling, if scrolling is used at all [15]. Taking this into consideration, scrolling is unnecessary when playing the game we created, unless users are viewing it on a screen smaller than standard size.

Children also respond well to incentives used to draw them into a game. One effective approach to creating incentives involves the use of rewards. Rewarding children at various levels leads them to continue playing to discover what other rewards could be awaiting them [13]. We created this sense of rewarding within our game by having the children collect treasures following completion of the math problems. Children are excited as they discover what type of treasure they have earned and are anxious to see what type of treasure they can collect next; thereby motivating them to continue play.

Characters further intrigue children interested in multimedia. A great majority of today's children grew up with the television, and as a result are obsessed with various characters which they see on cartoons and even commercials. This appeal of television characters such as Big Bird or Mickey Mouse is applied to multimedia products as well. Characters can add a sense of fantasy and creativity to a product. They can act as guides throughout the entire multimedia experience, becoming a source of consistency, information, and creativity. Children tend to identify with such characters, making them more apt to enjoy using a multimedia product [16]. In our game, the repeated wizard reference creates a character to which children can relate, similar to the "bay guy" in the television programs they watch.

Along with developing the multimedia interface for our game, we also chose the level of math to use in the problems. As second-graders were our target audience, age was the main determinant in choosing a general skill level to follow. Addition was chosen as the operation of choice, and the math problems selected were set at a level of difficulty at which the majority of second-graders should be proficient.

Prior to the comparison testing of the game and worksheet, we conducted an informal usability test involving one second-grade child. The test user was an eight-year old, second-grade girl, and testing took place in her home to increase her comfort level of being observed. We tested the user's ability to read the text in the game and to perform the intended operations. The appropriateness of the reading level and of the time allotted for reading was measured by having the user read aloud as she played the game. In this way, we were able to record what portions of the game were too fast for the user to read, and what words were too difficult for her to read. The user's greatest reading challenge derived from the name of the math wizard "Mathematicon." As a result of this testing, we rewrote the game to eliminate all uses of the wizard's name and instead used the phrase "math wizard" to refer to the villain. A secondary goal of the usability test was to gauge the effectiveness of the game in engaging its intended audience. Effectiveness was measured through observing the user playing the game and through a series of informal qualitative questions on the users' likes and dislikes. The user's enthusiasm and positive responses led us to conclude no other changes were needed to increase effectiveness.

3.1.2 Creation of Educational Worksheet

We created a worksheet using problems identical to those used in the computer game. (For a complete copy of this worksheet, see Appendix A: Testing Material: Math

Worksheet.) Therefore, like the game, the worksheet contained sixteen addition problems. The worksheet further carried out the medieval theme used in the game through an illustration of a castle placed in the worksheet's lower right hand corner. By designing the worksheet to complement the game in both substance and theme, we isolated the form in which we presented the math problems (worksheet versus game) to be the only variable between the two testing materials.

3.2 Instituational Review Board Certification

After creating the testing materials, we gained project approval from the Institutional Review Board for Research Involving Human Subjects (IRB). The IRB committee's mission is protect the interests of human subjects involved in research projects conducted by investigators affiliated with Mercer University. To prove our knowledge of testing methods used with human subjects, we each completed the Indiana University Human Subjects Protection Test and earned passing scores. IRB procedures further required us to complete an application under the "Minimal Risk and Non-Invasive" research category. We designed our test to meet the guidelines established for this type of research and for the age of our participants (ages 6-9). Therefore, in addition to the testing materials, we created a consent form to be distributed to parents/guardians of test participants. For a copy of the parental permission slip, see Appendix B: Test Subject Parental Permission Slip. We also created an assent form to be read aloud to the test participants. For a copy of the script used in asking for assent, see Appendix C: Test Subject Oral Assent Script. All other testing procedures were conducted in accordance with IRB regulations.

<u>3.3 Participants</u>

The study took place at Montessori of Macon in Macon, Georgia. The school is the only fully accredited Montessori education center south of Atlanta for children aged two and one-half through fourteen years. The participants included 22 students between the ages of six and nine. The study was originally intended for students at a second-grade level. However, Montessori of Macon groups all children between the ages of six and nine into one lower elementary class. Students are then allowed to work at their own level and pace in each subject. Because of the individualized structure of the school and in particular the individual skill levels of students in math, all 24 students within the lower elementary class were invited to participate in the study. Parental consent was obtained from all participants. Additionally, all participants were asked to give assent before participating. Two students declined. *Figure 2: Distribution of 22 Participants by Gender* depicts the ratio of male to female students who participated in the study. *Figure 3: Distribution of 22 Participants by Age* depicts the breakup of the 22 students who participated in the study in terms of age.

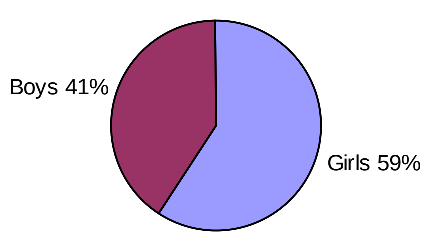

Figure 2: Distribution of 22 Participants by Gender

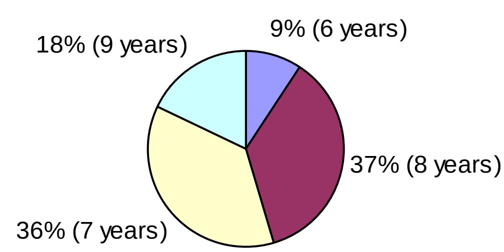

Figure 3: Distribution of 22 Participants by Age

3.4 Surveys

The study was based upon two nine-question surveys. One survey was completed by participants who played the game (see Appendix D: Survey for Educational Game Participants); the other was completed by participants who completed the worksheet (see Appendix E: Survey for Educational Worksheet Participants). The surveys assured participants of the study anonymity and encouraged participants to respond honestly as there were no right or wrong answers. Participants took approximately one to three minutes to complete the survey. We were available to answer questions regarding the intended meaning of questions as well as to read aloud to participants lacking strong vocabulary skills. The questionnaires were kept brief to avoid overwhelming the children and all responses were written in language children themselves use.

The first section of the survey (questions 1-2) acquired participant demographic information. This information included gender and age, thereby providing a profile for each participant. These profiles enabled the data to be analyzed by subgroups of the sample and allowed for comparisons between demographic groups to be made.

The second section of the survey (questions 3-5) assessed participants' satisfaction rates following their testing experiences. Therefore, participants who played the game answered questions relating to one experience while participants completing the worksheet answered questions relating to another. Questions included the following: How fun was this [activity]?, Would you do this [activity] again?, and Would school be more fun if you did more [activities] like this? Responses used a modified Likert scale with answers rated from one to four. As children often wish to please adults, an even number of responses were offered rather than the traditional five or seven responses so as to prohibit children from continually choosing the middle ground.

Section three on each survey consisted of questions six through eight. These questions were identical on both worksheets and were designed to gauge a propensity for the level of enjoyment children place on games in general. Issues specifically addressed included whether participants preferred worksheets or games, whether participants preferred board games or computer games, and how often participants played board games at home.

Section four on each survey consisted of one question, “Do you like math?” This question was posed to account for any skewing of results that could potentially occur because of children’s enjoyment of the subject matter rather than the enjoyment of the mediums on which the subject matter was presented.

3.5 Procedure

Parental consent forms were collected upon arrival at Montessori of Macon. All 24 students in the lower elementary school returned the consent forms. Therefore, the students were randomly divided into four groups of six, with no preference for gender or age. Groups were taken to the testing room for all subsequent parts of the experiment. The students in the first and third groupings of six formed control groups for the study, and their satisfaction levels following completion of a worksheet were measured. The second and fourth groupings of six formed experimental groups for the study, and their satisfaction levels following completion of the game were measured. Testing was conducted during school hours with one group at a time; groups not participating in testing took part in regularly scheduled class activities.

The school library was used as the testing room.   A long folding table was set up along with three chairs on each side of the table. The six chairs formed the six stations for students within the groups. Laptop computers were brought in for each station. Additionally, external mice were brought in to facilitate easy clicking. While the computers varied in model, each desktop background was identical and a file/icon named game.exe was located on the middle of the screen for easy access.

After students assumed their positions at the individual stations, a moderator using a script guided all interactions between the researchers and the students to ensure standardization between groups. Each group's test began with the reading of an assent form, and children were given the option to decline to participate.

After assenting, worksheets were distributed to participants in the control group. They were given approximately 3-7 minutes to complete the worksheet. Surveys were distributed following the worksheets. Participants were given approximately 5 minutes to complete the surveys.

Participants in the experimental group were given approximately 10-15 minutes to complete playing the computer game. Surveys were distributed after they finished, and participants were given approximately 5 minutes to complete the surveys.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Results

In examining the twenty-two participants' "satisfaction scores," the average satisfaction rating cited by children interacting with the worksheet was 2.861 while the average satisfaction rating cited by children interacting with the computer game was 3.533. Satisfaction scores were assigned by a Likert scale of 1-4, with high satisfaction responses receiving a value of 4 and low satisfaction responses receiving a value of 1. *Table 1: Satisfaction Response Scale* presents the possible answers for the questions by which satisfaction was measured as well as their corresponding scale ratings.

Table 1: Satisfaction Response Scale

Survey Responses Question 3	Survey Responses Question 4	Survey Responses Question 5	Assigned Satisfaction Scale Rating
Lots of fun	I would really like to play/do it again.	School would be a lot better.	4
Fun	I would like to play/do it again.	School would be better.	3
Okay	It doesn't matter.	It would be the same.	2
Not fun	I don't want to play/do it again.	I would not like school as much.	1

Table 2: Satisfaction Scores of Worksheet Participants and *Table 3: Satisfaction Scores of Computer Game Participants* provide a detailed satisfaction score analysis of all user responses. As shown in these tables, satisfaction, therefore, increased 23.5% between mediums. Furthermore, 77.3% of all participants responded that they would rather play a game than fill out a worksheet. 86.4% of participants cited that they would rather play a computer game than a board game.

Table 2: Satisfaction Scores of Worksheet Participants

Participant #	Question 3	Question 4	Question 5	Avg. Satisfaction
7	2.000	2.000	2.000	2.000
8	2.000	2.000	2.000	2.000
9	4.000	2.000	1.000	2.333
10	3.000	2.000	3.000	2.667
11	3.000	2.000	3.000	2.667
12	2.000	2.000	3.000	2.333
17	4.000	4.000	2.000	3.333
18	4.000	4.000	4.000	4.000
19	4.000	4.000	4.000	4.000
20	4.000	2.000	3.000	3.000
21	4.000	3.000	2.000	3.000
22	4.000	1.000	4.000	3.000
Average	3.333	2.500	2.750	2.861

Table 3: Satisfaction Scores of Computer Game Participants

Participant #	Question 3	Question 4	Question 5	Avg. Satisfaction
1	4.000	4.000	4.000	4.000
2	4.000	1.000	4.000	3.000
3	2.000	2.000	2.000	2.000
4	4.000	4.000	4.000	4.000
5	4.000	4.000	4.000	4.000
6	4.000	4.000	4.000	4.000
13	4.000	4.000	4.000	4.000
14	4.000	4.000	4.000	4.000
15	4.000	1.000	4.000	3.000
16	4.000	2.000	4.000	3.333
Average	3.800	3.000	3.800	3.533

4.2 Discussion

4.2.1 Discussion of Results

The hypothesis of this study was correct as children in the test groups reported stronger satisfaction ratings after interacting with a computer game than they did after a worksheet containing the same math problems. In addition to the 23.5% increase in self-reported satisfaction when using computers, the study also found that when given a choice, 77.3% of students prefer to learn using a computer. Therefore, a clear link exists between a child's use of a computer and his/her enjoyment of his/her learning experience. This preference towards technology is only further enhanced by the 86.4% of children in the study who would rather use a computer than a board game in their daily play. As children's expectations for their experiences to include interactivity with multimedia grow, so too will their disappointment and dissatisfaction when activities fail to meet these expectations. At such a critical time in development, children need to be stimulated and motivated to learn in both the present and the future. This study indicates that computer technology may be the needed link to put back the enjoyment in learning, thereby securing higher levels of achievement. This study provides a firm basis for further research into the area of multimedia and its affects on childhood learning.

4.2.2 Sources of Possible Error

Drawbacks of this study include the method of sampling. Given time and resource constraints, this study examined the role technology plays in one specific classroom, and therefore results are tied to that classroom rather than being representative of all elementary school children. Future tests may include the use of a simple random sample to increase accuracy and provide wide-spread data.

Another possible source of error was the collection of data using the self report method. As individuals gave their own assessment of their behaviors, problems arise regarding honesty in their responses. While error due to self-reporting is a common issue in any survey, the limited research involving children as test subjects escalates its potential to influence test results. Therefore, we cannot judge to what degree data may have been skewed by the participants' desire to please their surveyor. Similar discrepancies may have resulted from the small number of questions used to assess satisfaction and the different meanings children associate with the phrases the survey's scale uses such as "really fun" or "okay." The small number of participants in conjunction with the uneven number of students in each group, which resulted from two students declining assent at the last minute, may skew the data.

Finally, the testing materials may have contributed to error in test results. Due to limited time and resources, a formal usability test was not conducted on either the computer game of the worksheet. As the game we created for the study is theoretically representative of effective child-based multimedia, a formal usability test would validate its use as a testing material.

4.2.3 Areas for Future Research

Some areas for future research could include similar studies using a larger sample size or different testing materials for the game and worksheet. Examining differences in satisfaction scores between genders or other demographic groupings may also provide influential data on how best to teach children. An in-depth analysis of cross-cultural differences in multimedia-based satisfaction rates between American students and students of other countries with higher average achievement levels could provide an interesting look at the global role technology plays in the lives of school children. Finally, the time/satisfaction ratio involving use of technology in the classroom should be explored to judge whether the higher satisfaction scores justify any added time required to play a game in the place of more traditional learning methods.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Project Summary

This study examined the role that multimedia plays in the learner satisfaction rates of 22 elementary school children. In particular, the project compared the satisfaction rates produced by an educational computer game to those produced by a traditional worksheet in the context of a classroom setting. We created both the computer game and worksheet to ensure the educational content in both was equivalent. We then tested these materials inside a classroom to find the learner satisfaction rate produced by each. The learner satisfaction rate was defined as the enjoyment level that a child experienced upon completion of a school activity. The satisfaction rates resulting from the computer game were 23.5% higher than the rates produced from the worksheet.

5.2 Conclusion and Recommendations

We conclude that a positive correlation between the use of educational multimedia and learner satisfactions rates does exist. Thus, educational multimedia should be considered as a primary means of increasing motivation and achievement inside the classroom. We recommend, however, that further testing be conducted to include a wider sample size and to explore such issues as the time/satisfaction ratios of multimedia-based learning experiences.

APPENDICES

APPENDIX A

TESTING MATERIAL: MATH WORKSHEET

Number: ______

Addition

Addition is "putting together" or adding two or more numbers to find the sum.

Directions: Add.

3 + 4	6 + 2	7 + 1	8 + 2	5 + 4	3 + 1
11 + 4	9 + 5	10 + 3	6 + 6	4 + 9	7 + 7
9 + 3	8 + 7	6 + 5	7 + 9		

APPENDIX B

TEST SUBJECT PARENTAL PERMISSION SLIP

Mercer University Engineering Honors Program
Flashing into a Child's Mind: The Educational Impact of Children's Multimedia

Date: April 15, 2005

Dear Parent or Guardian:

Your child is invited to participate in a research project being conducted by Carla Paschke and Jen Paschke, senior Technical Communication majors in the Mercer University Engineering Honors Program.

The purpose of this study is to gain quantifiable data regarding the satisfaction levels of children in response to various learning methods. First through third graders at Montessori of Macon are invited to participate.

This study will divide participants into two groups. The first group of participants will engage with an educational computer game testing their math skills designed by Paschke and Paschke. The children will be observed throughout the testing to be followed by a short debriefing. The second group of participants will work a series of math problems using a traditional worksheet. This group will also be observed and debriefed. Testing will take place during school hours and should take no longer than 30 minutes per child.

While your child will receive no direct benefit from participation in this study, his/her participation may help us better understand the role technology should play in the classroom.

Following your consent, participation by your child in this study remains voluntary. Your child will also be asked to provide assent to participate and may refuse even if you consent. Your child can also refuse to answer any questions and may withdraw from the study at any time without penalty.

No identifying information will be included in the data your child provides. Your signed consent form will be kept separate from the data, and nobody will be able to link your children's responses to them. Only the age and gender of each child will be recorded with a random number being assigned to each child for identification purposes.

If you have any questions about this study, you may email Carla Paschke at carla.paschke@student.mercer.edu or Jen Paschke at jennifer.paschke@student.mercer.edu. This project has been reviewed and approved by the Mercer University Institutional Review Board.

………………………………………………………………………………………………………..

I have read the information provided above and all of my questions have been answered. I voluntarily agree to the participation of my child in this study.

____

Parent/ Legal Guardian Signature

____

Name of Child

APPENDIX C

TEST SUBJECT ORAL ASSENT SCRIPT

Mercer University Engineering Honors Program
Flashing into a Child's Mind: The Educational Impact of Children's Multimedia

Assent Form

Because the majority of our audience will be around seven years old, this form will be read to students rather than distributed to be signed.

1. Our names are Carla Paschke and Jen Paschke. We are students in the Engineering Honors Program at Mercer University.

2. We are asking you to take part in this activity because we are trying to learn more about the ways children your age like to learn.

3. If you agree to do the activity you will be solving math problems. Some of you will do it through a computer game. Others will do it on paper.

4. You can talk this over with your parents before you decide whether or not to do this. We will also ask your parents to give their permission for you to take part in the activity. But even if your parents say "yes" you can still decide not to.

5. If you don't want to do this activity, you don't have to. Remember, being in it is up to you and no one will be upset if you don't want to be in it or even if you change your mind later and want to stop.

6. You can ask us any questions that you have. If you have a question later that you didn't think of now, you can ask us later.

APPENDIX D

SURVEY FOR EDUCATIONAL GAME PARTICIPANTS

Circle your answers. There are no wrong answers!

1. Are you a boy or a girl?
   a. Boy
   b. Girl

2. How old are you?
   a. 6 years old
   b. 7 years old
   c. 8 years old
   d. 9 years old

3. How fun was this game?
   a. Lots of fun
   b. Fun
   c. Okay
   d. Not fun

4. Would you play this game again?
   a. I would really like to play again.
   b. I would like to play again.
   c. It doesn't matter.
   d. I don't want to play again.

5. Would school be more fun if you played more games like this?
   a. School would be a lot better.
   b. School would be better.
   c. It would be the same.
   d. I would not like school as much.

6. If you could choose, would you rather play a game or do a worksheet?
   a. Play a game
   b. Do a worksheet

7. How often do you play computer games at home?
   a. A lot
   b. Sometimes
   c. Not much
   d. Never

8. Which type of game would you rather play?
   a. Computer game
   b. Board game

9. Do you like math?
   a. I really like it.
   b. I like it.
   c. It's okay.
   d. I don't like it.

APPENDIX E

SURVEY FOR EDUCATIONAL WORKSHEET PARTICIPANTS

Circle your answers. There are no wrong answers!

1. Are you a boy or a girl?
    a. Boy
    b. Girl

2. How old are you?
    a. 6 years old
    b. 7 years old
    c. 8 years old
    d. 9 years old

3. How fun was this worksheet?
    a. Lots of fun
    b. Fun
    c. Okay
    d. Not fun

4. Would you do this worksheet again?
    a. I would really like to do it again.
    b. I would like to do it again.
    c. It doesn’t matter.
    d. I don’t want to do it again.

5. Would school be more fun if you did more worksheets like this?
    a. School would be a lot better.
    b. School would be better.
    c. It would be the same.
    d. I would not like school as much.

6. If you could choose, would you rather play a game or do a worksheet?
    a. Play a game
    b. Do a worksheet

7. How often do you play computer games at home?
    a. A lot
    b. Sometimes
    c. Not much
    d. Never

8. Which type of game would you rather play?
    a. Computer game
    b. Board game

9. Do you like math?
    e. I really like it.
    f. I like it.
    g. It’s okay.
    h. I don’t like it.

REFERENCES

[1] Carnegie Corporation of New York. (1996, Sept.). Years of Promise: A Comprehensive Learning Strategy for America's Children. The Report of the Carnegie Task Force on Learning in the Primary Grades. [Online]. Available: http://www.carnegie.org

[2] L. S. Lumsden. (1994, June). Student Motivation To Learn. *ERIC Digest*. [Online]. Number 92. Available: http://www.kidsource.com/kidsource/content2/Student_Motivatation.html

[3] T. D. Snyder, A. G. Tan, and C. M. Hoffman. (2004, Dec.). Digest of Education Statistics 2003. U.S. Department of Education, National Center for Education Statistics. [Online]. Available: http://nces.ed.gov/pubs2005/2005025.pdf

[4] National Council of Teachers of Mathematics. (2002, June). Educators Set Priorities to Boost Young Children's Interest in Math. [Online]. Available: http://www.nctm.org/news/releases/2002-06_educators.htm

[5] U.S. Department of Education, National Center for Education Statistics. (2004). National Assessment of Educational Progress (NAEP), 1992, 1994, 1998, 2000, 2002, and 2003 Reading Assessments. [Online]. Available: http://nces.ed.gov/nationsreportcard/

[6] C. McLoughin and R. Oliver. (1995) Who is in Control? Defining Interactive Learning Environments. Presented at ASCILITE Conference 1995. [Online]. Available: http://www.ascilite.org.au/conferences/melbourne95/smtu_bak/papers/mcloughlin.pdf

[7] K. Schoepp. (2001, Feb.). Reasons for Using Songs in the ESL/EFL Classroom. *The Internet TESL Journal*. [Online]. *7(2*). Available: http://iteslj.org/Articles/Schoepp-Songs.html

[8] M. Pivec, O. Dziabenko, I. Schinnerl. (2003). Aspects of Game Based Learning. [Online]. Available: http://www.unigame.net/html/I-Know_GBL-2704.pdf

[9] B. Cooper and P. Brna. (2000). Classroom Conundrums: The Use of a Participant Design Methodology. *Educational Technology & Society*. [Online]. *3(4)*. Available: http://ifets.ieee.org/periodical/vol_4_2000/cooper.html

[10] I. Hall and S. Higgins, "Primary School Students' Perceptions of Interactive Whiteboards," *Journal of Computer Assisted Learning*, vol. 21(2), pp. 102, April 2005.

[11] "Computer Game Helps Diabetics," *Current Health 1*, vol. 28(6), pp. 6, February 2005.

[12] K. D. Fishler, "Kids Talkback," *Adobe Magazine*, pp. 41-45, Summer 1998.

[13] M. L. Bernard. (2004, April). Criteria for Optimal Web Design (Designing for Usability). [Online]. Available: http://psychology.wichita.edu/optimalweb/children.htm

[14] J. Nielsen. (2002, April). Kid's Corner: Website Usability for Children. *Jakob Nielsen's Alertbox*. [Online]. Available: http://www.useit.com/alertbox/20020414.html

[15] L. Thomason. (2002, June). Design Tip: Appeal to Kids and Teens. *Webmaster Tips*. [Online]. *5(11)*. Available: http://www.netmechanic.com/news/vol5/design_no11.htm

[16] K. Wimpsett. (1998, Dec.). Building Websites for Kids. *Builder Com*. [Online]. Available: http://builder.cnet.com/webbuilding/pages/Graphics/Kids/index.html