

The Dependency of Early Childhood Computer Cognition Based Upon Human-Computer
Interaction

A Thesis

Presented to

The Faculty of the Graduate School
Southern University and A&M College

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science

By

Vyaisha L. Moss

May 2010

UMI Number: 1496657

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent on the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



UMI 1496657

Copyright 2011 by ProQuest LLC.

All rights reserved. This edition of the work is protected against unauthorized copying under Title 17, United States Code.



ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

The Graduate School
Southern University
Baton Rouge, Louisiana

CERTIFICATE OF APPROVAL
MASTER'S THESIS

This is to certify that the Master's Thesis of
Vyaisha L. Moss
Has been approved by the Examining Committee for the thesis
Requirements for the Master of Science degree in
Computer Science, May 2010
Major, Month and Year of Graduation

Name: Dr. Nigel Gwee Date
CHAIR, Thesis Committee

Name: Dr. Ebrahim Khosravi Date
Committee Member

Name: Dr. Matheiu Kourouma Date
Committee Member

Name: Date
Committee Member

Name: Dr. Ebrahim Khosravi Date
Department Chair/Program Director

Name: Robert H. Miller, Jr. Date
Dean of College/School

Name: Dr. Joseph A. Meyinsse Date
Dean of the Graduate School

The Dependency of Early Childhood Computer Cognition Based Upon Human-Computer
Interaction

An Abstract of a Thesis

Presented to

The Faculty of the Graduate School
Southern University and A&M College

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science

By

Vyaisha L. Moss

May 2010

Abstract

The focus of this paper is to illuminate the idea of children's increasing interaction with devices related to technology and how Human-Computer Interaction (HCI) plays a significant role in such. In recent years, these devices have infiltrated households and children are becoming more knowledgeable about computer components and their functionality. This study provides an in-depth look of how children's cognition of computers rely on Human-Computer Interaction and it aims to show that children are now capable of learning technology concepts at much younger ages than past generations. Learning technology includes, but is not limited to, basic functionality of computers, simple programming concepts, and software design. Subjects ages 5–12 were observed interacting with a computer while playing an educational software game called Wacky Calky™. The game is designed to incorporate Human-Computer Interactive mechanisms such as mouseover, drag-and-drop, audio, and tooltips. The subjects were evaluated using a series of questions about computers in general along with the usage of the created software. A qualitative analysis of whether children have enough cognition to begin learning basic computer and programming concepts at an early age. The conclusion of the study provides the following observation—with the usage of proper human computer interaction techniques, the vast majority of children are knowledgeable enough to comprehend computer activity as well as simple programming.

Acknowledgements

The author would like to extend her utmost gratitude to Dr. Nigel Gwee for his time, effort, assistance, and encouragement during this research. Dr. Gwee is a very notable and dedicated professor who has genuinely earned the author's respect. She would also like to express her gratitude to Dr. Matheiu Kourouma, and Dr. Ebrahim Khosravi for being instrumentally involved as committee members. Their assistance is sincerely appreciated. Without their collective efforts, the success of this research could not have been attained.

Special thanks are due to Ms. Joyce Gibbs and Mr. Lloyd Benson II, Headmaster of David Paul Community Center, as well as to the students and their parents who elected to participate in the study. It was extremely fun collaborating with them and their contribution was fundamental to the research.

To those who offered design ideas during the creation of the software Wacky Calky™, especially Ms. Flotanya Russell, Ms. Rainier Batiste, and Ms. Vanda Russell, their thoughts were very much appreciated.

The author also wishes to thank anyone else not previously mentioned who has offered any prayer, insight, and encouragement throughout the process of this study as well as the duration of the author's pursuit in her Master's program.

TABLE OF CONTENTS

CHAPTER	PAGE
I Introduction.....	9
1.1 Background	9
1.2 Significance.....	10
1.3 Motivation	11
1.4 Statement of the Problem	11
1.5 Hypothesis.....	12
1.6 Null Hypothesis.....	12
1.7 Research Questions	12
1.8 Keywords	13
1.9 Definition of Terms.....	13
1.10 Delimitations	14
1.11 Resources Needed to Conduct Study	14
II Review of Literature	15
2.1 Involvement of Children	15
2.2 Development of Technology Within Children.....	17
2.3 On-Going Projects.....	18
2.4 Programming Languages for Children.....	20
2.5 Benefits To This Study.....	20
III Methodology	21
3.1 Introduction to Methodology	21
3.2 Subjects	21
3.3 Design.....	21
3.4 Procedures	25
IV Data Analysis and Findings	27

4.1 Overall/Pivotal Age.....	27
4.2 Human Computer Interaction Breakdown	27
V Conclusion	32
5.1 Decision Based On Findings	32
5.2 What We Learned.....	32
5.3 Further Research	33
BIBLIOGRAPHY.....	34
APPENDIX.....	41
Appendix A—Wacky Calky™ Source Code	42
Appendix B—Observation Questions.....	68
Appendix C—Survey Questions.....	84
VITA 116	
APPROVAL OF SCHOLARLY DISSEMINATION	117

TABLE OF FIGURES

Figure 1: Initial login screen	22
Figure 2: Calculator	23
Figure 3: Math problems.....	24
Figure 4: Drag-and-drop feedback.....	27
Figure 5: Ease of use.....	28
Figure 6: Effectiveness of sounds	29
Figure 7: Color versus Black and White.....	29
Figure 8: Feelings while interacting with software.....	30
Figure 9: Interest in creating software	31

Chapter I

Introduction

1.1 Background

It is safe to say that with modern technology such as Nintendo's Wii console, Sony's Playstation 3 console, Apple's iPhone, human beings are currently intrigued by and focused on the interactive aspect of computer devices. The mechanisms involved in these devices that entice users are referred to as Human-Computer Interaction. Human-Computer Interaction (HCI) the study of the interaction between humans (users) and computers. The Association for Computing Machinery gives a more elaborate definition for human-computer interaction as "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them [ACM SIGCHI]."

Human relevance to HCI includes communication theory, graphic and industrial design disciplines, linguistics, social sciences, cognitive psychology, and human factors. Computer relevance to the subject includes computer graphics, operating systems, programming languages, and development environments. Over the past few years, Human-Computer Interaction has become a dominating subject matter to the point that curricula have been added to accommodate its concepts.

Human-Computer Interaction has to be perceived much differently with children than it is with adults. In the paper, HCI for Kids emphasis is placed on the important criteria that must be referred to when creating software as it relates to the cognition of users such as children. These criteria are dexterity, speech, reading, background

knowledge and interaction style [Jacko]. Of these five criteria, research has shown that interaction style takes precedence mainly because children are focused on what they hear and see.

The Indiana Institute on Disability and Community's Early Childhood Center defines cognition as "...how we know, learn, and remember. It involves the thinking skills that children use to make sense of all the general knowledge that they acquire. Among the most basic cognitive skills are perception, attention, imitation, and memory," [Cross]. Since this paper is focused on Human-Computer Interaction as it relates to the cognitive skills of children, one must mention that most researchers conclude that computers have a positive impact on the development of a child's cognitive skills.

In this thesis we examine how children's cognition of computers relies on Human-Computer Interaction and we show the extent to which children are now capable of learning technology concepts.

1.2 Significance

The overall significance is to shed light more on the children's perspective of computer concepts through human-computer interaction. As humans are more able to learn more languages in childhood than in adulthood, so certain levels of programming and technical aspects of computers could possibly be taught at an early age.

The study explores the percentage of human-computer interaction that plays a significant role in the interest of children in computers. It shows how human-computer interaction contributes to the cognition of children and computers. Getting children

interested in computer technology at an early age could mean attracting more people to the field of computer science and, who knows, create future Alan Turings.

1.3 Motivation

Comprehending what computers really could do took many years, however, this author's passion stemmed from what she could see (visually) and what she could do (interactively) at the age of 6 years old. Technology will continue to grow and change over the next few decades, and the field will constantly need innovative persons. The future creative minds are in developmental stages now. If these minds can be cultivated, then there is no doubt that they will be beneficial to the field of computer science. This is why she believes that children can develop their cognition for computers at an early age through proper design and interaction with computers. Those same children can develop a passion for technology which could lead them to a bright future in computers. With that being said, she must re-iterate an earlier point that such passion can attract more candidates into the field of computer science. In the future, she also wants to start an organization that caters to teaching and tutoring children to young adults about computers and programming, which lead me to conduct this research.

1.4 Statement of the Problem

Human-Computer Interaction (HCI) is a rapidly developing subject matter in computer science. It is currently studied within higher levels of education catering mainly to adults. This thesis will show the affect that HCI has on children during early childhood development of computer fundamentals. The intention is also to show that children can understand concepts of simple programming languages.

1.5 Hypothesis

The hypothesis for this study is:

With the usage of proper human computer interaction techniques, the vast majority of children are knowledgeable enough to comprehend computer activity as well as simple programming.

1.6 Null Hypothesis

In the event that children are not knowledgeable enough to comprehend computer activity and simple programming with the usage of proper human computer interaction, the hypothesis will be deemed as null.

1.7 Research Questions

In conducting this research, answers to the following questions were sought after.

1. What affect does Human-Computer Interaction (HCI) have on children's cognition of computers?
2. Do children have the capability of learning simple programming and its concepts?
3. Which factors, related to HCI, are pertinent to children's comprehension of computers?
4. How much of children's interest in computers are passive (visual, auditory)?
Interactive (action-based)?

1.8 Keywords

Below is a list of keywords that are pertinent to the study of Human-Computer Interaction as it pertains to children:

Human-Computer Interaction (HCI), Human-Computer Interface (HCI), Children and Computers, Cognition of Children, Human Factors, HCI Bibliography, HCI Webliography.

1.9 Definition of Terms

1. Human-Computer Interaction (HCI) is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.

– (retrieved from hcibib.org)

2. Cognition

- i. The mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment.
- ii. That which comes to be known, as through perception, reasoning, or intuition; knowledge.

– (retrieved from Merriam-Webster)

3. Human Factors is an area of psychology that focuses on a range of different topics, including ergonomics, workplace safety, human error, product design, human capability and human-computer interaction.

– (retrieved from about.com)

4. The age range of 5–12 defined for this research as early childhood.

1.10 Delimitations

This research only focused on children of ages 5–12 in the city of Baton Rouge, LA with no emphasis on cultural differences. Also for the purpose of this research children with special needs were excluded. Another delimitation was that children were only evaluated on an individual basis meaning one child will not be compared to another child. Finally, there was no in-depth investigation into psychological or educational aspects of cognition other than what is relevant to human-computer interaction. Demographics other than age were not pertinent to this particular study.

1.11 Resources Needed to Conduct Study

In order to conduct this study and get the results desired, the following resources were needed:

- 1 Children ages 5–12 are eligible to participate.
- 2 The Framework for design and implementation of software applications is .Net and the specific programming language is vb.net.
- 3 Adobe Photoshop for the graphic design.
- 4 An intuitive evaluation sheet as well as survey questions for the children to answer after their interaction with the applications.
- 5 Permission from Southern University's Institutional Review Board to use human subjects.
- 6 Permission from human subject's parents/children to participate.
- 7 Experts in the subject matter of HCI and Educational Technology.

Chapter II

Review of Literature

2.1 Involvement of Children

Human-Computer Interaction in children is a topic that is still in the early stages of research and the field has yet to mature. Professor Allison Druin of The University of Maryland agrees. She is the current director of the Human-Computer Interaction Lab at the university. She has founded CHIkids Activities which is a program established for and about children as a branch under the ACM's SIGCHI (Special Interest Group on Computer Human Interaction). The aim of CHIkids is to allow children to be software testers, conference reporters, and multimedia storytellers [Website 1].

Since 1998, Professor Druin and her research associates have been working on research titled Children as Design Partners. The research paper Mixing Ideas: A New Technique for Working with Young Children as Design Partners “sets forth a new technique for working with young children as design partners [Reuter].” The research stems from another project previously conducted at The University of Maryland called Cooperative Inquiry. The two researches combined dealt with children ages 4-11. The purpose of the research was to elaborate on the idea that children are capable of being a part of the intricate design of children's technology. Here is a brief synopsis of how they conducted their study taken from the CHI Conference Publication they submitted:

The mixing ideas technique is designed to support young children in successfully collaborating during a brainstorming design process. With this in mind, we present a case study of how the mixing ideas technique

can work with young design partners. In the [f]all of 2003, we began work with our newest design partners at the CYC. They were 11 ethnically diverse children, all of whom were age 5 at the beginning of the process. There were 5 boys and 6 girls. The process described here took approximately one month, with hour-long sessions held twice a week.

Due to periodic illness and other class activities, and the fact that most of the activities were done in small groups, all of the children were not involved in every design session.

Our goal was [to both] innovate new technology and to enable young children to collaborate successfully in the design process. Our technology design work focused on a critical part of an early-childhood educational experience: center time. During center time, sometimes called learning centers or work time, children are able to choose different centers or classroom areas at which to explore, play, and learn. Typical centers may include: building with blocks, dramatic play (sometimes referred to as "dress-up" or "housekeeping"), computer time, book-reading area, etc.

Our overarching question to our child design partners became: "How would you change the centers in your classroom if you could?" We used cooperative inquiry methods including the new process of mixing ideas to come up with answers for this question. The next sections present the process of mixing ideas as it occurred in three stages, from individual

generation of ideas, to small group mixing of ideas, to the final mixing to create one team idea [Reuter].

The research conducted at the University of Maryland by this team will be very instrumental to this current research in various ways. Since several publications have been created from this group, the information not only assists in the design of the software for the children, but also helps in the guidance of how to work with children and technology. The foundation of this research stemmed from the idea that children need to have a significant role in technology. Professor Druin also states this in a similar way by saying, “We have a chance to change technology, but more importantly we have a chance to change the life of a child. Every time a new technology enables a child to do something they never dreamed of, there are new possibilities for the future [Website 1].”

2.2 Development of Technology Within Children

Similar to the group developed at the University of Maryland, there are several additional organizations concerned with the development of technology within children. The University of Michigan hosts the Center for Highly Interactive Computers in Education where they develop “learner-centered technology and curriculum that addressed major needs of schools today [Website 2]. iD Tech Camp is a nationwide camp that some of the nations prolific universities that offer children ages 7-17 to create video games, experience game modding, improve your gaming skills, build robots, design websites, film and edit digital movies, create your own comic book, learn programming, and more [Website 4].

The findings and the interaction in working with the children in these two organizations will shed light on educational technology and programming at a child's level which is instrumental to answering the questions desired by this research.

2.3 On-Going Projects

In the last decade, there have been numerous highly recognized on-going projects dedicated to children in the areas of programming and human-computer interaction. Some stand-out projects are Carnegie Mellon's The Natural Project. It is comprised of several different projects but the common goal of them is "to make computer programming more accessible to children and adult non-programmers [Website 5]". Kids Talk Back is another initiative to find out from children and their parents on what they like to see in websites for children. In the article, Karen Fishler reports that, "kids have a blast online." She also offers advice to developers taken from the children. She states that, "kids love glitz, but it is interaction that gets them jazzed." The other project that will offer insight to this research is the Playground Project which was conducted by the University of London. To summarize, this project investigates children programming computer games. They also have kept a database that references games that children have created [Website 4]. Although the project was housed in Europe and this research is catering to the children of the United States, the methodology used in the Playground Project and its results will assist in the development of this research.

In 2008, two researchers, Cynthia Carter Ching, Associate Professor of education at the University of California, Davis and X. Christine Wang from the University at Buffalo, SUNY, conducted two studies dealing with kindergarten and first grade students.

In the first study, they observed students playing computer games in their spare time. In the second study, they gave the students digital computer and told them to create a digital journal. Their research concluded with the ideas like “contrary to common education wisdom, computer games and other technologies can foster community-building, a strong sense of identity and higher-level planning even in very young students,” [Website 6].

Ching also addressed the debate of whether technology should be prevalent in the classrooms and households of younger children. She states, "There is a lot of hemming and hawing among educators about the introduction of technology in the early grades. But the worst-case scenarios just don't pan out. Technology can facilitate creativity and social awareness, even when we don't design the use of it to do so. And when we do design technology activities with these things in mind, the possibilities are endless," [Website 6].

Since simple programming is a component of this research, the past and present programming languages designed for children must be exposed. As with any topic, especially ones related to what children are capable of performing; there are several debates which are seemingly based on opinion. Debates span over whether children can understand programming concepts, will it be beneficial to even introduce programming to children, the purpose of children programming, and even more so the design/logic of programming languages. Several studies have been done on these topics; however, a recent study conducted in 2009 has stood out for the benefit of this research. The paper written by professors Michael Eisenberg, Nwanua Elumeze, and Michael MacFerrin at

the University of Colorado's Department of Computer Science gives an overview of the sides of the programming debate:

Broadly speaking, the “advocate” position here [5, 11] has argued that programming is an empowering, creative, and fertile medium for children's activities; while the “opponent” position has argued variously that programming is unnecessary, overly difficult, or (in the extreme) cognitively harmful for children [8, 14,18]. [Eisenberg].

2.4 Programming Languages for Children

Despite the many debates and controversy of the children's programming topic, over the past three decades programming language and IDEs (Integrated Development Environments) designed for children have been developed. Amongst some of the most popular are LEGO Mindstorms, Scratch, SiMPLE, KPL(Kids Programming Languages), Logo, SmallTalk, and Squeak. There has even been a release of a new IDE in 2010 called Kojo-Scala for Kids.

2.5 Benefits To This Study

The topic of Human-Computer Interaction pertaining to children has enough previous work to provide a consistent trail of prerequisites for this particular study. This study will further the research already conducted by the former studies and projects which mainly focused on design. Hence, in this particular study, one of the keywords is interaction.

Chapter III

Methodology

3.1 Introduction to Methodology

In this study, a software application “Wacky Calky™” was designed to cater to children ages 5-12. Direct observation was made to perceive how each child interacted with the software. In addition to direct observation, the children were surveyed on several factors dealing with their retention of the application related to Human-Computer Interaction concepts. “There are several valid reasons for asking children for their opinions of interactive products. One is that adults and children live in different worlds and for that reason adults may not understand what children want,” [Baecker]. The goal of the research is to develop ideas pertaining to HCI as it relates to children and attempt to prove or disprove them.

3.2 Subjects

Subjects used in this research were between the ages of 5–12. They attend David Paul Community Center, an after-school program for children of diverse backgrounds do their homework, interact, and develop skills needed for everyday life. The children’s participation in this study was strictly voluntary and required parental consent.

3.3 Design

Educational technology software was created specifically for this study titled Wacky Calky™. It is an interactive calculator as well as a math practice game for basic math functions such as addition, subtraction, multiplication, and division. Math functionality was chosen because it is known as a mechanism prevalent to logic skills and

also a major topic in early childhood education [Druin]. The software was designed from creative ideas from others which included adults as well as an eight year old child. Design ideas were also gathered from the previous research studies discussed in the review of literature section of this paper.

Human-Computer Interactive concepts were highly essential in both the design and implementation of Wacky Calky™. Such concepts were animation of objects, mouseover which showed tooltips, drag-and-drop with audio sounds, point and click with audio sounds, and pop-up directions. Wacky Calky™ was designed to be completely interactive. Figures 1, 2, and 3 depict the graphical user interfaces associated with the software.



Figure 1: Initial login screen

The home screen was designed with dancing numbers, the .gif files used are courtesy of <http://www.animatedgif.net/numberscharacters/numbers.shtml>. The animation provides an excitement to the younger user enticing him/her to want to go further into the software. As one may notice, there are lots of colors and large font sizes

because research has shown that these are important design tactics for creating children's software.

The software is created into two parts, the first being the Wacky Calky™ calculator (see Figure 2). With the calculator, the child is able to drag-and-drop numbers into the blank boxes and clicks the equal sign to reveal the answer. The child may choose which type of operation he/she would like to play with by clicking one of the signs to the left side of the screen.

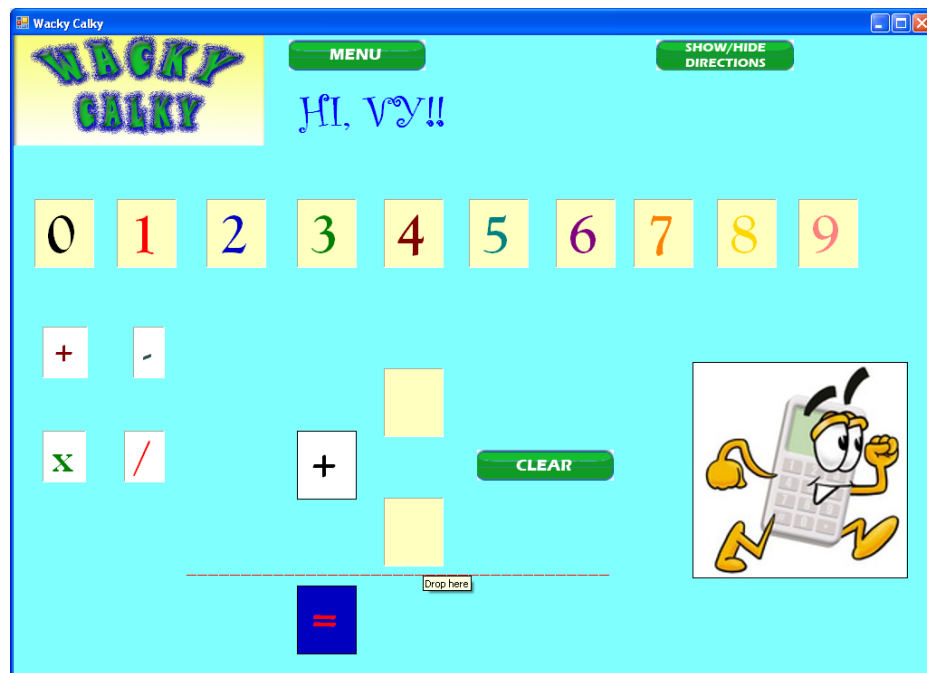


Figure 2: Calculator solves problems it receives

Part two of Wacky Calky™ software is a game in which is a practice problem machine that randomly generates math problems (see Figure 3). The user has to drag-and-drop the answer into the blank box, click the equal sign and depending upon the right or

wrong answer a sound is made. If correct, a new problem is generated. The same functionality applies with the math operators as it does in the calculator.

There are additional functions associated with the software such as popup directions when the show/hide directions button is clicked as well as tooltips with short directions on the mouseover of certain objects. There are several sound effects that occur when objects are dropped, when answers are rendered, and when buttons are clicked.



Figure 3: Math problems are generated for subject to solve

Every one of the functionalities in Wacky Calky™ has a purpose related to known research facts about Human-Computer Interaction. The drag-and-drop feature is included in the software to correlate with the drag-and-drop feature in majority of the simple programming languages and frameworks.

3.4 Procedures

Fifteen children participated in this study. Each child was isolated and individually ran the Wacky Calky™ software on a single computer. This was important in order for proper evaluation of each individual. The experience could not be a group effort. Each child was provided an average of fifteen minutes to interact with the software. While the child interacted with the software, they were evaluated on several operations. A few of the observation questions were:

1. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
2. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
3. Is it obvious that the child uses computers or related technological devices on a regular basis?
4. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?

A complete list of the evaluation is located in Appendix B.

After interacting with the software, each child was asked to take a brief survey, which was designed in a language that children can understand with a graphical approach. Smiley faces and colorful words were an intricate detail to aid in effective results for the study. The purpose of the survey was to indirectly get the child's feedback as it related to Human-Computer Interactive concepts.

The survey questions were formatted as such:

1. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

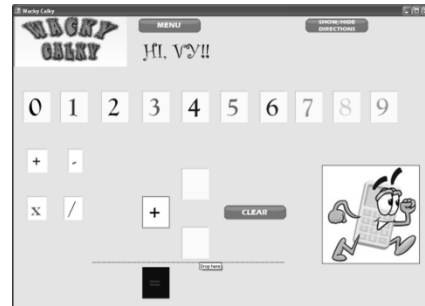


Yes



Yes Yes!!

2. Which picture do you like better?



3. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

The complete survey is located in Appendix C.

Chapter IV

Data Analysis and Findings

4.1 Overall/Pivotal Age

Overall the subjects exemplified common knowledge of basic computer functionality such as mouse/keyboard navigation and awareness. Eight years of age seemed to be the pivotal point for more advanced computer usage. At this age, it was notable that the subjects were entering their names with two hands, clicking, as well as, dragging/dropping faster and maximizing/minimizing windows without assistance. The following explanation comes from direct observations and survey responses.

4.2 Human Computer Interaction Breakdown

Most of the subjects initially tried to click the numbers before utilizing drag-and-drop. 40% of the subjects did not like drag-and-drop, which was opposite of the initial assumption that children would prefer that action over clicking. The responses below were from the subjects regarding drag-and-drop.

Not at all	A little	No feeling	Yes	Yes Yes!!!
13%	20%	6%	47%	13%

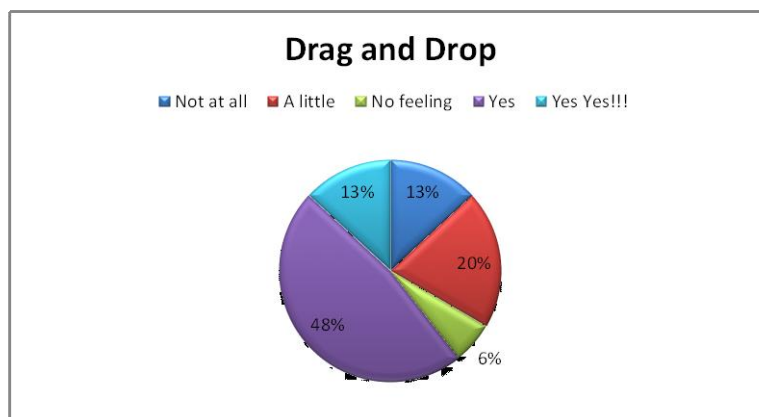


Figure 4: Drag-and-drop feedback

After reviewing related literature pertaining to the topic of this study, we formulated a theory that mouseover would be a significant human-computer interaction in children's usage of computers. Contrary to our formulated theory, our findings proved mouseover not to be major factor. From the feedback received, sound was a major factor for the subjects. They were not more interested in aesthetics over functionality, in fact, they were equally important. Their survey responses reflected that ease of use is vital to software and helps with participants' interest.

Really hard 0% A little hard 13% No feeling 6% Easy 6% Super easy 73%

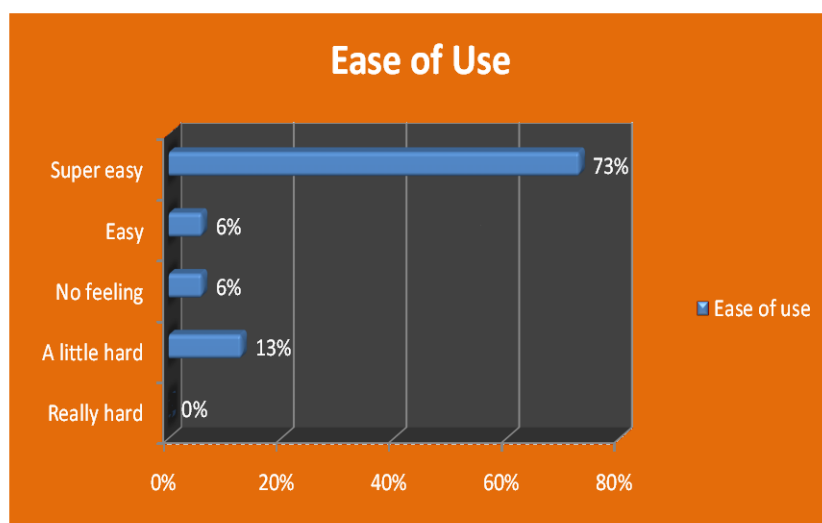


Figure 5: Ease of use

Statistics showed that frequent computer usage by children is now a norm. Of this group 33% of the subjects use computers daily, 33% weekends, 20% weekly, 6% monthly, and 6% not at all. They had to respond to this question —what do you remember most and what was favorite thing about the software?

Sounds received the most enthusiastic response with colors following thereafter.

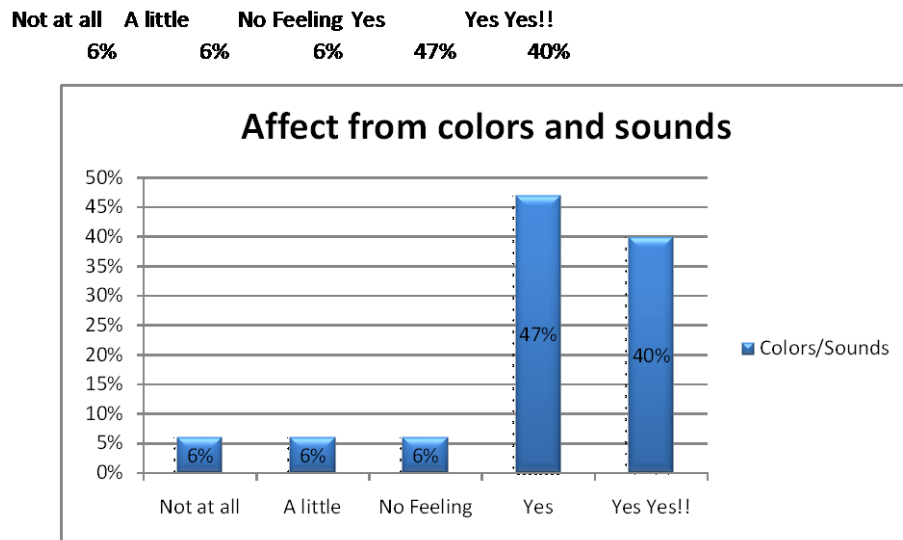


Figure 6: Effectiveness of sounds

Several subjects noted the bouncing numbers on load screen. Others reference the colorful numbers.

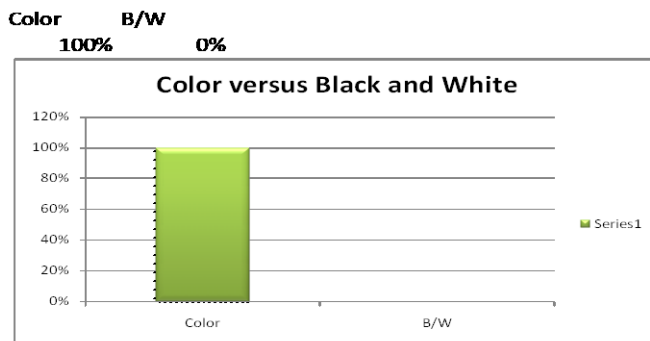


Figure 7: Color versus Black and White

The older subjects answered the math problems and how it related to what they are currently learning in class. They also stated that the software was helpful and fun. While observing the subjects interaction with the software, 2/15 seemed bored, 2/15 showed no feeling, and 11/15 seemed intrigued; however, all of the responses from the survey yielded different results. None of the subjects answered that they were bored.

Bored	Sad	No Feeling	Happy	Excited
0%	0%	14%	26%	60%

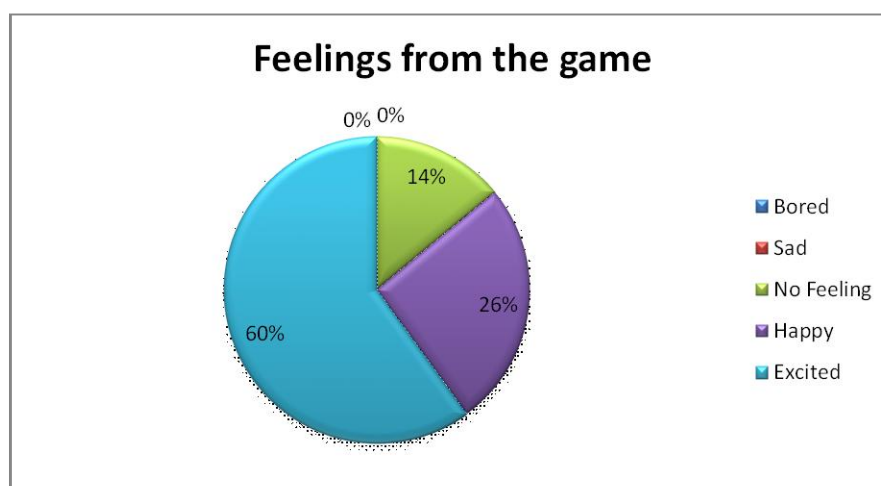


Figure 8: Feelings while interacting with software

Those who were intrigued showed the following trends. They asked numerous questions, concentrated on answering problems correctly, mentioned that they were excited to see name re-appear on the screen, and even danced to the music on the loading screen. In any capacity, all of the observations and answers can be categorized into a particular factor of Human-Computer Interaction.

Regarding learning how to create their own game, the subjects mostly replied that they would be interested in doing so. The following graph represents their responses.

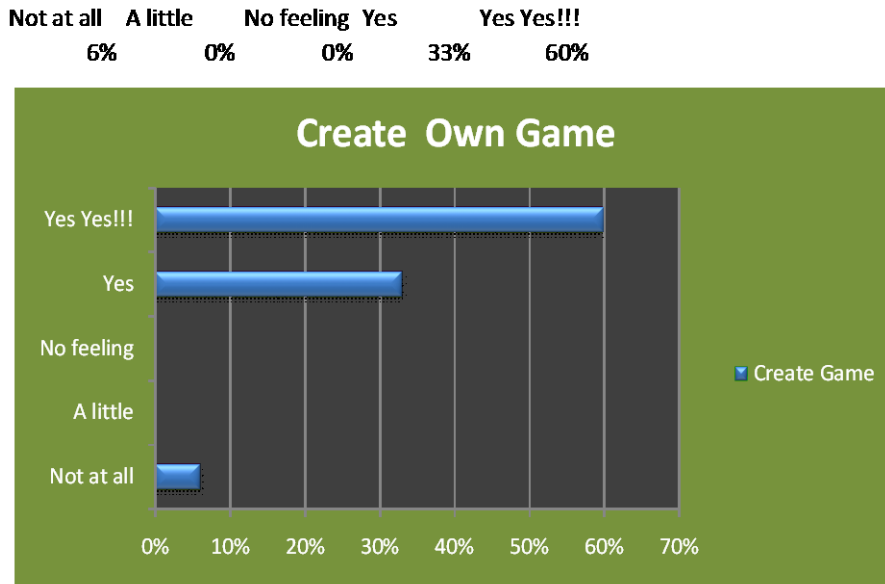


Figure 9: Interest in creating software

This particular graph shows that the subjects are interested in software and willing to learn the mechanisms behind creating software in order to create their own.

Chapter V

Conclusion

5.1 Decision Based On Findings

According to the findings in this study, the following hypothesis is concluded as true: *With the usage of proper human computer interaction techniques, the vast majority of children are knowledgeable enough to comprehend computer activity as well as simple programming.*

5.2 What We Learned

We learned the Human Computer Interactions that were important to children ages 5-12 which were sounds (responsive), colors (100% preferred color over b/w), and clicking rather than drag-and-drop, which disproved the theory that children would like drag-and-drop better. The percentage of children's interest in computer is determined to be evenly divided between the visual and interactive aspects. Both mechanisms equally weigh in that the visual is to keep the child focused and entertained.

One of the most sought out answers was: Do children have the capability to learn simple programming and concepts? The answer determined from this study is "yes". The majority of the children in this study were far advanced with technology usage and we believe that this proves that they are capable of learning simple programming. If proper avenues and teaching methods are used to teach, the children proved that they could be fully focused and interested and 93% of the children said they would be wanted to learn to create their own games. According to the findings in this study, there is a relationship between Human-Computer Interaction and children's cognition of computers. By

observing the children, it was obvious that repetition, colors, and sounds assisted in the children with the usage of the computer and software. HCI mechanisms also proved to be the factor that kept the subject interested in using the software.

5.3 Further Research

There are several ways in which this research can be extended. It would be nice to know why the children in that age range have objection to the mechanisms of drag-and-drop. The study can be done on a broader group of children, for example, the public school system compared to the private school system. It could also be categorized and broken into a study by age groups. Also this study can include an in depth psychological assessment teamed with psychologists for the expansion of the cognitive aspect of the study for more precise and justifiable conclusions, e.g. the correlation between human computer interaction and children's cognition of computers.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. ACM SIGCHI Curriculum Development Group. (1992). ACM SIGCHI Curricula for Human Computer Interaction. New York: ACM.
2. Alborzi, H., Druin, A., Montemayor, J., Sherman, L., Taxen, G., Best, J., Hammer, J., Kruskal, A., Lal, A., Plaisant Schwenn, T., Sumida, L., Wagner, R., Hendler, J. (2000). Designing StoryRooms: Interactive Storytelling Spaces for Children. Designing Interactive Systems (DIS)
3. Frazeur, Alice. (2006). The Early Childhood Briefing Paper Series: All Children Ready for School. Publication of the Indiana Institute on Disability and Community, Early Childhood Center. Indiana University.
4. Baecker Ronald M., William A. S. Buxton (Editors). (1987). Readings in Human-Computer Interaction: A Multidisciplinary Approach. Los Altos, CA: Morgan-Kaufmann.
5. Baecker Ronald M., Jonathan Grudin, William A. S. Buxton, and Saul Greenberg (Editors). (1995). Readings in Human-Computer Interaction: Toward the Year 2000 (Second Edition). Los Altos, CA: Morgan-Kaufmann Publishers.
6. Baecker, R.M., Grudin, J., Buxton, W., and Greenberg, S. (Editors). (1995). Readings in human-computer interaction: toward the year 2000. Morgan Kaufmann Publishers. San Mateo, CA .
7. Blattner, M. and Dannenberg, R.. Multimedia interface design. ACM Press. Addison Wesley. New York, NY. 1992.

8. Card, Stuart K., Thomas P. Moran, and Allen Newell. (1983). *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
9. Carroll, John .*Human computer interaction in the new millennium*. Addison-Wesley. 2002.
10. Cato, John. (2001). *User centered interface design*. Addison-Wesley.
11. Chipman, G., Druin, A., Fails, J., Guha, M. L., Simms, S., Beers, D. (2006). A case study of Tangible Flags: A collaborative technology to enhance field trips. In *Proceedings of Interaction Design and Children (IDC'2006)*, Finland.
12. Collins, Dave. *Designing Object-Oriented User Interfaces*. (2005). Benjamin/Cummings. Redwood City, CA.
13. Cooper, A.. (1995). *About face: the essentials of user interface design*. IDG Books, Foster City, CA.
14. Cooper, Alan. (1999). *The inmates are running the asylum*. SAMS Publishing, Indiana.
15. Dix, Alan, Janet Finlay, Gregory Abowd, and Russell Beale. (1993). *Human-Computer Interaction*. Hillsdale, NJ: Prentice Hall.
16. Druin, A. & Fast, K. (2002). The Child as Learner, Critic, Inventor, and Technology Design Partner: An Analysis of Three Years of Swedish Student Journals. *The International Journal for Technology and Design Education*, 12(3), 189-213.
17. Druin, A. (1997-2003). *Computers and Kids Column*. SIGCHI Bulletin. ACM Press.
18. Druin, A. (1999). *Cooperative inquiry: Developing new technologies for children with children*. *Proceedings of CHI'99*, ACM Press.

19. Druin, A. (2002). The Role of Children in the Design of New Technology. *Behaviour and Information Technology*, 21(1) 1-25.
20. Druin, A. (2005). What children can teach us: Developing digital libraries for children. *Library Quarterly* , 75(1), 20-41.
21. Druin, A., Bederson, B. B., Massey, S., Rose, A., & Weeks, A. (In Press). From New Zealand to Mongolia: Co-designing and deploying a digital library for the world's children. *Children, Youth, and Environment: Special Issue on Children in Technological Environments*.
22. Druin, A., Bederson, B., Hourcade, J.P., Sherman, L., Revelle, G., Platner, M., & Weng, S. (2001). Designing a Digital Library for Young Children: An Intergenerational Partnership. *Joint Conference on Digital Libraries (JCDDL'01)*
23. Druin, A., Montemayor, J., Hendler, McAlister, B., Boltman, A., Fiterman, E., Plaisant, A., Kruskal, A., Olsen, H., Revett, I., Plaisant- Schwenn, T., Sumida, L., & Wagner, R. (1999). Designing PETS: A Personal Electronic Teller of Stories. *Proceedings of CHI 99*, ACM Press.
24. Druin, A., Revelle, G., Bederson, B. B., Hourcade, J. P., Farber, A., Lee, J., & Campbell, D. (2003). A Collaborative Digital Library for Children: A Descriptive Study of Children's Collaborative Behaviors and Dialogue. *Journal of Computer-Assisted Learning* 19(2), pp.239-24.

25. Druin, A., Stewart, J., Proft, D., Bederson, B., Hollan, J. (1997). KidPad: A design collaboration between children, technologists, and educators. Proceedings of CHI '97, Atlanta, GA.
26. Druin, A., Weeks, A., Massey, S., & Bederson, B. B. (2007). Children's interests and concerns when using the International Children's Digital Library: A four country case study. In Proceedings of Joint Conference on Digital Libraries (JCDL'2007) Vancouver, British Columbia, Canada.167-176.
27. Eisenberg, M., Elumeze, N., MacFerrin, M.(2009). “Children's Programming, Reconsidered: Settings, Stuff, and Surfaces.” IDC 2009 3-5 June, 2009 – Como, Italy
28. Fishler, Karen D. (1998). Kids talk back. Adobe Magazine, 9 (3), 40–45.
29. Gould, J.D. & Lewis, C. Designing for usability: Key principles and what
30. Hourcade, J., Bederson, B., Druin, A., Rose, A., Farber, A., & Takayama, Y. (2003). The International Children's Digital Library: Viewing Digital Books Online. Interacting with Computers,15, pp. 151-167.
31. Hutchinson, H., Druin, A , & Bederson, B. B., (2007). Supporting Elementary-Age Children's Searching and Browsing: Design and Evaluation Using the International Children's Digital Library. Journal of the American Society for Information Science and Technology (JASIST), 58(11), 1618-1630.
32. Hutchinson, H., Bederson, B.B., & Druin, A. (2006). The evolution of the International Children's Digital Library searching and browsing interface. In Proceedings of Interaction Design and Children (IDC'2006), Finland.

33. Jacko, Julie A. and Andrew Sears (Editors). (2003). *The Human-Computer Interaction Handbook*. Lawrence Erlbaum Associates.
34. Jacko, Julie A. and Andrew Sears (Editors). (2009). *Human-Computer Interaction: Designing for Diverse Users and Domains*. CRC Press.
35. Lewis, Clayton and John Rieman. (1993). *Task-Centered User Interface Design: A Practical Introduction*. Boulder, Colorado: University of Colorado-Boulder.
36. Montemayor, J., Druin, A., Chipman, G., Farber, A., & Guha, M. L. (2004). Tools for children to create physical interactive StoryRooms. *Computers in Entertainment: Educating children through entertainment Part II*, 2(1).
37. Montemayor, J., Druin, A., Farber, A., Sims, S., Churaman, W., & D'Amour, A. (2002). Physical programming: Designing tools for children to create physical interactive environments. *Proceedings of CHI2002*, ACM Press.
38. No Child Left Behind (NCLB, P.L. 107-110). (2002). *The Facts: 21st Century Technology*. Available online at <http://www.nochildleftbehind.gov/start/facts/21centtech.html>.
39. Papert, S. (1980). "Mindstorms: Children, Computers, and Powerful Ideas." BasicBooks. (Foreword, Introduction, Chapter 1, Chapter 8)
40. Plaisant, C., Druin, A., Lathan, C., Dakhane, K., Edwards, K., Vice, J. M., Montemayor, J. (2000). *A Storytelling Robot for Pediatric Rehabilitation*. ASSETS'00
41. Reuter, K. & Druin, A. (2004). Bringing together children and books: An initial descriptive study of children's book searching and selection behavior in a digital

- library. In Proceedings of American Society for Information Science and Technology Conference (ASIST). Providence, RI.
42. Revelle G., Druin A., Platner M., Weng S., Bederson B.B., Hourcade J.P., & Sherman, L. (2002). Young Children's Search Strategies and Construction of Search Queries. *Journal of Science Education and Technology*, 11(1), 48-57.
 43. Ryokai, K. and Cassell, J., (1999). "Computer Support for Children's Collaborative Fantasy Play and Storytelling", In Proceedings of CSCL '99.
 44. Sears, Andrew and Julie A. Jacko (Editors). (2007). *The Human-Computer Interaction Handbook*. (2nd edition) CRC Press.
 45. Stephens, E. C., Carswell, C. M., & Schumacher, M. M.. Evidence for an elders' advantage in the naive product usability judgments of older and younger adults. *Human factors*, 48(3), 422–433.
 46. Taxen, G., Druin, A., Fast, C., & Kjellin, M (2001). KidStory: A Technology Design Partnership with Children. *Behaviour and Information Technology*, 20(2), 119-125.
 47. [Website 1] <http://www.cs.cmu.edu/~NatProg/>
 48. [Website 2] <http://www.cs.umd.edu/hcil/kiddesign/>
 49. [Website 3] <http://www.hcibib.org/kids/>
 50. [Website 4] http://www.news.ucdavis.edu/search/news_detail.lasso?id=8568
 51. [Website 5] <http://www.sigchi.org>
 52. [Website 6] <http://www.umiacs.umd.edu/~allison/>

APPENDIX

Appendix A—Wacky Calky™ Source Code

The following code represents the software in its entirety broken into three modules.

```
Imports MediaPlayer
```

```
Public Class WackyCalky
```

```
    Private Sub Button1_MouseHover(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button1.MouseHover
```

```
        Dim tip As New ToolTip
```

```
        tip.SetToolTip(Button1, "Use Wacky Calculator")
```

```
    End Sub
```

```
    Private Sub Button2_MouseHover(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Button2.MouseHover
```

```
        Dim tip As New ToolTip
```

```
        tip.SetToolTip(Button2, "Play Wacky Game")
```

```
    End Sub
```

```
    Private Sub TextBox1_MouseHover(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles TextBox1.MouseHover
```

```
        Dim tip As New ToolTip
```

```
        tip.SetToolTip(TextBox1, "Put your name here")
```

```
    End Sub
```

```
    Private Sub PictureBox1_MouseHover(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles PictureBox1.MouseHover
```

```
        Dim tip As New ToolTip
```

```

tip.SetToolTip(PictureBox1, "A WACKY CREATION BY: VYAISHA L. MOSS")
End Sub

Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
    If TextBox1.Text = "" Then
        MsgBox("Must type your name first.", MsgBoxStyle.OkOnly, "WAIT")
    Else
        AxWindowsMediaPlayer1.Ctlcontrols.stop()
        Dim name As String = TextBox1.Text
        Dim wcalcky As New WCalky(name)
        wcalcky.Show()
        Me.Hide()
    End If
End Sub

Private Sub Button2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click
    If TextBox1.Text = "" Then
        MsgBox("Must type your name first.", MsgBoxStyle.OkOnly, "WAIT")
    Else
        AxWindowsMediaPlayer1.Ctlcontrols.stop()
        Dim name As String = TextBox1.Text
        Dim wGame As New WGame(name)
        wGame.Show()
        Me.Hide()
    End If
End Sub
End Class

```

```
Public Class WCalky
```

```
    Dim username As String
```

```
Public Sub New(ByVal name As String)
```

```
    Me.InitializeComponent()
```

```
    username = name
```

```
End Sub
```

```
Private Sub WCalky_Load(ByVal sender As System.Object, ByVal e As  
System.EventArgs) Handles MyBase.Load
```

```
    name1bl.Text = name1bl.Text & ", " & UCase(username) & "!!"
```

```
End Sub
```

```
' Start drag
```

```
Private Sub one_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles one.MouseDown
```

```
    one.DoDragDrop(one, DragDropEffects.Copy)
```

```
End Sub
```

```
Private Sub two_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles two.MouseDown
```

```
    two.DoDragDrop(two, DragDropEffects.Copy)
```

```
End Sub
```

```
Private Sub three_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles three.MouseDown
```

```
    three.DoDragDrop(three, DragDropEffects.Copy)
```

```
End Sub
```

```
Private Sub four_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles four.MouseDown  
    four.DoDragDrop(four, DragDropEffects.Copy)  
End Sub
```

```
Private Sub five_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles five.MouseDown  
    five.DoDragDrop(five, DragDropEffects.Copy)  
End Sub
```

```
Private Sub six_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles six.MouseDown  
    six.DoDragDrop(six, DragDropEffects.Copy)  
End Sub
```

```
Private Sub seven_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles seven.MouseDown  
    seven.DoDragDrop(seven, DragDropEffects.Copy)  
End Sub
```

```
Private Sub eight_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles eight.MouseDown  
    eight.DoDragDrop(eight, DragDropEffects.Copy)  
End Sub
```

```
Private Sub nine_MouseDown(ByVal sender As System.Object, ByVal e As  
System.Windows.Forms.MouseEventArgs) Handles nine.MouseDown  
    nine.DoDragDrop(nine, DragDropEffects.Copy)
```

End Sub

```
Private Sub zero_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles zero.MouseDown
    zero.DoDragDrop(zero, DragDropEffects.Copy)
```

End Sub

' Copy effect.

```
Private Sub PanelTarget_DragEnter(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.DragEventArgs) Handles Panel1.DragEnter, Panel2.DragEnter
```

'Check label

```
If e.Data.GetDataPresent(GetType(Label)) Then
```

' There is Label data. Allow copy.

```
e.Effect = DragDropEffects.Copy
```

' Highlight the control.

```
sender.BorderStyle = BorderStyle.FixedSingle
```

Else

' There is no Label. Prohibit drop.

```
e.Effect = DragDropEffects.None
```

End If

End Sub

' Unhighlight control.

```
Private Sub Panel_DragLeave(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Panel1.DragLeave, Panel2.DragLeave
    sender.BorderStyle = BorderStyle.Fixed3D
```

End Sub

' Perform the drop.

```

Private Sub Panel1_DragDrop(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.DragEventArgs) Handles Panel1.DragDrop
    Dim lbl As New Label
    lbl = DirectCast(e.Data.GetData(GetType(Label)), Label)

    If Panel1.Text = "" Then
        sender.text = lbl.Text
    Else
        sender.Text = Panel1.Text & lbl.Text
        'In case of multidigit number
        sender.AutoSize = True
    End If

    sender.BackColor = lbl.BackColor
    sender.BorderStyle = BorderStyle.Fixed3D
    sender.forecolor = lbl.ForeColor
    sender.font = lbl.Font
    sender.size = lbl.Size

    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\waterdrip.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()
End Sub

```

' Perform the drop.


```

Private Sub Panel2_DragDrop(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.DragEventArgs) Handles Panel2.DragDrop
    Dim lbl As New Label
    lbl = DirectCast(e.Data.GetData(GetType(Label)), Label)

    If Panel2.Text = "" Then
        sender.text = lbl.Text
    'In case of multidigit number
        sender.AutoSize = True
    Else
        sender.Text = Panel2.Text & lbl.Text
    End If

    sender.BackColor = lbl.BackColor
    sender.BorderStyle = BorderStyle.Fixed3D
    sender.forecolor = lbl.ForeColor
    sender.font = lbl.Font
    sender.size = lbl.Size

    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\waterdrip.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()
End Sub

```

```

Private Sub PictureBox1_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles PictureBox1.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(PictureBox1, "A WACKY CREATION BY: VYAISHA L. MOSS")
End Sub

```

```

Private Sub Panel1_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Panel1.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(Panel1, "Drop here")
End Sub

```

```

Private Sub Panel2_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Panel2.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(Panel2, "Drop here")
End Sub

```

```

Private Sub Add_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles Add.Click
    mathoptr.Text = Add.Text
    mathoptr.ForeColor = Add.ForeColor
End Sub

```

```

Private Sub add_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Add.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(Add, "Click to add")
End Sub

```

```

Private Sub subtract_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles subtract.Click
    mathoptr.Text = subtract.Text
    mathoptr.ForeColor = subtract.ForeColor
End Sub

```

```

Private Sub subtract_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles subtract.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(subtract, "Click to subtract")
End Sub

```

```

Private Sub multiply_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles multiply.Click
    mathoptr.Text = multiply.Text
    mathoptr.ForeColor = multiply.ForeColor
End Sub

```

```

Private Sub multiply_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles multiply.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(multiply, "Click to multiply")
End Sub

```

```

Private Sub divide_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles divide.Click
    mathoptr.Text = divide.Text
    mathoptr.ForeColor = divide.ForeColor
End Sub

```

```

Private Sub divide_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles divide.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(divide, "Click to add")

```

End Sub

```
Private Sub equal_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles equal.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(equal, "Click for answer")
End Sub
```

```
Private Sub equal_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles equal.Click
    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\flintstonerun.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()
```

```
Dim num1 As Integer = CType(Panel1.Text, Integer)
```

```
Dim num2 As Integer = CType(Panel2.Text, Integer)
```

```
Dim oper As String = mathoptr.Text
```

```
Dim ans As Int64
```

```
If oper = "+" Then
```

```
    ans = num1 + num2
```

```
    answer.Visible = True
```

```
    answer.BackColor = Color.Green
```

```
    answer.ForeColor = Color.Gold
```

```
    answer.Text = ans.ToString
```

```
ElseIf oper = "-" Then
```

```
    ans = num1 - num2
```

```
    answer.Visible = True
```

```
    answer.BackColor = Color.Green
```

```
    answer.ForeColor = Color.Gold
```

```

    answer.Text = ans.ToString
ElseIf oper = "x" Then
    ans = num1 * num2
    answer.Visible = True
    answer.BackColor = Color.Green
    answer.ForeColor = Color.Gold
    answer.Text = ans.ToString
ElseIf oper = "/" Then
    If num2 <> 0 Then
        ans = num1 \ num2
        Dim remainder As Int64 = 0
        remainder = num1 Mod num2
        answer.Visible = True
        answer.BackColor = Color.Green
        answer.ForeColor = Color.Gold
        If remainder = 0 Then
            answer.Text = ans.ToString
        Else
            answer.Text = ans.ToString & " remainder " & remainder.ToString
        End If
    Else
        MsgBox("Cannot divide by zero", MsgBoxStyle.OkOnly, "WAIT")
    End If

Else
    MsgBox("Must choose +, -, x, or / first", MsgBoxStyle.OkOnly, "WAIT")
End If

```

End Sub

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Rewind.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()
    Panel1.AutoSize = False
    Panel2.AutoSize = False
    Panel1.Text = ""
    Panel2.Text = ""
    mathoptr.Text = "+"
    answer.Visible = False
End Sub
```

```
Private Sub button1_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(Button1, "Reset numbers")
End Sub
```

```
Private Sub menu_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button2.Click
    Dim Home As New WackyCalky
    Home.Show()
    Me.Hide()
End Sub

Private Sub hidirections()
    dir1.Visible = False
```

```
dir2.Visible = False  
dir3.Visible = False  
dir4.Visible = False  
dir5.Visible = False  
dir6.Visible = False  
dir7.Visible = False  
dir8.Visible = False
```

```
End Sub
```

```
Private Sub showdirections()
```

```
dir1.Visible = True  
dir2.Visible = True  
dir3.Visible = True  
dir4.Visible = True  
dir5.Visible = True  
dir6.Visible = True  
dir7.Visible = True  
dir8.Visible = True
```

```
End Sub
```

```
Private Sub directions_Click(ByVal sender As System.Object, ByVal e As
```

```
System.EventArgs) Handles directions.Click
```

```
    If dir1.Visible = True Then
```

```
        hidirections()
```

```
    Else
```

```
        showdirections()
```

```
    End If
```

```
End Sub
```

```
'Private Sub lbl_MouseLeave(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Add.MouseLeave, one.MouseLeave, _
    two.MouseLeave, three.MouseLeave, four.MouseLeave, five.MouseLeave,
six.MouseLeave, seven.MouseLeave, eight.MouseLeave, _
    nine.MouseLeave, zero.MouseLeave, subtract.MouseLeave, multiply.MouseLeave,
divide.MouseLeave
```

```
    sender.Font = New Font(Add.Font.FontFamily, 36, FontStyle.Regular)
```

```
'End Sub
```

```
'Private Sub lbl_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Add.MouseLeave, one.MouseLeave, _
```

```
    two.MouseLeave, three.MouseLeave, four.MouseLeave, five.MouseLeave,
six.MouseLeave, seven.MouseLeave, eight.MouseLeave, _
```

```
    nine.MouseLeave, zero.MouseLeave, subtract.MouseLeave, multiply.MouseLeave,
divide.MouseLeave
```

```
    sender.Font = New Font(Add.Font.FontFamily, 48, FontStyle.Regular)
```

```
'End Sub
```

End Class

Public Class WGame

```
Dim username As String
```

```
Public Sub New(ByVal name As String)
```

```
    Me.InitializeComponent()
```

```
    username = name
```

```
End Sub
```

```
Private Sub WGame_Load(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles MyBase.Load
```

```
    nameLabel.Text = nameLabel.Text & ", " & UCase(username) & "!!!"
```

```
    randomNumGen()
```

```
End Sub
```

```
' Start drag
```

```
Private Sub one_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles one.MouseDown
```

```
    one.DoDragDrop(one, DragDropEffects.Copy)
```


End Sub

```
Private Sub two_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles two.MouseDown
    two.DoDragDrop(two, DragDropEffects.Copy)
```

End Sub

```
Private Sub three_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles three.MouseDown
    three.DoDragDrop(three, DragDropEffects.Copy)
```

End Sub

```
Private Sub four_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles four.MouseDown
    four.DoDragDrop(four, DragDropEffects.Copy)
```

End Sub

```
Private Sub five_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles five.MouseDown
    five.DoDragDrop(five, DragDropEffects.Copy)
```

End Sub

```
Private Sub six_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles six.MouseDown
    six.DoDragDrop(six, DragDropEffects.Copy)
```

End Sub

```
Private Sub seven_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles seven.MouseDown
```

```

seven.DoDragDrop(seven, DragDropEffects.Copy)
End Sub

Private Sub eight_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles eight.MouseDown
    eight.DoDragDrop(eight, DragDropEffects.Copy)
End Sub

Private Sub nine_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles nine.MouseDown
    nine.DoDragDrop(nine, DragDropEffects.Copy)
End Sub

Private Sub zero_MouseDown(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.MouseEventArgs) Handles zero.MouseDown
    zero.DoDragDrop(zero, DragDropEffects.Copy)
End Sub

' Copy effect.

Private Sub PanelTarget_DragEnter(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.DragEventArgs) Handles ansPanel.DragEnter
    'Check label
    If e.Data.GetDataPresent(GetType(Label)) Then
        ' There is Label data. Allow copy.
        e.Effect = DragDropEffects.Copy

        ' Highlight the control.
        sender.BorderStyle = BorderStyle.FixedSingle
    Else

```

```

        ' There is no Label. Prohibit drop.
        e.Effect = DragDropEffects.None
    End If
End Sub

' Unhighlight control.
Private Sub Panel_DragLeave(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles ansPanel.DragLeave
    sender.BorderStyle = BorderStyle.Fixed3D
End Sub

' Perform the drop.
Private Sub ans_DragDrop(ByVal sender As System.Object, ByVal e As
System.Windows.Forms.DragEventArgs) Handles ansPanel.DragDrop
    Dim lbl As New Label
    lbl = DirectCast(e.Data.GetData(GetType(Label)), Label)

    If ansPanel.Text = "" Then
        sender.text = lbl.Text
        'In case of multidigit number
        sender.AutoSize = True
    Else
        sender.Text = ansPanel.Text & lbl.Text
    End If

    sender.BackColor = lbl.BackColor
    sender.BorderStyle = BorderStyle.Fixed3D
    sender.forecolor = lbl.ForeColor
    sender.font = lbl.Font
    sender.size = lbl.Size

```

```

AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\waterdrip.wav"
AxWindowsMediaPlayer1.Ctlcontrols.play()
End Sub

```

```

Private Sub PictureBox1_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles PictureBox1.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(PictureBox1, "A WACKY CREATION BY: VYAISHA L. MOSS")
End Sub

```

```

Private Sub Add_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles Add.Click
    mathoptr.Text = Add.Text
    mathoptr.ForeColor = Add.ForeColor
    randomNumGen()
End Sub

```

```

Private Sub add_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Add.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(Add, "Click to add")
End Sub

```

```

Private Sub subtract_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles subtract.Click
    mathoptr.Text = subtract.Text
    mathoptr.ForeColor = subtract.ForeColor
    randomNumGen()

```

End Sub

```
Private Sub subtract_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles subtract.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(subtract, "Click to subtract")
End Sub
```

```
Private Sub multiply_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles multiply.Click
    mathoptr.Text = multiply.Text
    mathoptr.ForeColor = multiply.ForeColor
    randomNumGen()
End Sub
```

```
Private Sub multiply_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles multiply.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(multiply, "Click to multiply")
End Sub
```

```
Private Sub divide_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles divide.Click
    mathoptr.Text = divide.Text
    mathoptr.ForeColor = divide.ForeColor
    randomNumGen()
End Sub
```

```

Private Sub divide_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles divide.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(divide, "Click to add")
End Sub

```

```

Private Sub equal_MouseHover(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles equal.MouseHover
    Dim tip As New ToolTip
    tip.SetToolTip(equal, "Click for answer")
End Sub

```

```

Private Sub equal_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles equal.Click
    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\flintstonerun.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()

    Dim num1 As Integer = CType(Panel1.Text, Integer)
    Dim num2 As Integer = CType(Panel2.Text, Integer)
    Dim oper As String = mathoptr.Text
    Dim ans As Int64
    If oper = "+" Then
        ans = num1 + num2

        If ans.ToString = ansPanel.Text.ToString Then
            AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Cheer.wav"
            AxWindowsMediaPlayer1.Ctlcontrols.play()

```

```
ansPanel.AutoSize = False
```

```
ansPanel.Text = ""
```

```
randomNumGen()
```

```
Else
```

```
AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Wrong.wav"
```

```
AxWindowsMediaPlayer1.Ctlcontrols.play()
```

```
ansPanel.AutoSize = False
```

```
ansPanel.Text = ""
```

```
End If
```

```
ElseIf oper = "-" Then
```

```
ans = num1 - num2
```

```
If ans.ToString = ansPanel.Text.ToString Then
```

```
AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Cheer.wav"
```

```
AxWindowsMediaPlayer1.Ctlcontrols.play()
```

```
ansPanel.AutoSize = False
```

```
ansPanel.Text = ""
```

```
randomNumGen()
```

```
Else
```

```
AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Wrong.wav"
```

```
AxWindowsMediaPlayer1.Ctlcontrols.play()
```

```
ansPanel.AutoSize = False
```

```
ansPanel.Text = ""
```

```
End If
```

```
ElseIf oper = "x" Then
```

```
ans = num1 * num2
```

```

If ans.ToString = ansPanel.Text.ToString Then
    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Cheer.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()
    ansPanel.AutoSize = False
    ansPanel.Text = ""
    randomNumGen()
Else
    AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Wrong.wav"
    AxWindowsMediaPlayer1.Ctlcontrols.play()
    ansPanel.AutoSize = False
    ansPanel.Text = ""
End If

```

```

ElseIf oper = "/" Then
    ans = num1 \ num2
    Dim remainder As Int64 = 0
    remainder = num1 Mod num2
    If ans.ToString = ansPanel.Text.ToString Then
        AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Cheer.wav"
        AxWindowsMediaPlayer1.Ctlcontrols.play()
        ansPanel.AutoSize = False
        ansPanel.Text = ""
        randomNumGen()
    Else
        AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Wrong.wav"

```



```
AxWindowsMediaPlayer1.Ctlcontrols.play()
```

```
ansPanel.AutoSize = False
```

```
ansPanel.Text = ""
```

```
End If
```

```
Else
```

```
MsgBox("Must choose +, -, x, or / first", MsgBoxStyle.OkOnly, "WAIT")
```

```
End If
```

```
End Sub
```

```
Private Sub clear_Click(ByVal sender As System.Object, ByVal e As  
System.EventArgs) Handles Button1.Click
```

```
AxWindowsMediaPlayer1.URL = "C:\Documents and Settings\vmoss\My  
Documents\Visual Studio 2008\Projects\EducationalSoftware\Images\Rewind.wav"
```

```
AxWindowsMediaPlayer1.Ctlcontrols.play()
```

```
ansPanel.AutoSize = False
```

```
ansPanel.Text = ""
```

```
End Sub
```

```
Private Sub clear_MouseHover(ByVal sender As System.Object, ByVal e As  
System.EventArgs) Handles Button1.MouseHover
```

```
Dim tip As New ToolTip
```

```
tip.SetToolTip(Button1, "Reset numbers")
```

```
End Sub
```

```
Private Sub menu_Click(ByVal sender As System.Object, ByVal e As  
System.EventArgs) Handles Button2.Click
```

```
Dim Home As New WackyCalky
```

```
Home.Show()  
Me.Hide()  
End Sub  
Private Sub hidedirections()  
    'dir1.Visible = False  
    dir2.Visible = False  
    dir3.Visible = False  
    dir4.Visible = False  
    dir5.Visible = False  
    dir6.Visible = False  
    dir7.Visible = False  
    dir8.Visible = False  
End Sub  
  
Private Sub showdirections()  
    'dir1.Visible = True  
    dir2.Visible = True  
    dir3.Visible = True  
    dir4.Visible = True  
    dir5.Visible = True  
    dir6.Visible = True  
    dir7.Visible = True  
    dir8.Visible = True  
End Sub  
  
Private Sub directions_Click(ByVal sender As System.Object, ByVal e As  
System.EventArgs) Handles directions.Click  
    If dir2.Visible = True Then  
        hidedirections()  
    End If  
End Sub
```

```

Else
    showdirections()
End If
End Sub

Private Sub randomNumGen()
    Dim num1, num2 As Integer
    Dim random As New Random()
    If mathoptr.Text = "/" Then
        num1 = random.Next(0, 10)
        num2 = random.Next(1, 10)
        Panel1.Text = num1
        Panel2.Text = num2
    ElseIf mathoptr.Text = "-" Then

        num1 = random.Next(0, 10)
        num2 = random.Next(0, 10)
        'To avoid negative numbers
        If num1 < num2 Then
            Panel1.Text = num2
            Panel2.Text = num1
        Else
            Panel1.Text = num1
            Panel2.Text = num2
        End If
    Else
        num1 = random.Next(0, 10)
        num2 = random.Next(0, 10)
        Panel1.Text = num1
    
```

```
Panel2.Text = num2  
End If  
End Sub  
End Class
```

Appendix B—Observation Questions

The following questions were used to observe the subjects as they interacted with the software. The goal of this observation was to assess the techniques of Human Computer Interaction used by the subjects.

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
3. Does the child seem more interested in the aesthetics of the software or the functionality?
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Closed windows
 - Maximized windows without help
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Tried to click versus drag-and-drop at first
 - Preferred to use mouse on the laptop instead
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Functionality
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes, has tremendous laptop awareness
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - She seemed interested during the interaction with the software
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - The numbers because they are colorful
 - Uses social network site on a regular basis(stated)

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Yes ease of use with the keyboard
 - Clicked all of the buttons on the screen
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Faster with drag-and-drop than younger subjects
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Functionality
 - Wanted to see the code that created the software
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes, very knowledgeable
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Interested
 - Asked lots of questions about the software
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - The numbers and the operators
 - Likes the fact that it is similar to math class but on a computer
 - Interested in creating her own websites and has tried to do so before

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Younger subject stated that the “window was opening” computer terminology
 - Maximized windows
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Drag-and-drop with ease
 - Mouseover not used at all
 - Preferred to click the numbers
 -
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Aesthetics
 - Appears to be having fun with the music(dancing)
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - No it's not obvious
 - Some functionality had to assist with
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - She seemed highly interested during the interaction with the software
 - Smiling, dancing
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Putting the numbers in the boxes
 - Stated that she plays her dress up game on the computer

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Older subject typing name in with two hands
 - Very aware of drag-and-drop
 - Easy navigation of application
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Curious entered multiple digits in the drop box
 - Fast mouse clicks and drag-and-drop
 - No assistance needed at all
 -
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Functionality
 - However, initial load screen made her seem intrigued stated “Oh Wow”
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes very obvious
5. Did the human-computer interactive elements have an obvious affect on the child’s interest in the software? For example did the child seem intrigued or bored during interaction?
 - Intrigued
 - Focused on solving the problems
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - The math
 - Very helpful and fun

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Two hand typing
 - Very impatient with mouse, multiple clicks
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Needed some assistance with drag-and-drop
 - Preferred to click
 - Did mouseover all objects to read the tooltip
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Curious about dragging multiple numbers
 - Clicked all objects to see what happened
 - Wants to try all functionality
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Appears to use the computer sometimes
 - Not very obvious
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Interested
 - Dancing
 - Excited to see her name on the re-appear on the screen
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Problems stood out
 - The song on the first screen
 - Bouncing numbers on the first screen

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Mouse yes
 - Keyboard awareness
 - Needed assistance navigating
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - After trying to click read directions
 - Drag-and-drop with ease but at a slow pace
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Both he got excited when the sounds came and when the screen showed his name
 - Very concentrated on the math problems
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Appears to be learning to use computers and has a frequent interaction with basic computers
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Stated he was excited
 - Colors of numbers excited him
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Math numbers
 - “Very helpful with the pluses(functionality)

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Yes keyboard navigation great
 - Mouse usage good
 - Navigation with directions figured everything out
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Drag-and-drop fast
 - Mouseover read all tooltips
 - Inquisitive about the game
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Aesthetics and functionality
 - Clicked the reset button repeatedly to hear the sound
 - Tried to click images to see what would happen
 - Tried to see how fast he could answer the next question
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes, he also stated that he was a big video gamer
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Child seemed intrigued
 - Became restless after some time
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Teaches math facts
 - Choosing the problems for the calculator to solve
 - Giving the answer in the game

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Two hand typing
 - Read every aspect on the screen
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - 1st clicked directions to understand the game
 - No assistance needed
 - Fast on functionality
 -
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Interested in functionality
 - Liked dragging and dropping multiple numbers
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - “I love computers, oh I like games”
 - Seems to use computers everyday
5. Did the human-computer interactive elements have an obvious affect on the child’s interest in the software? For example did the child seem intrigued or bored during interaction?
 - Interaction
 - Wanted challenging questions
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Dual use calculator and math problems
 - Different sounds for different actions
 - Dragging answers to math problems

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Eager to type on keyboard
 - Maximized windows
 - Good use of mouse
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Expected drag-and-drop to show number dragging instead of symbol
 - Thought is wasn't working
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Functionality
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes subject seems to use computers often
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Showed no emotion or feeling
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - The multiplication questions
 - The sound effects

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Can type with two hands
 - Went directly for the directions
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Drag-and-drop with ease and multiple numbers
 - Mouseover not used sometimes
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Functionality
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes
 - Drag-and-drop really fast
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Seemed bored during interaction
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Math problems
 - The fact that it gave sounds with the answers

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Aware of functions of the computer peripherals
 - Uses peripherals at a slower rate
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Needed some assistance with drag-and-drop
 - No mouseover usage
 - Popup directions initially
 -
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Dancing to music
 - Said calculator was cool
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - No it's the subject does not appear to use computers often
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Subject was focused on problems
 - Concentrated hard on the other problems
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Redirection to wrongly answered problems
 - The calculator man in the corner of the screen

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Somewhat
 - Tried to use keyboard over mouse
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Needed some assistance with drag-and-drop, dragging past the box
 - Aware of game with directions
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Aesthetics not a huge factor
 - More concentrated on answering questions correctly
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Says she rarely uses a computer
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Showed no reaction
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Name shows up on the screen
 - Multiplication practice

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Fast at entering name
 - Used mouse and keyboard well
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Advanced user
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Very interested in functionality
 - Multiple numbers entered into calculator
 - Asked to see the code
 -
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes very obvious
 - Stated she has 2 computers and a laptop at home
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Very intrigued, very focused
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Numbers because they were lined up across the screen
 - Likes to play games on Disney

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Curious about laptop functions
 - Mouse yes
 - Keyboard yes
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - Yes no assistance needed at all
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Aesthetics
 - Facial expressions with the sounds
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - Yes preferred to get answer wrong to get a different sound
 - Smiling, dancing
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - Correct answers one sound, wrong answer another sound
 - Playing bowling on the computer

Observations Questions Per Participant

1. Does the child exemplify common knowledge of basic computer functions i.e. mouse usage, keyboard awareness, and navigation?
 - Yes awareness keen
2. Is the child making use of human-computer interaction mechanisms such i.e. drag-and-drop, mouseover, etc without assistance?
 - No assistance needed
 - Read directions and played the game
3. Does the child seem more interested in the aesthetics of the software or the functionality?
 - Aesthetics enjoys wrong answer sound
 - Laughing and clicking for sounds
4. Is it obvious that the child uses computers or related technological devices on a regular basis?
 - Yes very obvious
5. Did the human-computer interactive elements have an obvious affect on the child's interest in the software? For example did the child seem intrigued or bored during interaction?
 - He was intrigued and very talkative while playing
6. Direct question to participant— what did you remember the most while playing the game? What was your favorite thing about the software?
 - The colors of the numbers, “very colorful”
 - The math problems changing(random)

Appendix C—Survey Questions

The following survey was used to obtain critical feedback from the subjects after they interacted with the software. The goal of this survey was to see how the techniques of Human Computer Interaction affected the subjects.

Directions: Circle or place an X on your answer. Pick only one answer per question.

4. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

5. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

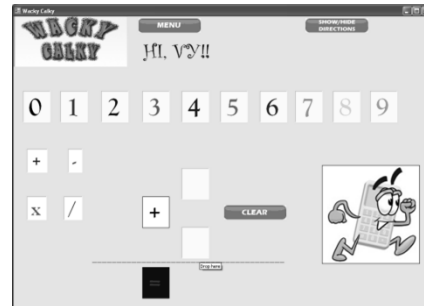


Yes



Yes Yes!!

6. Which picture do you like better?



7. Was the game easy to use?



Really hard



A little hard



No feeling

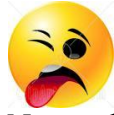


Easy



Super easy

8. Did you like to drag-and-drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

9. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

10. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

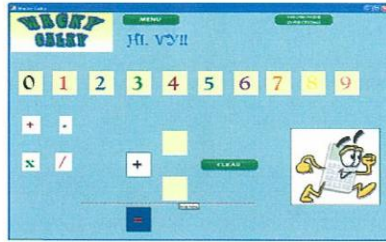


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!



Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

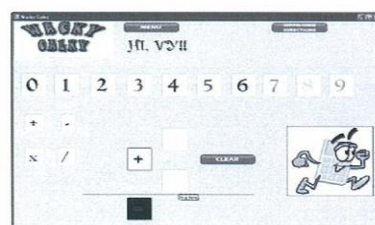


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

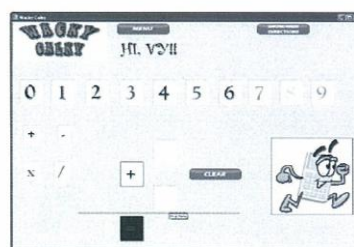
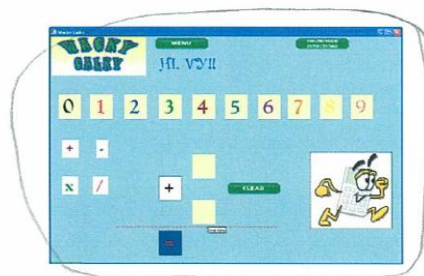


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

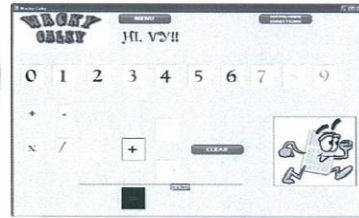
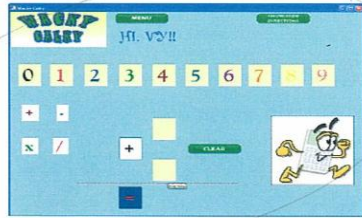


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

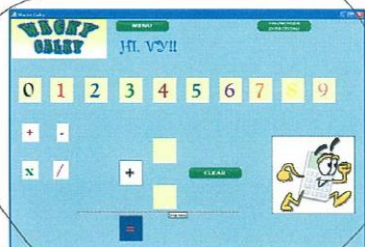


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

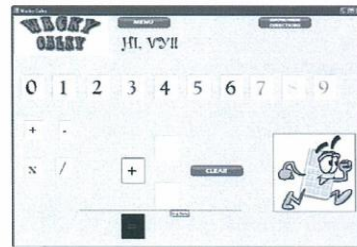
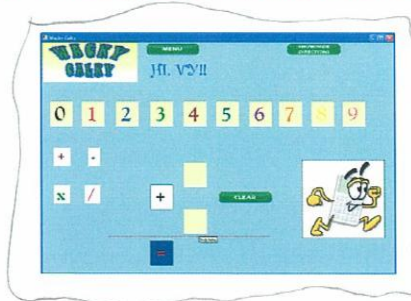


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

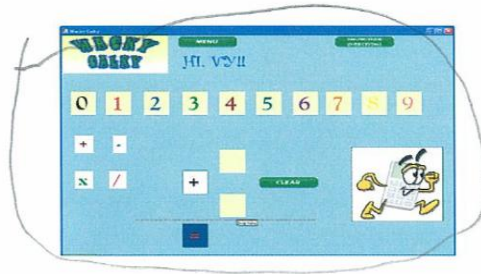


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey for Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

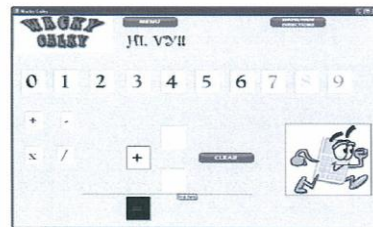
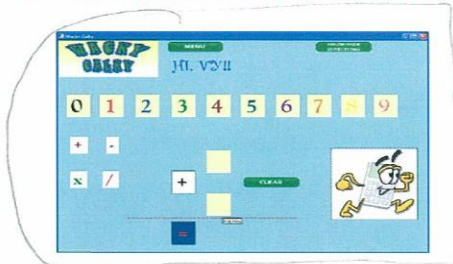


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

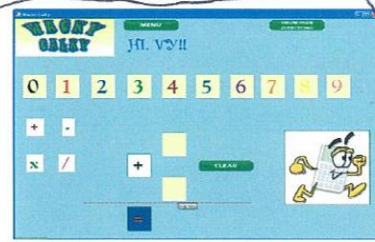


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling



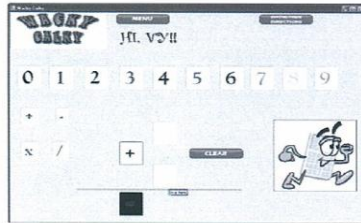
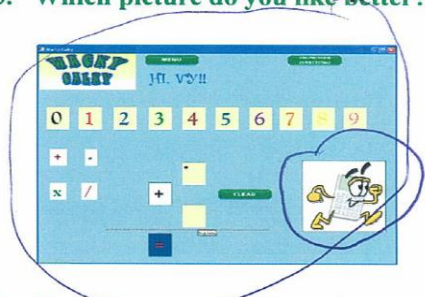
Yes



Yes Yes!!



3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!



Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

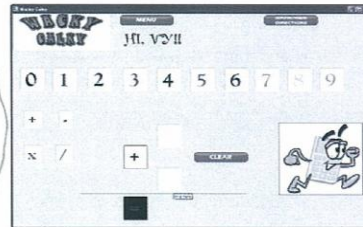
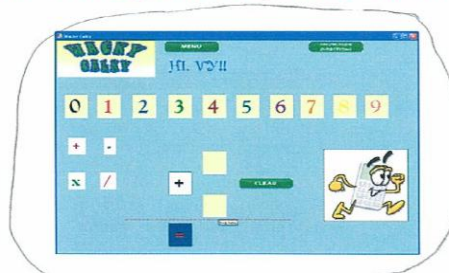


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

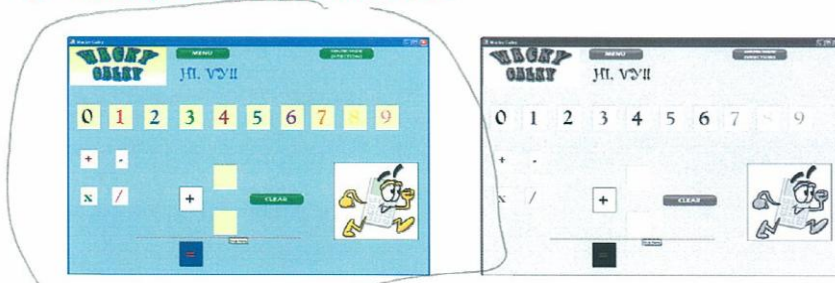


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

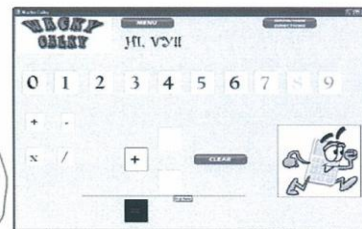


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

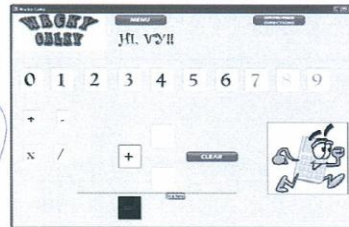


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

Children's Survey Per Participant

Directions: Circle or place an X on your answer. Pick only one answer per question.

1. How did the game make you feel?



Bored



Sad



No feeling



Happy



Excited

2. Did the colors and sounds make the game exciting?



Not at all



A little



No feeling

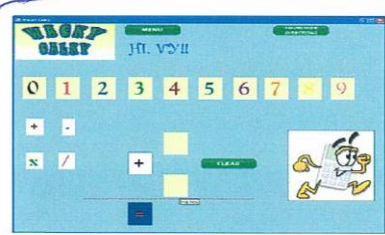


Yes



Yes Yes!!

3. Which picture do you like better?



4. Was the game easy to use?



Really hard



A little hard



No feeling



Easy



Super easy

5. Did you like to drag and drop the numbers into boxes?



Not at all



A little



No feeling



Yes



Yes Yes!!

6. How often do you use a computer?



Not at all



Monthly



Weekly



Weekends



Everyday

7. Would you like to learn how to make your own game?



Not at all



A little



No feeling



Yes



Yes Yes!

VITA

Vyaisha Lavenia Moss, daughter of Vanda Russell, was born October 1, 1986 in Hayward, California. Prior to college, she attended schools in both Oakland, California and Baton Rouge, Louisiana. She obtained her Bachelor of Science in Computer Science at Xavier University in New Orleans, Louisiana.

After realizing that the world of technology was more complex than what she learned in undergraduate studies, Vyaisha decided to further her education by pursuing a Master's degree in Computer Science with an emphasis in Software Engineering at Southern University and A & M College. Since May 2007, she has also gained experience in her respective field working for Methods Technology Solutions, Inc. an information technology consulting company located in Baton Rouge, Louisiana.

Vyaisha's future goal is to open a computer facility that caters to children and the development of their computer-related skills. With this facility she aspires to stimulate their interest in computers in hopes that they may pursue computer science as a field of study and career.

Signature

APPROVAL OF SCHOLARLY DISSEMINATION

The author grants to the John B. Cade Library of Southern University and A & M College the right to reproduce, by appropriate methods, upon request, any or all portions of this Thesis. It is understood that “proper request” consists of the agreement, on the part of the requesting party, that said reproduction is for his personal use and that subsequent reproduction will not occur without written approval of the author of this Thesis. Further, any portions of the Thesis used in books, papers, and other works must be appropriately referenced to this Thesis.

Finally, the author of this Thesis reserves the right to publish freely, in the literature, at any time, any or all portions of this Thesis.

Vyaisha L. Moss

03/22/2010