THE IMPROVEMENT OF COMPUTER PERFORMANCE AND SELF-EFFICACY AMONG SENIOR CITIZENS THROUGH TRAINING AND VIRTUAL CLASSROOMS

Kelley La rae Clanton

Certificate of Approval:

N. Hari Narayanan Professor Computer Science and Software Engineering	Cheryl D. Seals, Chair Associate Professor Computer Science and Software Engineering
Juan E. Gilbert Professor Computer Science and Software Engineering	George T. Flowers Dean Graduate School

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Kelley La rae Clanton

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Kelley La rae Clanton

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Signature of Author

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Date of Graduation

VITA

Kelley La rae Clanton is the daughter of Joseph and Helen Clanton. She received her Bachelor of Science in Computer Science along with a Minor in Business Administration from Auburn University in December 1999. Kelley has been an Information Technology Specialist III at the Auburn University College of Veterinary Medicine for the past eight years. In 2004 she decided to further her education by pursuing a Master of Science in Software Engineering part-time while continuing her full-time employment at the Auburn University CVM.

THESIS ABSTRACT

THE IMPROVEMENT OF COMPUTER PERFORMANCE AND SELF-EFFICACY AMONG SENIOR CITIZENS THROUGH TRAINING AND VIRTUAL CLASSROOMS

Kelley La rae Clanton

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Senior citizens represent the fastest growing demographic worldwide. As indicated in the Year 2000 U.S. census, there are 35 million people 65 years old or older in the United States, and by 2030, it is estimated that there will be about 70 million older adults in the U.S. alone (Chadwick-Dias, McNulty, Tullis, 2000). With computers being used both in the workplace and in homes and the older population growing rapidly, it is important that senior adults be instructed on what computer technology can do for them.

Using a computer requires cognitive skills that may be challenging for older adults, and decrements in working memory could put older adults at a disadvantage when performing computer-interactive tasks. To aid in the computer instruction of senior citizens, some workshops have been conducted to introduce seniors to personal productivity software, (e.g. Microsoft Office Suite), Email, Internet basics, and visual programming with ALICE 3D. The details and results of these workshops are presented.

However, the primary focus of this thesis is the creation and utilization of a virtual learning center within the virtual world of Second Life to increase older adults' knowledge of and performance with computer technology. Workshops have been conducted to introduce seniors to Second Life as well as our learning center, and the results from these workshops are discussed. In the final section, the conclusions and lessons learned from this work are presented as well as plans for future educational opportunities for senior adults.

Three hypotheses were tested in this study: older adult-centered computer training would yield better performance for older adults; seniors who participate in computer training show a positive change in attitudes towards computers and the Internet, and a gain in confidence in their own proficiency with technology; and senior adults' task performance would improve from receiving virtual computer training. Age-related issues were evident in training time, task completion time, and usability ratings in that the older participants had fairly long training and task completion times and low performance on certain tasks. However, their self-efficacy and usability were improved.

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Style manual of journal used	Journal of SAMPE
Computer software used	Microsoft Word 2007

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

With the expanding power of computers and the recent growth of information technologies such as the Internet, it is possible for large numbers of people to have direct access to a wide array of information sources and services. Network usage is tremendously increasing and new interfaces, search engines, and state-of-the-art features are becoming available at an unimaginable rate. According to the U.S. Department of Commerce, in 2003, about 61.8% of households in the United States (U.S.) owned a personal computer (PC) and approximately 54.7% of these households had Internet access. In essence, the use of technology has become an integral part of work, education, communication, and entertainment. Thus, in order to function independently and interact successfully with the environment, people of all ages must interact with some form of technology.

Along with the technology explosion is the aging of the population. In 2004, persons of 65 years or older represented 12.4% of the U.S. population and it is estimated that people in this particular age group will represent 20.6% of the population by 2050. Also, the older population itself is becoming older. Presently, about 44.5 million people are over the age of 75 years, and by 2050, nearly 50 million people will be 75 years or older (Czaja and Lee). Figure 1 shows the increasing older population over time.

Given that older people represent a rather large proportion of the population and will need to be active users of technology, issues regarding aging and information technologies are of vital importance within the domain of human-computer interaction.

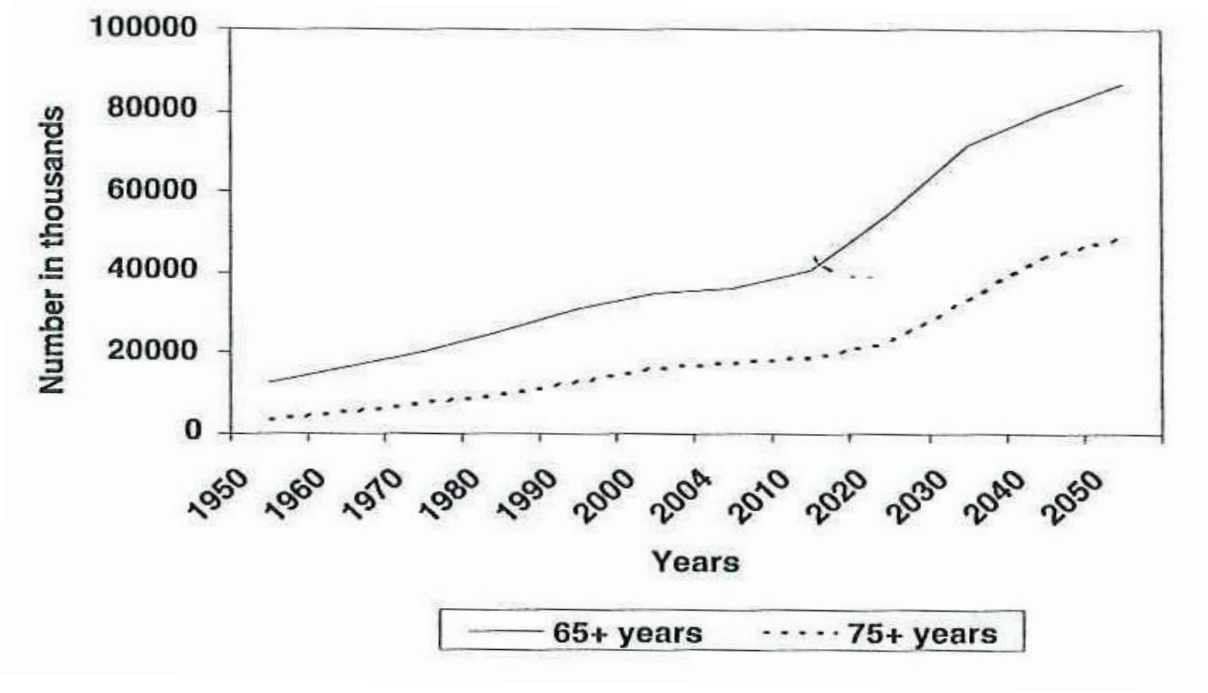


Figure 1: U.S. population. (Source: National Center for Health Statistics, 2005)

1.1 PROBLEM STATEMENT

There are a number of places where older people are likely to encounter computers and other forms of communication technologies, such as the Internet, including the workplace, the home, healthcare, and service settings. However, in spite of increased computer use among older people, the use of computers and other forms of technology is still lower among older people compared to younger people. This lack of

technology use places older adults at a disadvantage in terms of their abilities to live and function independently. Technology holds great potential for improving the quality of life for older people. However, the use of computers and the Internet can also be problematic for older people due to the skills necessary for successful interaction with computers. In general, the skill acquisition literature indicates that older people have more difficulty than younger people in acquiring new skills, and that they achieve lower levels of performance. This is largely due to age-related changes in cognitive processes. There is substantial evidence that there are age-related declines in most component processes of cognition, including attention processes, working memory capabilities, discourse comprehension, inference formation and interpretation, encoding and retrieval process in memory, and information processing speed. Decrements in these components abilities place older people at a disadvantage with regard to computer-interactive tasks, as these tasks are primarily characterized by cognitive demands (Czaja, 1996).

To reduce these disadvantages, older adults should learn new concepts and apply new meaning to familiar concepts. Although other training alternatives (classroom training, simulation training) exist to ensure the success of older workers with computer technology, this study will focus on virtual-world training, a type of training many companies and universities are moving towards in the workplace and in the educational realm.

Because of several limitations with the traditional classroom training and simulation training, organizations are slowly moving away from these traditional

approaches. Some of these limitations include cost, meeting trainees' needs, and skills practice. Traditional classroom and simulation training methods can be very expensive for organizations. Many organizations have to incur the cost of travel for transporting the trainees to a remote location for training and transporting trainers to different locations to train the individuals. Plus, the use of traditional methods of training is not individualized to meet the trainees' needs. The pace and plan of the instruction are set by the trainer and do not accommodate the individual trainees. Traditional training programs are usually scheduled and presented at a certain time. Also, traditional instructional training can only provide a minimal amount of time for skilled practice. More individualized training requires multiple trainers. The practice time during the training must be shared among all the trainees attending the training session, and practice is often limited to just the examples completed during the session. Traditional classroom and simulation training are both used to teach older adults; however, virtual communities for creativity and learning are becoming increasingly popular. Therefore, the purpose of this study was to develop an older-adult centered virtual community learning center.

1.2 RESEARCH JUSTIFICATION

1.2.1 Virtual Communities for Creativity and Learning

The growth of virtual learning communities has emerged as a by-product of the rapid growth of the Internet and related new media. Data and information are now being created at a rate far faster than most experts can convert this information into forms of knowledge that can be communicated successfully to teachers, students, and the general

public. Virtual communities address this problem by providing an environment for people to connect with and learn from others through collaboratively participating in the construction of new knowledge (Kahn, 1999). In addition, virtual communities address the needs of their members such as interest (cars, gardening, or history), relationship (shared life events, senior adults seeking companionship), fantasy and imagination, and transactions (trading, buying and selling).

Research in the cognitive and learning sciences has demonstrated that different people learn in various ways and have distinct learning needs at various times in their lives. These differences in learning can be addressed with virtual learning communities. Such communities allow members/trainees to control their teaching and learn at their own pace, which is ideal for older adults wanting to learn new skills. Older adults would have the flexibility to learn from different locations having Internet access (home, work, public areas) at his/her preferred times.

1.2.2 Computer use and older adults

There have been few studies of older adults actively involved with computers, and that is likely attributed to having very few members of this population willing to facilitate such research. One resource that provides plentiful information about seniors is SeniorNet (www.seniornet.org). This web site is designed "to provide older adults access to computer technologies to improve their lives and enable them to share knowledge and wisdom." SeniorNet provides exposure and educational support to its members for such things as desktop publishing, e-mail, and financial management (Adler, 2006).

Another example of a large international senior community is Elderhostel (www.elderhostel.org). This is a nonprofit continuing educational organization that offers a myriad of resources for seniors, among which are several short-term learning opportunities.

Computers and information technologies hold promise in terms of increasing the quality of life for older adults. However, successful use of technology by older adults is based on systems that are designed to accommodate the needs and preferences of this particular group of users. It is also fairly established that many technology products and systems are not easily accessible to older people because of cost and lack of access to training programs. Teaching and training older adults to use technology and computers promotes mental activity and overall mental health. Research indicates "computer teaching does have an effect on the reporting of positive physical and mental health outcomes in older adults" (Czaja & Lee, 2007). Effective education and training programs meet the specific needs (e.g., physical, sensorimotor, cognitive, socioemotional, environmental, and practical) of seniors in the design and delivery of lessons and cover specific areas.

1.3 RESEARCH PURPOSE

The primary objectives of this research were to:

1. Design a virtual-world classroom to provide older adults opportunities to gain knowledge about various topics in a new computing environment.

2. Investigate if learning a new computer skill affects an individual's computer self-efficacy.
3. Determine if older adults' task performance will improve from the type of virtual computer training received.

1.4 HYPOTHESES

Two hypotheses of this study were that older adult-centered computer training would yield better performance for older adults, and older adults who participate in computer training show a positive change in attitudes towards computers and the Internet, and a gain in confidence in their own proficiency with technology. Also, a third hypothesis was that the task performance of older adults would improve from the type of virtual computer training they received.

1.5 DOCUMENT OVERVIEW

The rest of this thesis is organized as follows: Chapter 2 consists of a literature review, which discusses cognitive aging theories and then applying these theories to computer training for older adults. Chapter 3 presents a description of the preliminary workshops conducted to train older adults, a description of the materials used to build a virtual world classroom specific to teaching older adults, and overview of the participants involved in the study. The details and the analysis of the results are included in Chapter 4 while Chapter 5 concludes the thesis with the results of the project along with the future work to come.

CHAPTER 2: LITERATURE REVIEW

2.1 COGNITIVE AGING

A number of factors influence cognitive performance and learning. Two known factors are processing speed and cognitive resources. Researchers have concluded that age-related differences are associated with processing speed and cognitive resources, and that these factors are closely interdependent in working memory. Working memory which refers to the ability to keep information active while processing or using it, declines with age as does the ability to select or attend to cues/information in the environment.

For example, age-related reductions in processing speed may have a negative impact on the ability of older people to acquire computer skills. Declines in processing speed not only limit the speed at which older people are able to respond but also the performance of other cognitive operations. A study by Salthouse in 1993 suggests that age-related reductions in working memory are mediated by the slowing of processing speed. Age differences in learning, attention, and reading comprehension have also been linked to slower rates of processing (Czaja 1996). Older adults require additional time to receive and process information especially if the task is complex. Plus, older people often trade speed for accuracy. Therefore, allowing sufficient time for older adults to

process information is important for learning, especially learning complex computer tasks.

Age decrements in memory could also contribute to difficulties in the acquisition of computer skills. One of the primary characteristics of computer tasks is the high demand placed on working memory. Users must learn new concepts or how to attach new meaning to familiar concepts (e.g. *file*). Furthermore, age-related difficulties in learning and recall are especially visible if the learning problem is in an unfamiliar cognitive domain and requires building new schemata (Czaja 1996). It is likely that computers are an unfamiliar cognitive domain for a majority of older people and require learning new schemata (for example, concepts related to window and mouse operation).

The processing resource theory of aging and cognition further asserts that older adults will have difficulty acquiring skills that involve the formation of new schemata. This theory maintains that age differences in the performance of cognitive tasks become manifest when tasks require a substantial amount of processing as is the case when the task to be learned represents an unfamiliar cognitive domain (Czaja 1996). In addition, the skill acquisition literature in general indicates that older adults learn new skills more slowly than younger adults and may not reach the same levels of performance

Whereas there may be age differences on measures of learning in acquiring computer skills, older people are able to learn to use computer technology. It may be that the existing interfaces or traditional training methods create problems for older users. In this respect, it has been recommended that training for older adults to learn new computer

skills be self-paced or goal-oriented to improve performance and minimize working memory demands. Also, it has been suggested that older adults require specific procedural training to learn new computer technology (Hickman, Rogers, and Fisk, 2007).

2.2 COMPUTER TRAINING AND OLDER ADULTS

A number of studies have been conducted that have examined the ability of older adults to learn to use computer technology. These studies cover a variety of computer applications and also vary with respect to training strategies such as conceptual versus procedural training or computer-based or instructor-based versus manual-based training. Additionally, the influences of variables, such as attitudes toward computers and computer anxiety on learning have been examined. Overall, the results of these studies indicate that older adults are able to use computers for a variety of tasks; however, they often have more difficulty acquiring new computers skills than younger people and require more training and more assistance during training.

For example, Egan and Gomez (1985) conducted a series of experiments in order to identify individual differences in learning a text editing task. They discovered that age was a significant predictor of learning difficulty. Their participants ranged in age from 28 to 62 years. And, in terms of isolating the components of text-editing that account for learning difficulty, they found that age was associated with difficulty producing the correct sequence of symbols and patterns to accomplish the desired editing change. The text editor was command-based and required remembering a command language and

producing a complicated syntax. In fact, they discovered that when a display editor was used, in which changes were made by positioning a cursor at the location of change and using labeled function keys rather than a command language, the predictive power of age, with the respect to the difficulty of learning, was greatly reduced.

A study conducted by Czaja, Hammond, & Joyce in 1989 attempted to identify training strategies that would be effective in teaching older adults to learn text editing. They designed a goal-oriented training method and compared it with a more traditional method—use of a manual and lecture (Czaja 1996). The use of the goal-oriented approach resulted in improved performance for all participants in the experiment. People who received this type of training took less time per task and made fewer errors. Overall, the results did show that the learning performance of older people can be improved by the manipulation of training strategies. The goal-oriented approach involved introducing the elements of text editing in an incremental fashion, moving from the simple to the more complex. It also involved structuring the training into a series of problem-solving tasks such that the participants were given a number of text editing tasks and had to use a specially-designed manual (written as a series of goal-oriented units) to complete those tasks. One more important finding from this study was that, even though there were age differences on the performance of the tasks, the older adults were able to master the basic concepts of text editing (Czaja 1996).

In another such study, S.E. Mead (1997) examined the effects of the type of training on efficiency in a World Wide Web search activity. The participants in the study were trained with a "hands-on" Web navigation tutorial or a verbal description of

available navigation tools. The results of the study showed that the hands-on training was superior, especially for older adults. Older adults who received hands-on training increased the use of efficient navigation tools. These findings suggested that the type of training strategy has an impact on the ability of older people to acquire skills. Generally, the data suggested that procedural "hands-on" training with an action component is superior for older adults.

A more recent study was conducted by Hickman, Rogers, and Fisk in 2007 at the Georgia Institute of Technology. The purpose of this study was to provide insight into what type of training (procedural, goal-oriented, part-task) is best suited for older adults, so that working memory is engaged but not overloaded. They provided guided action training to reduce working memory demands because past researchers hypothesized that this kind of training was best for older adults. Guided action training involved giving the older adults step-by-step instructions on what to do to accomplish the task. They also designed guided attention training for the younger adult participants that assisted them in maintaining their focus and attention but required them to actively determine what to do for each step of the task. It was noted that the guided attention training would be too working-memory demanding for the older adults and therefore be ineffective.

The participants included 32 young adults and 32 older adults, and the experiment was a computer simulation of a hydroponic garden control system. Hydroponic gardening is gardening without soil using another growing medium, such as nutrient-enriched water. The researchers measured task completion time and accuracy of

performance during training, at test for trained tasks, and at test for untrained tasks.

The results of this study demonstrated that participants who received guided action training performed faster (for older adults) and more accurately (for both age groups) than did participants who received guided attention training. When participants had to perform tasks without the training materials being available, there was clearly a benefit for those participants who had originally received the guided attention training compared to those who had received guided action training. Benefits of attention training were evident for younger and older adults and for trained and untrained tasks. For older adults, the benefits of the guided attention training were evident for both accuracy and task completion time. For younger adults, the benefits of guided attention training over guided action training were primarily evident in task time—they were 23% faster for trained tasks and 24% faster for untrained tasks. In addition, the younger adults who had received guided attention training were able to perform the test trials more quickly, thus indicating that they had learned the system better compared to those who had received guided action training. This study provided clear implications for developing training programs for younger and older adults learning to use a technology system. If the goal is fast and accurate performance with training materials in view, then guided action training is best, especially for older adults. If, however, the goal is to support learning to enable people to use systems even when training materials are not available, guided attention training is best, again especially for older adults (Hickman, Rogers, and Fisk 2007).

Many more studies like the ones discussed above have been conducted over the years, and overall, the results from these studies indicate that older people are able to

learn to use computer technology for routine tasks and other applications. However, they have more difficulty and are slower to acquire computer skills than younger people and generally require more help and "hands-on" practice. Furthermore, they typically need training on basic computer concepts (mouse, windows), and require information on the types of technologies available, the potential benefits of such technologies, and where and how to access them. Also, special attention needs to be given to the design of training materials to accommodate age-related changes in cognitive abilities. The following are some recommendations for developing training programs for older people (Czaja and Lee):

1. Allow extra time for training, self-paced learning schedules appear to be optimal.
2. Ensure that help is available and easy to access; create a supportive learning environment.
3. Ensure that the training environment is free from distractions.
4. Training materials should be well organized, and important information should be highlighted.
5. Make use of illustrations in training manuals when possible.
6. Training materials should be designed so that they are concise and easy to read. "How to" information should be presented in a step-by-step format.
7. Allow the learner to make errors, but provide immediate feedback reading how to correct mistakes.
8. Provide sufficient practice on task components.

9. Provide an active learning situation; allow the learner to “discover’ ways of accomplishing tasks.
10. Structure the learning situation so that the learner proceeds from the simple to the more complex.
11. Minimize demands on spatial abilities and working memory.
12. Familiarize the learner with basic concepts regarding hardware and software and use of the equipment; address any concerns the learner has about the use of the equipment.
13. Emphasize distinctions between computers and typewriters.

Many of the studies regarding the training of older adults to use computer technology have relied on a traditional classroom environment or simulations. But, in addition to these, virtual communities for learning (i.e. Second Life) can be designed to address cognitive issues associated with older adults and can help improve the time it takes for older adults to learn new computer technology.

2.3 VIRTUAL LEARNING COMMUNITIES IN SECOND LIFE

A virtual community/world is an Internet-based, simulated environment where users interact via graphical images that represent people called avatars. Over the past several years, educators have begun to explore virtual worlds as a powerful method for training and instruction due to the following benefits:

- Virtual worlds’ persistence allows for continuing and growing social interactions, which can serve as a basis for collaborative education.

- Virtual worlds give users the ability to carry out tasks that could be difficult in the real world due to constraints such as cost, scheduling or location.
- Virtual worlds can adapt and grow to meet different user needs.

The goal of all educators is to teach individuals essential skills that will help them become more productive and successful, and by using new technologies for education such as Second Life, learning can be both effective and engaging.

2.3.1 What is Second Life?

Second Life is a 3-D virtual world entirely built and owned by its residents (the users of Second Life). It was developed by Linden Lab and opened to the public in 2003 from San Francisco. Today, it is inhabited by more than 5 million people from around the globe (Zhu, Wang, Jia 2007). Residents are surrounded by the digital creations of other residents, and they can buy, sell and trade with other residents through the use of the Linden dollar which can be converted to US dollars. Residents can also participate in various social activities like arts, science, sports, and education.

2.3.2 Second Life for Educational Purposes

Second Life has great potential for teaching and learning. It includes two kinds of text-based communication methods: chat and Instant Message (IM). Chat is usually used to talk with other residents locally in a public fashion, and all the residents nearby within a certain distance can hear it. IM is used for private conversation among two or more people, and other people cannot hear it. The communication is also enhanced by various gestures and animations that an avatar can possess.

Second Life also provides powerful creation tools including a 3-D modeling tool, and a script language called Linden Script Language (LSL). LSL is similar to other programming languages and is easy to learn. It also has number of useful interfaces to avatars and the web itself, allowing scripting to expand to include web resources and complex interactions with other residents. The 3-D tool and LSL can be used to create anything you can imagine, and you own the intellectual property of your creations. With its avatar-based communications, wide range of online activities, and development of various in-world teaching and learning tools, Second Life is an ideal platform for computer-related teaching and learning.

2.3.3 Advantages and Limitations of Second Life as a Teaching Method

Teaching in a virtual world has a number of advantages such as the instructor can have a discussion with a fictional or historical personality that has been created. The building and scripting functions allow students to create objects and contents by themselves, which facilitate experiential learning. Also, distance learning becomes much more feasible when students from around the world can log in and interact as if they were sitting right next to each other. Perhaps though, one of the major advantages is the social networking capability. Participants in the virtual classrooms may find opportunities to communicate with others within blogs and wiki pages linked from inside Second Life.

In spite of its advantages, Second Life has its limitations as well. Building is accomplished through primitive objects called prims, and the number of prims allowed on a given piece of land is limited due to the processing power required to track and render the items (Gollub 2008). Only twenty avatars can co-exist simultaneously on a

given simulation (sim) — any more than that and the sim slows down enormously, and can become unusable. Plus, even though it has an excellent support team, the grid is periodically down because of attacks, server failures, or bugs, and the time it takes for users even with high-bandwidth connections and powerful graphics cards to render a scene can be slow enough that conversation lags or objects fail to be drawn properly. Also, with regard to virtual teaching, the learning curve could be steep, especially for people with little technical or gaming background.

2.3.4 Institutions Using Second Life

Higher education institutes are advancing their online teaching methods by offering classes in Second Life. One of the most widely known schools within Second life is Harvard University. In fall 2006, Harvard Law School and Harvard Extension School jointly offered a class in Second Life. In the class, student groups developed an argument for presentation at a virtual court room with other students acting as the judges. Different from other typical distance learning platforms, "Second Life gives us the capability to really have a classroom experience with the students", said Rebecca Nesson, the class instructor (Zhang 2007). In addition, the course integrated Web 2.0 tools such as wikis and blogs with the SL environment to further enrich learner's media experience.

Another institute using Second Life is Monroe College in Bronx, New York. Their online learning program takes advantage of the unique opportunities that exist on Second Life to provide students virtual internships, which students in most programs are required to complete one or two semesters of (Angel Learning 2008). To create the

Monroe College Office of Online Learning Internships in Second Life, the college sought companies willing to take on teams of interns. Interdisciplinary teams were established that included, for example, a business student and an IT student who provided technical support for the business student. A typical internship job might be to promote a product or activity for the company, which might include creating and distributing handouts. The business student creates the handouts and designs the method of distribution. Whereas, the IT student provides scripts and textures needed to implement the solution

During its first year the Monroe College Office of Online Learning Internships focuses on building community, networking and fun! Working for small businesses and non-profit organizations, interns acquired real-life experiences, applied the skills and knowledge they acquired in the classroom to the workplace and were able to evaluate their strengths and weaknesses and target the skills they needed to work on prior to graduation. The results of these internships were positive networking opportunities and, in two cases, employment. Furthermore, they have exposed inner-city students to international companies and have provided valuable experiences and opportunities for students who have hectic schedules and are unable to participate in onsite internships during traditional work hours (Angel Learning 2008).

CHAPTER 3: METHODOLOGY

3.1 DESCRIPTION OF INITIAL STUDY

The goals of this study were to (a) enhance the skills of experienced computers users and (b) teach new skills to non-experienced computer users. The areas that were targeted for the study were the learning of new computer skills, comprehension, and computer technology. Prior to the study, data was gathered from the senior adult population to find if the planned activities were right for this group. The researcher created a broad array of activities to be utilized if needed such as Microsoft Word, PowerPoint, Excel, the Internet, visual programming, and computer and Internet safety. The researcher used the instrument Computer User Experience (Appendix A) to find how computer savvy the senior adult participants were to help create the right level of activities for this group. Fifty percent self-reported that they were either good with computers or computer literate; but during the study, it was discovered that in many cases self-reports were exaggerated.

A series of three Computing Senior workshops were presented. These workshops were designed for a population of senior citizens from the Auburn, Alabama community and were conducted at an Auburn University computer lab. A subsequent workshop was conducted at a senior center in Auburn. During the workshops, the researcher initially planned two different experiences. Level I workshop introduced

Computing Seniors to personal productivity software (e.g., MS Word, PowerPoint, Excel). Level II workshop introduced Computing Seniors to basic programming concepts, visual programming, programming for the Web, and game programming. Survey data and interview information were collected during the workshops. The participants were presented with an informed consent (Appendix B), and they were given a pre-questionnaire (Appendix C). After each workshop, they were given a post-questionnaire (Appendix D).

3.1.1 Details of Workshops

Each workshop lasted three hours and during each workshop session, the researcher provided individualized activities for each participant. During the first workshop, the original plan was to introduce the senior adults to visual programming techniques and direct manipulation (i.e., Alice 3D). Many of the senior participants found this application amusing and focused on the tutorial materials. Some found it a very stimulating activity as they created their own 3D world, but some found it too complicated and were more interested in using Word, PowerPoint, Excel, and surfing the Web. During the second workshop, the researcher and senior adults continued working with personal productivity software and Internet activities that would be immediately useful to the senior adults (i.e., resizing their Web fonts to make them more readable). And, during the third workshop, the researcher and participants further explored productivity software by creating letterheads, using word art and clip art, and resizing images. Throughout all the workshops, input was recorded from the participants about the problems that they encountered with their home computers. The plan was to assist

them in recovering from these problems (usability or human error) to improve their computer efficacy. At each subsequent workshop, answers were provided to the questions that the participants had asked in the previous session. Also, at the end of each workshop, review materials were given to the participants to take home to support these newly learned skills.

3.2 VIRTUAL WORLD STUDY AND EXPERIMENT

Before the onset of technology such as the Internet and virtual environments such as Second Life, as time wore on people lost the ability to perform certain actions they were once capable of. The prominence of such environments partly comes from the ability to relive these times or to do things people could never previously do. For example, senior adults can reclaim their youth in such a world and run around without any concern as to their age or health. Therefore, this fact provided the motivation for the study.

3.2.1 Hypotheses and Variables

The two main hypotheses that the researcher was interested in investigating for this study were the following:

1. Are there performance and/or preference differences between senior users and younger users?
2. Does Second Life help seniors become more computer literate and improve their computer efficacy more than it does with younger users?

In order to test these hypotheses, the researcher configured a set of variables. For the study, the Independent Variables were determined to be the virtual community software being used and the age group being investigated. The software that was chosen for this experiment was the virtual community Second Life and whether this environment was appropriate for different age populations. With the ages of the senior citizen participants in the study, age groups involved were a result of opportunistic sampling.

The Dependent Variables were selected with the purpose of disproving the null hypothesis which states that the apparent preference of seniors over younger users, or their improved computer literacy, is attributable purely to chance in the assigning of ratings. As such, the Dependent Variables were selected to be the amount of time taken to perform certain benchmark tasks and the number of mistakes or errors made performing these tasks.

For the second hypothesis, a post-questionnaire using a Likert scale was completed by the participants. The seniors' computer self-efficacy was measured by their responses and overall ratings of the system.

3.2.2 Setup of Experiment

In order to perform an experiment and collect data, an area in Second Life needed to be crafted to perform several tasks. A premium account was purchased through Second Life's website (www.secondlife.com) which allows for many added capabilities, the most significant being the ability to own land and build structures on it. With this land, found in the Woodhenville region, a cottage was created from the basic Second Life

building blocks called “prims”. Prims can be thought of as Second Life Legos or a connectable design system that facilitates easy construction.

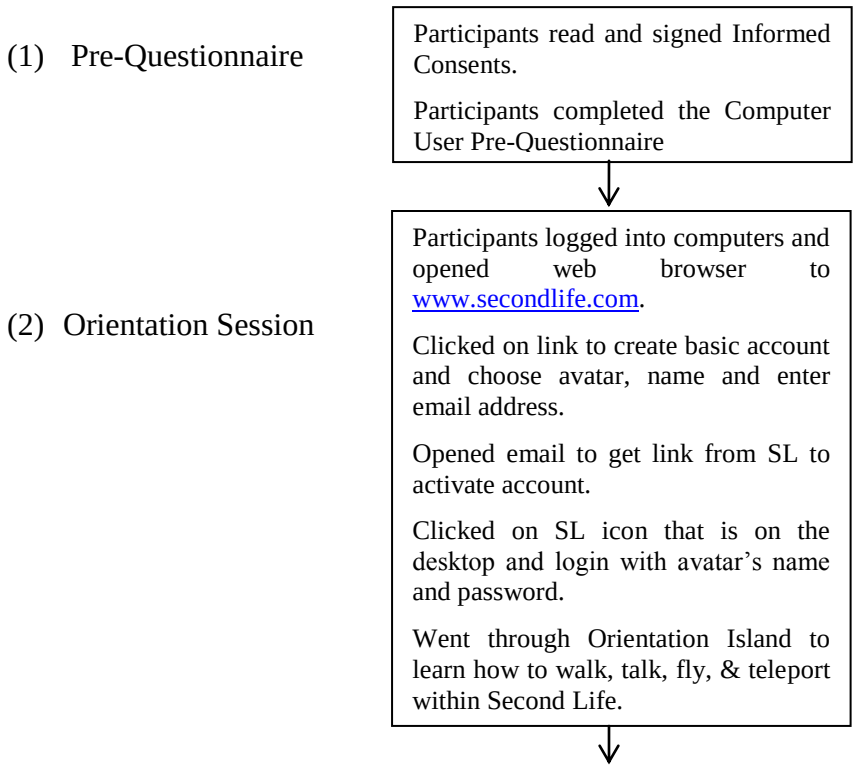
Within this cottage, two areas of significance were created. The first area was a bench with a link to Flickr.com, a picture-sharing website. When clicked upon, this link opened a new window within the SL client that allowed the user to browse this site and, when completed, close the window and return to the virtual world. Ultimately, the purpose of this link was to provide a mechanism for senior adults to post and share pictures of their family, grandchildren or other events that were significant to them. The second object was a note card directing the user to travel to another region in Second Life called Health Info Island. This region contains immense amounts of technical, medical data regarding everything from HIV to Cancer to the common cold. The primary focus of this link was information associated with prolonged health or other health concerns that may arise for senior adults.

The testing environment for most subjects was a computer lab in the Shelby Center for Engineering where Second Life was already installed on the computers when they arrived. However, for some users, due to unforeseen technical difficulties, the test was performed on their own computers. This was not thought to be significant as the interface, a simple mouse and keyboard, was common across all systems and should not have influenced the results. The test subjects consisted of two main groups. The first was a group of three senior volunteers who were members of OLLI, the Osher Lifelong Learning Institute. The second group was made up of four student volunteers. Each of

the members in the senior group could be characterized as having at least basic computer knowledge whereas members of the younger group could be characterized as having at least novice computer knowledge. All participants in the study did not have any prior experience using a virtual world such as Second Life.

3.2.3 Experimental Procedure

Since the experiment was set up within a computer lab, the participants were limited to only three hours to complete the study. The experiment included four major sections: (1) Pre-questionnaires, (2) Orientation session, (3) Virtual world application, and (4) Post-questionnaire. Figure 2 shows a flowchart describing the benchmark tasks the participants were to complete.



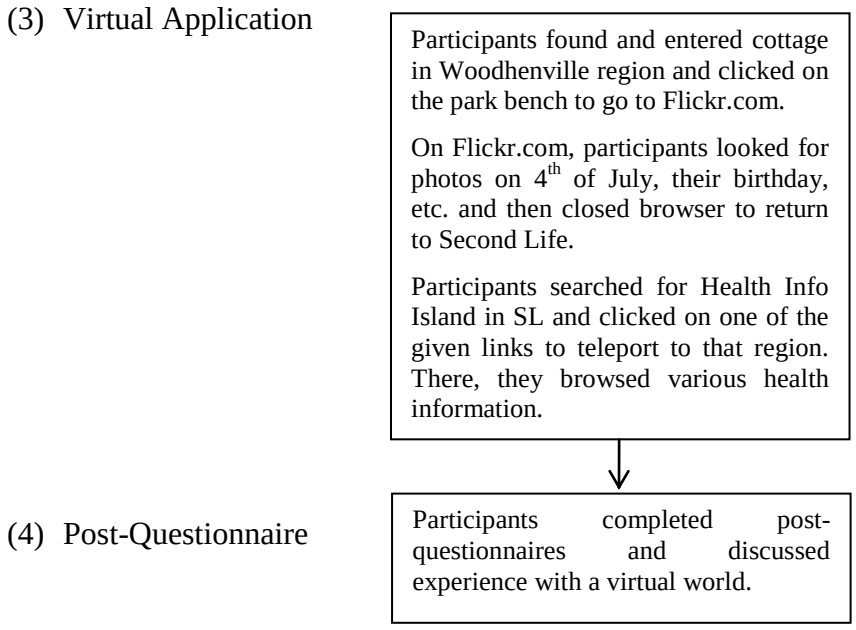


Figure 2. Flowchart describing the benchmark tasks for this study.

The questionnaires used in this study can be found in Appendices A, C, and D, and the pre-questionnaire came from Computer Understanding and Experience by Potosky and Bobko. These questionnaires used a Likert scale ranging from Strongly Agree to Strongly Disagree and had eight questions of this type. Also included on the post-questionnaire were four questions regarding the user's reactions to the virtual system.

3.3 VIRTUAL CLASSROOMS FOR SENIOR ADULTS

The purpose of this particular study was to further identify best practices for designing for a senior population while promoting computer and Internet use among senior adults as well as reducing their techno-phobia. Based on an interest survey (Appendix F) completed by members of OLLI, four major interests were chosen as

themes for the design of a virtual classroom in Second Life that catered to senior adults. Not only were virtual classrooms created but also a supporting website for the project and a tutorial on how to use the classrooms.

3.3.1 Designing for Senior Adults

Surveys were taken from approximately thirty-five senior adults to determine what areas were of most interest to them. There was a wide variety of topics listed including gardening, reading, health, sports, and history. After tallying the results, four areas were selected from among the most popular topics to use for designing classes for the senior adults in Second Life. Art Exhibits, Email, Gardening, and Health Care were the chosen topics.

During design it was taken under consideration that some senior adults may not be familiar with using computers since the technological age did not come about until they were well into middle age. Therefore, preparing classes that are computer-based may require instructions with many details to support novice computer users and encourage even those with little computer experience. The comfort level of senior adults in a traditional classroom was also considered. Day-time and weekday hours may not be convenient for older adults who have jobs and families to care for. Thus, the idea of online classes within Second Life that can be accessed in the comfort of their own homes, at a senior center, in a public area with WI-FI, at anytime, gives a much more flexible learning experience.

3.3.2 The Classrooms

The Art classroom (Appendix D) exposed senior adults to various kinds of art such as visual art, African-American art, representation art, contemporary art, modern art, and European art. Senior adults, through their avatars, were required to read the introductory part on the art class to learn more about seniors in Second Life before proceeding further. After the introduction, users were encouraged to select a subject of interest from the tutorial display boards and teleport to the location to view or study the art. At the end of the class, users could make any comments or suggestions about the class.

The Email classroom was designed to teach senior adults how to setup and use an Email account. The class provided a tutorial on creating an Email account using Gmail and sending an email to a recipient. In the Email classroom (Appendix D), the seniors entered and took a seat at a computer station, turned on the computer, logged into their individual accounts and followed along as the instructor walked through the process of preparing and sending emails. The instructor conducted the class by projecting the image of her computer monitor's screen to the whiteboard at the front of the class so that everyone could see what he/she was doing. Then, the senior adults were asked to complete the following tasks as part of the learning process:

1. Create an email account (if student does not have one).
    a. Open a web browser.
    b. Navigate to Google's web site by typing www.google.com into the address box.

c. Click on the “Sign up for Gmail” link.

d. Complete the information on this page, then click “I Accept” and “Create my account” buttons.

e. Click the link at the bottom of the page to sign into Gmail.

2. Compose an Email

a. Click on the “Compose Mail” link. The cursor is in the “To” box of the new email.

b. Enter the email address of the recipient, i.e., username@gmail.com

c. Click the tab button and move to the subject box and type in the subject.

d. Click the tab button and move to the message body to type the message. Once completed, click on the “Send” button at the bottom.

e. To save a draft and send the message later, click on the “Save Now button. To discard the message and not send, click on the “Discard” button

3. Attach a picture to an Email.

a. Click on the “Attach a file” link located under the subject line.

b. Search for the picture you would like to add to your email. Double-click on it or click on it once and then click on open. The filename will appear next to the paperclip under the subject line.

c. You will have the option to remove the file, otherwise continue to type your message, add another picture, or send your message.

The Virtual Health Fair was designed to provide senior adults with information about searching for health-related topics on the Internet. The classroom (Appendix D) gave a short introduction to performing a search on health information using Google. The classroom also provided links to resources supporting healthy living available on the web and in Second Life. Upon entering the classroom a user received a disclaimer stating, "The AU Virtual Health Fair provides tips about finding Health Information using the Internet. The AU Virtual Health Fair in no way will attempt to diagnose any disease and in no way replaced the advice that is provided by a licensed physician." After viewing the disclaimer, a user was presented three choices 1) Healthy Living, 2) The Internet as a Tool for Health Information, and 3) Managing Disease, Becoming an Informed Patient, and Helpful Links. Each of these choices provided the user with links to websites regarding information about diabetes, heart disease, and cancer.

The final classroom was a Gardening classroom (Appendix D). It provided information on various gardening topics such as popular gardening tools, popular plants, and basic gardening tips. Once in the classroom, users were presented with note cards directing them to a wide range of gardening websites, i.e., Better Homes and Gardens, or inviting them to visit a virtual garden within Second Life such as Oriental Gardens or Botanical@Straylight. In addition, short presentations were given about "Creating a Square Foot Garden" and "How to Plant Spring Bulbs".

3.3.3 Application and Questionnaires

Following a Pre-questionnaire and the Informed Consents, the participants were introduced to the virtual classrooms in Second Life. After describing each of the

classrooms in detail, the researcher provided the senior participants with avatars that had already been created. The researcher asked the senior participants, again from OLLI, to log into Second Life with their respective avatars and teleport to the Education Center located in the Patrick Bay region. Then, the participants were instructed to enter the house and perform certain tasks in each classroom like viewing the short presentations provided in each classroom as well as visit some websites that the classrooms provided links to. After visiting and experiencing each classroom, the participants exited Second Life and were required to complete a Post-Questionnaire.

CHAPTER 4: RESULTS AND DISCUSSION

As stated in Chapter 1, the primary objectives of this study were to address the following issues:

1. Design a virtual-world classroom to provide older adults opportunities to gain knowledge about various topics in a new computing environment.
2. Investigate if learning a new computer skill affects an individual's computer self-efficacy.
3. Determine if older adults' task performance will improve from the type of virtual computer training received

To address these issues, a series of workshops was conducted in summer 2007, and a virtual world experiment in Second Life was conducted in spring 2008. In addition, an experiment involving virtual world classrooms in Second Life was conducted during this current semester. The results from each of these episodes provided much information about how to train senior adults to use computers in order to improve their performance and self-efficacy.

4.1 INFORMATION GATHERED FROM WORKSHOP SERIES

Based on survey information obtained from the participants, many were very new to the information age and using computers. Some were still at an early developmental stage of building their computer literacy and just wanted to become proficient at

computer use (i.e., based on researcher observations during the workshop experience). This novice computer audience shaped the design of the workshops with subsequent impact on the results. They reported that the most informative parts of the workshops dealt with basic computer usage like word processing. One of the applications that has been successful among other age groups is Alice Visual programming software, but for this group, programming was a most frustrating activity. The researcher attributed this to the participants being uncomfortable about trying something new. Therefore, the participants did not list programming as one of the things that they would like to do in the future.

The researcher's gauging of the level of understanding for workshop activities was good; all of the participants expressed that they understood all the activities. One of the strongest statements in support of providing future workshops to improve computer literacy and efficacy for seniors was that 100% of the workshop participants indicated that they felt much more motivated to try new computer projects. One participant reported, "I have a greater knowledge and enjoyed the sessions very much." From the workshops, the researcher found that the senior participants were a very mature and informative group in that even if the seniors did not know a lot about the computer, they were better able to express what their expectations were for their computing experience as well as the use of their valuable time. Many of them desired more one-on-one instruction so as to not get lost during a group learning session. Overall, the participants were very industrious, had good attention spans, and looked forward to more workshops.

4.2 RESULTS OF 1ST VIRTUAL WORLD EXPERIMENT

This experiment involved both senior adults from OLLI and a group of students from Auburn University. Coming from different computing backgrounds, each group had a noticeably different reaction to the virtual system. And, from the data in Tables 1 and 2, it is quite apparent that the two groups had a significantly different experience.

Table 1: Pre-Questionnaire Results

Question	Seniors	Youth
I frequently read computer magazines or other sources of information that describe new technology.	100% disagree	50% agree, 50% disagree
I know how to recover deleted/lost data on a computer.	100% disagree	100% agree
I know what a LAN is.	66% agree, 34% disagree	100% agree
I know what an operating system is.	66% agree, 34% disagree	100% agree
I know how to install software on a personal computer.	66% disagree, 34% agree	100% agree
I know what a database is.	100% agree	100% agree
I am computer literate.	66% agree, 34% disagree	100% agree
I am good with computers.	66% agree, 34% disagree	100% agree

Table 2: Post-Questionnaire Results

Question	Seniors	Youth
Do you think that you were able to accomplish all activities today?	100% agree	75% agree, 25% disagree
Were you comfortable with the technology used?	66% agree, 34% disagree	75% agree, 25% disagree
Do you feel that you know more about computers after this experience?	100% agree	25% agree, 50% neutral, 25% disagree
Do you feel more computer savvy after this experience?	100% agree	25% agree, 50% neutral, 25% disagree
Would you use this type of software to keep in touch with family and friends?	66% agree, 34% disagree	100% disagree
Do you feel safe in talking to other people in a virtual community?	66% agree, 34% disagree	50% agree, 50% disagree
Would you like to hang out with your grandkids in this type of virtual community?	66% agree, 34% disagree	50% agree, 25% neutral, 25% disagree

The senior group showed a significant improvement in their opinion of their own computer prowess and their desire to use the system again over the younger group. In fact, the difference was almost a polar opposite in some cases (Table 2, Question 5). This greatly reinforced the second hypothesis and lends the researcher to believe there is a real change noticed here.

The more in-depth analysis came from the error data in Tables 6, 7, and 8. In order to analyze this data, it was determined that a t-test should be used, more specifically a two-sample unpaired t-test. The variance between the two groups was not large in most cases, but the variance within a group for a given task could be fairly large. After conferring with Dr. Seals, and analyzing the data, this seemed the most logical fit given the variances and small sample size.

The full analysis of this data is shown in Table 9, but to summarize the groups were statistically different with a confidence of at least 75% for all tests and at least 80% for all but one test. Moreover, analyzing the errors committed in performing the second teleportation showed that senior adults were actually learning while using the system. In completing this tasks and assessing the difference between tasks three and five, seniors were found to make statistically fewer errors with a 95% confidence. This directly supported the second hypothesis. Counter-intuitively, younger users made more errors when they repeated this task, thus seniors were more proficient at performing this teleportation action. The researcher would have desired repeating this test on the time data collected in Tables 3, 4 and 5, but the second teleportation experiment included time spent traveling the island which skewed the results.

Table 3: Time statistics for Senior group (minutes)

	Basic Second Life Tasks		Woodhenville Tasks		
Subject #	Create Account and Avatar	Complete Orientation Island	Find Cottage	Visit Flickr.com	Visit Health Info Island
1	5	20	2	7	12
2	5	20	5	9	19
3	5	25	5	7	22
Mean	**5**	**22**	**4**	**8**	**18**

Table 4: Time statistics for Youth group (minutes)

	Basic Second Life Tasks		Woodhenville Tasks		
Subject #	Create Account and Avatar	Complete Orientation Island	Find Cottage	Visit Flickr.com	Visit Health Info Island
4	3	15	3	8	9
5	2	10	2	6	7
6	2	10	2	5	5
7	2	10	2	5	6
Mean	**2**	**11**	**2**	**6**	**7**

Table 5: Comparative time statistics (minutes)

	Basic Second Life Tasks		Woodhenville Tasks		
Group	Create Account and Avatar	Complete Orientation Island	Find Cottage	Visit Flickr.com	Visit Health Info Island
Seniors	5	22	4	8	18
Youth	2	11	2	6	7

Table 6: Error statistics for Senior group

	Basic Second Life Tasks		Woodhenville Tasks		
Subject #	Create Account and Avatar	Complete Orientation Island	Find Cottage	Visit Flickr.com	Visit Health Info Island
1	0	2	1	0	0
2	0	1	3	0	1
3	0	2	2	0	1
Mean	**0**	**2**	**2**	**0**	**1**

Table 7: Error statistics for Youth group

	Basic Second Life Tasks		Woodhenville Tasks		
Subject #	Create Account and Avatar	Complete Orientation Island	Find Cottage	Visit Flickr.com	Visit Health Info Island
4	0	2	1	0	1
5	0	1	0	0	2
6	0	2	0	0	1
7	0	1	0	0	2
Mean	**0**	**2**	**0**	**0**	**2**

Table 8: Comparative error statistics

	Basic Second Life Tasks		Woodhenville Tasks		
Group	Create Account and Avatar	Complete Orientation Island	Find Cottage	Visit Flickr.com	Visit Health Info Island
Seniors	0	2	2	0	1
Youth	0	2	0	0	2

Table 9: T-Test Calculations and Confidence

	S Average	S Variance	Y Average	Y Variance		t	#Deg Freedom	Confidence Interval
1	5.00	0.00	2.25	0.75		44	3	99.95%
2	21.67	16.67	11.25	18.75		2.4	4.032258065	95%
3	4.00	6.00	2.25	0.75		1.647059	2.251948052	85%
4	7.67	2.67	6	6		1.764706	4.898305085	90%
5	17.66666667	47.33333333	6.75	8.75		1.26672	2.37328774	80%
				Time Taken to Perform Benchmark Tasks				
	S Average	S Variance	Y Average	Y Variance		t	#Deg Freedom	Confidence Interval
1	0.00	0.00	0.00	0.00		Same sampling, no difference		100%
2	1.67	0.67	1.50	1.00		0.857143	4.454545455	75%
3	2.00	2.00	0.25	0.75		4.421053	2.755725191	97.50%
4	0.00	0.00	0.00	0.00		Same sampling, no difference		100%
5	0.67	0.67	1.50	1.00		4.285714	4.454545455	99%
				Errors Made Performing Benchmark Tasks				

After analyzing the data visually and statistically, there were definite differences between the two groups with respect to performance and preference. With no worse than a 75% confidence, the two tested groups were significantly different. It was also found that with a 95% confidence, the seniors did learn from using the system and made fewer

errors the second time they performed a given task. These findings combined with the results from the questionnaires which showed seniors were more interested in using Second Life again than the younger group lead us to believe there is a future in this area. The researcher is interested in performing these tasks on a wider sampling of the population to ensure that such data extrapolate as expected but for initial results, these were quite promising.

4.3 THE VIRTUAL WORLD CLASSROOMS EXPERIMENT

Due to the positive feedback from the seniors in the first virtual world experience, an experiment to determine the usability and effectiveness of virtual classrooms in Second Life was conducted. It included seven volunteers from the Osher Lifelong Learning Institute. In order to shorten the duration of the experiment and decrease the possibility of the senior adults becoming fatigued, which is a common problem, the researcher already had the Second Life client software installed on laptop computers as well as avatars for each participant. In the first virtual experiment, the participants themselves had to install the Second Life client and create an avatar as part of the assigned tasks.

After completing the Informed Consent (Appendix B), Pre-Questionnaire (Appendix A) and survey (Appendix C), participants were asked to log into Second Life with their assigned avatars and teleport to the Education Center containing the classrooms. In Second Life, an avatar can have a designated home location, and the avatars the seniors used had a home location at the virtual classroom site. Once at the

site, the seniors were instructed to enter the building and go to the AU Email classroom. In this room, their avatars took a seat at a computer station and followed the instructions in the PowerPoint presentations to create an email account on google.com.

After completing the email class, the seniors were instructed to enter the Virtual Health Fair Classroom, AU Art Classroom, or the AU Gardening Classroom. In the Virtual Health Fair Classroom, their avatars touched the Healthy Living board, which presented several links to web sites promoting healthy living, and the 'The Internet as a tool for Health Information', which provided a short introduction on how to search the Internet by explaining terms such as browser, keywords, and URL. In the AU Art Classroom, seniors clicked on the whiteboard to view an introduction, and they viewed Powerpoint presentations on Modern Art, Egyptian Art, or Afro-American Art. In the AU Gardening Classroom, the seniors clicked on the pictures of flowers to go to various gardening web sites or to tour virtual gardens in Second life (i.e., Gardens of Apollo). They also were given a Powerpoint presentation on 'Square Foot Gardening' and 'How to Plant Spring Bulbs'.

After exploring the virtual classrooms, the participants completed a Post-Questionnaire (Appendix D) regarding their experience. Since the results from the previous virtual world study demonstrated that senior adults enjoyed Second Life and actually learned from it, the researcher expected results from this study (Tables 10-12) to be similar if not better. Most of the participants had some prior computer experience, and they found Second Life as well as the virtual classrooms to be a very interesting and

worthwhile experience. In addition, they indicated that they felt they knew more about computers as a result of this experiment. However, a few of the senior adults found it rather difficult (Table 12). One participant did not have any previous computer experience ; therefore, she had a lot of difficulty learning not only the virtual world but also maneuvering the mouse. Thus, she required a considerable amount of one-on-one instruction and displayed some frustration.

By using the tutorials provided in a virtual environment, participants were able to access information conveniently and from the privacy of a preferred location. This provides an advantage over traditional classroom settings which are usually more structured in terms of time and location. However, more research will be required to determine if this approach will be effective in promoting learning activities and increasing interest in using virtual worlds for educational and academic purposes.

Table 10: Pre-Questionnaire Results

Question	**Response from Senior Participants**
I frequently read computer magazines or other sources of information that describe new computer technology.	100% disagree
I know how to recover deleted or lost data on a computer or PC.	100% disagree
I know what a LAN is	90% disagree; 10% neutral
I know what an operating system is.	90% disagree; 10% agree
I know how to install software on a personal computer.	90% disagree; 10% agree
I know what a database is.	90% disagree; 10% agree
I am computer literate.	90% disagree; 10% agree
I am good with computers.	90% disagree; 10% agree

Table 11: Post-Questionnaire Results

Question	**Response from Senior Participants**
Do you think that you were able to accomplish all activities today?	29% agree; 57% neutral; 14% disagree
Were you comfortable with the technology used?	14% agree; 71% neutral; 15% disagree
Do you feel that you know more about computers after this experience?	70% agree; 15% neutral; 15% disagree
Do you feel more computer savvy after this experience?	43% agree; 43% neutral; 14% disagree
Would you use this type of software to keep in touch with family and friends?	29% agree; 28% neutral; 43% disagree
Do you feel safe in talking to other people in the virtual community?	29% agree; 43% neutral; 28% disagree
Would you like to hang out with your grandkids in this type of virtual community?	29% agree; 71% neutral

Table 12: Post-Questionnaire Ratings

Subjects	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Avg.**
Terrible/Wonderful	7	8	9	5	5	7	8	7
Frustrating/Satisfying	7	5	8	3	4	7	8	6
Dull/Stimulating	9	8	8	6	7	8	9	8
Difficult/Easy	4	8	5	3	5	2	6	5

*Data was collected on a 9 point scale with 9 indicating positive and 1 indicating negative.

CHAPTER 5 : CONCLUSION AND FUTURE WORK

5.1 CONCLUSION

The primary objectives of this study were to design a virtual learning environment to accommodate age related degradations due to cognitive aging and examine if an older individual's computer knowledge and self-efficacy are affected by learning new computer software via a virtual world. This research helps to support the literature (Czaja, 1996 ; Czaja and Lee, 2007 ; Hickman, Rogers, and Fisk, 2007; Bean and Laven, 2003), which suggests that senior adults can learn a new computer skill just as their younger counterparts. However, due to the limit of having small-sized groups of participants, this research cannot make any generalizations for the larger population of older adults.

The first part of this study (workshops) took place in one of the computer labs at Auburn University where the participants were introduced to personal productivity software (Microsoft Word, Excel) and Alice 3D. During this study, the researcher found that senior adults are not technology adverse ; however, they want technology that supports activities that they are already familiar with. Many of the technologies that the seniors used, or wanted to experience, were extensions of applications that they already used. However, they were willing to learn new technology as long as it had great usability and was not frustrating.

The results of the virtual world experiments showed that senior adults can learn through a virtual world such as Second Life and that their computer self-efficacy did improve. However, due to the complexity of Second Life (teleporting, talking), the results and feedback in the Second Life studies were not as high as those from the workshop series. The participants did express a sense that the virtual learning environment was satisfying, usable, and very worthwhile. They liked the fact that they could access Second Life and return to the virtual classrooms from the privacy of their own homes at a time convenient for them. The virtual world classrooms were overall very successful in achieving what they were meant to do: teaching senior adults to use computers while also increasing their self-efficacy and reducing their fear of technology.

5.2 FUTURE WORK

The future plans of this study are to continue this project by expanding the functionality of the virtual learning environment through the addition of more classrooms that teach subjects that senior adults are interested in. Such subjects could be history, finance, games, and perhaps, even computer programming.

As server power and bandwidth increase, more possibilities will open up around Second Life use. The private simulations can be easily connected to public simulations via Second Life URLS, thus taking advantage of the powerful social nature of Second Life without tying it to a commerical entity or restricted performance. This increase in power will allow Second Life to develop more realistic looks and interfaces, with more powerful tools for communication and interaction. As this technology improves, one can

only imagine the kind of experiences that senior adults will be able to have within a virtual learning environment.

There is also the potential of designing computer software that is similar to Cognifit's MindFit or Nintendo's Brain-Age software, which helps to improve the user's cognitive abilities and working memory through games and puzzles. Senior adults would benefit from a human-computer interaction system that provides great usability through the use of large font sizes, different colors, and easy-to-follow directions. Although cognitive abilities can decline with age, this decline can be counteracted with mental exercise and activity that such computer software provides.

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APPENDICES

APPENDIX A

Pre-Questionnaire

Computer Understanding and Experience

Potosky & Bobko

In the section below, choose the response that most accurately describes you.

1. I frequently read computer magazines or other sources of information that describe new computer technology.

Strongly Agree Agree Neutral Disagree Strongly Disagree

2. I know how to recover deleted or lost data on a computer or PC.

Strongly Agree Agree Neutral Disagree Strongly Disagree

3. I know what a LAN is.

Strongly Agree Agree Neutral Disagree Strongly Disagree

4. I know what an operating system is.

Strongly Agree Agree Neutral Disagree Strongly Disagree

5. I know how to install software on a personal computer.

Strongly Agree Agree Neutral Disagree Strongly Disagree

6. I know what a database is.

Strongly Agree Agree Neutral Disagree Strongly Disagree

7. I am computer literate.

Strongly Agree Agree Neutral Disagree Strongly Disagree

APPENDIX B

INFORMED CONSENT

for a Research Study Entitled
---Senior Citizens' Interaction with Computer Technology---

You are invited to participate in a research study designed to expose seniors to new computer software (i.e., word processing, Internet, webpage creation) in order to increase their knowledge and level of comfort with computers. This study includes examining seniors' attitudes\responses to the impact of computer technology on their lifestyles. This study is being conducted by Kelley Clanton and Dr. Cheryl Seals. We hope to learn if more exposure to computing improves seniors overall computing comfort level.

If you decide to participate, we will give you a pre-questionnaire at the beginning of the workshop. The workshop and data collection are planned for duration of 3 hours and will conclude with a post-questionnaire and interview. There are no risks associated with your participation and we will conduct the workshop in a familiar and/or comfortable environment. For those seniors who do not want to participate in the research aspect of our study but do want to participate in the actual workshop, they are welcome to do so without penalty.
The benefits to participants are the increased knowledge and comfortability with computers and will promote higher levels of computing self efficacy. We cannot promise you that you will receive any or all of the benefits described.

Any information obtained in connection with this study and that can be identified with you will remain confidential. The data will be coded by number and the associate between the name and code will be kept confidential. Information collected through your participation may be (e.g., used to fulfill an educational requirement, published in a professional journal, and/or presented at a professional meeting, etc.) If so, none of your identifiable information will be included. _____

Participant's Initials

Participants may withdraw from participation at any time, without penalty. Also your decision whether or not to participate will not jeopardize your future relations with Auburn University or the Computer Science and Software Engineering Department.

If you have any questions, we invite you to ask them now. If you have questions later, Kelley Clanton, (334) 844-3704, clantkl@auburn.edu, and Cheryl Seals, Ph. D. (334) 844-6319, sealscd@auburn.edu will be happy to answer them. You will be provided a copy of this form to keep.

For more information regarding your rights as a research participant you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE.

_____	_____
Participant's signature Date	Investigator obtaining consent Date
_____	_____
Print Name	Print Name

APPENDIX C

Computer and Internet Usage Questionnaire

This is a survey of computer and internet usage to find out what technology you normally use. This will help us to provide future computer related services to your group.

DATE:		
Please indicate Yes or No in the appropriate column with an X.	YES	NO
1. I primarily access the Internet by using:		
My own computer		
A friend or relative's computer		
A computer at the library or other community center		
A computer at work		
2. In an average week I use the Internet: (Check one)		
Less than 5 hours		
5-9 hours		
10-19 hours		
20 or more hours		
3. I use the Internet to do the following (check all that apply)		
Stay in touch with friends and relatives		
Stay current with news and events		
Access chat rooms		
Play games		
Check stocks and investments		
Research health information		
Make purchases online		
Buy or Sell on Ebay		
4. I learned to use the Internet by (check all that apply):		
Getting help from a peer		
Getting help from a relative		
Taking a class		
Teaching myself		
Accessing it in the workplace		

5. I have been using the Internet for:		
Less than 6 months		
6-11 months		
12-23 months		
2-5 years		
Over 5 years		
6a. I have researched the following on the Internet in order to give me information to purchase them in stores (offline)		
Apparel		
Automobiles		
Books		
Computer software or hardware		
Music		
Prescription drugs		
Travel packages, plane tickets, rental cars, etc.		
6b. I have purchased the following items on the Internet:		
Apparel		
Automobiles		
Books		
Computer software or hardware		
Music		
Prescription drugs		
Travel packages, plan tickets, rental cars, etc.		
7. I think that the Internet (rank from 1 to 5 in terms of importance – 1 being most important, 5 being least important		
Is a good way to stay in touch with friends and family		
Provides convenient shopping		
Helps me to make purchasing decisions		
Provides opportunities for making new connections		
Is a useful research tool		
8a. I avoid chat rooms because:		
Privacy/security issues		
I prefer transactions by phone or in person		
I don’t know how to do this		

8b. I avoid discussion groups because:		
Privacy/security issues		
I prefer transactions by phone or in person		
I am not interested in doing this		
I don't know how to do this		
8c. I avoid shopping online because:		
Privacy/security issues		
I prefer transactions by phone or in person		
I am not interested in doing this		
I don't know how to do this		
8d. I avoid online investing because:		
Privacy/security issues		
I prefer transactions by phone or in person		
I am not interested in doing this		
I don't know how to do this		
9. I am in this age group:		
50-54		
55-59		
60-64		
65-69		
70-74		
75-79		
80-84		
85 & up		
10. I am:		
Male		
Female		
11. I would like to learn more about creating documents?		

Would you like to learn more about creating documents?

1. Would you like to learn more about creating presentations?
2. Would you like to learn more about web design ?
3. Would you like to learn more about creating Gaming and Game creation?
4. Would you like to learn more about Programming concepts?

Questions 1-10 are created by seniornet.org

APPENDIX D

Post-Questionnaire

Name : _____ AU COMPUTING SENIORS

Do you think that you were able to accomplish all activities today ?

___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

Were you comfortable with the technology used ?

___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

Do you feel that you know more about computers after this experience ?

___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

Do you feel more computer savvy after this experience ?

___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

Would you use this type of software to keep in touch with family and friends ?

___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

Do you feel safe in talking to other people in the virtual community ?

___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

Would you like to hang out with your grandkids in this type of virtual community ?

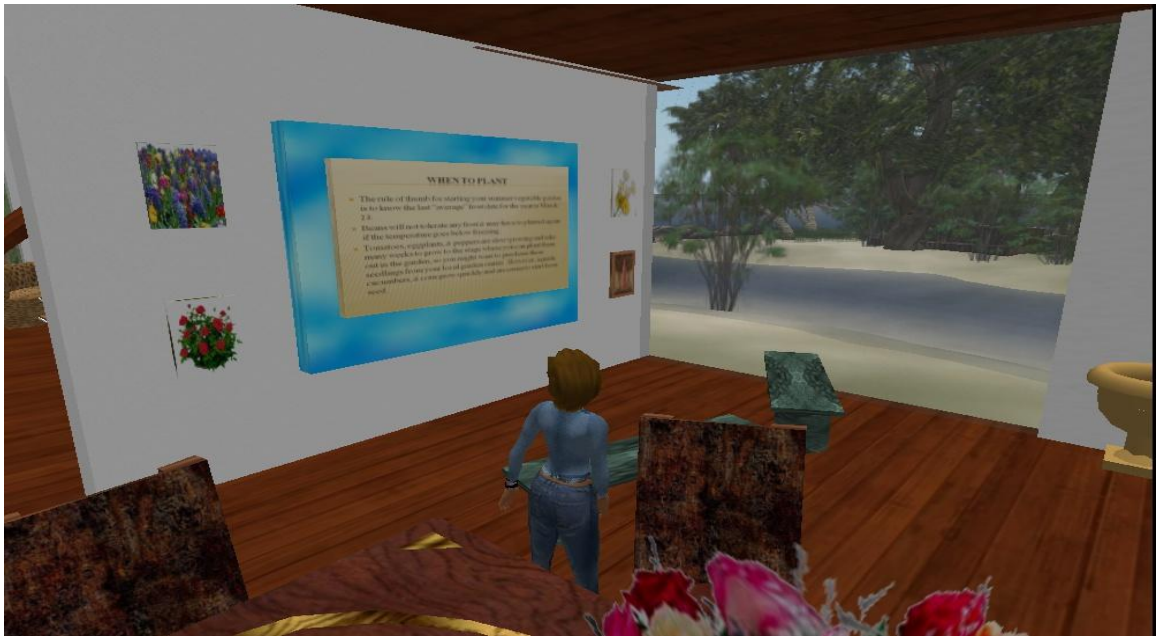
___ Strongly Agree _____ Agree _____ Neutral _____ Disagree ____ Strongly Disagree

What were your overall reactions to the system (circle your choice) ?

Terrible								Wonderful
1	2	3	4	5	6	7	8	9
Frustrating								Satisfying
1	2	3	4	5	6	7	8	9
Dull								Stimulating
1	2	3	4	5	6	7	8	9
Difficult								Easy
1	2	3	4	5	6	7	8	9

APPENDIX E

Screen Shots of Virtual Learning Center and Classrooms



Gardening Classroom

Email Classroom

Art Classroom

Virtual Health Fair Classroom

APPENDIX F

AU Computing Seniors
Skills & Interests Survey

Senior Research at Auburn University Computer Science & Software Engineering wants to create a Virtual Learning Space for senior citizens within Second Life. By knowing more about your interests, skills, and hobbies, we can better design this virtual classroom to give you the most beneficial learning experience.

Please fill out the form below. By completing this survey, you are not committing to being a volunteer for our project at this time. You will be contacted if you are needed. Thanks!

First Name _____ Last name_____

Email _____ Address _____

City _____State _____ Zip Code _____

What Times Work For You? (Click all that apply)

Mornings _____ Afternoons _____ Evenings _____ Weekends _____

Place a checkmark by those areas that you have interest in. We know this lists does not include everything. There is space provided for you to give additional information.

AGRICULTURE-ENVIRONMENT

Farming _____

Gardening _____

Pets _____

Other _____

ART

Art Exhibits _____

Art History _____

Painting _____

Drawing _____

Pottery _____

Other _____

COMMUNICATIONS

Photography _____

Radio _____

Writing _____

Other _____

COMPUTERS

Document Creation _____

Internet/Web Surfing _____

Programming _____

Games _____

Email _____

Other _____

BUSINESS/FINANCIAL

Financial Mgmt. _____

Accounting _____

Investments _____

Stock Market _____

Budgeting _____

Tax Preparation _____

Other _____

RECREATION

Sports _____

Basketball _____

Baseball _____

Football _____

Swimming _____

Tennis _____

Other _____

HEALTH-MEDICAL SERVICES

Health Care _____

Assisted Living _____

Drug Information _____

Other _____

SCIENCE

Archaelogy _____

Astronony _____

Mathematics _____

Other _____

HISTORY

Civil War _____

World War I _____

World War II _____

Korean War _____

Vietnam War _____

Native American _____

Other _____

HOBBIES

Antiques _____

Ceramics _____

Crafts _____

Coin Collecting _____

Reading _____

Puzzles _____

Other _____

If you would like for us to contact you about participating in our project, please supply the following:

Phone _____ Email _____