Senior citizens represent the fastest growing demographic worldwide. As indicated in the Year 2000 U.S. Census, there are 35 million people...

We would like to thank members from senior centers in the Auburn University area and Auburn City community for participating in our workshops as well as Auburn University for allowing us to use their computing facilities.

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65 or older in the United States (U.S.). By 2030, it is estimated that there will be about 70 million older adults in the U.S. alone (Chadwick-Dias, McNulty, & Tullis, 2003). With the older population growing rapidly and being increasingly exposed to computer technology, it is important that they become informed of what computers can do for them, (e.g., e-mail, document creation, games, and access to information via the Internet) (Shapira, Barak, & Gal, 2007; White, McConnell, Clipp, Branch, Sloane et al., 2002). The longitudinal study presented employs a mixed method data collection and analysis approach that includes the use of standardized surveys, measures of physical fitness and physiology, observations in the retirement community, and structured interviews. Drawing upon Auburn University faculty in the College of Engineering, senior citizens participated in workshops designed to develop their skills in computing. The potential significance of the project was to create a valid and reliable model for outreach to retirement and assisted living communities and other centers for senior citizens.

The older adult population is growing rapidly (Chadwick-Dias, McNulty, & Tullis, 2003). Although this population would benefit from interaction with computer technology, it has had minimal exposure to such technology and is experiencing difficulty with its mastery. As a result, the well-being of older adults is negatively impacted. Many forms of technology can be a source of stress for seniors (Nycyk & Redsell, 2006). It is important that older adults become aware of the advantages of computers (e.g., e-mail, document creation, games, Internet) to improve their overall quality of life (Shapira, Barak, & Gal, 2007; White, McConnell, Clipp, Branch, & Sloane, et al., 2002). Therefore, it is crucial for software developers to design systems with seniors in mind (Mead, Batsakes, Fisk, & Mykityshyn, 1999). Since this population is ever expanding, responsive and inclusive computer training and education is needed.

A group of Auburn University researchers from the College of Engineering have embraced the senior community and have designed a series of workshops to develop its skills in computing and to improve its overall computer efficacy. The objective of this project was to create a valid and reliable model for outreach to retirement and assisted living communities and other centers for senior citizens.

Many senior citizens no longer have their nuclear family near their current location. This is a result of migration patterns caused by individuals following jobs all over the country during the last 40 years. In some circumstances, seniors resist being uprooted from friends in order to live near their children or other family
members. Other times, relocation is not possible for physical, economic or emotional reasons. Whatever the situation, seniors need to avoid loneliness by maintaining contact with family members and social networks that are in distant locations. Loneliness in older adulthood correlates positively with depression. Thus, it is important for seniors to stay connected to persons who provide social support and help to sustain feelings of quality of life (Nycyk & Redsell, 2006; Minardi & Blanchard, 2004). The use of computer technology can help achieve this end. Also, seniors who are in close proximity to relatives and social networks frequently care for young grandchildren and other young people who are more computer literate than they are. Computer utilization would bridge a communication gap for those individuals. Yet, with the use of computer technology there are risks. For example, there are potentially harmful situations involving identity theft (White et al., 2002). However, proper training about computer technology can aid seniors in being self-sufficient, empowering them to protect themselves.

The purpose of the Computing Seniors workshop series was to introduce senior citizens to multiple types of computing applications such as Microsoft Word, PowerPoint, the Internet, search engines, and visual programming environments (e.g., Alice 3D). Our initial workshop series was planned for three sessions and one exploration home intervention (Alexy, 2000) where we visited each participant in their own home computing environment.

**SENIORS AND COMPUTING**

We have found few studies of seniors actively involved with computers, and we believe that this is attributed to having very few members of this population willing to facilitate such research. One resource that provided plentiful information about seniors was SeniorNet (www.seniornet.org), an organization joined by more than 65,000 older adults in the last decade. 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, touching up photos, and financial management (Adler, 2006; White et al., 2002). 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.
SENIORS AND USABILITY

Most computer applications are created by young developers; generally, this means that they will have great vision and lots of exposure to computing technology. This can cause a problem of not supporting “universal usability.” Developers should never just design for one audience; they should design for the community at large. When designing for special populations and applying the principles of universal usability, we improve the overall usability of the system for these groups and, thus, improve the usability of the system for all users.

Web sites tend to be less user-friendly for senior citizens because of font size and design of the layout. Seniors are impaired more by usability problems as compared to the younger generation. Poor designs can make searching the Web more than twice as hard for seniors (Nielsen, 2002).

One of the main principles for supporting seniors’ computer use is to provide larger font sizes than those preferred by a younger audience. Web sites that target the senior population should use at least 12-point type as the default; in addition, they should let the users increase the text size if they desire. Large text is extremely important for hypertext links to ensure readability of these essential design components and to make them more prominent targets for clicking. When Web sites do not use different colors to distinguish between visited and unvisited links, senior users tend to easily become confused as to where they have been (Craig & Dunn, 2007; Zaphiris & Kurniawan, 2005). Therefore, they are more likely to waste time by repeatedly going to the same Web page.

COMPANIES SUPPORT COMPUTING SENIORS

Seniors’ computer usage has attracted wide interest and many companies are now becoming responsive to the growing numbers of seniors on the Internet. “Corporate interest in an aging population is reflected by Intel Corp. and Acer America providing 100 Pentium PCs to 20 learning centers across the country.” This indicates that there is truly a growing market for products that support these communities as evidenced by interest from many other companies (e.g., America OnLine, CompuServe, Prodigy, Delphi, and Microsoft) (Sederberg, n.d.; Mead et al., 1999).

Seniors are willing to adopt new products and technologies where it promotes their “self-fulfillment, self actualization, personal
enrichment, and self-transcendence” (Sederberg, n.d.). With this as the norm and not the exception, seniors will engage in activities that expand and facilitate their goals and hobbies as well as enhance their functioning (Craig & Dunn, 2007).

**SENIOR COMPUTER TRAINING**

Teaching and training seniors 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” (Nycyk & Redsell, 2006, p. 298). Although cognitive abilities can decline with older age, this decline can be counteracted with mental exercise and activity (memory, reasoning, speed of processing) that computer training can provide (Craig & Dunn, 2007; Edwards, Wadley, Vance, Wood, & Roenker et al., 2005). 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 several areas.

Jones and Bayen (1998) provide recommendations for teaching older adults to use computers:

1. Break up the instruction into small units with specific goals and relate new information to older adults’ existing knowledge.
2. Allow sufficient time during instruction for older adults to process events and information. Set aside time for class discussions so that older adults have extra processing time.
3. Provide more pauses during lectures so that older adults have time to take notes and allow them to ask questions during instruction to help clarify information.
4. Minimize the amount of reading required during instruction—or provide extra time for reading.
5. Allow older adults to practice each unit after it has been taught. Provide opportunities for students to complete hands-on activities at their own pace. Allow older adults to work in pairs during hands-on activities. Organize hands-on activities so that older adults work on only one specific task at a time. Have a sufficient number of instructors available to answer questions and provide support during hands-on computer sessions.
6. Adjust the “control panel” settings to accommodate older adults’ needs. Customize toolbars to include large buttons. Teach older adults to use “toolbars” that have buttons with images (icons).
7. Select computer programs, and options within programs, that use menu systems or graphical user interfaces (GUIs) instead of command languages. Select font styles and sizes that are easy to read. Make extra-large monitors available and position computer monitors to reduce glare. Adjust the colors of the text and hyperlinks to increase the contrast between the text and the background.
8. Familiarize older adults with online help features that accompany most computer programs to provide them with additional environmental support.
9. Be aware of and regulate other environmental distractions in the classroom such as unnecessary movement, extreme temperatures, and poor lighting. Choose an appropriate time of day to schedule classes.

STUDY POPULATION

Initially, we gathered data from our population to find if our activities would be right for this group. We didn’t have this information to better inform the first workshop session, but created a broad array of activities to be utilized if needed such as Word, PowerPoint, Excel, Internet, visual programming, computer and Internet safety. Initial survey data helped us to navigate to a better workshop design for subsequent workshops. We utilized the instrument Computer User Experience to find how computer savvy our audiences of seniors were to help us 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 our study, we discovered that in many cases self-reports were exaggerated.

METHODS

The goals of this study were to (a) enhance the skills of experienced computers users and (b) teach new skills to nonexperienced computer users. The areas that we targeted for the study were the learning of new computer skills, comprehension, and computer technology. The authors describe each targeted area, research methods, and procedures for data collection.

Computing Senior Workshops

We presented a series of three Computing Senior workshops. These workshops were designed for a population of senior citizens from the Auburn, Alabama community. Three workshops were conducted
at an Auburn University computer lab, and a subsequent workshop was conducted at a senior center in Auburn. Our rationale was to conduct workshops in familiar settings. But, in many cases, senior centers did not have computer facilities; therefore, we utilized campus labs. Our first series of workshops were scheduled for the spring 2007 semester. The plan is to continue the workshop series in subsequent semesters as long we find sufficient interest for new technology in the senior community.

During the workshop, we 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 was collected during the workshop. The user was presented with an informed consent to participate in the workshop. Next, seniors were given a prequestionnaire and then they participated in the workshop activity. After the activity, they were given a postquestionnaire.

Each workshop lasted three hours, and during that time we recorded workshop activities. In our plans for the fall workshop, we will include retrospective interviews of seniors and use either video, digital audio, or pictures to record the activities for future study of user interaction. We collected data with a survey of participants during the past workshops. For our future workshops, we plan to perform interviews as well.

During the workshop session, we provided individualized activities for each participant. During the first session, our initial plan was to introduce the seniors to visual programming techniques and direct manipulation (i.e., Alice 3D). Many of the seniors found this application amusing and focused on the tutorial materials. Some found it a very stimulating activity as they created their own 3D world. We had one gentleman, interested in aircraft, who created his own airstrip, plane, and pilot. On the other hand, some found it too complicated, which left them bored for not meeting their expectations (e.g., Web surfing and correspondence activities). Since the use of Alice 3D did not meet their immediate goals, some participants stated, “What are we going to use this for?” We explained the rationale was to become more familiar with new computing applications, but offered them another activity if they desired. Some of the main activities were using personal productivity tools like Microsoft Word, PowerPoint, Excel and surfing the Web. And you guessed it, they chose surfing the Web! But even in this compromise, we were able to expose them to some useful Internet applications like Google Maps and WebMD.
During the second workshop, we continued working with personal productivity software and Internet activities that would be immediately useful to our seniors (i.e., resizing their Web fonts to make them more readable, and saving bookmarks). During the third workshop session, we further explored productivity software by creating letterheads, using word art and clip art, and resizing images. Computing Seniors were also exposed to the editing tools in Microsoft Word, which gave them a greater ability to use different fonts and functions such as copy, paste, etc.

During all the workshops, we recorded input from the participants about the problems that they encountered with their home computer. Our plan was to assist them in recovering from these problems (usability or human error) to improve their computer efficacy. At each subsequent workshop, we provided answers to the questions that the participants had asked in the previous session. At the end of each workshop, we provided review materials for seniors to take home to support these newly learned activities. We were very pleased that a group of the seniors relied upon, and successfully utilized, these materials for their own use (i.e., self-report of materials use by seniors).

**In-Home Workshop Experience**

We conducted a workshop that involved going to our participants’ homes. The seniors were really enthusiastic with our visiting their home environments, and all seemed much more comfortable with using their home computers (Alexy, 2000). Each participant had many pragmatic questions relating to his or her personal computer experiences. Their questions ranged from e-mail issues to Internet issues to Microsoft Word issues. One of the e-mail issues was how to make the font larger so messages would be easier to read. This problem would trouble many from the senior training groups, but might not be evident to a young, keen-eyed designer. This question prompted a suggestion that they adjust the font within the Compose window of the e-mail application, and this resolved the problem for them in this case. Another e-mail issue that was addressed concerned printing from within the e-mail application. One of the participants had to use File—Print Preview to print the e-mail message because the Print View within the actual message window did not work. His e-mail program also did not remember his login password even though Save Login and Password was checked and he had followed what seemed to be the proper procedure. We identified this as a usability error and plan to alert the software company.
There were many questions that the participants’ had regarding the Internet. Questions were primarily about My Favorites and/or Bookmarks. They were not familiar with how to save frequently-visited Web sites, (i.e., Foxnews.com) to My Favorites or Bookmarks (depending on their Internet service provider). We taught each participant how to do this as well as how to install the Internet browser FireFox 2.0.

Others had problems with personal productivity tools such as word processing. Two of the participants had a question about Microsoft Word. They wanted to know how to enlarge the font within the application to make the screen easier to read. We showed them how to change the font to a larger size, but the larger font did not carry over to the pop-up menus. These menus automatically reset to the standard 12-point font. This brought up another suggestion: there should be a way to permanently change the font size to 14-point or 16-point so that the application is much more user-friendly to older users.

**PARTICIPANT REACTION TO WORKSHOP**

Based on survey information obtained from participants, many were very new to the information age and utilizing 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 evaluator observations during the workshop experience). This novice computer audience shaped the design of the workshops, with subsequent impact on our results. They reported that the most informative parts of the workshop dealt with basic computer usage, word processing, and an introductory lesson for visual programming in Alice3D. There were also some stimulating Internet activities offered.

The workshop consisted of many activities for text manipulation such as cut and paste. Individual attention was given to participants based on their needs. The focus was on how to better use a computer, and we gave seniors additional practice on their computer skills. Our plan was to present seniors with computer applications to bolster their interest in computing. One of the applications that we have had success with for other age groups was the Alice Visual programming software. For this audience, programming was one of their most frustrating activities. Nevertheless, participants indicated that Alice and Internet activities were their most fun activities. We attribute this to our participants being uncomfortable about trying something new. Even though they noted that the Alice 3D activity
was fun, they were initially frustrated and later appreciated the activity after they became more comfortable with it. But since it was a frustrating new activity, out of their comfort zone, our senior participants did not list it as one of the things that they would like to do in the future.

Our gauging of the level of understanding for workshop activities was good: all of our participants expressed that they understood all workshop activities. One of our 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 more motivated to try new computer projects. One participant reported, “I have a greater knowledge and enjoyed the sessions very much.” They were all excited to attend future workshops with searching the Internet as the topic of greatest interest.

Some Liked It, Some Didn’t, and We Lost Some

For some participants, we couldn’t pry them away from their books to participate because it was not a self-actualizing event for those individuals. The perception and reality is that computing in many cases is challenging, but it should not be. In many cases, it is challenging because designers have not taken into consideration the needs of the senior population since almost none of the developers are in the same chronological age group as this group of users. We cry out for universal usability!

WORKSHOP INSIGHTS

From our workshops, we found that our seniors were a very unpredictable group in that we were expecting a typical novice computer user group. Most of the novice groups that we have worked with in the past were children with little computer experience and even less experience of the world. When we began working with our seniors, we discovered a big group difference. Even if seniors didn’t know a lot about the computer, they were better able to express what their expectations were for their computing experience, and they had definite expectations for the use of their valuable time. Our seniors were very enthusiastic to work with the facilitators and appreciated our time; whereas, all of the children that we have worked with assumed that we have all the time in the world and were not as appreciative. We had a myriad of activities planned for the seniors, but they were very independent, and many came with their own agendas. They
wanted to learn to meet their immediate needs and did not really want to focus on any particular software. We had software exercises planned; but, instead, one participant wanted to know how to “download the music I received during the holidays.” All wanted to learn to better manipulate their e-mail and how to attach and download pictures. The set of activities that seniors wanted more experience with were activities beneficial to their immediate need to stay connected to the community. For our senior group, the majority was not primarily interested in learning to use productivity tools. Rather, they wanted to know how to utilize the computer to become more connected with their virtual community and family. They were very interested in keeping track of current events. We see this as a way for them to do a familiar activity in a new medium. They also appreciated the handouts from the workshops, which provided them support of the workshop activities and reinforced their new learning during their free time. Many desired more one-on-one instruction so as to not get lost during a group learning session.

Overall, our seniors were a very industrious and had good attention spans: all had anticipated longer sessions and more sessions. We attribute this to the maturity of the group as opposed to most of our younger novice computer users (e.g., children in grades K–6). For the younger group, more than 50 minutes is generally longer than their developmental attention span can handle—unless the activity is a TV program (leisure) or a video game (interactive).

**RECOMMENDATIONS**

**Some Issues with Assisted Technology for Seniors**

The senior population, which was largely bypassed by the first wave of computer technology, is finding it more and more necessary to be able to use computers. Yet, as they try to catch up, they find that they have a hard time learning to use computers. Computer classes and manuals tend to be directed toward a younger audience with basic technical skills (Bean & Laven 2003). In addition, older adults often struggle with just the computer hardware such as the mouse (e.g., one participant had a very hard time double clicking because of dexterity issues). Many need to learn the difference between single-click and double-clicks as well as the left-click and right-click buttons. For example, if a senior clicks the wrong button on the mouse, it causes error prompts.
These errors can be annoying and confusing to a senior who is a novice computer user; however, most senior citizens are persistent and have a thirst for knowledge. They view learning computers as a way to keep their minds alert and active. For example, in the July 31, 2007 issue of the East Bay Newspapers, there was an article stating that “Senior citizens are becoming tech savvy, with a little help.” One of the seniors that had been interviewed said “learning to use a computer is also good therapy for older people. I think it’s very good because it will keep (senior citizens) from vegetating and off the couch. It can help keep their mind alert and have a less chance of getting Alzheimer’s....”

**Training Senior Citizens**

Older adults can learn to use computers, and they can even become experts. But due to changes that occur with aging (Craig & Dunn, 2007), they require much more repetition and practice for new skills to become automatic (Bean & Laven, 2003). Printed materials such as handouts should be made senior-friendly by providing step-by-step instructions in simple, clear language. Also, handouts that include extensive, labeled graphics help keep their attention focused.

In learning to use a computer, seniors have quite a few strengths. They are much more concerned about making mistakes, which motivates them to spend extra time mastering new skills. Also, they have a great deal of perseverance and determination as demonstrated by taking notes and asking questions (e.g., they were able to try out things at home from their great notes).

**Addressing the Challenges of Senior Populations**

As we have discovered, senior citizens can reap many benefits from computers including acquiring new information through the Internet, keeping in touch with family and friends, and improving various skills. However, due to the effects of aging, computer applications and learning materials should be designed to facilitate the learning experience of senior citizens.

As people age, they have a decline in visual acuity (the ability to see fine detail) and experience higher sensitivity to glare and reduced sensitivity to color (Craig & Dunn, 2007; Zaphiris & Kurniawan, 2001). We also found that many of the seniors had decreased motor control and at least one—because of hand tremble—was not able to precisely click (i.e., double click). This might lead us to suggest that universal usability support with voice recognition or other multimedia
approaches might be better for this population. For individuals with low visual acuity, computer applications should use 12- or 14-point type, only sans serif fonts (Arial, Helvetica, Verdana), and a black type on a white background. Designers should create links that are distinct and easy to see, are fairly large in size, and have plenty of open space around them.

Also as part of the aging process, there seems to be a general slowing of cognitive processing speed (memory and attention capacity) and a decline in the ability to make fast movements (working with the mouse) (Craig & Dunn, 2007). To address this age-related decline in function, computer materials and applications should be designed with one of the best methodologies, which is user-centered design (UCD) (Zaphiris & Kurniawan, 2001). UCD is a philosophy and a process. It is a philosophy in that it places the person (as opposed to a thing) at the center; it is a process in that it focuses on the cognitive factors such as perception, memory, learning, and problem-solving as they come into play during peoples’ interactions with things. This UCD methodology has been adapted to only involve older users and is called “senior-centered design” (SCD) by Panayiotis Zaphiris at the Centre for HCI Design (Zaphiris & Kurniawan, 2001).

We strongly advocate the use of the senior-centered design when developing computer products and services, especially those that are targeted towards the aging population.

CONCLUSIONS

During this study, the authors found that seniors are not technology adverse; however, they want technology that supports activities that they are already familiar with. Many of the technologies that our seniors used, or wanted to experience, were extensions of applications they already use. Many wanted to check the news online and navigate, because they are familiar with newspaper format.

Also, they were willing to learn new technology as long as it has great usability and is not frustrating. When one uses some software and is able to say “that makes perfect sense” for the system to react that way, that points toward its great usability.

When considering a senior audience, many times the software that they use does not have great usability. This can be attributed to designer conceptual models being based on a younger perspective and not broadening their designs to support a wider range of users. Our hope is that this article will encourage software designers to be more sensitive to issues that impact senior populations (e.g., visual
acuity, tactile and motor responses, etc.) so that they can provide more universal usability in systems.

PRACTITIONERS TAKE AWAY

If developers relied upon Universal Usability when providing software, we would have more accessible systems. Many of the problems encountered by our seniors were things that would not occur to the mind of a 25-year-old software developer who lacks the physical limitations caused by time. With any computer activity, it is recommended to take short breaks every 20 minutes, and to stretch muscles to warm up before working (e.g., applications that keep this in mind would have better universal usability). Consider text messaging, an activity that is even more demanding on our dexterity. Texting is not suggested for long periods of time, especially with audiences older than 50 (i.e., where arthritis and joint strain may be more common). Studies suggest that users in the over 50-year-old demographic should only text for 20–30 minute intervals. Long term use of computers can also lead to eyestrain. These concerns should lead designers to create applications that would not keep users engaged for extensive periods of time (Hammond, 2005).

FUTURE PLANS

We plan to continue workshops in future semesters to increase computing competencies and gather more information about the novice computing seniors. Our hope is to improve their overall computer efficacy and satisfactory computer usage. With our Computing Seniors mainly interested in applications that improved their social networking and other activities that they are already involved in, participant interests will shape the type and scope of future workshop topics. Our future workshops will further develop Internet-savvy seniors through greater exposure to personal productivity tools. This indicates that segments on virtual community, Internet use, Internet safety, and financial management software (e.g., MS Money) could be very useful to Computing Seniors.

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