Computer and Internet Attitudes among Ethnically Diverse Older Adults: A Path Analysis

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Interdisciplinary Studies, Gerontology

by

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Dedication

This thesis is dedicated to my respected professors, Dr. Lagana’, Dr. Otten, Dr. Harrel-Smith, Dr. Lucero-Liu, and to my supervisor, Mr. Parham, as well as to my honorable parents.

Dr. Lagana’ has helped me through the difficulties and challenges that I have encountered in graduate school. She is always one step ahead of students as a shield and is open-minded enough to accept everything without judgment. Her door is always open, even if it is only problems that students ask her to discuss; not only does she listen, but she is a resilient soundboard allowing for the light at the end of the tunnel. She empowers to fight against injustice. Thank you Dr. Lagana’ for your continued support and your strength, as well as for being the chair of my thesis committee.

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Abstract

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The purpose of this study was to investigate whether demographic factors such as age, gender, and income, as well as self-reported cognitive failure, prior computer experiences, and state of anxiety, were significant predictors of computer attitudes among community-dwelling, ethnically diverse older adults (Mean age=68.01; N=161). Using the structural equation modeling software “EQS”, we performed a path model analysis to examine the possible significance of the various hypothesized factors in our computer attitude model. The findings of our analyses showed that the fit of our original model was somewhat adequate, but we needed to make several adjustments to it before we obtained strong fit indexes. Indeed, the fit of our final model was ideal: overall $\chi^2 (34, N=161) = 86.24, p < .00$, with perfect CFI = .877, NNFI =and RMSEA = .098. Several direct and indirect paths from some of the hypothesized predictors to computer attitudes were identified as significant. Most notably, prior computer experience strongly mediated the relationship among age, gender, income, and computer attitudes for seniors. Additionally, anxiety was a significant predictor of computer attitudes, although the anxiety-related result was not
as outstanding as the finding on prior computer experience. The numerous implications of our findings are discussed.
Chapter I: Introduction

Statement of Idea

In the past, aging populations and rapid technological development were irrelevant to each other but, in current developed societies, their conjunction has become ubiquitous. Adopting technology has brought human beings into a beneficial world. People have adapted to technology to manage their lives as various innovations have evolved, whether by the popularity of cell phones or by the convenience of home-based technologies. The Internet was introduced into people’s lives as well; everything that we do now has become associated with technology. Through computers and digital processes, the procedures and roles of daily life have been greatly revised. For example, whether one wants to conduct online banking using artificial intelligence application on one’s cell phone, or one looks for information using an online search engine such as Google, intensive interaction with a computer or online system is hardly avoidable. There are so many beneficial applications of computer technology. Among them, people with disabilities are capable of doing most things by themselves such as online shopping, as well as contacting friends or their workplace via an Internet interface, and have direct access to almost limitless information. Also, downloading and uploading materials such as software and documents is part of the construct of our life. Another example that demonstrates how computers benefit people’s lives with effective time-saving and personal convenience processes is the availability of government documents and materials online. Computer use has become compulsory across most domains of our lives, and people can pursue a vast range of personal goals through online services and connect to the Internet from a variety of places.
There has been much conjecture regarding the influential factors of older adults’ computer attitudes on their use of computers, especially due to the advancement and popularity of this technology. Cutler, Hendricks, and Guyer (2003) found that computer usage was highly associated with home computer availability. They also reported that home computer availability and usage has not been evaluated much among older individuals who do have access to computers at home. Perhaps the ease of computer access and availability might not be an issue for older adults when researchers assess their attitude toward computers and the Internet, but this has not been studied extensively yet. An explanation regarding computer attitudes suggested by Regan and Fazio (1977) is that attitudes towards technology influence the user’s willingness to accept and implement it, since behaviors tend to be guided by attitudes. Therefore, if computer and Internet attitudes are enhanced, it would theoretically increase computer usage in positive ways in any age groups, including older age groups.

Given the complexity of use of many technological products, cognitive abilities could possibly have a significant role in advancing comprehension, usage, and maintenance of those new products. Indeed, without taking prior computer experience into account, older adults who took self-paced word-processing instruction needed to spend almost twice as much time learning a new word processor as younger adults did (Charness et.al, 2001). Additionally, aside from the increase in learning time by age, age plays an affirmative role during the process of computer use prediction (Czaja et.al, 2006), with younger people using this technology more. Regarding the learning possibilities of older adults, there is a biased perspective among the general population that older people are technologically inadequate. Researchers have addressed the
relationship of computer technology use and one’s physiological and cognitive abilities change that often accompany the aging process, with better physical and cognitive functioning being positively related to such use (e.g., Purdie & Boulton-Lewis, 2003). In the same study, older adults reported that the major perceived barriers to learning this technology were deficiencies in cognitive functions, in particular attention and memory.

In view of the many concerns about the learning possibilities of older adults, the aim of prior research has been concentrated mostly on motor function, cognitive change, as well as perceptual sensitivity, given that these abilities seem most relevant to complicated computer use (Morris, 1992). Therefore, it appears that age and cognitive abilities are critical in our discussion of computer technology attitudes and use in older age, with cognitive abilities playing a potential mediator role between age and seniors’ learning performance in many areas, such as computer technology.

Nowadays, it is a trend to expose people’s lives to many computerized benefits, and the younger generations seem to be naturally adapting to operating technology. Conversely, it is a well-established finding that older adults use computer technology much less than other age groups (e.g., Morrell & Park, 1993; U.S Department Commerce, 2002). Indeed, older adults typically have more negative attitudes toward computers and similar technologies, and are less likely to use them as well, often because they believe that they are less likely than younger people to benefit from computer use, the Internet, or other information communication technologies (ICT) in their daily life (e.g., Brickfield, 1984; Russell & Drew, 2001). These two studies concluded that, perhaps, when older adults will clearly perceive the benefits of computers and other technologies, they will then seek new ways of doing things, in this case, they will seek to use computer
technology (Eisma et al., 2004; Purdie & Boulton-Lewis, 2003). In other words, older people would have a positive willingness to become more involved with computer technology use. A decade ago, Melenhorst, Rogers & Caylor (2001) had already suggested that older adults should be well conscious of this trend towards Internet use, and that if one is unaware of the advantages of a product such as a computer, he/she will not be motivated to use the product.

Several studies indicate that older adults are less interested in learning and using computer technology than are young adults (Czaja & Lee, 2001; Carpenter & Buday, 2007; Morrell, 2002). Indeed, especially if older adults are not cognizant of the benefits of computer technologies, they may not be motivated to learn them or to use them frequently. It is still an open question whether, once these misgivings are alleviated, older people will show positive attitudes and openness to computer technology. Technology is constantly changing, and older adults need to adopt new computer skills and learn all the new computer systems in order to keep themselves updated (Karvidas et al., 2005).

Are older adults starting to catch up on the digital divide? It is possible, as a recent Pew Internet Project (2010) revealed that the number of older-generation populations (65+) who participated in activities related to online communication and entertainment has grown faster than it did in 2005, particularly in using social networking sites such as Facebook and Twitter. However, when compared to younger generations, the percentage of computer and Internet usage among older adults is still lower, and older adults are also the least likely to see having no Internet access at home as a disadvantage. Hence, it is necessary for gerontology professionals to understand the reasons behind older adults’ concerns with computer technology and related negative attitudes towards
computers and the Internet to help them act on/influence their environment through computers, and to assist those who are at risk of activity disengagement and health-related decline (Cassel, 2002; Phelan et al., 2004). Findings from researchers who investigated older adults’ perceived barriers to learning in general (not computer-specific) generally show that seniors will directly inquire to learn about something if their needs are related to transportation, safety, and health, but needs related to technology are completely excluded (Purdie & Boulton-Lewis, 2003).

Mayhorn et al. (2004) found that, when older people were asked why they wanted to participate in a computer training program, they provided enthusiastic and positive feedback that was split into four different motivations: learning for pleasure, information searching, remaining active, and enhancing communication. The aforementioned researchers found that older adults actively sought computer training programs that taught them to become familiar with computers in general and with the Internet in particular (Czaja, 1997; Marrell et al., 2000; Morris, 1994). Computer technology attitudes are very likely to play an important role in whether seniors will pursue a computer education in the form of engaging in computer and Internet training and consequent use. Thus, in this study, we focused on variables related to computer technology attitudes, a topic that has been seldom investigated in prior research on ethnically diverse older adults, who are the target of this thesis.

**Purpose**

The purpose of this research was to study whether demographic factors such as age, gender, income, and ethnicity, as well as psychological factors, including self-reported cognitive failure and states of anxiety, are predictors for older adults’ attitudes
toward computer and Internet usage. Likewise, prior computer experience was hypothesized to be a mediator between older adults’ computer attitudes and the aforementioned demographic and psychological factors.

**Definition of Computer Attitude and Computer Use**

According to Ajzen and Fishbein (2000), computer attitude is defined as an attitude toward how computers affect one’s willingness to accept and practice its use, because ones’ behaviors tend to be guided by attitudes. Later, Ajzen (2001) also defined attitude as any belief or choice that involves an evaluation of some object, person, or event from negative to positive or vice versa. Attitudes then drive people to react in a certain way toward an object, person, or event. Likewise, Smith, Caputi, and Rawstrone (2000) defined computer attitude as an overall feeling of favorableness or unfavorableness toward computers and other computer-related activities.

The difference between the terms ‘computer use’ and ‘computer experience’ is that computer use is an externally observed interaction between people and computers that happens over time, which is considered to be an objective computer experience (Smith et al., 1999). Computer experience, on the other hand, is a mental state that reflects the feelings and thoughts that a person internally attributes to some preexisting computer event, and is considered as a subjective computer interaction experience (Smith et al., 1999). Therefore, computer use, computer experience, and computer attitude are three independent although likely highly related constructs, and the definition of these terms provided above offers a concise explanation of the central concept/outcome variable of the present study.

**Theoretical Framework**
The technology acceptance model (TAM) was a model developed and refined by Davis, Bagozzi, and Warshaw in 1989. This model conceptualized two perceived beliefs related to computer attitude: perceived usefulness (PU) and perceived ease of use (PEU); both beliefs together constitute the components of people’s attitudes when it comes to using existing information technology. Perceived usefulness was defined by Davis as “the degree to which people believe that using a certain system would improve their job performance,” and perceived ease of use as “the degree to which people believe that using a particular system would be free of effort.” In the other words, according to TAM, the easier the system use is perceived to be, the more likely it is that the system will be accepted by users.

It is difficult to distinguish the direct effects of individuals’ subjective perception of what other people think of their behaviors from the indirect effects that stem from unavoidable factors regarding their pre-existing attitudes about their intended behaviors (Davis, Bagozzi, & Warshaw, 1989). Hence, along with these entangled subjective and objective feelings and perceptions, one must wonder which factors facilitate individual responses to computers and Internet use, as well as what other personal traits elicit one’s instinctual reactions when sitting in front of a computer (Korukonda & Finn, 2003). Although, like all models, TAM is not comprehensive, this model provides a sound foundation for predicting computer and Internet attitudes among older adults in research, offering a plausible explanation of why older adults often refuse to use accessible computers and online systems. Based on the TAM model, we have postulated herein that computer attitudes are critical to computer use in older age; indeed, studying predictors of such attitudes is important, yet is usually neglected within the gerontology literature.
Chapter II: Review of Literature

Computer Attitude and Age

Several researchers in this field of study have investigated computer use, but not enough research is available on computer attitudes in older age. Thus, a young field called Gerontechnology has been promoted in recent years in order to identify the predictors of technology use in older adults and to determine how to design better technology products for older populations (Czaja & Lee, 2007; Stronge, Rogers, & Fisk, 2006). Moreover, Contarello, Sarrica, and Romaioli (2011) found there was a positive association between computer technology and active or positive aging, due to reasons including how helpful the new technologies are in assisting older adults with their aging processes and whether/to what extent these new technologies are seen as enslaving instruments for older adults. The authors in question also found that most participants (N=100) did realize that the Internet is a source of information, is useful, and represents progress, yet many seniors also criticized the Internet with descriptions such as that it was taboo, something unknown, complex, and dangerous. Overall, older adults regarded computers and the Internet in a generally positive way, even though they had judgments about its difficulty and its artifice. Furthermore, the results of this study suggest that a variety of other social and psychological variables have to be considered in the relationship between aging and ICT. Age differences regarding digital technology use is a preexisting factor to be considered regarding whether some people’s abilities trump over others or whether and how people of different ages adjust to computer technologies (either in similar or in a different ways).

The findings of several previous studies in this area indicate that maintaining
social contacts is the most frequent use that older adults have for computers, and
computer technology not only plays an important role in work, leisure, and health care
delivery, but also holds a significant position in prevention of age-associated impairment
(Charness & Boot, 2009). Moreover, learning plays an essential role in productive aging
(Ardelt, 2000; Withnall, 2000). Hence, Phelan et al. (2004) suggested that successful
aging is a multidimensional development and includes physical, functional, psychological,
and social health; in particular, learning is an important part of the process of active aging
(Boulton-Lewis et al., 2007). In the study by Boulton and colleagues, older adults
reported that the reasons why they needed and wanted to learn how to keep up-to date
with technology included wanting to make an effort in order to learn new things and new
activities, wanting to fulfill personal goals, feeling that they had more to do in life, and
wanting to learn to be confident. These responses suggest that seniors are aware of the
positive and self-motivated engagement with the future, and are generally proactive in
learning. Similarly, McMellon and Schiffman (2002) showed that involvement in many
online behaviors and activities contribute to older adults’ enhanced empowerment and
personal control. Internet use also seems to improve seniors’ well-being and sense of
empowerment by influencing their interactions, promoting their cognitive functioning,
and contributing to their experience of control and independence (Shapira, Barak, & Gal,
2007).

Chen and Persson (2002) found that Internet use among older people was
associated with greater sense of well-being, in contrast to other findings attesting to the
negative relationship between Internet usage and several psychological factors. Indeed,
older adults who learned how to use the Internet perceived more social supports and had
more positive attitude toward aging, according to Cody et al. (1999). Igbaria and Chakrabarti (1990) found that computer attitudes were negatively correlated with age. It should be noted that, during the mid-90’s, it was reported that, compared with younger adults, older adults have less positive attitudes toward computers and are less capable of using new technology (e.g., Czaja & Sharit, 1998; Ryan et al., 1992). However, after the millennium, scholars such as Broady, Chan, and Caputi commented that there are now fewer differences among age cohorts in this area, and that older generations’ attitudes regarding computer are increasingly positive (2010).

Overall, it seems that several exclusive features of computers and the Internet can enhance the quality of life of older adults as well as empower them. The use of computers and Internet among older adults contributes to better coping with this age group’s mental and physical difficulties. This results in aging with fewer difficulties, higher independence, higher social inclusion (less neglect) and more joy.

**Computer Attitude and Gender**

Gender discrepancies in the direction of more computer use or knowledge among older men as opposed to older women have also been found (Cline & Haynes, 2001). Older men are often more skillful than older women at using this technology, as they typically operate computers more easily and navigate the Internet more; older women have typically been somewhat under-represented online, and often report not gaining significant benefits from this usage (e.g., Durndell & Haag, 2002; Karvidas et al., 2005).

Schumacher and Morahan-Martin (2001) confirmed that competence and comfort levels with computers and the Internet are highly intercorrelated and either one could influence computer and Internet attitudes and behaviors. In the same study, they found
that women had less competency and comfort regarding using both computers and the Internet than men. The authors also pointed out that negative computer and Internet attitudes in women may affect levels of comfort and competency with this technology. Moreover, the results of previous research show that women have less positive attitudes towards computers than men (e.g., Dyck & Smither, 1996). Particularly, when computer anxiety was factored in together with interactions with computers, greater gender differences were found (Whitley, 1996). Regarding the related issues of liking computers, gender, and age difference, young women appear to like computers less than young men, while there are no differences between older women and older men, according to Dyck and Smither (1994).

**Computer Attitudes and Income**

With regard to the relationship between income and computer attitudes, many previous studies targeted younger-generation participants such as college students or teenagers (e.g., Williams et al., 2011). Income appears to be strongly related to computer use in a national sample (e.g., U.S. Census Bureau, 1984, 1989, 1993). However, very few studies have investigated income as a potential predictor of computer attitudes among older adults. Kelly et al. (1999) found that income was associated with the opportunity to use a computer rather than with whether people were motivated to use computers. Porter and Donthu (2006) identified income as an important factor related to older adults’ perceptions of access barriers towards computer usage. A major perceived barrier to access for both computers and the Internet is the worry regarding the needed financial investment related to the purchase of a) a personal computer and b) Internet access devices. These financial considerations are very often the main reason why low-
income people of all ages, including financially disadvantaged older adults, refuse to use a computer (Fisk & Rogers, 2002; Venkatesh & Brown, 2001). Older adults with higher levels of income are more likely to use the Internet for information searching as well as for online shopping (Gervey & Lin, 2000). Eastman and Iyer (2004) confirmed previously established results that older adults with higher incomes are more eager to utilize the Internet not only by gradually using more online services, but also by reporting being more comfortable with purchasing products online. One’s subjective perceptions about the costs of technology use may be conceptualized as a belief that both computer use as well as Internet usage are expensive and difficult. Thus, according to the Technology Acceptance Model (TAM), the perceived belief is mediated by one’s attitude and is likely to influence one’s technology use (Davis et al., 1989).

**Computer Attitudes and Ethnicities**

Stanley (2003) suggested that African-Americans and Hispanics are more likely to report higher perceived access barriers related to Internet and computer usage, regardless of whether they in fact perceive that access to the Internet is cost-prohibitive. Also, minorities such as African-Americans and Hispanics typically have lower than average incomes, and this justifies their perception of the expensive cost of computer usage (Humphreys, 2004).

**Computer Attitude and Prior Computer Experience**

Some research findings suggest that prior computer experience mediates attitudes toward computers. For instance, Hawthorn (2007) suggested that older adults’ negative computer attitudes may be caused by their limited level of experience with computers. Therefore, prior computer experience may play an important role in influencing computer
attitude among older adults.

Dyck and Smither (1994) reported that older adults actually show more positive attitudes towards computers and less computer anxiety than younger adults; however, with higher levels of computer experience, both older and younger adults tend to have more positive computer attitudes and feel less anxious about computer and Internet usage. In the same study, there were no gender differences in positive computer attitudes and computer anxiety when the factor of prior computer experience was controlled for (1994). Moreover, several studies indicate that older adults may hold concerns about computers and computer technology use (e.g., Eisma et al., 2004; White & Weatherall, 2000). Renaud and Ramsay (2007) found that not having prior computer experience is likely to impede an older adult’s attempt at learning how to use computers, while younger people without prior computer experience have less troubling learning. In acquiring new skills, seniors are more likely to call upon past experience; hence, lack of prior computer knowledge could inhibit older adults from greater acquisition of computer-related skills and use (Baltes, Staudinger, & Lindenberger, 1999). In addition, the frequency of computer usage as well as perceptions of Internet usefulness can affect positive attitude changes toward computer technology among older adults (Kelley et al., 1999).

**The State of Anxiety and Computer Attitude**

Concerning the association among gender differences, anxiety, and computer attitudes, the results from previous studies are conflicting. Several studies do indicate that older males feel less computer anxiety than do older women (Durnell & Haag, 2002; Koohang, 1989), whereas findings from other studies showed that there is no gender difference in computer anxiety (e.g., Heinssen, Glass & Knight, 1987; Woodrow, 1991).
Indeed, the topic of computer attitudes in relation to gender differences seems to be influenced by many elements simultaneously (Aguirre-Urreta & Marakas, 2010).

With regard to the simple relationship between anxiety and computer attitudes, Kelley and Charness (1995) found that negative computer attitudes and high anxiety levels do not influence older adults’ computers task performance very much. Rather, several authors have suggested that older adults’ computer attitudes were actually modified by certain conditions such as the length of time of the training program (usually more than two weeks), training strategy, and prior computer experiences (e.g., Charness, Schumann & Boritz, 1992; Dyck & Smither, 1994; Jay & Willis, 1992). Czaja et al. (2006) found that attitudes toward computers vary as a function of age, and reported that older adults (60-91yrs old) showed more computer anxiety and lower computer self-efficacy than did younger and middle-aged adults.

There is empirical evidence showing that computer attitudes are negatively correlated with computer anxiety and, in turn, individuals with higher anxiety towards computers are more likely to have negative attitudes towards using this technology (e.g., Igbaria & Chakrabarti, 1990). In addition, computer-related anxiety seems to increase with age (Laguna & Babcock, 1997), with greater computer experience being associated with more positive computer attitudes and lower computer anxiety in older adults (Czaja & Sharit, 1998; Dyck & Smither, 1996; Ellis & Allaire, 1999).

**Computer Skill Acquisition/Prior Computer Experience and Cognitive Failure**

Martin (1983) explained that cognitive failures are cognitive-based mistakes that result in errors. Cognitive failures have been connected with behavioral outcomes such as driving accidents (Larson et al., 1997; Larson & Merritt, 1991) and stress vulnerability
(Broadbent et al., 1982; these authors created the questionnaire to assess this variable used in the present study, i.e., the Cognitive Failure Questionnaire, abbreviated as CFQ). Other researchers have proposed that the CFQ can be used to measure more than its original three constructed factors, which are memory, perception, and motor function. In this regard, the CFQ could also be used to assess items such as physical clumsiness, forgetting people’s names, forgetting planned social interactions, forgetting how to talk, lack of concentration, inattentiveness, and distractibility (Larson et. al., 1997; Matthews et al., 1990; Pollina et al., 1992). Additionally, CFQ questions such as “Do you find you forget appointments,” seemed not only related to memory function loss but also to attention and action control processes. In turn, CFQ items measure not only pure indices of memory, attention, and action, but also identify whether cognitive impairments in other brain areas are greatly involved (Merckelbach et al., 1996).

Indeed, examining cognitive impairments among older adults is important, because individuals’ everyday functions rely on complex cognitive tasks and, generally speaking, computer tasks are relevant to cognitive demands. Research on ethnically diverse samples (e.g., Mehta, Yaffe, & Covinsky, 2002) shows that older adults are at strong risk for a variety of problems, such as worsened performance in their functional activities of daily living (including bathing, eating, toileting, dressing). Hence, there is agreement on the notion that current computer designs for older adults should be modified, and that it is also necessary to create specialized computer training programs in order to meet the broad learning criteria demanded by older adults (Morrell & Echt, 1996).

Czaja and Lee found that older adults are more excited to learn how to use
computers and the Internet whenever training opportunities are provided to them (2001). Therefore, computer training programs specifically aimed at older adults are likely to improve their attitudes towards computers and the Internet. Previous research findings indicate that older adults would have better computer performance when the training program has guided action or intervening trainers (e.g. Hickman, Rogers & Fisk, 2007; Slegers et. al, 2006). Moreover, Wright (2000) found that older adults who used e-mail for socializing more frequently had greater satisfaction because of their online social support network. Based on these findings, offering specialized computer training programs for older adults could enhance levels of motivation to learn computer technology among older adults, and they could induce positive attitude changes towards computers in older age.

Computer attitudes and cognitive abilities are predictors of computer usage among older adults, and using a computer in older age allows seniors to engage in a variety of productive and socially satisfying activities (e.g., Charness & Boot, 2009; Mitzner et.al, 2010). Also, experiencing cognitive failure among those having disadvantaged demographic characteristics (such as much older age, financial limitations, and being a woman in an often sexist environment) plays a significant role in levels of personal confidence as well as general quality of life (e.g., Slegers, Boxtel, & Jolles, 2008).

**Cognitive Failure and State of Anxiety**

Cognitive failure scores (CFQ) have been positively correlated to severity of anxiety as well as to major depressive syndromes, including both seasonal and affective disorders, with CFQ scores providing evidence of individual cognitive changes that are
negatively impacted by anxiety and depression (Merckelbach et al., 1996; Sullivan & Payne, 2007). Also, individuals’ differences in self-perceived daily cognitive failures and in state of anxiety among older adults are associated with ones’ varied abilities for fluid and crystallized skills (Hayslip & Cooper, 2012). Moreover, Hayslip (1988) suggested that there is a similarity between the association of older adults’ anxiety and cognitive variability and the connection between personalized problem-solving characteristics and fluid abilities. Based on the previous findings, perhaps people’s perceived senses of control about their cognitive changes may lead to their experience of anxious feelings about their everyday activities.

According to the findings from previous studies briefly reviewed above, sense of control may benefit older adults by minimizing the negative occurrences of cognitive failures and costs related to aging (Lachman & Firth, 2004; Miller & Lachman, 1999). In turn, if one exerts great efforts at learning new things such as how to use computer technologies (which could reduce the cognitive declines typically associated with aging), the sense of control achieved by engaging in such activities might help older adults acquire new technology skills easily and could lead to higher self-efficacy as well as more useful coping styles, given that the latter are highly associated with anxiety and affective disorders. Also, Huston (1989) found that cognitive failures are related to ones’ individual characteristics such as social anxiety and self-consciousness. Considering these available findings, a collided process between changes in cognitive ability in people’s later life and their anxious feelings, as well as their perceived sense of control, may mediate their levels of anxiety, thus contributing to cognitive changes.
Research Questions/Hypotheses

As suggested by the results of a previous study by Lagana et al. (2011) on older adults’ computer attitudes, the existence of non-orthogonal dimensions of the measure used herein to quantify them (named “OACTAS” and described later on) indicates that older adults’ attitudes regarding computer technology are not easily compartmentalized. Moreover, these attitudes are more like a process of feedback in which each dimension of attitudes is entangled with the others, eventually influencing overall attitudes towards computer technology in general. Czaja et al. (2006) found that more (i.e., higher frequency of) technology use was associated with younger age and higher education. In their study, conducted on a sample of 1,204 participants, Blacks/African Americans used the technology less than Whites/European Americans and Hispanics/Latinos.

In view of the aforementioned findings, the following hypotheses were formulated in the present research regarding selected demographics, i.e., age, gender, income, and two major ethnicities (White, Hispanics, versus other) in our subject recruitment area: (1) lower age, higher income, and Caucasian status were predicted to be related to higher total computer attitude scores; (2) male gender was hypothesized to predict higher computer attitude total scores; and (3) lower age and higher income were envisioned as predictive of lower cognitive failure.

With regard to the aforementioned psychological predictors (i.e., cognitive failure and anxiety): (1) we expected them to be highly related, and to be the two mediators of the relationship between demographics and the total scores of computer attitudes. Specifically, (2) we hypothesized that higher cognitive failure would be predictive of
lower total computer attitude scores. Furthermore, concerning anxiety: (1) we expected higher anxiety levels to be related to lower total scores on computer attitudes (not to any specific factor within the computer attitudes’ construct).

As to prior computer experience, we hypothesized it to be a critical mediator, in that (1) we anticipated that higher levels of prior computer experience would be related to lower age, being male, and higher income; and (2) we also expected lower prior computer experience to be related to higher cognitive failures. Additionally, (3) this predictor was exploratorily conceptualized as a mediator between demographics and computer attitudes.
Chapter III: Methodology

Participants

As part of a longitudinal study conducted by Dr. Lagana on older adults’ computer attitudes and related quality of life issues, 161 community-dwelling older adults (90 women and 71 men) recruited from the greater Los Angeles area, were recruited through an effort that focused on ethnically diverse populations. Ages ranged from 52 to 94 (Mean = 68.01 years, SD = 8.03) years old, with 82 participants having prior computer experiences while 79 older adults had no experiences with computer before. A total of 46.6% participants evaluated themselves over seven in total scores on the Beck Anxiety Inventory (according to Beck, Epstein, Brown, & Steer, 1988 & 1990, total scores over seven indicate mild anxiety).

Table 1 lists the demographic characteristics of the sample and all the descriptive statistics and frequencies for our variables. Over one fourth of the participants self-identified their ethnicity as other or mixed. Almost forty percent of the respondents were White European American. Moreover, participants reported a variety of educational backgrounds normally distributed into all fields, and over two thirds of the participants finished or completed a high school diploma. Regarding income information, three participants missed answering the question, 9.3% participants refused to answer, 5.6% of the people did not know how much they earned in a year, 26.1% persons earned less than $20,000, 24.8% of the people were in the group earning over $20,000 but less than $40,000, and 32.3% of the respondents made over $40,000 per year.

Design

This research is based on an archived dataset collected by professor Lagana’s
research assistants. The present study is also the continuation of a study published in 2011 by Lagana et al. on older adults’ computer and Internet attitudes (testing a new assessment tool on this topic). The association between socio-demographic attributes such as age, gender, and income as well as cognitive failure level, prior computer experience, and the state of anxiety was investigated herein in order to predict seniors’ attitudes towards computer technology.

**Procedure**

All the participants interested in this study were assigned a code number for confidentiality reasons, and research assistants did not record any names. Undergraduate and graduate students of Dr. Lagana collected the data in Los Angeles County, recruiting participants at locations including churches, parks, and libraries. The sample was gathered using convenience and snowball sampling, as older adults were interviewed individually at their own homes or at locations such as the CSUN library. Participants responded verbally when asked several questions contained in a booklet of questionnaires; the interviewers carefully wrote the responses in the booklet. Via the assessment tools described below, basic demographic information was collected, such as gender, income, educational background, and age. Moreover, selected variables were assessed, including prior computer experience, one’s state of anxiety, cognitive failure level, and attitudes toward computers and the Internet.

**Measures**

**Cognitive Failures**

*Cognitive Failure Questionnaires.* The *Cognitive Failure Questionnaires* (CFQ; Broadbent, Cooper, FitzGerald & Parkes, 1982; Wagle, Berrios & Ho, 1999) is a
questionnaire developed to assess daily cognitive functional difficulties including errors in perception, memory or actions that may lead to injury in self or others. The CFQ consists of 25 questions that assess the regularity of particular mistakes such as forgetting names, losing one’s temper easily, and feeling regretful or having trouble making up the mind within the past six months. The items of the CFQ are negatively worded and rated by degree of occurrence on a range from 0 to 4, with the description of ‘0’ = never and ‘4’ = very often. The maximum score of the CFQ is 100. According to the factor analytic procedures from Broadbent et al. (1982), high internal consistency of CFQ has been demonstrated. Rabbit and Abson (1991) have disagreed regarding the validity of the CFQ, suggesting that CFQ scores do not reflect associations with aging and are not indices of early stages of severe cognitive impairment. However, a recent longitudinal study provided affirmative support for the validity of CFQ scores and showed good evidence that such scores are indicative of age-related changes of memory function and brain activity among older adults (Hohman et al., 2010).

Anxiety

Beck Anxiety Inventory. The Beck Anxiety Inventory (BAI; Beck et al., 1988) was developed to measure the severity of anxiety in adults and young people. The 21-item multiple-choice self-report inventory contains descriptive symptoms of emotional, physiological, and cognitive aspects in the state of anxiety, but not depression. It can discriminate symptoms of anxiety disorder, such as panic disorder and generalized anxiety disorder, from depressive disorders such as major depression or bipolar disorder (Leyfer, Ruberg, & Woodruff-Borden, 2006). Within its multidimensional 21-item scale, several clear and simple descriptions of the symptoms of anxiety were collected and put
into the measure, including four main aspects: (1) subjective (e.g., “unable to relax”), (2) neurophysiologic (e.g., “shaky and hands trembling”), (3) autonomic (e.g., “sweating”), and (4) panic-related (e.g., “fear of the worst happening”).

The BAI is qualified for use in the general population and for individuals with intellectual disabilities, and only takes five to ten minutes for individuals to complete. Also, according to its concise descriptions of the possible uses of this inventory, visually impaired persons are able to have the inventory administered orally by professionals or paraprofessionals with adequate training and experience (like we did in the present study). Hence, if older respondents are experiencing cognitive impairments, they would still be able to answer the questions contained in the BAI. As already mentioned, seven is the clinical cutoff score of the BAI, with people achieving a score of 7 or more having at least mild, medium, or severe anxiety.

**Attitude toward Computer and Internet Use Among Older Adults**

Although there are several scales designed for the investigation of attitudes towards computers, such as the *Internet Attitude Scale* (IAS) by Zhang (2007) and the *Attitude Toward Computer Scale* (ATCS) by Richter, Naumann and Groeben (2000), the existing scales were developed for undergraduate and graduate students to study perceptions of computers and Internet. Another example is the *Attitudes Toward the Internet Scale* (ATIS), which was designed for attitude examination within college students who use the Internet; ATIS’s strong content and construct validity has been well-documented (Morse et al., 2011). Some researchers have used scales that were designed for younger individuals to assess computer attitudes in older age. For instance, Jay and Willis (1992) used the *Attitude Toward Computer Questionnaires* (ATCQ),
which was originally created in 1989 by Jay for examining college students’ attitudes towards computers, to test computer attitude among older adults (Lovell-Martin, 2009; Segrist, 2004). Overall, most of the published computer attitudes studies have targeted younger generations. Hence, there is no qualified computer attitude scales available for older populations, especially for seniors of age 65 years old and over, other than the one discussed herein. To circumvent the aforementioned problems, Dr. Lagana’s *Older Adults’ Computer Technology Attitude Scale* (OACTAS) was adopted in the present study in order to properly assess computer attitudes within an older sample.

The *Older Adults’ Computer Technology Attitude Scale*: this scale was developed and revised by Dr. Lagana (OACTAS; Lagana, 2008 & Lagana et al., 2011; see Appendix A) for use with older adults in particular. It is a new measure of attitudes toward computer technology in older populations. The original version contained in the appendix is a 22-item questionnaire that categorized computer technology attitudes into four components: (1) Comfort Communicating via Internet (CCVI), (2) Satisfaction with Available Computer Technology (SACT), (3) Physical Comfort with Computer Technology (PhyCCT), and (4) Psychological Comfort with Computer Technology (PsyCCT). Among these aspects, all the items were phrased adversely. The disinclined expression of computer technology use was used in order to encourage truthful responses from seniors potentially unfamiliar with computer technology such as the Internet. This tool was successfully pilot-tested by Lagana in 2008 on a small size sample (N=32; Cronbach’s α=0.88). However, given the very limited sample size of the 2008 pilot study, the feasibility of this tool needed to be verified; thus, in a follow-up study conducted in 2011 by Lagana and her colleagues, this measure was re-tested. In 2011, according to
the results of the item-total correlations for each of the OACTAS statements, five items were eliminated because of their weak inter-correlation (having an item-total correlation lower than 0.30; Tabachnick & Fidell, 2007). On review, these items contained unwanted attributes such as being dismissed and/or not being precisely associated with a measure of attitudes toward computers. The reliability of the revised OACTAS was found to be very strong (Cronbach’s $\alpha=0.92$).

Based on the findings of the previous studies by Lagana` (2008) and Lagana` et al. (2011), in the present study, the seventeen items of the revised OACTAS were coded as a seven-Likert scale format and the responses ranged from ‘-3’, “strongly disagree”, to ‘+3’, “strongly agree.” The scales were scored reversely in the data analyses; therefore, in the present study, higher numbers imply more positive attitudes toward computer technology.
Chapter IV: Results

Analysis 1: Descriptive Statistics and Data Screening

For all assessed demographics, we first ran descriptive analyses in SPSS (Version 19.0) and calculated all scores in order to eliminate participants with missing data; seven of the recruited participants were excluded from the original sample of N=168. Hence, the sample size was reduced to N=161, and range scores were provided whenever applicable. In addition, there was only one missing data among cognitive failure total scores; it was imputed using the mean score of 35 (M = 34.6).

Moreover, because there was only one person with intensive computer experience, this participant was put into the group of people who had quite extensive computer experience. Additionally, concerning ethnicities, Black/African Americans, Asian Americans, and Mexican Americans were some of the minorities included in this study, which accounted for 4.3%, 10.6%, and 8.1% of the 161 participants respectively. Given the low sub-sample size for these ethnic groups, we chose Caucasian/ White American versus Hispanics/ Latinos as the ethnicity variable in the path analysis conducted, and grouped the rest of the ethnicities as “other ethnic groups” all together.

Analysis 2: SEM

A path analysis was run to test the relationship among our variables; this analysis is a variant of structural equation modeling (SEM). According to Byrne (1998), path analysis takes an accurate method such as hypothesis testing and applies it to the multivariate analysis of a structural theory. By using this analytical approach, the proposed causal relationships under investigation in our original model are displayed by a chain of structural equations (i.e., regressions), and these structural equations can then be
The EQS structural equations program (Bentler, 2007) was used to test the proposed model in Figure 1. EQS produces several fit indices to assess how well the proposed model fits the sample data. First, the maximum-likelihood chi-square ($\chi^2$) statistic (at $\alpha = .05$) was used to assess the goodness of fit between the sample covariance and fitted covariance matrices (Byrne, 1998). The smaller values indicate a better fitting model and, with the higher probability associated with chi-square, a closer fit between the proposed model and a perfect fit. In addition, other indices were used to assess the appropriateness of the proposed model to the sample data. These indices included: the Goodness of Fit Index (GFI), the Non-Normed Fit Index (NNFI), and the Comparative Fit Index (CFI). Values for these indices, .95 and above are typically indicative of optimal fit and, in turn, if these indices have larger values, this suggests a better fit (Hu & Bentler, 1995; Schumaker & Lomax, 1996). Furthermore, the Root Mean Square of Approximation (RMSEA) is another fit index, which takes into account the error of approximation in the population (Byrne, 1998). RMSEA values less than .06 indicate good fit, and values of .08 or less indicate reasonable errors of approximation in the population (see Preacher & MacCallum, 2003). Values of .08 to 1.0 indicate mediocre fit, and values above .10 indicate poor fit.

First, concerning our proposed model, the fit indices showed that this initial model was not a perfectly fitting model for the sample’s data ($\chi^2=115.45$, df =27, $p<.001$). The values for the NNFI, CFI and GFI were .64, .73, .86, respectively. The Root Mean Square Error of Approximation was .14, indicative of a poor fit. Thus, post-hoc model modifications were performed next, in order to find the best fitting model for the
sample’s data. For this purpose, the Wald test was conducted and implemented via the deletion of several insignificant relationships between variables, including those between age and cognitive failures, age and prior computer experience, gender and computer attitudes, gender and prior computer experiences, income and computer attitudes, as well as prior computer experiences and cognitive failures. These deletions made the final model more parsimonious.

Path analysis allows for the adjustment of models via the aforementioned post-hoc analysis (Byran, 1998). The adjustment of the specified model is based on modification indices that ultimately point to the unspecified paths that, through withdrawing, may improve model fit. Modification indices can be conceptualized as chi-square statistics with one degree of freedom, which represent the predicted change of estimation for each fixed parameter in the model, and modification indices provide important information regarding the sensitivity of the evaluation of fit to any parameterization of the model (Bryne, 1998). The higher the value of the modification index, the more the overall fit of the model would improve if the parameters were deleted from the model (Kline, 2010). Researchers are allowed to specify models, usually starting with the freeing parameters with the largest modification indices, given that these are also substantively meaningful (Bryne, 1998).

Hence, model reduction was applied to our hypothesized model, as paths with highest standard errors were removed consecutively until a structural model was attained in which all paths were significant (please see Table 2 for the sequence of these modifications). After our original model was reformed, the best fitting overall model ($\chi^2 = 86.24$, df = 34, $p<.001$) was calculated for the entire sample ($N= 161$), as shown in Figure
2. The fit indices for this revised model indicated a good model fit. Fit statistics were greatly improved from those that were originally obtained. The new values for the NNFI, CFI, and GFI were .84, .88, and .90, respectively. The new Root Mean Square Error of Approximation was .09, also indicative of a good model fit. There were other two correlations that were found to be significant; one was expected (the relationship between cognitive failures and anxiety; $r = .48, p < .05$) and one was not in our original model, the association of gender with income ($r = .20, p < .05$), thus it was added to the final model.
Chapter V: Discussion

Discussion of the Findings

A revised version of our original model fit our data well. Although we did not put the gender-income relationship in our model, the findings of this study revealed that income and gender were significantly correlated to each other. This result corroborates many prior findings showing that men have higher income than women at all ages (e.g., Judge, Livingston & Hurst, 2011; Roszkowski & Grable, 2010); we did not have it in our original model because we did not want to assume that a gender-based income differential was still in place in a progressive area such as Los Angeles County in 2012, but, unfortunately, it is. Additionally, like we expected (in view of the available literature), prior computer experience, anxiety, as well as age predicted older adults’ computer attitudes directly.

In this study, prior computer experience in particular proved to be a variable that was critical within our improved model. Although anxiety was a significant predictor of computer attitudes, this result was not as outstanding as the findings on prior computer experience. The latter strongly mediated the relationship between income and our outcome variable, playing a large role in predicting computer and Internet attitudes. In other words, our findings show that older adults with higher incomes had higher levels of previous experience with computers and, in turn, more positive computer and Internet attitudes.

Moreover, cognitive failures and anxiety were also related to each other as we predicted, indicating that the higher the cognitive failures’ total scores, the higher the levels of anxiety that older adults reported and vice versa. Furthermore, higher income
predicted lower cognitive failure, which is a reasonable finding, as older adults who have
good income could afford to engage in activities and buy things such as memory
supplements to minimize cognitive failures, as reported by researchers such as Huisman,
Kunst and Mackenbach (2003) as well as Andresen and Brownson (2000). The strong
association between lower socioeconomic status (SES) and negative health outcomes
such as lower cognitive functioning among older people has been well-documented, and
indices of poverty have been found to be predictors of cognitive failures in several
research populations (e.g., Keskinoglu et al., 2006; Tung & Mutran, 2005). The findings
of the present investigation also showed that older adults with higher income have lower
levels of cognitive failures; in turn, this is related to lower anxiety levels and better
computer attitudes. Our findings are not longitudinal, so they do not imply causation, yet
they are interesting and require further research.

There were several predictions formulated within our proposed model that were
not supported by our findings. Among other non-significant findings, ethnicity did not
matter in the prediction of computer attitudes; this suggests that our revised model could
apply to older adults from a variety of ethnic backgrounds. We did not hypothesize this,
reasoning instead that non-Caucasian seniors would be more shielded from the typically
American/commercial pressure to use computer gadgets and thus would be more adverse
to computer technology; however, this was not the case in our sample. Also, age was not
significantly associated with cognitive failure or with prior computer experiences,
although many aforementioned studies on this topic found aging to be an influential
factor in learning and performance, as well as in cognitive problems. Indeed, some
studies have shown that the changes in one’s fluid intelligence (which, in turn, is
involved in changes within one’s cognitive abilities such as short-term memory and speed of processing) differ widely individually, and this change was found to be the most influential factor concerning whether older adults were motivated to learn new skills such as computer technology (Czaja & Lee, 2007).

The fact that, in our study, age of the older adults recruited did not predict prior computer experience with age is an encouraging finding, considering that the age range of our sample was 52 to 94. This result suggests that being in one’s 50s or 90s does not make a significant difference in the lives of seniors concerning how much computer experience they have had. This is an indication that it is possible for seniors of all ages to learn how to use computer technology, which in turn is related to their computer and Internet attitudes, as found in the present study. The latter are modifiable, as reported in prior literature (e.g., Lagana`, 2008); therefore, by exposing older adults to computer experiences, their computer attitudes could be enhanced, and this could in turn increase their motivation to use the computer and the Internet. Importantly, such usage is related to better quality of life in older age, as already mentioned, with computer-based training interventions having the potential to improve older adults’ psychological well-being as well as decrease social-isolation (e.g., White et al., 1999).

We also found no gender differences in computer attitudes and in prior computer experiences in older age. This result refers exclusively to computer attitudes, not use; thus, it does not directly contradict the findings of some previous studies (i.e., Durndell & Haag, 2002; Karvidas et al., 2005) in which older men were found to be more skillful than older women in using computer technology (as they typically used computers and surf on the Internet more). More research is needed on this topic to elucidate whether
more negative computer attitudes held by older women (as opposed to older men) do translate into lower frequency of use of computer technology for women in their later part of life. The relationship of age, gender, and computer attitudes is complex, as shown in a study by Dyck and Smither (1994) in which young women had lower computer liking than young men, yet there were no differences between older women and older men regarding computer liking. Certainly, this area of study needs more in-depth investigations of the variables targeted in the present study.

Again, prior computer experience was a main factor in the results of the present study, thus this variable should be put more into perspective. Briefly, recent research conducted by Buse (2010) suggests that the experience stemming from using computing technology (including a typewriter many years ago, a variable not assessed herein) remains grounded in one’s embodiment. Thus, had we not controlled for prior experiences with computer technology, we would have confounded our results with technological body techniques (involving embodied knowledge grasped through action; Crossley, 2007) possessed by those seniors who had some prior computer and/or Internet experience. In the case of positive prior experiences, participants would likely have been more comfortable with this technology than individuals without such positive experiences, both physically and psychologically, and vice versa.

Because Buse (2010) pointed out that computer-related attitudes, experiences, and physical comfort are critical variables to be considered in older age, it is very important to provide older adults with positive initial experiences with computer technology at different levels, wherever they are at, and to successfully increase their abilities at a comfortable pace. The quality of such experiences could significantly
characterize older adults’ future interactions with new technology. As mentioned earlier, frequent computer usage has become a significant contributor to enhancement of quality of life recently, yet it is likely (although beyond the scope of the present study) that negative initial experience with computer technology could make older adults disengage from/avoid computer and Internet use. In order to minimize this, clinicians and other service professionals who believe in the value of computer technology use in older age could refer them to community-based, affordable computer and Internet training tailored to the needs of older adults.

**Need for Future Research, Limitations, and Conclusion**

There are many topics related to computer attitudes that should be explored in future investigations, as our model did not contain all possible predictors of this outcome variable. For instance, it would be interesting to study the potential factorial relations among older adults’ coping styles, state of anxiety, self-efficacy, and cognitive failure as they simultaneously relate to computer and Internet attitudes. It should be noted that, in some previous studies, researchers have transferred the focus of research in this area from attitudes towards computer technology’s hardware to Internet-driven attitudes (e.g., Anderson, 2005; Durndell & Haag, 2002; Tsai, Lin, & Tsai, 2001) while, in the current study, we used the revised OACTAS scale, which combines both computing and Internet attitudes. Therefore, we did not separate computer and Internet attitudes (although one sub-scale of the OACTACS does target Internet attitudes in particular). In the future, it would be interesting to assess more in-depth the specific attitudes concerning the Internet in older age, as this would give us an idea of what is most valued online by older adults.

Moreover, in previous studies, positive computer attitude changes were observed
during short training time (less than two weeks) of older adults who previously had poor computer task performance (Ansley & Erber, 1988; Czaja et al., 1989). Therefore, attitude changes toward computer technology as well as better computer task performance among older people are not necessarily dependent upon the length of computer technology training; more research (beyond the scope of this study) should be conducted on this topic, comparing training protocols of different lengths. Also, we have learned from prior studies that computer attitudes are not typically associated with general levels of anxiety or with initially high anxiety levels that then diminish gradually once older adults engage in training sessions (e.g., Charness & Bosman 1992; Jay & Willis, 1992). However, age does play a role in this discussion, as Laguna and Babcock (1997) found that older adults indeed have higher levels of anxiety toward computer technology than young adults. According to our results, anxiety was a mediator of cognitive failures (in turn, predicted by income) and computer attitudes.

In view of our findings, in further research, the link between demographics such as income, variables including cognitive problems, anxiety, and the specific type of prior computer experience that seniors have acquired should be carefully investigated. Laganá (2008) reported that it is indeed feasible to create and implement successful interventions providing computer training to seniors, and that this training can truly enhance computer attitudes in older age. Research evidence should be collected on whether intervention types (e.g., individual versus group training) apply in a uniform way to aging individuals from various ethnicities. Furthermore, although our findings were not significant concerning ethnicity and computer attitudes, this does not mean that ethnicity does not play a role in learning computer and Internet use, which an interesting topic that is
beyond the focus of this study and should certainly be investigated in-depth so that computer training interventions can be sensitive to the cultural needs of a variety of older populations.

Concerning the limitations of this investigation, our sample did not include participants from retirement homes or assisted care facilities. This was done because we wanted to keep our sample as high-cognitive-functioning as possible, and many institutionalized older adults have at least some degree of cognitive impairment. For this reason, our findings are not generalizable to all senior populations. In addition, in the current study, we did not use a tool for measuring whether the prior computer experiences among older adults were positive or not, as we only quantified the frequency of this experience. The addition of a measure for the quantification of positive or negative prior computer experience would be helpful in future research. Also, the design of the present study (not of the original training study based on a portion of this dataset, which, as described in Lagana`, 2008, was longitudinal) was cross-sectional. Thus, no causation can be inferred. Furthermore, for aging populations, it is difficult to determine whether worse cognitive failures scores occur because 1) of the normal aging process, 2) they may represent psychiatric disorders (Wagle, Berrios & Ho, 1999), or 3), as discussed in the article by Lagana` and colleagues (2011), worse cognitive failure scores can be seen as an indicator of vulnerability to stress. More research is needed to clarify these complex issues. In addition, levels of fatigue among our participants were not accounted for; visual problems, for instance, might have contributed to self-report errors. Also, combining some ethnicities did not allow us to test all ethnic group differences, an important task for future research in this area. Additionally, more variables such as older
adults’ coping styles could be added to our model, given that coping styles are highly related to anxiety (Huston, 1989) and that, in the present study, anxiety was associated with cognitive failure and also with computer attitudes. Indeed, the relationship between cognitive failure and coping styles needs more attention when predicting our outcome variable. It would also be interesting to assess whether coping styles are influential when predicting whether older adults view computers and the Internet positively.

Conclusions

In conclusion, as prior computer experience was found to be a key predictor in our model, stronger efforts should be made to create and implement computer skill programs for older adults (especially for women) that are affordable and easy to access. We also hope to have contributed to the literature on older adults’ computer and Internet attitudes by having targeted some demographic and psychological factors simultaneously via using path analysis to predict computer and Internet attitudes among older adults. For the next generations, a question remains whether future generations of older adults, such as today’s younger or middle-aged adults, will experience the same difficulties that some of today’s older adults are experiencing in learning computer technology (obviously at a different level, given how computer-savvy many people are these days). Research suggests that it is likely that the newer generations too will experience difficulties with new technology once younger people will age (e.g., Hanson, 2009). This is because, unless they make a constant effort to update their computer technology skills, younger people could face similar challenges, as today’s computer or Internet skills may no longer be enough or apply well once the development of future technology grows exponentially. In a negative scenario, when the next new technological era comes, the currently young
cohort's might become the ones disengaged from the new society’s computer technology unless a serious effort to stay current is made. Within this framework, the results of the current study may provide a big picture for further investigations of computer and Internet attitudes and the consequences on staying behind technologically among older adults. Certainly, based on this discussion, providing continuing education-type of training to older adults on the latest computer and Internet skills needed to use the quickly evolving computer technology could be critical, and it is also important to keep a farsighted perspective regarding the creation and implementation of future designs of computer classes for aging populations.

It is well-known that young people are typically seen as being “superior” to seniors when it comes to using computer technology. This has been reported by some researchers, including Buse (2010) and Richardson, Weaver, and Zorn (2005). The media is not helping this topic, as television shows and other entertainment programs often depict older adults as incompetent in computer technology. Ageism is a serious problem that exists also among mental health professionals (as reported by scholars such as Lagana and Shanks, 2002). Researchers interested in the topic of computer technology attitudes and/or use by older adults should remain aware of these multiple problems in order to respect the dignity and needs of ethnically diverse older adults.
Table 1 Characteristics of the participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
<th>Range</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) (N=161)</td>
<td>68.01</td>
<td>8.03</td>
<td>52-94</td>
<td></td>
</tr>
<tr>
<td>OACTAS Scores</td>
<td>-6.28</td>
<td>20.74</td>
<td>-49-43</td>
<td></td>
</tr>
<tr>
<td>BAI Scores</td>
<td>8.58</td>
<td>8.17</td>
<td>0-42</td>
<td></td>
</tr>
</tbody>
</table>

Ethnicity
- Black/African American: 4.3
- Asian American: 10.6
- Mexican American: 8.1
- Other Hispanic/Latino American: 10.6
- White/European American: 37.9
- Mixed: 26.7
- Refuse to Answer: 1.9

Education
- Less than High School: 18.0
- Graduated from High School: 24.2
- Completed Trade School: 5.6
- Some College: 19.9
- Bachelor’s Degree: 20.5
- Some Graduate School: 3.1
- Master’s Degree: 6.2
- Ph.D., M.D., and /or J.D.: 2.5

Notes: MD: Doctor of Medicine. JD: Doctor of Jurisprudence.
<table>
<thead>
<tr>
<th>Model</th>
<th>df</th>
<th>$\chi^2$</th>
<th>$p(H_0)$</th>
<th>CFI</th>
<th>GFI</th>
<th>NNFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Null Model</td>
<td>27</td>
<td>115.45</td>
<td>&lt; .001</td>
<td>.73</td>
<td>.861</td>
<td>.637</td>
<td>.14</td>
</tr>
<tr>
<td>2. Drop I-F1 path</td>
<td>20</td>
<td>77.016</td>
<td>&lt; .001</td>
<td>.805</td>
<td>.890</td>
<td>.728</td>
<td>.133</td>
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<tr>
<td>3. Drop II-F1 path</td>
<td>14</td>
<td>62.967</td>
<td>&lt; .001</td>
<td>.828</td>
<td>.893</td>
<td>.743</td>
<td>.148</td>
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<tr>
<td>4. Initial Full Model</td>
<td>32</td>
<td>144.541</td>
<td>&lt; .001</td>
<td>.735</td>
<td>.838</td>
<td>.627</td>
<td>.148</td>
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<tr>
<td>5. Add VI-VII path</td>
<td>31</td>
<td>105.056</td>
<td>&lt; .001</td>
<td>.826</td>
<td>.876</td>
<td>.747</td>
<td>.122</td>
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<tr>
<td>6. Add V-VIII path</td>
<td>30</td>
<td>90.668</td>
<td>&lt; .001</td>
<td>.857</td>
<td>.891</td>
<td>.786</td>
<td>.112</td>
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<tr>
<td>7. Add IV-V path</td>
<td>29</td>
<td>84.232</td>
<td>&lt; .001</td>
<td>.87</td>
<td>.899</td>
<td>.798</td>
<td>.109</td>
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<tr>
<td>8. Drop VII-F1 path</td>
<td>28</td>
<td>78.765</td>
<td>&lt; .001</td>
<td>.88</td>
<td>.904</td>
<td>.808</td>
<td>.106</td>
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<tr>
<td>9. Drop V-F1 path</td>
<td>29</td>
<td>78.963</td>
<td>&lt; .001</td>
<td>.882</td>
<td>.903</td>
<td>.817</td>
<td>.104</td>
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<td>10. Drop VIII-VI path</td>
<td>30</td>
<td>79.238</td>
<td>&lt; .001</td>
<td>.884</td>
<td>.903</td>
<td>.826</td>
<td>.101</td>
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<tr>
<td>11. Drop IV-F1 path</td>
<td>31</td>
<td>80.467</td>
<td>&lt; .001</td>
<td>.883</td>
<td>.901</td>
<td>.831</td>
<td>.01</td>
</tr>
<tr>
<td>12. Drop III-VIII path</td>
<td>32</td>
<td>81.972</td>
<td>&lt; .001</td>
<td>.882</td>
<td>.900</td>
<td>.834</td>
<td>.099</td>
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<td>13. Drop III-VI path</td>
<td>33</td>
<td>83.646</td>
<td>&lt; .001</td>
<td>.881</td>
<td>.898</td>
<td>.837</td>
<td>.098</td>
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<td>14. Drop VIII-VII path</td>
<td>34</td>
<td>86.24</td>
<td>&lt; .001</td>
<td>.877</td>
<td>.895</td>
<td>.837</td>
<td>.098</td>
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*Note.* I = Caucasian. II = Hispanics. III = Age. IV = Gender. V = Income. VI= Cognitive Failure. VII = Anxiety. VIII= Prior Computer Experience. F1= OACTAS Total Scores
Figure 1—Proposed Structural Equation Model (SEM) to predict computer attitude among older adults. The rounded rectangles indicate proposed latent variables (factors). The oval indicates the proposed measured variable. The rectangles represent four subscales of OACTAS. Straight arrows represent regression. Double arrows represent correlation. Pluses and minuses represent the predicted direction (positive or negative) of the regression coefficients.
Figure 2—Final Structural Equation Model (SEM) for the prediction of older adults’ computer attitudes after post-hoc modification (structural model only). The rounded rectangles indicate hypothesized latent variables (factors). The oval indicates the hypothesized measured variables and the rectangles represent four subscales of OACTAS. Straight arrows represent regressions. Double arrows represent correlation. * $p<.05$
References


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doi:10.1016/j.chb.2006.08.015

doi:10.1001/jama.288.18.2333


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Appendix A

ELDERLY’S ATTITUDES TOWARDS THEIR USE OF COMPUTERS AND THE INTERNET (original version with 22 items)

My age is: _______  My ethnicity is (please specify): ____________________

PLEASE CIRCLE THE ANSWER THAT MATCHES HOW YOU FEEL MOST CLOSELY (ONLY 1 ANSWER PER QUESTION PLEASE)

<table>
<thead>
<tr>
<th></th>
<th>1) I cannot afford buying a computer</th>
<th>2) I am not comfortable with the idea of using a computer</th>
<th>3) I do not believe that I would ever be able to learn how to properly use a computer</th>
<th>4) Computer makes me feel left behind technologically</th>
<th>5) Computers are a necessity in this day and age</th>
<th>6) Computer screens are hard to read</th>
<th>7) To sit in front of a computer is uncomfortable</th>
<th>8) The computer mouse is hard to use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly</td>
<td>Moderately</td>
<td>Disagree</td>
<td>Neither agree</td>
<td>Agree</td>
<td>moderately</td>
<td>strongly</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Disagree</td>
<td>disagree</td>
<td>a little</td>
<td>or disagree</td>
<td>a little</td>
<td>agree</td>
<td>agree</td>
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</table>
9) It is hard to type on the keyboard of a computer
Disagree disagree a little or disagree a little agree agree

10) I wish a computer screen were built to be easier to use by older adults than it is now
Disagree disagree a little or disagree a little agree agree

11) I wish a computer keyboard were built to be easier to use by older adults than it is now
Disagree disagree a little or disagree a little agree agree

12) I wish a computer mouse were built to be easier to use by older adults than it is now
Disagree disagree a little or disagree a little agree agree

13) I would buy a computer if I had the money to be built to accommodate the needs of older adults
Disagree disagree a little or disagree a little agree agree

14) I would buy a computer if I had the money to do so
Disagree disagree a little or disagree a little agree agree

15) I do not like the idea of use the Internet as a way to communicate with people
Disagree disagree a little or disagree a little agree agree

16) I believe that elderly have no use for the Internet
Disagree disagree a little or disagree a little agree agree

17) Once I learn how to use the Internet, I will do so regularly
Disagree disagree a little or disagree a little agree agree
18) I am curious about the Internet and want to learn how to use it

<table>
<thead>
<tr>
<th>Strongly</th>
<th>Moderately</th>
<th>Disagree</th>
<th>Neither agree</th>
<th>Agree</th>
<th>moderately</th>
<th>strongly</th>
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19) I do not want to use the Internet because I much prefer human contact

<table>
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<th>Strongly</th>
<th>Moderately</th>
<th>Disagree</th>
<th>Neither agree</th>
<th>Agree</th>
<th>moderately</th>
<th>strongly</th>
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20) The Internet is only intended to be used by young and middle-age people

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<thead>
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<th>Strongly</th>
<th>Moderately</th>
<th>Disagree</th>
<th>Neither agree</th>
<th>Agree</th>
<th>moderately</th>
<th>strongly</th>
<th>N/A</th>
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</table>

21) I would rather write or telephone than send message to people through the Internet

<table>
<thead>
<tr>
<th>Strongly</th>
<th>Moderately</th>
<th>Disagree</th>
<th>Neither agree</th>
<th>Agree</th>
<th>moderately</th>
<th>strongly</th>
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22) I do not feel comfortable with the idea of “surfing the net” (like looking up information on different topics on the Internet)

<table>
<thead>
<tr>
<th>Strongly</th>
<th>Moderately</th>
<th>Disagree</th>
<th>Neither agree</th>
<th>Agree</th>
<th>moderately</th>
<th>strongly</th>
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Disagree disagree a little or disagree a little agree agree