Silver Surfers: Training And Evaluating Internet Use Among Older Adult Learners

Michael J. Cody, Deborah Dunn, Shari Hoppin, and Pamela Wendt

Two hundred ninety-two older adult learners (averaging 80 years of age) were recruited from assisted and independent living facilities to learn about computer technologies and surf the Internet. A training program designed for adult learners involved weekly meetings with a mentor who helped individuals visit sites of their own choosing. Those who learned to surf the Internet had more positive attitudes toward aging, higher levels of perceived social support, and higher levels of connectivity. Surfers spent more time on-line when computer efficacy was high, computer anxiety low, and attitudes toward aging were positive. Participation in the 4-month program was associated with significantly reduced computer anxiety and increased ratings of perceived social support and connectivity. Keywords: universal access, computer anxiety, computer efficacy, social support, Internet, computer training, older adult, elderly

Scholars have focused on how to incorporate new technologies into communication courses for diverse populations, including “adult learners” (Benson, 1994, 1998; Berge, 1994; McComb, 1994; Pearson, 1998; Pearson et al., 1998; Ratilffe, 1998; Rowland, 1994; Ryan, 1994). Successful use of new technologies in instruction can best be achieved if individuals (a) have access to computers and hardware, (b) have access to the Internet, and (c) are trained to use the new technologies. This report addresses the latter issue, acknowledging, first, that many individuals have virtually no background in using keyboards, manipulating a mouse, and more. Second, remarkably little money and time is devoted to training (Pearson et al., 1998). Third, many individuals experience fairly high levels of computer anxiety. These problems are especially acute among the elderly, who represent one of the largest groups of information “have nots” in the United States, and who would benefit in many ways from gaining computer literacy.

Training adult learners is important because of the increasing numbers of this segment of the population and because providing Internet access to this group theoretically provides a number of significant benefits including the ability to enroll in distance learning courses on-line for life-long education, increased knowledge of news, current events, and medical/health breakthroughs, increased connectivity with family members who may live far away, increased intergenerational communi-

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cation, increased perceptions of social support, and the ability to feel mentally alert, challenged, useful and to feel “younger” (Czaja, 1992; Eilers, 1989; Furlong, 1989).

**Information Have Nots**

Despite a decade-long fascination with computer mediated communication research, Internet studies share certain biases: Individuals who have access to computers are young to middle-aged and predominately Caucasian from middle- to upper-income backgrounds (Anderson, Bikson, Law, & Mitchell, 1995). Members of minorities, the poor, and older adults are Internet “Have Nots,” who do not have access to the mountains of data on-line (Anderson et al., 1995; Eilers, 1989; Furlong, 1989). How can we train the older adults to use the Internet and to fulfill social and information needs? Can we demonstrate that Internet access will produce the intended, desirable, cognitive, educational, and social outcomes?

Adults aged 55 and over represent a growing demographic group in America. Yet, 10 years ago fewer than 25% of older adults had any exposure to computers or to related technologies (Ansley & Erber, 1988). Today, it is estimated that 10% of the 60 and older age group has access to a computer in the home (compared to 30% of under-60 households), and only 3% of the age group are utilizing computer networks from homes (compared to 19–20% of the 20–59 age group) (Anderson et al., 1995). The average age of Web site surfers is roughly 35.2 to 36.5 (CyberAtlas, 1997a, 1997b; GVU, 1997; Hoffman, Novak, & Chatterjee, 1995), and annual assessments reveal an increase from 32.7 in 1993/94 to 35.2 in 1997, possibly reflecting a nation which is getting older. With U.S. citizens living longer, retired 55 or 65 and older individuals can potentially benefit from communicating on-line for 30 years or more.

Extending universal Internet access to older adults depends on training more 55 and older individuals to use technology and/or adapting technology to make network connections easier for the non-technically trained. The project reported here utilizes a recent product, WebTV, which was designed to increase the ability for non-technically oriented individuals to surf the Internet and to use e-mail. Further, the project relies on the principles of social learning theory and literature on “community based” education and cooperative learning in order to train older adults.

**Training Adult Learners**

Unfortunately, the few studies published to date specifically geared at exposing older adults to computer technology have been lacking in theory and rigor and have failed to study effects over time (longer than a few weeks). No consistent finding of improved attitudes or skills have surfaced, and in one study (Dyck & Smither, 1996) older adults’ liking for computers significantly decreased after exposure to a 6-week word processing course. Many projects provided limited exposure to computers: Ansley & Erber (1988) provided older adults with only 10 minutes of exposure to a computer generated vocabulary test; Czaja, Hammond, Blascovich, and Swede (1986) provided one day of word processing training, and Temple and Gavillet (1990) provided two classes in computer confidence. These brief interventions do not offer sufficient exposure to computers to significantly improve attitudes or performance, nor do they allow sufficient time for individual exploration and practice.

Indeed, our view is that training of older adults should first adhere to principles of social learning theory, and to related works in “community based education,”
"active" and "cooperative" learning (Dobos, 1996; Johnson, Johnson, & Smith, 1991, 1998). Second, learning of new technologies requires substantial hands-on experiences and opportunities to facilitate exploration of new technologies over time. Third, successful outcomes of training should focus on more than attitudes toward technology, altered rates of computer anxiety, knowledge of use or time spent using the technology. Successful mastery of new technology should be assessed on the basis of whether individuals enjoy the experience, become absorbed in it, and believe they have gained control and engaged in a challenging experience. Successfully trained adults should experience "optimal flow" in human-computer interactions (Csikszentmihalyi, 1988; 1990; Csikszentmihalyi & Rathunde, 1993; Dobos, 1996; Ghani & Deshpande, 1994).

Computer Training

Theories of Learning. Bandura's social learning theory and works on self-efficacy (Bandura, 1977, 1986), coupled with recent projects on training technological skills, guided both the design of the training procedures and manuals as well as expectations regarding outcomes. Another body of literature on adult learning (Ratcliffe, 1998) and on cooperative learning (Bruffee, 1993; Dobos, 1996; Johnson et al., 1991, 1998; Slavin, 1983, 1995) focuses on the motivations of the learners, providing optimal learning contexts, self-directed peer interactions, immediate feedback, and high levels of participant involvement. A considerable body of literature has addressed the problem of teaching new technological skills to novices, young and old. Each of these approaches relies on rewards, familiar analogies, immediate feedback, active involvement, and self-exploration. Important findings indicate that the following are helpful: 1) a preview of upcoming lessons phrased optimistically and in encouraging formats, which is matched to participants' own initial starting points and which builds confidence and reduces anxiety (Gardner, Dukes, & Discenza, 1993; Reznich, 1996; Russon, Josefowitz, & Edmonds, 1994; Todman & Monaghan, 1994); 2) training that involves high participant involvement and hands-on experiences, which encourages and fosters "self-use" periods and involves immediate feedback (Charness, Schumann, & Boritz, 1992; Jay & Willis, 1992; Ratcliffe, 1998); 3) training incorporating cooperation between mentor and tutor, or cooperation between small groups of trainees who help one another and explore new technologies together (Baron, 1997; Dobos, 1996; Johnson et al., 1991; Polk, 1996; Webb, 1988); 4) training utilizing manuals and programs which are of high interest value to participants, easy to use, provide opportunities to engage in different tasks, and incorporate participants' goals and interests (Baron, D'Amico, Sissons, & Peters, 1996; Jay & Willis, 1992); and 5) cooperative learning, relying on theories of social interdependence, cognitive development and behavioral learning, modeling, coaching, and scaffolding, positive interdependence among group learners (and mentors), and maintenance of rewarding experiences between individuals who work together to learn and use new technologies (Johnson et al., 1991, 1998).

Based on these reports, a highly interactive and participatory training program was launched. Further, literature on training indicates that several variables are significantly related to learning and utilizing new technology: computer anxiety, computer efficacy, attitude toward aging, and social support.

Computer Anxiety. Considerable literature addresses the measurement and consequences of computer anxiety (Bear, Richards, & Lancaster, 1987; Brock & Sulsky, 1994; Chu & Spires, 1991; Farina, Arce, Sobral, & Carames, 1991; Gardner,
Discenza, & Dukes, 1993; Gardner, Dukes, et al., 1993; Gressard & Loyd, 1986; Heinnessen, Glass, & Knight, 1987; Kernan & Howard, 1990; Loyd & Loyd, 1985; Maurer, 1994; Nelson, Wiese, & Cooper, 1991; Pope-Davis & Twing, 1991; Reznich, 1996; Todman & Monaghan, 1994; Whitely, 1996a, 1996b, 1997; Woodrow, 1991). Individuals who have high levels of computer anxiety tend to drop out of computer training programs and courses and utilize computers less than others (Heinnessen et al., 1987), although at least one project found that computer anxiety was unrelated to withdrawing from computer courses and did not predict course grades (Kernan & Howard, 1990). Gender differences in computer anxiety may exist among the young, but are not consistently observed over the life cycle (see Farina et al., 1991; Heinnessen et al., 1987; Pope-Davis & Twing, 1991; Whitely, 1996a, 1996b). Our expectation was that computer anxiety will be related to attrition, to time spent on-line, and to exploring various avenues on the Internet.

**Computer Efficacy.** As Bandura (1986) argued, self-efficacy involves more than just knowing what to do, being persistent or maintaining an enduring positive attitude during training:

...[E]fficacy involves a generative capability in which cognitive, social, and behavioral subskills must be organized into integrated courses of action to serve innumerable purposes. Success is often attained only after generating and testing alternative forms of behavior and strategies, which requires perseverant effort. Self-doubters are quick to abort this generative process if their initial efforts prove deficient. (p. 391)

Busch (1996), Gist, Schwoerer, and Rosen (1989), and Morris (1994) indicate that self-efficacy scores should predict learning and enhanced performance of computers and technology.

**Attitude toward aging.** A considerable body of literature indicates that maintaining a positive attitude toward aging and life ("subjective well-being") is an important predictor of an individual's involvement with surroundings, volunteerism, participation in cultural events, time spent exercising, and involvement in leisure activity and in accepting new adventures, such as learning new technologies (Goff, 1993; Kennedy, King, Muraco, 1983; Lawton, 1984; Menec & Chipperfield, 1997; Morganti, Nehrke, & Hulicka, 1990; Okun & Stock, 1987). However, there is no body of literature specifically linking "attitude toward aging" or subjective well-being among an older population with computer training. Further, original measures designed to assess attitudes toward aging developed in gerontology in the 1970s are ageist by today's standards (Lawton, 1975), including items such as "Things keep getting worse as I get older," and "As you get older you are less useful." A new version of an Attitude toward aging scale was developed similar to related measures of "subjective well-being" (Robinson, Shaver & Wrightsman, 1991). We developed a measure of attitudes toward aging similar to related measures of "subjective well-being" (Robinson, Shaver & Wrightsman, 1991). A positive attitude toward aging should correspond with completing the 4-month program and with exploring a wider range of functions on the Internet.

**Social support and connectivity.** Sauer and Coward (1985) discussed a number of different definitions of social support, and noted that social networks facilitate personal independence in three ways: (1) helping directly with the tasks of everyday living, (2) helping expand social contact, and (3) providing information. Social support is also important as a mediator of stress (Fitzpatrick, 1987; Pettegrew & Logan, 1987) and has implications for people's health to the extent that stress has an
impact on well-being. Although social support networks help people enhance their well-being and cope with difficult life events, obtaining and maintaining social support is as important for everyday activities as it is in times of crisis (Monge, 1987). Most individuals maintain some type of social support network. Pattison and Pattison (1981) indicated that typical individuals rely on about 25 relatives, close friends, neighbors, and coworkers for social support. With the proliferation of computers, scholars have investigated whether this medium can be used to help form and sustain relationships offering social support.

Research indicates that computer supported social networks can sustain strong, intermediate, and weak ties that provide information and social support (Wellman et al., 1996). Participants in computer support networks may initially have negative attitudes toward each other and toward the interaction process, but these attitudes can change over time with the repeated use of computer support (Chidambaram, 1996), thereby enhancing a sense of social support. Studies have indicated that social support can have a positive influence on health (Feenberg Licht, Kane, Moran, & Smith, 1996), especially among older individuals (Chappell, 1992; Raube, 1992; Sauer & Coward, 1985).

Outcome Measures: Training Participation, Internet Time, Utilizing Functions, Flow

Evaluation of the training consisted of examining 1) who stayed in the program to learn to use the Internet during the 4-month period (compared to those who left), 2) who spent relatively more time on-line, 3) who spent time accessing different functions (chat, news, e-mail, bulletin boards), and 4) flow. The experience of "flow" involves individuals becoming absorbed in their activities and feeling "in control of our actions, masters of our own fate... we feel a deep sense of exhilaration, a deep sense of enjoyment" (Csikszentmihalyi, 1990, p. 3). Flow is fundamentally linked to Csikszentmihalyi's (1975, 1985, 1988, 1990, 1992, Csikszentmihalyi & Rathunde, 1993) theory of emergent motivation (also see Dobos, 1996; Ghani & Deshpande, 1994; Jackson & Marsh, 1996). This theory focuses on why people initiate and/or continue to engage in an activity "... because they enjoy its performance in the present" (Csikszentmihalyi & Rathunde, 1993, p. 57). An optimal experience of flow is possible when (1) a person is pursuing clearly defined goals and is receiving immediate and unambiguous feedback, and (2) there is a balance between one's own assessment of skills and abilities and one's expectations of the challenges of the task. Individuals are more likely to experience apathy when skills and challenges are both low, anxiety when skills are low and challenges are high, and boredom when skill is high and the challenge is low. They are more likely to experience "flow" when skills and challenges are both high or skills are matched for the amount of challenge provided (Csikszentmihalyi & Rathunde, 1993; Moneta & Csikszentmihalyi, 1996).

Computer mediated communication (CMC) scholars argue that the flow concept is particularly relevant to CMC because users interact with the technology itself; the search for information is both challenging and satisfying; arousal is high, simultaneously satisfying curiosity and increasing curiosity; playfulness is fostered; and, immediate feedback is possible (Ghani & Deshpande, 1994; Hoffman & Novak, 1995; Trevino & Webster, 1992; Webster, Trevino, & Ryan, 1993; Witmer & Taweesuk, 1998). Further, if our training program is effective in teaching skills, then success can be measured, in part, by participants’ ratings of experiencing flow.
Several measures of optimal flow have been offered (Ghani & Deshpande, 1994; Jackson & Marsh, 1996; Trevino & Webster, 1992; Webster et al., 1993), and Trevino and Webster (1992) describe flow as the extent to which: (a) users perceive a sense of control over the interaction, (b) users perceive that their attention is focused on the interaction, (c) users’ curiosity is aroused during the interaction, and (d) users find the interaction intrinsically interesting.

We expect that adult learners who question their abilities to learn new technologies are less likely to experience "flow"; those who are more anxious (low perceived skills relative to the challenge) will experience less flow. On the other hand, adult learners who are interested in challenging their abilities may commit more time and energy to the challenge of learning new technologies, and to explore more diverse services offered by the Internet. More up to the challenge are those who have higher levels of perceived social support, more frequent contact with others (engaging in more cooperative learning), and more positive attitudes toward aging.

Hypotheses

The first hypothesis focuses on predicting participation on the Internet from pre-test measures. Two types of participation on the Internet were examined: (a) staying in the program and learning to use the technology and (b) amount of time spent on-line on an average weekly basis. We also raised a research question as to which services or functions would be utilized by the participants and asked whether anxiety, efficacy, attitude toward aging, and perceived social support would predict different functions or services. The second hypothesis focused on changes possibly due to participation in the program and training, and involves pretest-posttest comparisons. The third hypothesis focused on predicting flow from pretest measures.

H1a: Higher scores on computer efficacy, attitudes toward aging, perceived social support, and perceived communication connectivity will predict greater Internet participation than will lower scores.

H1b: Lower scores on computer anxiety will predict greater Internet participation than will higher scores.

RQ: Which on-line services or functions will adult learners utilize, and will computer anxiety, efficacy, attitude toward aging, perceived social support, and perceived connectivity predict to utilizing different services or functions?

H2: Increased participation on the Internet over time will be associated with increased ratings of communication connectivity, perceived social support, positive attitude toward aging, and computer efficacy, and with decreased ratings of computer anxiety.

H3a: Higher scores on attitudes toward aging, perceived social support, and perceived communication connectivity are more likely to predict optimal flow than are low scores.

H3b: Low scores on computer anxiety are more likely to predict optimal flow than high scores.

Method

Participants

Two hundred ninety-two individuals were recruited in 11 assisted living and independent living facilities. They were recruited in December 1996 and January 1997 through announcements, newsletters, and contact with the activity directors of the facilities. The project ended in May 1997. The average age of participants was 80.4 years (SD = 8.39). Ninety-one (31.2%) were male, and 201 were female. Ten percent were never married, 20% currently married, 58% widowed, and 13%
divorced. Ninety (30.8%) had held professional jobs, 87 (29.8%) managerial jobs, 51 (17.5%) skilled/technical jobs, and 64 (21.9%) unskilled/non-technical jobs. Participants averaged 14.5 years of education (SD = 3.34).

The majority of the sample (57%) reported no prior experience with computers; 16% had hardly any experience with computers. A majority (87%) indicated that they had no experience with the Internet. This lack of computer experience may account, in part, for the fact that 140 (48% of the sample) volunteers left the program over the 4-month period. Forty-five of the participants indicated that WebTV was too difficult to learn, and 77 individuals indicated they had changed their mind—they did not have sufficient time to spend surfing the Internet and attending the sessions (some of the latter group were caregivers to others, whose health was declining over time). When participants signed consent forms, they completed a questionnaire that included measures of computer anxiety, computer efficacy, attitudes toward aging, connectivity, perceived social support, and a self-report on health. During the program, participants completed “adventure sheets,” which provided weekly averages for the time spent on-line and the extent to which they explored different Internet activities. We acknowledge the limitations of such self-reported data; however, the decision to use adventure sheets was based on the fact it was impossible to determine which individual participant at a given site was using the WebTV at any time, because WebTV assigned only one login name per site. When the project ended, participants completed the computer anxiety, computer efficacy, connectivity, perceived social support, and attitudes toward aging scales, along with measures of optimal flow and Internet exploration.

Computer Anxiety and Computer Efficacy. Ten items comprising the Computer Anxiety Subscale of the Computer Attitude Scale (Gressard & Loyd, 1986; Woodrow, 1991) were used to measure computer anxiety (α = .846, pretest; α = .861, posttest) (example: “Computer technology makes me feel uneasy and confused.”). Five items comprising Busch’s (1996) Computer Efficacy scale were used (α = .856, pretest; α = .874, posttest) (example: “I think I am capable of learning to use computer technology.”).

Health Limitations. Items pertaining to health which may affect Internet use included: “My eyes get tired easily,” “I have trouble with hand-eye coordination,” “I become uncomfortable sitting for long periods of time,” “My hands sometimes shake,” “I sometimes experience pain that is moderate to severe in intensity,” and, “I am easily distracted” (α = .837).

Attitude Toward Aging.1 The proposed measure of holding a positive attitude toward aging assessed three important aspects: (1) 10 items assessed being able to enjoy what life offers (example: “I feel like I can learn new things”); (2) 10 items assessed the individual’s view of him/herself as an active participant in life (versus a passive observer) (example: “I feel like I am an active participant in life”); and, (3) 10 items assessed an optimistic view of life (example: “I feel optimistic about the future”) (α = .929, pretest; α = .932, posttest).

Social Support. Items measuring perceived social support included: “I have meaningful contacts with others each week,” “I have companionship whenever I need it,” “I value my conversations with others every week,” “I often feel like others ignore me” (reversed), “I get plenty of emotional support from others,” “I get plenty of useful information from others,” “I feel I belong in a real ‘circle of friends’,” “I am
never lonely for long,” “I feel isolated” (reversed), and, “I feel like others really do listen to what I am saying” (α = .918, pretest; α = .974, posttest).

Connectivity. The 12 items measuring perceived connectivity with others included repeating three questions for the participant’s immediate community: where s/he lived, religious/spiritual community, family community, and contacts in community service or volunteer work (“There is frequent contact with others in this community,” “I am highly satisfied with the amount of contact I have with others in this community,” and “I am highly satisfied with the quality of contact I have with others in this community”) (α = .897, pretest; α = .849, posttest).

Internet Exploration. Participants rated each of 15 categories of services on how frequently they used the service or visited the sites (1 = 75–100% of the time; 5 = 0% of the time). The most frequently used services included Search (M = 2.33) and Explore (M = 2.55) functions, and since the two were highly intercorrelated, r = .557, the ratings were averaged together (M = 2.44). E-mail was rated as the next most frequently used option (M = 2.71), followed by news/current events (M = 2.95). Chat options were used rather infrequently (M = 4.12), but we retained Chat as a separate category for our analyses because of its interactive features. The remaining categories and sites included medical information, genealogy, games, banking, travel, arts/museums, cooking, buying goods and services, religion and “other.” The means ranged from 3.34 (travel) to 4.42 (cooking), and the relatively infrequently used categories were averaged together to form a category of tasks/interests (M = 4.02; α = .791). Five types of Internet exploration, then, were examined: search/explore, e-mail, news, chat, and tasks/interests.

Experiencing Flow. The 28 items were designed based upon Trevino and Webster’s (1992) research (example: “Using the Internet is intrinsically interesting”) (α = .930).

Time On-line. “Adventure sheets” recorded sites visited by the participants and how long they were on-line during the week. Participants were on-line from only a few minutes to as many as 435 minutes per week (M = 45.18, SD = 71.75). Scores were re-coded so that analyses would be uniform; all positive correlations reflect positive relationships, all negative correlations reflect negative relationships.

Training Program. In initial sessions, participants were taught about the WebTV keyboard and how to log on to the WebTV system to get started. Subsequent lessons addressed selecting different options from the WebTV menu, surfing the Internet (including using links and commands such as “Back” and “Forward”), and using search engines to look for specific information. Participants were also taught to use e-mail and, finally, to participate in chat rooms. Trained facilitators visited sites each week to review the previous week’s lesson, present the next lesson in the series, and to collect adventure sheets. Manuals outlining these lessons were left beside the WebTV at each site and participants also often helped each other. On the “adventure sheets” mentioned above, which were collected weekly, participants recorded which Internet sites they had visited in the past week, which sites they found most enjoyable, and any problems experienced while exploring the Internet, in addition to how much time they had spent online in the past week.

The weekly “adventure sheets” tracked four issues: (1) how much time each individual spent on-line, (2) which sites they visited each week, (3) which sites they found enjoyable, reasons why they were enjoyable, and their recommendation to others, and, (4) problems while exploring the Internet. Answers to Question 3 were
Compiled by the trainers, who meet every week, and were circulated to all locations. Problems identified by the participants were used to troubleshoot and to work with WebTV to resolve problems.

Highlights of two “adventure sheets” for a widowed woman born in 1929 are summarized as follows: (1) Two and a half hours on line. Searched Paris, Art-Museums and opera Music-Life of Verdi, Italian Provinces/train travel. Enjoyed Art and Music. No problems; and (2) 3 hours. E-mailed, Mozart-Opera and Verdi/Favorites/postcards. Windows on Italy-Regions of Perugia-Siena-Etruscan. Federal Insurance savings network. Best national CD rates. Visited Austria. Salzburg. Enjoyed e-mail, travel, Met Opera. Elderhostel—long wait, no answer.

Results

Predicting Participation on the Internet

The first hypothesis stated that increased participation on the Internet would be associated with computer efficacy, positive attitudes toward aging, increased ratings of perceived social support and communication connectivity, while computer anxiety would limit participation. These predictions were tested in two analyses. First, a two-group discriminant analysis was performed in order to identify the set of variables that significantly differentiated between participants who stayed in the program from those who withdrew from the program. Second, correlational analyses were performed between the predictor variables and the outcome variables—Internet exploration, optimal flow, and time on-line. Age and health limitations were included in these analyses, since it is possible that both variables may impact either motivation or ability to participate over time.

The two-group discriminant analysis yielded a significant function (Wilks’ lambda = .871, eigenvalue = .148, canonical correlation = .359, $\chi^2(7) = 39.193$, $p < .001$), defined by computer efficacy, computer anxiety, connectivity, perceived social support and attitudes toward aging (see Table 1). Surfers had higher levels of computer efficacy, lower levels of computer anxiety, more positive attitudes toward aging, higher levels of perceived social support and higher levels of connectivity. Health limitations were not significantly related to participation ($p = .069$). Sixty-six percent of participants were correctly classified.

Table 2 presents correlations among age, pre-test measures, and use of the

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*Represents Standardized Canonical Discriminant Function Coefficients. All degrees of freedom for univariate tests are 1,290. Smaller means reflect lower levels of anxiety, fewer health limitations, higher levels of efficacy, social support, and connectivity, and more positive attitudes toward aging.
internet. Regression analyses indicated that on-line time was significantly influenced by computer efficacy ($\beta = .277$, $p = .017$), computer anxiety ($\beta = -.238$, $p = .033$), and attitudes toward aging ($\beta = .248$, $p = .044$) ($R = .379$, adjusted $R^2 = .102$). More time was spent on-line when efficacy was high, attitudes toward aging positive, and computer anxiety low. E-mail use was significantly influenced by connectivity ($\beta = .268$, $p = .002$) and by age ($\beta = .259$, $p = .001$) ($R = .378$, adjusted $R^2 = .101$). Younger and more connected individuals used e-mail functions more than others. Connectivity was the sole significant predictor of task/interests (service) functions ($\beta = .182$, $p = .044$) ($R = .291$, adjusted $R^2 = .040$). Individuals who were more highly connected spent more time investigating a range of services and functions on the Internet. The use of chat was significantly influenced by computer efficacy ($\beta = -.249$, $p = .037$) and by age ($\beta = .173$, $p = .038$) ($R = .292$, adjusted $R^2 = .041$). Younger and less efficacious individuals visited chat areas more than others. The use of news services was affected solely by attitude toward aging ($\beta = .222$, $p = .006$) ($R = .222$, adjusted $R^2 = .043$). However, no variable significantly predicted the use of explore/search functions, perhaps because the functions were commonly used by all learners each week.

The first hypothesis was generally supported. Attitude toward aging, computer efficacy, and computer anxiety predicted time spent on-line, while neither perceived social support nor connectivity made unique contributions the outcome variable. However, connectivity was related to more diverse uses (services and functions, and to e-mail) and age and attitude toward aging similarly contributed to several Internet uses. One unexpected finding is that individuals low in efficacy visited chat rooms. We expected that more efficacious individuals would visit chat areas. However, this study assessed only time spent in certain areas and we have no evidence that individuals who visited chat areas actually engaged in chat—younger, less efficacious individuals may have “lurked” in chat rooms after being encouraged to visit them by their mentors.

Assessing the Consequences of On-line Participation

The second hypothesis stated that increased participation on the Internet over time would significantly decrease computer anxiety, and significantly increase ratings on computer efficacy, communication connectivity, perceived social support, and attitudes toward aging. This hypothesis was tested utilizing a repeated measures MANOVA with time (pre- and post-training) as the within-subjects factor, and gender (male, female), age (younger, older), and health limitations (limitations, few
limitations) as between-subjects factors. The between-subjects factors were included because of the possibility that one group (i.e., younger, healthier females) may change significantly while other groups do not (i.e., older males with health limitations). A median split on the Health Limitations items distinguished between healthier males and females from those reporting health limitations. The results of the 2 (time) × 2 (gender) × 2 (age) × 2 (health) MANOVA revealed a significant main effect for time \( F(5, 140) = 15.202, p < .001, E^2 = .352 \), a significant effect due to health limitations \( F(5, 140) = 9.508, p < .001, E^2 = .253 \), and no significant main effects for gender \( p = .761 \) or for age \( p = .471 \). One significant interaction effect was obtained: time by gender by health \( F(5, 140) = 3.038, p = .012, E^2 = .098 \).

The significant main effect for time was due to changes in perceived social support \( F(1, 144) = 45.678, p < .000, E^2 = .241 \), computer anxiety \( F(1, 144) = 11.294, p = .001, E^2 = .073 \) and connectivity \( F(1, 144) = 4.867, p = .029, E^2 = .033 \). There were no significant effects for computer efficacy \( F = .003, p = .953 \) or for attitude toward aging \( F = .300, p = .585 \). Table 3 presents the means and standard deviations for the variables. At the end of the program, participants rated perceived social support higher \( M = 2.13 \) [compared to 2.46], computer anxiety lower \( M = 1.98 \) [compared to 2.20], and connectivity higher \( M = 2.21 \) [compared to 2.36]. Partial support was obtained for Hypothesis 3—those who stayed in the training program increased perceived social support and connectivity and reduced ratings of computer anxiety.

The main effect for health was due to differences in attitude toward aging \( F(1, 144) = 40.763, p < .001, E^2 = .221 \), computer efficacy \( F(1, 144) = 16.437, p < .001, E^2 = .102 \), computer anxiety \( F(1, 144) = 14.032, p < .001, E^2 = .089 \), connectivity \( F(1, 144) = 9.730, p = .002, E^2 = .063 \), and perceived social support \( F(1, 144) = 7.310, p = .008, E^2 = .048 \). Participants who had fewer health limitations had, relative to those claiming more health limitations, more positive attitudes toward aging \( M = 1.83 \) [compared to 2.29], greater efficacy \( M = 1.64 \) [compared to 2.06], less computer anxiety \( M = 1.86 \) [compared to 2.29], greater connectivity \( M = 2.11 \) [compared to 2.44], and increased perceived social support \( M = 2.18 \) [compared to 2.39].

The significant time by gender by health interaction effect was due to significant differences in ratings of computer anxiety \( F(1, 144) = 9.306, p = .003, E^2 = .061 \), connectivity \( F(1, 144) = 5.178, p = .024, E^2 = .035 \), and attitudes toward aging \( F(1, 144) = 3.786, p = .054, E^2 = .026 \) (see Table 4). Following training, males with health limitations expressed lower levels of anxiety \( M = 2.00 \) [compared to 2.34], higher levels of connectivity \( M = 2.38 \) [compared to 2.66], and more positive attitudes toward aging \( M = 2.19 \) [compared to 2.38]. Healthy males, however, maintained more positive attitudes, greater connectivity and less anxiety throughout the program, compared to their less healthy counterparts. On the other hand, females with health limitations did not exhibit changes in anxiety, connectivity or attitudes following training; healthier females expressed significantly less anxiety \( M = 1.67 \) [compared to 2.10] and greater connectivity \( M = 1.977 \) [compared to 2.28] than their less healthy counterparts. Thus, for these particular measures, the individuals who benefited from participation were healthy females, and males with health limitations.

The main effect for time indicated pre- and post-program changes for perceived social support, anxiety, and connectivity. In order to associate specific Internet
TABLE 3

MEANS AND STANDARD DEVIATIONS FOR VARIABLES ASSESSING CONSEQUENCES OF INTERNET PARTICIPATION

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre-Program</th>
<th>Post-Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>$M = 2.20$</td>
<td>$M = 1.98$</td>
</tr>
<tr>
<td></td>
<td>$S.D. = .739$</td>
<td>$S.D. = .720$</td>
</tr>
<tr>
<td>Efficacy</td>
<td>$M = 1.87$</td>
<td>$M = 1.86$</td>
</tr>
<tr>
<td></td>
<td>$S.D. = .662$</td>
<td>$S.D. = .673$</td>
</tr>
<tr>
<td>Attitude Toward Aging</td>
<td>$M = 2.08$</td>
<td>$M = 2.06$</td>
</tr>
<tr>
<td></td>
<td>$S.D. = .525$</td>
<td>$S.D. = .502$</td>
</tr>
<tr>
<td>Social Support</td>
<td>$M = 2.45$</td>
<td>$M = 2.13$</td>
</tr>
<tr>
<td></td>
<td>$S.D. = .479$</td>
<td>$S.D. = .605$</td>
</tr>
<tr>
<td>Connectivity</td>
<td>$M = 2.36$</td>
<td>$M = 2.21$</td>
</tr>
<tr>
<td></td>
<td>$S.D. = .760$</td>
<td>$S.D. = .822$</td>
</tr>
</tbody>
</table>

Smaller means reflect lower levels of anxiety, higher levels of efficacy and connectivity, and more positive attitudes toward aging.

activity with changes in these variables, correlational analyses were computed. Table 5 presents the correlations between the specific types of Internet uses and the pretest and posttest measures for each of the three variables (first two rows in each panel), followed by the correlations between types of Internet uses and posttest scores, partalling out the effects of pre-test scores. Increased levels of perceived social support were associated with utilizing Internet services (various websites about history, medicine, travel, and more), news, and with staying on-line longer. Reduced anxiety scores were correlated with spending more time on-line, and with flow/Internet involvement. Increased ratings of connectivity were correlated with utilizing news functions, and with staying on-line longer.

Optimal Flow

Optimal flow was correlated with attitude toward aging ($r = .476$), perceived social support ($r = .272$), connectivity ($r = .257$), computer efficacy ($r = .221$), lower levels of anxiety ($r = .167$), and with health limitations ($r = -.254$) (see first column, Table

TABLE 4

COMPUTER ANXIETY, CONNECTIVITY AND ATTITUDES TOWARD AGING BY GENDER, AND HEALTH

<table>
<thead>
<tr>
<th></th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$S.D.$</td>
<td>$M$</td>
<td>$S.D.$</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male–Limited Health</td>
<td>2.342</td>
<td>.531</td>
<td>2.004</td>
<td>.617*</td>
</tr>
<tr>
<td>Male–Healthy</td>
<td>1.813</td>
<td>.752</td>
<td>1.841</td>
<td>.678</td>
</tr>
<tr>
<td>Female–Limited Health</td>
<td>2.402</td>
<td>.722</td>
<td>2.293</td>
<td>.712</td>
</tr>
<tr>
<td>Female–Healthy</td>
<td>2.096</td>
<td>.762</td>
<td>1.667</td>
<td>.667*</td>
</tr>
<tr>
<td>Connectivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male–Limited Health</td>
<td>2.657</td>
<td>.593</td>
<td>2.377</td>
<td>.650*</td>
</tr>
<tr>
<td>Male–Healthy</td>
<td>2.068</td>
<td>.588</td>
<td>2.113</td>
<td>.744</td>
</tr>
<tr>
<td>Female–Limited Health</td>
<td>2.438</td>
<td>.750</td>
<td>2.379</td>
<td>.905</td>
</tr>
<tr>
<td>Female–Healthy</td>
<td>2.280</td>
<td>.887</td>
<td>1.977</td>
<td>.804*</td>
</tr>
<tr>
<td>Attitude Toward Aging</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male–Limited Health</td>
<td>2.383</td>
<td>.468</td>
<td>2.187</td>
<td>.490*</td>
</tr>
<tr>
<td>Male–Healthy</td>
<td>1.848</td>
<td>.453</td>
<td>1.906</td>
<td>.449</td>
</tr>
<tr>
<td>Female–Limited Health</td>
<td>2.292</td>
<td>.486</td>
<td>2.302</td>
<td>.451</td>
</tr>
<tr>
<td>Female–Healthy</td>
<td>1.789</td>
<td>.432</td>
<td>1.798</td>
<td>.448</td>
</tr>
</tbody>
</table>

*Indicates means in the row are significantly different, $p < .05$. Smaller means reflect lower levels of anxiety, higher levels of connectivity, and more positive attitude toward aging.
TABLE 5
RELATIONSHIPS BETWEEN INTERNET PARTICIPATION AND CONSEQUENCES OF INTERNET USE

<table>
<thead>
<tr>
<th></th>
<th>Flow</th>
<th>Time On-line</th>
<th>E-mail</th>
<th>Tasks/News</th>
<th>Interests</th>
<th>Explore/Search</th>
<th>Chat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soc Sup-1</td>
<td>.272**</td>
<td>.219**</td>
<td>.144*</td>
<td>.179*</td>
<td>.198*</td>
<td>.135*</td>
<td>.135*</td>
</tr>
<tr>
<td>Soc Sup-2</td>
<td>.314**</td>
<td>.214**</td>
<td>.109</td>
<td>.254**</td>
<td>.314**</td>
<td>.142*</td>
<td>.087</td>
</tr>
<tr>
<td>Partial r</td>
<td>.254**</td>
<td>.179*</td>
<td>.036</td>
<td>.204**</td>
<td>.263**</td>
<td>.080</td>
<td>.027</td>
</tr>
<tr>
<td>Anxiety-1</td>
<td>.167*</td>
<td>.067</td>
<td>.096</td>
<td>.168*</td>
<td>.018</td>
<td>-.029</td>
<td>-.068</td>
</tr>
<tr>
<td>Anxiety-2</td>
<td>.374**</td>
<td>.165*</td>
<td>.055</td>
<td>.177*</td>
<td>.070</td>
<td>.057</td>
<td>-.063</td>
</tr>
<tr>
<td>Partial r</td>
<td>.344**</td>
<td>.188*</td>
<td>-.010</td>
<td>.103</td>
<td>.073</td>
<td>.081</td>
<td>-.033</td>
</tr>
<tr>
<td>Connect-1</td>
<td>.257**</td>
<td>.185*</td>
<td>.233*</td>
<td>.172*</td>
<td>.206**</td>
<td>.045</td>
<td>.015</td>
</tr>
<tr>
<td>Connect-2</td>
<td>.242**</td>
<td>.187*</td>
<td>.150*</td>
<td>.203*</td>
<td>.177*</td>
<td>-.061</td>
<td>.008</td>
</tr>
<tr>
<td>Partial</td>
<td>.137*</td>
<td>.148*</td>
<td>.030</td>
<td>.141*</td>
<td>.090</td>
<td>-.109</td>
<td>-.002</td>
</tr>
</tbody>
</table>

*p < .01, *p < .05. Partial correlations are between the amount of Internet Use and post-test scores on Social Support, Anxiety, and Connectivity, partialing out the effects, respectively, of the pre-test scores for Social Support, Anxiety and Connectivity.

A stepwise multiple regression analysis revealed that flow was significantly influenced solely by one predictor variable: attitudes toward aging ($\beta = .445$, $p < .001$) ($R = .487$, adjusted $R^2 = .199$). Hypothesis 3 was partially supported. Achieving optimal flow was related to significant increases in perceived social support and connectivity, and to a reduction in computer anxiety (see first column, Table 5); partialing out the effects of pre-test scores, flow was related to increased perceived social support ($r = .254$) and connectivity $r = .137$), and to a lower levels of computer anxiety ($r = .344$).

Discussion

Two hundred ninety-two individuals (average age of 80.4 years) were recruited to learn how to surf the Internet, e-mail others, and join discussions in chat rooms. The adult learners had limited, if any, previous experience with new technologies or with the Internet. Forty-eight percent withdrew from the project over the 4-month period, many within the first 6 weeks. Forty-five individuals (15% of the entire sample) believed that WebTV was too difficult to learn, while 77 individuals (26% of the entire sample) withdrew because they felt that they did not have sufficient time to devote to learning to use WebTV. The fact that individuals reacted so differently to the same technology and training implies that some individuals need training at a more rudimentary level, while others may need more stimulation or challenge (see below). Computer anxiety, computer efficacy, and attitude toward aging were significantly related to staying in the program, and the results similarly have implications for future training programs. To be successful, we believe programs should focus on reducing anxiety and building efficacy (and to do so early) and feature lessons phrased optimistically and in encouraging formats.

Once trained, on-line adult learners experienced increased feelings of social support, connectivity, and reduced technology-related anxiety. Some learned to spend hours on-line each week, and some became absorbed in searching web sites, e-mailing, and gathering news on-line. Over time, this increased connectivity and feelings of social support ought to correspond to maintaining friendships longer, maintenance of positive self-esteem, reduced age-related stress and depression, and to gains in knowledge about a wide range of topics—medical, travel, and the like. A positive first experience in training should also correspond to an increased interest in enrolling in additional courses on communication skills, writing, and exploration.
Our results indicate further that training in the use of new technologies is largely predictable, and the results indicate ways in which to identify and utilize remedial work for some participants. The fact that the same program was too challenging to some and insufficiently stimulating to others suggests two approaches to be adopted by communication educators. First, training programs can benefit from developing a "paced format" method of training geared toward different profiles of adult learners. Some will require fundamental, basic, exposure to keyboarding, manipulating a mouse, and an explanation of the sounds the computer makes, and why it does so. We have also observed that early learners do not know how to "problem solve"; that is, if the computer screen does not "look right" or the connection is not made, early learners do not know how to return the technology system to an original starting point. Second, it is clear that many learners would benefit from earlier programs which would reduce anxiety, build confidence, and provide individually-oriented training which is engaging and stimulating (Ratcliffe, 1998). Having positive experiences early with computers and offering stimulating games to be mastered, separate from web surfing, are important elements to be added (see, for instance, Charness et al., 1992; Temple & Gavillet, 1990).

Other participants left because they believed that WebTV was not as stimulating or as challenging as they had anticipated. Since the graphics are only as good as the available televisions, some attrition is expected. However, this observation highlights the opposite end of the motivational continuum of the Csikszentmihalyi theory (1975, 1985, 1988, 1990; Dobos, 1996). If the "paced format" is too simplistic and not sufficiently challenging, then learners will be bored and exit the program. If the training is too challenging (relative to their skills), the training will serve to increase anxiety, and adult learners will exit. Successful development and implementation of a theoretically-based training program will focus on the balance of the adult learner's skills and the challenges of the task at hand. We believe that this balanced paced format is one of the most important issues to be addressed, if communication scholars desire to reach and train a sizeable population of adult learners.

Communication on the Internet affected some people in predictable ways. Attitudes strongly affected on-line use (anxiety, efficacy, and attitudes toward aging). Being highly interconnected with others—having many contacts and satisfying contacts with friends and relatives—prompted greater use of a wider range of functions and greater use of e-mail. These results reinforce the importance of emphasizing attitudes, efficacy, anxiety, and interpersonal skills when training adult learners—and that fostering connectivity and involvement via cooperative learning and exploration will further increase usage and level of competence. One interesting finding which will require further study is the interaction effect between health limitations and gender. One possible explanation for this effect may stem from how men and women are socialized. Males are traditionally raised to view the world in a competitive light, and males whom admit to having health limitations may view the process of learning a new technology as a challenge. Males with self-admitted health limitations who rise to the challenge and learn the new technology benefit from a bolstered self-confidence—they experience decreased anxiety, increased sense of connectivity, and display a slight increase in positive attitude toward aging. Healthier males remained optimistic throughout our program. Females with health problems were not affected by training. They may have adopted a "self-fulfilling prophecy" that their lives will remain unchanged. Healthier females, however, experienced
changes in anxiety and connectivity. Many women enter the “flaming 50s” and experience “post-menopausal zest” [term attributed to Margaret Mead], and healthy women used this training program as a way to expand their horizons, reduce anxiety, and to become more connected.

A final recommendation involves developing the right type of method for delivering the training: While relying on theories of learning, we did not have sufficient resources to test different programs or elements of “cooperative learning” or rival methods. Our focus centered on maintaining a high level of participation, providing immediate feedback and rewarding experiences, and satisfying the needs of learners. Formal tests of training would compare and contrast mentoring, groups that are truly inter-dependent and cooperative, formalized instruction, and other methods.

Notes

1Contact the senior author for a copy of the items.
2Contact the senior author for a copy of the items.

References


