



Perceived versus actual computer-email-web fluency

Ulla Bunz ^{a,*}, Carey Curry ^{b,1}, William Voon ^{c,1}

^a Department of Communication, Florida State University, University Center C, Suite 3100,
Tallahassee, FL 32306, United States

^b Department of Communication, Rutgers University, 4 Huntington Street, New Brunswick, NJ 08901,
United States

^c Department of Library and Information Studies, Rutgers University, 4 Huntington Street, New Brunswick,
NJ 08901, United States

Available online 19 May 2006

Abstract

The purpose of this study was to compare people's *perception* of their computer-email-web (CEW) fluency to their *actual* abilities performing related tasks. A total of 61 subjects (51% female, mean age 19) participated in the research sessions. Participants completed the CEW fluency scale [Bunz, U. (2004). The computer-email-web (CEW) fluency scale – Development and validation. *International Journal of Human-Computer Interaction*, 17(4), 477–504.], the computer anxiety ratings scale [Heinssen, R. K., Glass, C. R., & Knight L. A. (1987). Assessing computer anxiety: Development and validation of the computer anxiety rating scale. *Computers in Human Behavior*, 3, 49–59.], and an applied protocol developed for this study. Results show that the less computer anxiety subjects reported, the higher they *perceived* their CEW fluency to be ($p = .001$), but there was no significant relationship between computer anxiety and *actual* fluency ($p = .12$). There was no gender difference as to *actual* CEW fluency ($p = .11$), but women *perceived* their fluency lower than did men ($p = .012$). Overall results validate the robustness of the CEW fluency scale, help identify CEW fluency as a digital divide component, and underscore the importance of initiatives to raise women's technological self-confidence.

© 2006 Elsevier Ltd. All rights reserved.

Keywords: Computer-email-web (CEW) fluency; Computer anxiety; Gender and technology; Perception of technology skill

* Corresponding author. Tel.: +1 850 644 1809; fax: +1 850 644 8642.

E-mail addresses: ubunz@fsu.edu (U. Bunz), ccurry@scils.rutgers.edu (C. Curry), wvoon@scils.rutgers.edu (W. Voon).

¹ Tel.: +1 732 932 7500; fax: +1 732 932 3756.

0. Introduction

In 1991 the formalization of HTML code enabled the world wide web (hereafter: web) as we know it today. Today, being technologically savvy or competent with computer and Internet technology has become the “must have” skill in our society. There is certainly a potential for tension between the dimensions of social desirability and anxiety as one pair of seemingly conflicting issues that may influence someone’s accurate perception of their own skill. Social desirability factors may even lead some technology users to over-estimate or boast about their computer-email-web (CEW) fluency. At the same time, some people prefer not to use technologies for varying reasons and computer anxiety factors can potentially lead people to underestimate their CEW fluency. Another pair of factors is exposure to technology and usage of the same. Some people may feel comfortable around technologies, but are simply not exposed to them frequently enough to develop high-level skills, a troublesome situation considered part of the digital divide. Others may have easy access, but low motivation to put the technology to use in their lives. Other influencing factors could be identified, but already each of these four factors is exerting influence of varying degrees upon technology users, affecting self-perception. The question poses itself, Can a person ever accurately assess his or her own technological aptitude, even with what is now considered “basic technology” such as the computer, email, or the web, or will self-perception always be clouded and inaccurate?

The purpose of this study was to compare and contrast people’s perception of their CEW fluency, a term discussed in more detail below, to their actual abilities performing related tasks in an applied computer-lab session. A closer look at how one perceives one’s skills versus one’s actual skill level could provide valuable insight into these issues and establish CEW fluency as an important contributing digital divide factor. After a review of applicable literature, the paper details the procedures and results of the study. The discussion section interprets results and provides contexts of application.

1. Related literature

With the distinction between “actual” and “perceived” fluency, the study at hand presents a continuation of previous thinking that has pointed towards a technology-related dichotomy (Geissler & Horridge, 1993; Smith, Caputi, & Rawstorne, 2000). Geissler and Horridge (1993) studied university students’ current computer knowledge and how it related to their level of commitment about learning more about computers. They found that students with higher self-perceived current knowledge – mostly due to having taken a computer course in high school or college, or owning a computer – were more willing to learn more about computers. Though Geissler and Horridge’s study did not look at actual knowledge, it introduces the potential for a relationship between perceived skill and openness to learn more and a potential discrepancy between perceived and actual knowledge.

Smith et al. (2000) distinguished between subjective and objective computer experience. Subjective computer experience is “a private psychological state reflecting the thoughts and feelings a person ascribes to some existing computing event” (Smith, Caputi, Crittenden, Jayasuriya, & Rawstorne, 1999, p. 228). Objective computer experience is “the totality of externally observable, direct and/or indirect human–computer interactions which transpire over time” (Smith et al., 1999, p. 228). In order to better understand some of the complexities surrounding technological fluency, the following sections review pertinent

terminology, social contexts in which fluency develops (or not), and major influencing factors determined by previous research.

1.1. Computer literacy and CEW fluency

Traditionally, “literacy” refers to reading and writing. Just as the ability to read and write – to be literate – once opened social and professional opportunities, the ability to develop and work with the once new technology of the computer currently provides similar opportunities. It seems intuitive then, to form the term “computer literacy”, which indeed has a long history. A number of scholars have defined “computer literacy” (e.g., LaLomia & Sidowski, 1990; Rhodes, 1986), often including specific skills such as programming in addition to more general abilities such as using the computer to satisfy personal needs. A definition less tied to specific functions and applicable even 25 years after it was originated is provided by Watt (1980) who sees computer literacy as a collection of knowledge skills that allow a person to “function comfortably as a productive citizen in a computer-oriented society” (p. 3).

Even though the term “literacy” has become commonly accepted with regard to technology in the past decades, it may not be the most appropriate term to use. Other terms, such as “computer-mediated communication” have become popular though they are self-limiting and narrow today. More and more people refer to *technology*-mediated communication to include evolving technologies such as cell phones or podcasting, technologies that may use microchips but are not associated with the desktop computer. Likewise, the term “literacy” suggests a narrow, short-term focus along a more traditional line with a tendency to divide those who are literate versus those who are not quite so. It hints that at its core, literacy is an “on–off” state, and does not take into consideration the dynamic nature of the evolution of computer applications and technology. Marcum (2002) suggests that the concept of “information literacy be refocused away from information toward learning, and beyond literacy in the direction of sociotechnical fluency” (p. 1), implying that literacy is essentially a static concept while fluency involves change. Thus, in an era where the feel and functionality of applications change rapidly there appears to be a need for “lifelong” learning to constantly upgrade one’s skills with new and evolving computer applications. The term “literacy” does not truly account for fluctuating levels of aptitude or comfort, neither with regard to reading and writing, nor with regard to technology skills.

Due to the inadequacy of the term “literacy,” the Committee on Information Technology Literacy (CITL) (1999) of the National Research Board suggests use of the term “fluency.” To national experts, the term “fluency” connotes the involvement of a “higher level of competency” (CITL, 1999, p. 2) than those implied by terms such as “literacy.” The attainment of fluency requires three kinds of knowledge: foundational concepts, contemporary skills, and intellectual capabilities. Such differentiations in the kinds of knowledge have already been adopted by researchers (e.g., Lin, 2000).

The third component, intellectual capabilities, refers to the ability to apply skills and experiences of computer usage in complex and sustained situations. This, according to Lin (2000), involves the ability to handle unintended and unexpected problems when they arise as well as the ability for more abstract thinking about the possibilities for the manipulation of information. As such, fluency is not a skill that can be acquired overnight; rather it entails a continuous process of computer use that involves the repeated learning,

unlearning and re-learning of technology skills over a period of time. Terms such as “literacy” or “competency” do not take into account the fact that existing skills can become obsolete due to changes in technology (Bunz, 2003). While competency or literacy largely are a function of applying current technologies, fluency suggests a more encompassing capability for adapting or applying past knowledge to untried (future) situations.

At Rutgers University, the English as a Second Language Program defines two stages of language appropriation, competency and fluency, with fluency connoting a higher level appropriation of the English language than competency. Just as with technological applications, having basic competency in a language works only as long as no unfamiliar or surprising situations occurs. Fluency is required both in language and in technology skill to deal successfully with the unexpected. In research on reading and language acquisition, Reynolds (2007) also distinguishes between competency in grammar and actual linguistic fluency which allows the use of language in social practice. These examples support the distinction made here between technological competence and literacy, and technological fluency.

Based on the presented arguments, the term “fluency” or “technological fluency” was adopted for this line of research. Adopting the broader concept of fluency as opposed to literacy or competency, and incorporating information and interaction perspectives into the scope of computer usage, the effective use of computers was extended to include the use of email for communication and the web for information seeking and dissemination, leading to the concept of computer-email-web fluency as introduced by Bunz (2004).

1.2. Digital divide and fluency

Although the National Telecommunications and Information Administration (NTIA) declared in July, 1999, that “society should not be separated into information haves and information have-nots” (NTIA, 1999, p. xiii) and thus defined the digital divide by access alone, many (e.g., Warschauer, 2002) have since argued that a definition based on access alone attaches too much emphasis on the physical availability of computers and connectivity. A number of other factors such as content, language, education, literacy, community, or social resources and networks, can be identified which can affect the digital divide both positively and negatively (e.g., Cullen, 2001).

Besides physical access to information and communication technologies, researchers consider attitudes and content important contributing factors (Bertot, 2003) as well as the embeddedness of the Internet in the existing communication infrastructure (Loges & Jung, 2001). Stanley (2003) points out that even before computer cost becomes a factor in deterring access, potential users may summarily dismiss the relevance of computer technology in their lives. Parental values toward home computer and Internet use may help children develop both positive and negative attitudes towards these and other technologies. Stanley reasons that challenges to one’s psychological comfort zones include perceived difficulty of use, presumed lack of technical competence, and computer related anxiety and that these are obstacles to learning computer technologies.

1.3. Factors affecting CEW fluency

The main factor identified by the literature in relation to “computer literacy” is computer anxiety, which in turn is related to several underlying and interconnected issues

including self-efficacy; the availability of suitable computer training, learning styles, and past computer related experiences; age; and gender. The literature on each is briefly reviewed here as it is reasonable to suspect that each could influence technological fluency either directly, or through computer anxiety.

1.3.1. Self-efficacy

Computer self-efficacy is defined as an individual's judgment of their capability to use a computer (Compeau & Higgins, 1995) and is a major determinant of persistence in studying computing (Brosnan, 1998). Though some researchers (e.g., Colley, Gale, & Harris, 1994; Levine & Donitsa-Schmidt, 1998) argue that computer self-confidence, computer attitudes and computer anxiety are so closely related that they are, in fact, part of the same construct, others have identified computer use and acceptance as important separate determinants (Hong, Thong, Wong, & Tam, 2002; Venkatesh & Davis, 1996), as both increase with computer training (Decker, 2002; Torkzadeh & Koufteros, 1994).

1.3.2. Training

Quite a large body of literature exists on the relationship between computer training and computer anxiety. Overall, most studies conclude that there is an inverse relationship between computer anxiety and computer experience. As experience with computers increases, computer anxiety will decrease (Bozionelos, 2001; Chou, 2001; Chua, Chen, & Wong, 1999; Heinszen, Glass, & Knight, 1987) and computer performance will increase (Compeau & Higgins, 1995; Compeau, Higgins, & Huff, 1999; Torkzadeh, Pifughoft, & Hall, 1999; Torkzadeh & Van Dyke, 2002; Vician & Davis, 2002). Adapting training programs to correspond to learning styles may increase computer self-efficacy which in turn would reduce computer anxiety levels (Bozionelos, 2001; Chou & Wang, 2000; McIlroy, Bunting, Tierney, & Gordon, 2001). However, training had no affect on people with negative attitudes towards computers (Torkzadeh et al., 1999), attitudes which may result from past negative computer-related experiences (Marakas, Yi, & Johnson, 1998), or a limited understanding of the usefulness of a computer in a person's life. Also, Potosky (2002) shows that self-rated knowledge and performance during a training session positively influenced post training technological efficacy. A study assessing both self-rated or perceived knowledge and applied skills or performance should thus control for order effects.

1.3.3. Age

Overwhelmingly, the literature shows that computer anxiety is related to age in that older people experience higher anxiety (e.g., Baracat & Marquie, 1994; Charness, Schumann, & Boritz, 1992; Delgoulet, Marquie, & Escribe, 1997; Kelly & Charness, 1995; Marquie, Jourdan-Boddaert, & Huet, 2002). However, recent literature points out that there are portions of the elderly population who are comfortable with Internet technology, even using their own websites as expressions of social identity (Harwood, 2004). Reports by the Pew Internet and American Life Project also show that not only are seniors going online in larger numbers, but they are enjoying it (Fox, 2001, 2004). As the sample population for the study at hand was very homogenous with regard to age, age differences were not investigated.

1.3.4. Gender

Computer anxiety studies that have differentiated by gender have concluded that overall, men seem to have higher computer and Internet self-efficacy (Torkzadeh & Koufteros, 1994;

Torkzadeh & Van Dyke, 2002); rate themselves higher on perceived self-efficacy (Carlson & Grabowski, 1992; Miura, 1987); express more positive attitudes towards computers and the Internet (Durdell & Haag, 2002; Whitely, 1997); have more of a feeling of control when dealing with technology (Hattie, 1990); and overall show less computer anxiety (McIlroy et al., 2001) as compared to women. However, recent studies also show that overall, men have used the Internet for longer (Durdell & Haag, 2002), and that gender differences with regard to computer anxiety are declining (Durdell & Haag, 2002; Schumacher & Morahan-Martin, 2001), partially due to the increased use of computers in the workplace (Rainer, Lao-sethakul, & Astone, 2003). Also, at least one study (Torkzadeh et al., 1999) found no significant differences in gender responses. However, stereotypes regarding gender differences in technology use may still prevail in society. Only a few years ago, Farenga and Joyce (1999) showed that both boys and girls thought physical science and technology-related courses to be more appropriate for boys than for girls, even though neither had been exposed to any such courses yet. Enrollment in such courses years later seemed to parallel the earlier stereotypes, indicating no change in attitude either for boys or for girls. Steele (1997) has shown how such negative stereotypes can have actual negative consequences. In his research, women in advanced quantitative areas were less likely to identify with positive influences on their education due to stereotyped gender roles. Steele showed that the simple threat of possibly joining a group that is socially stereotyped negatively can cause poorer performance on standardized tests. Promoting enrollment in computer-related courses during high school or college could decrease computer anxiety in women and further increase women's active choice of technological careers (Honey & Bennet, 1994; Nowak & Krcmar, 2003), but this strategy will work only if both men and women are educated on the falseness of gender stereotypes. Tentative indicators for the success of such programs can be found in selected East European countries (Durdell, Cameron, Knox, & Stocks, 1997).

An additional complicating factor is the issue of self-perception and the questionable accuracy of such evaluation. Research shows that people often have preconceived notions of their skill, and that these (often faulty) notions can lead them to estimate their actual performance inaccurately. Ehrlinger and Dunning (2003) found that altering people's view of their capabilities changed performance estimates although it did not change actual performance. In their research, Dunning, Johnson, Ehrlinger, and Kruger (2003) charted how those with poor performance often over-estimated their expected performance because they lacked the metacognitive judgments to realize their own incompetence, or, expressed more simply, they knew too little to realize that they did not know a lot. High performers, on the other hand, tended to slightly under-estimate their expected performance, but this under-estimate was still higher than the over-estimate of poor performers. Thus, in a way no one perceived their skills accurately, and people's perception of their skills tended to be opposite of their actual skill.

From the above literature review on computer anxiety, there does appear to be some link between age, gender, self-efficacy, and computer training with computer anxiety. Different learning styles or teaching approaches to computer classes may also play some role in moderating learners' level of computer anxiety. Past experiences with computer usage may influence attitudes toward computer use and hence affect computer anxiety. Age and gender are also seen as having some correlation with computer anxiety, though it may well be moderated by self-efficacy and past experiences. In turn computer anxiety could conceivably affect one's perceived CEW fluency and eventually one's actual CEW fluency, as indicated by the research on computer anxiety and self-efficacy.

Based on such arguments, the following research questions and hypotheses were formulated:

RQ1: In which way is computer anxiety related to *perceived* versus *actual* CEW fluency?

H1a: There is a direct relationship between computer anxiety and *perceived* CEW fluency so that people with higher computer anxiety will perceive themselves to have lower CEW fluency. People with lower computer anxiety will perceive their CEW fluency to be higher.

H1b: There is a direct relationship between computer anxiety and *actual* CEW fluency so that people with higher computer anxiety will perform significantly worse on an applied CEW fluency test than those with lower computer anxiety.

RQ2: Are there gender differences in regard to *perceived* CEW fluency, to *actual* CEW fluency, and to computer anxiety?

H2: Despite wide diffusion of technology within the US and in line with a number of previous studies reviewed above, gender stereotypes regarding technology still exist and may overcome even personal experience. Thus, (a) women are hypothesized to have higher computer anxiety than men, and (b) women are hypothesized to *perceive* themselves as having lower CEW fluency.

2. Methodology

2.1. Participants

Participants ($N = 61$) were recruited from a large first-year introductory course at a major research university in the Northeast of the United States. Students were informed that they would receive \$15 for their participation in a research session that would last up to one hour. Subjects were assigned to research sessions based on their availability. They were notified of their session time by email – addresses in the BCC line for anonymity – and reminded by phone one day before their appointment. No identifying information was collected during the study itself.

2.2. Measurement instruments

The research packet was comprised of 69 items in three main measurement instruments – two Likert-type questionnaires and an applied protocol made up of tasks for the participant to complete. Demographic variables of age, gender, type of operating system normally used, and frequency of Yahoo! email use were also captured.

Two versions of the research packet were used – one with the questionnaire section first and applied portion second, and the other with the applied portion first followed by the questionnaires to control for order effects. In addition to the issue of faulty perception introduced above (see Dunning et al., 2003), the recency of being asked to perform a task may influence one's perception of one's ability (i.e., a person who was just asked to perform a task may report a different skill level with the task than someone who was asked about their skill level prior to attempting that task). In addition to the questionnaire and consent forms, each research packet included the participant ID number, a unique Yahoo! email account ID set up specifically for the research, the Yahoo! email password, and a floppy disk marked with the subject's participation ID.

2.2.1. Computer anxiety scale

Computer anxiety and computer-mediated communication anxiety relate to CEW fluency as it can be hypothesized that people with higher technology anxiety will perform below average on the applied portion of the study, while people with low technology anxiety may overestimate their fluency.² The computer anxiety ratings scale (CARS), developed by and available in Heinszen et al. (1987) and well established in the literature (e.g., Beckers & Schmidt, 2001; Durndell & Haag, 2002), was chosen to determine subjects' level of computer anxiety.³ The scale is reported as having high internal consistency ($\alpha = .87$) and test-retest reliability ($r = .70$, $p < .001$; $t = -1.06$, $p < .30$; Heinszen et al., 1987, p. 54). The scale is also relatively short, which was of essence for this study. As subjects were required to complete several instruments, questionnaire fatigue had to be avoided. The original scale was modified from 19 to 17 Likert-type statements. Two statements ("I feel insecure about my ability to interpret a computer printout", and "I am sure that with time and practice I will be as comfortable working with computers as I am in working with a typewriter") were deleted because the references to a computer printout and typewriter are outdated. The remaining 17 items asked about the following: using a computer on the job; learning to program; excitement, motivation, confidence, and apprehension regarding (learning about) computers; practice; fear of dependence on computer; keeping up with advances in the computer field; disliking "smart" machines; understanding technical aspects; consequence of and fear of making mistakes; required intellectual capacity; intimidation about the unfamiliar; computers as necessary tools. Items were arranged on a 5-point Likert scale from 1 = strongly disagree to 5 = strongly agree.

2.2.2. Computer-email-web fluency scale

The CEW fluency scale was originally developed by (Bunz, 2004). During the development, 52 items were reduced to 21 items in four constructs (computer, email, web navigation, web editing). Though the scale's reliability held up in various applications (scale coefficient $\alpha > .80$ in all applications), internal variance of responses was low. Several of the more difficult items had been factored out and wording of items was more in line with "yes/no" answer options rather than the Likert-type answer options used.

In order to improve on the scale, a pilot study was conducted. Wording of the original 52 items was adjusted and rather than asking subjects to evaluate how strongly they agreed or disagreed with the items, the 5-point Likert scale instructions now asked about how much thought it would require for the subject to perform each item. The answer options were: "no thought," "a little thought," "some thought," "a fair amount of thought," and "a great deal of thought." Examples were provided on the questionnaire for the meanings of "a little thought," (If you would only stop for a brief moment and then perform the task

² Ideally, a computer-mediated communication anxiety scale should have been used as the items tested in the applied portion of the study extended beyond the computer. However, only one such scale could be identified, the 20-item computer-mediated communication apprehension scale (Clarke, 1991), which reports high overall reliability ($\alpha = .95$) as well as high reliability for its subscales (α ranging from .88 to .93). As the scale seems to include several reverse coded items, the scale's author was contacted but unfortunately coding information could not be obtained before the first scheduled computer lab session. Thus, we were forced to use a computer anxiety scale instead of the computer-mediated communication instrument.

³ This scale should not be confused with a scale with the exact same name and abbreviation developed by Rosen and Weil (1992) which recently has been criticized as lacking validity (Gordon, Kiley, Shevlin, McIlroy, & Tierney, 2003).

without problems, you may want to choose “4, a little thought.”) and for “a fair amount of thought,” (If you kind of remembered how to do the task, but it would require you to figure out how to do the task rather than really knowing it, you may want to choose “2, a fair amount of thought.”). Items were still arranged in three main groups focusing on computer tasks, email tasks, and web tasks. In addition, the pilot study questionnaire asked subjects to record their start time and end time for completing the questionnaire, and four questions on gender, age, operating system most commonly used, and how often subjects used Yahoo! email during a typical month.

The pilot questionnaire was distributed in an upper level research methods course where students could complete it for extra credit. A total of 140 questionnaires were returned. Subjects were predominantly female (76%), 21 years old (range 18–38), and PC/Windows users (97%). More than half (57%) never used Yahoo! email, and one quarter (25%) used it daily with the remaining subjects falling in-between. The revised CEW fluency scale showed high reliability overall (coefficient alpha = .96), as well as in its three subscales, computer (alpha = .89); email (alpha = .93); and web (alpha = .89). The revised scale also showed greater internal variance within items than the shorter version. Thus, while a shorter version may have been more desirable, the revised, longer version of the CEW fluency scale was used for the study at hand due to its statistical strengths.

In order to gauge difficulty levels of items, which was important in order to score the applied part of the study, a principle component factor analysis with varimax rotation was conducted. A three-factor solution, explaining 52% of variance, emerged and divided the items into skill levels as defined in the literature (CITL, 1999). Items of all three subscales (computer, email, web) loaded in each of the three skill level factors. For the applied component of the study, correctly completed “fundamental skills” tasks were worth 1 point; “contemporary concepts” tasks were worth 2 points; and “intellectual capabilities” tasks, which required application of other skills, were worth 3 points.

2.2.3. *Applied protocol*

The applied protocol (see [Appendix A](#)) was developed in order to measure whether or not participants could actually complete tasks listed in the CEW fluency scale. The complete list of 52 items was broken down into its three subscales: computer skills, web skills, and email skills. Then each list was arranged in a logical successive order. Due to time restrictions certain items such as switching on a computer or creating a website were deemed unsuitable for the study and were omitted from the applied portion. As much as possible, tasks were arranged to ensure that subsequent steps did not depend on the completion of prior steps. For most tasks, the final protocol structure allowed participants to skip steps if they were unable to complete certain portions of the protocol while still being able to accomplish other tasks. To some degree, this quasi logical progression through the applied protocol may have facilitated completion of individual items. It is possible that scores on the applied portion of the study would have been lower overall if tasks had been arranged more randomly.

Participants were asked to use the Google search engine to show their ability to perform a search (items W1 and W4). A target website was needed (a) showing reliability (i.e., subjects could find the website each time and the content of the website would not have changed during the study period) and (b) being non-intuitive (meaning that subjects would not guess the URL). The English-language version of the Tour de France website fulfills these criteria and was thus selected with its web address of <http://www.letour.fr>. The interna-

tional extension of “.fr” as part of a domain name is not obvious to U.S. Americans. Since the Tour had ended by the time the study was performed, most portions of the site remained constant.

Although the task of editing a bookmark (item W9) did not require users to actually visit the website, it did require an existing website. The Centers for Disease Control and Prevention website (<http://www.cdc.gov>) was chosen as it was assumed that the majority of subjects would not be familiar with this site while the site itself fulfilled the research requirements.

After the development of the applied protocol, appropriate documents for subjects to work with and email accounts were created. An informal time and readability test was conducted with four volunteers. Each research session was scheduled for 60 min. Taking into account a potential delayed start of a few minutes, the verbal instructions, and the returning of research materials, the target time period for actual completion of the entire research packet was set at 45 min. Volunteers were able to complete the applied protocol well within the target time period, finishing within 20–30 min. Based on the volunteers’ feedback, the wording of one step was changed from “Save a paragraph of text to the Fluency Folder” to “Save the first paragraph of text, starting with ‘And then there were five’ to the Fluency Folder under a new file name” in order to be more explicit and avoid confusion.

In order to test the email portion of the applied protocol, the researchers created 95 accounts at Yahoo! – five for the accounts that were sending the mail accessible only by the researchers and 90 for the participants to receive the mail and perform the required tasks.⁴ A username standard was developed that incorporated the participant identification number for each participant account. From each of the five sender accounts, short messages were sent to all of the participant accounts.

2.3. Procedures

Prior to subject arrival, the computer lab was cleared of any users and the computers were rebooted which removed any extraneous files left by other users and cleared all the bookmarks. Necessary electronic folders, bookmarks, etc. were created by the researchers on each computer and two copies of the consent form were placed at each computer terminal.

Upon entering the lab, participants were given verbal instructions and each handed one of the two versions of the questionnaire. Though subjects participated in groups of approximately 4–10 people per session, the lab was large enough to space participants at least one seat apart from each other so that no direct comparison between one’s own computer screen and the neighbor’s was possible. This helped not only to suppress “cheating” during the applied portion of the study, but also minimized potential gender comparisons (e.g., “He/she is further along than me. I must be better/less capable.”). Participants were instructed that upon completion they should leave their completed consent form, questionnaires, disk, and printout (if available) at the computer and leave the computer

⁴ Initially, we aimed for 40–45 subjects per group but were able to complete tests for only 61 subjects, mostly due to subject drop-out and adverse weather conditions, and despite the addition of an extra research session. With a larger sample, the correlation analysis for Research Question 1, which now approaches significance with $p = .07$, may have reached significance.

on. Following each research session, the researcher retrieved data from each computer, such as whether the bookmark had been edited, whether the appropriate website had been visited, etc., and recorded each subject's performance on a coding sheet.

2.4. Coding

After adjustments were made for the 9 reverse-worded CARS items, all items from the CEW fluency and CARS scales were coded by the circled Likert values. The applied portion was coded based on an item checklist where each task was verified and assigned a score. The point value of each item was based on the factor analysis of the pilot study that delineated items into three difficulty levels. One point was assigned to easy items, two points for mediocre items, and three points for difficult items. The sum of the points for completed items yielded the participants' score on the applied section with a possible maximum score of 49 points.

Coding of the applied protocol was conducted by two of the three researchers. If either encountered a problem or question about an uncommon occurrence (e.g., a folder was created somewhere other than the required location), all three researchers collaborated and discussed the issue until there was full agreement on how to award credit for the item. Such discussions were required three times: for creating a folder in a place other than where specified; for saving an entire website rather than an image; and for identifying a domain name. The researchers determined if the task was completed as instructed within the context of the protocol and if the participant understood the concept that was being measured by the task. Partial credit was awarded in certain cases and the same criteria were then used to evaluate all cases and award points in the same way.

Partial credit was also awarded for the listserve question of the applied protocol (question 9, testing item E15). Based on a definition of the term "Listserve" provided by the website <http://whatis.com>, a 10% sample of subjects' responses, and the researchers' extensive experience with communication technologies, the definition of "Listserve" for the purpose of this study was determined to include four criteria: (1) that it involved email or electronic messages, (2) that one must subscribe to the service, (3) that it gets dispersed so that everyone gets the same message, and (4) that it is a one to many distribution such that a single message is sent only to the name of the listserve, but is distributed to everyone subscribed to the particular listserve. As the question asked the difference between an address book and a listserve, credit was awarded in the following manner: One point was given if only the definition of an address book was correct, or 2 or 3 of the listserve definition criteria were met including the reference to its distribution. Two points were given if the response met all four criteria of the listserve definition, but missed the definition of an address book. Full credit of three points was given if both answers were completely correct.

3. Results

3.1. Basic frequencies and reliabilities

Subjects' gender distribution was almost equal with 51% of participants being female, and most were 19 years of age (mean and mode age = 19; range 18–23). Just as subjects in the pilot study, participants were predominantly PC/Windows users (98%) and tended to

use Yahoo! email either never (64%) or daily (18%), with the remaining 18% using the service anywhere between once a month to several times a week. The majority of subjects could thus be considered familiar with the operating system used in the study at hand, but not familiar at all or not very familiar with the email service used for the study at hand. Participants took an average of seven (6.93) minutes to complete the questionnaire portion of the study packet (SD = 2.26; range 4–20), and an average of 23 (22.73) minutes to complete the applied portion of the research packet (SD = 5.82; range 14–40). Overall, subjects completed the entire research packet in an average of 30 (29.65) minutes (SD = 6.98; range 19–60; modes at 27 and 30; median at 29).

Independent samples *t*-tests showed no significant difference between the two groups (questionnaire first vs. applied portion first) either on the overall CEW fluency scale, $t(56) = 1.07$, $p = .29$, power = .18; the computer subscale, $t(59) = 1.48$, $p = 1.44$, power = .30; the email subscale $t(59) = 1.25$, $p = .22$, power = .23; or the web subscale, $t(56) = .36$, $p = .72$, power = .06, which allowed combining the two groups' data sets. These results speak for the robustness of the revised CEW fluency scale, as well as demonstrating that as a group, subjects' fluency did not differ by condition. Similarly, the two groups did not differ significantly in their computer anxiety, $t(55) = -1.20$, $p = .24$, power = .05 which could have been affected by the study's procedures.

Reliabilities as measured by coefficient alphas were high for all scales and subscales (between .82 and .95), as is displayed in Table 1. On the applied portion of the study, subjects scored a mean average of 37.78 points (SD = 5.50; possible range 0 to 49; scored range 20–46). The following sections provide results of more analyses in terms of the research questions and hypotheses.

3.2. RQ1: Relationship between computer anxiety and perceived vs. actual CEW fluency

Based on the “subjective/objective” and similar distinctions made in the literature (Geissler & Horridge, 1993; Smith et al., 2000; Smith et al., 1999) and social desirability effects mentioned earlier, we argue that people may not assess their own technological fluency correctly. *Perceived* CEW fluency was measured as a subject's score on the CEW fluency scale (possible range 1–5). *Actual* CEW fluency was measured by a subject's score on the applied skills component of the research study (possible range 0–49).

In order to investigate how computer anxiety is related to *perceived* versus *actual* CEW fluency, first a 1-tailed bivariate correlation analysis was conducted. Results show that *perceived* fluency and *actual* fluency are related significantly, $r = .23$, $p = .037$, $R^2 = .05$. Correlation analysis also showed that there is a significant relationship between subjects'

Table 1
Basic frequencies and reliability measures for perceived CEW fluency, actual CEW scoring, and computer anxiety

	Mean	SD	Standard error	Coefficient alpha
CEW fluency				
Total	4.11	.45	.06	.95
Computer	4.30	.42	.05	.87
Email	3.98	.52	.07	.90
Web	4.06	.54	.07	.87
Computer anxiety	2.04	.41	.05	.82
Applied CEW tasks	37.79	5.50	.70	N/A

computer anxiety and their *perceived* CEW fluency, $r = -.42$, $p = .001$, $R^2 = .18$. As was predicted by hypothesis 1a, the less anxiety subjects reported, the higher they *perceived* their CEW fluency to be. Hypothesis 1a was thus supported.

However, the data show no significant relationship between computer anxiety and subjects' *actual* CEW skills, $r = -.20$, $p = .12$. When controlling for anxiety, there is no improvement in the prediction of *actual* fluency scores. Thus, hypothesis 1b was not supported. For the tasks tested in the applied portion of the study, computer anxiety did not significantly relate to or affect subjects' *actual* CEW fluency performance.

3.3. RQ2: Gender differences

The literature reports closing, but still existing gender gaps with regard to computer anxiety. The sample for the study at hand consisted predominantly of college freshmen (age range 18–23). General demographics of the University show that the majority of students enrolled come from the immediate urban environment and middle-class households. In combination with government initiatives to provide computer and Internet access in all schools in the US, entering freshmen at the University can be assumed to have been exposed to computer, email and web technology independent of gender. As part of research question 2, it was tested whether there would be a gender difference with regard to *actual* CEW fluency. The results of independent samples *t*-tests were non-significant, $t(59) = -1.63$, $p = .11$, power = .35. Based on these results there is no reason to suggest that there are gender differences in *actual* CEW fluency.

As gender stereotypes with regard to technology still prevail and few if any programs have been initiated to alleviate such stereotypes and actively promote young women's exposure to and use of technology beyond everyday encounters, it was hypothesized that women would score higher on the computer anxiety scale (hypothesis 2a), and lower on self-perceived CEW fluency (hypothesis 2b). Results show that there was no significant gender difference with regard to computer anxiety, $t(59) = 1.75$, $p = .09$, power = .53. However, there was a significant difference with regard to *perceived* CEW fluency, $t(55) = -2.61$, $p = .012$, $R^2 = .11$, with men ($M = 4.26$, $SD = .48$) perceiving their CEW fluency to be higher than women ($M = 3.97$, $SD = .37$), as hypothesis 2b predicted. Specifically, men perceived their computer fluency, $t(57) = -2.98$, $p = .004$, $R^2 = .13$ ($M = 4.45$, $SD = .42$), and their web fluency, $t(58) = -3.06$, $p = .003$, $R^2 = .14$ ($M = 4.26$, $SD = .51$), to be higher than women did (computer fluency $M = 4.15$, $SD = .36$; web fluency $M = 3.87$, $SD = .50$), but there were no significant differences between the genders for email fluency, $t(52) = -1.33$, $p = .19$, power = .36. Thus, there is partial support for hypothesis 2; gender differences exist for *perceived* CEW fluency (2b), but not for computer anxiety (2a). It is interesting to observe that – at least for this sample – although women did not differ from men with regard to computer anxiety, they still perceived their technological fluency to be lower than men perceived their fluency levels. Future studies ought to investigate what other influencing factors shape this perception.

4. Discussion

Technological fluency is an important, lifelong learning process of increasing importance in today's technology-driven society. The purpose of this investigation was

to compare and contrast people's *perception* of their CEW fluency to their *actual* abilities performing related tasks in an applied computer-lab session. Due to its interconnectedness with computer anxiety, technological fluency can also be seen as a digital divide factor. *Perception* of CEW fluency was assessed by the CEW fluency scale (Bunz, 2004). *Actual* CEW fluency was assessed by an applied protocol developed for this study based on the CEW fluency scale. Computer anxiety was measured by the computer anxiety rating scale (Heinssen et al., 1987).

Results showed that direct exposure to technology during the study itself was not significantly related to people's *perception* of their CEW fluency. Future research ought to investigate whether a significant relationship emerges between *perceived* technological fluency and *actual* technological fluency when subjects are confronted with a new, entirely unfamiliar technology or technological application that they are asked to use before or after they have completed a survey questionnaire. Also, as results are approaching significance with the comparatively small total number of participants ($N = 61$), a larger sample may have shown order effects (applied computer use first, or questionnaire first). If order effects can be shown, the concept of technological self-efficacy or self-confidence may be more fluid than assumed in previous research, placing greater emphasis on social or environmental factors than on factors emerging from the technologies themselves. As a result, attempts to understand and overcome *actual* differences in CEW fluency researchers may have to place more emphasis on factors affecting *perception* of fluency, for example through experimental research.

While these results do not help us understand order effects better, they do support the stability and validity of the measurement instrument itself in that the self-evaluative instrument seems to assess CEW fluency accurately. If there was a discrepancy between *actual* fluency and *perceived* fluency as assessed by the CEW fluency scale, it would have emerged at this point.

The study at hand also investigated the relationship between computer anxiety and perceived versus actual CEW fluency. Results showed that the less anxiety subjects reported, the higher they *perceived* their CEW fluency to be. As the literature on computer anxiety shows, training efforts tend to be successful only with people who have positive attitudes towards computers. Lowering anxiety levels creates a positive self-fulfilling prophecy. Thus, it is essential to reduce technology anxiety in potential technology users. This result has important implications for digital divide policy makers and educators. In addition to existing digital divide initiatives to, for example, increase access to technology, initiatives could be directed at children and adults alike to show that technology use can be entertaining.

Richter, Nauman, and Groeben (2000) investigated three dimensions of computers, one of which was the use of the computer for entertainment purposes. It is not farfetched to investigate the enjoyment inherent in using computer technology itself. Such an approach may avoid the development of technology anxiety and instead motivate interactions with various technologies. Studies of after-school programs have already shown that creating a "fun" learning atmosphere is related to self-determination and a more successful learning outcome (Grosshandler & Grosshandler, 2000). Special value seems to lie in creating a feeling that is the "opposite of control" (Wong, Packard, Girod, & Pugh, 2000) but without feeling anxious or out of control. McLester (1998) suggests that rather than focusing on learning specific skills, any training program should first introduce a threat-free and playful approach to the new technology. With low levels of anxiety, users may then be

more likely to perceive themselves as being in control of the technology – or having the “opposite of control” without feeling out of control, which may raise their motivation to learn more, and eventually may even lead to higher levels of actual technological fluency.

In the study at hand, a direct link between computer anxiety and *actual* CEW fluency performance could not be shown. Several possible explanations can be found for this result. First, this study was set up as a one-time assessment and not a training program or a long-term investigation. Subjects signed up for participation in the study, and though potential participants were told during recruitment that “We are interested in people with all levels of skills, no matter whether you think you have low skills or high skills”, people with higher computer anxiety levels may have opted out of participating due to their anxiety. While that would still result in participants with a range of skill levels, the group would be comparably homogeneous with regard to computer anxiety. Future studies can overcome this potential problem if they can require participation in a study from all people in a particular group, such as all students in a class, rather than making participation optional.

Another possible explanation for the non-significant relationship between computer anxiety and *actual* CEW fluency may lie in the measurement instrument itself. The CARS (Heinssen et al., 1987) is more than 20 years old and it could be hypothesized that the scale is no longer reliable with the advances in computer technology. However, this is an unlikely explanation as a reliability or validity problem with the scale should have emerged for all results, meaning for both *perceived* and *actual* fluency. This was not the case. In addition, the scale has continued to be used frequently and successfully in recent studies (e.g., Barbeite & Weiss, 2004; Durndell & Haag, 2002).

Two additional explanations can be found that may have contributed to the non-significant result, geographical culture and issues of self-perception. First, geographical culture refers to the fact that overall attitudes and behaviors differ in different regions of the United States. The study at hand was conducted at Rutgers University, which is located in the metropolitan area near New York City in the Northeast of the United States. That particular area is known for fast-paced life and the population of New Jersey is often stereotyped as having a particularly (overly) confident attitude (Moffatt, 1989; Pomper, 1986). Parental education levels also tend to be high in this area which could contribute to younger generations’ higher confidence. Finally, this particular metropolitan area is very diverse ethnically with many students being first or second generation Americans. Their parents would have had to take chances and work hard to make a living in a new country and such an attitude that would not allow for the fear of failure could have been instilled in the children. Repeating the study in different regions of the United States would control for cultural influences related to geography.

Second, the attitudes described in the paragraph above can be related to the issue of self-perception which has been investigated in a number of studies, including in studies dealing with technology. Dunning and colleagues in particular have looked at issues of self-assessment and reasons why someone might over- or under-estimate his or her own performance. Both measurement instruments used (CEW fluency for *perceived* fluency; CARS for anxiety) are self-report instruments. If people are likely to over- or under-estimate on one such instrument, their estimate on a second instrument may parallel such faulty estimate. This would explain the significant relationship between *perceived* fluency and computer anxiety. Dunning et al.’s (2003) study on recognizing one’s own

incompetence as well as Kruger and Dunning's (1999) study support such an interpretation. Dunning and colleagues show that people tend to consistently but incorrectly assess their own performance. The highest performers tend to under-estimate their performance, while all others tend to over-estimate their performance. Over-estimating one's performance as a concept is not too far from possibly under-estimating one's anxiety, an issue potentially intensified by social desirability factors of not wanting to look "stupid" or anxious. In a way, one could then argue that the non-significant result for *actual* CEW fluency and computer anxiety almost supports the idea that there is a relationship, but that the relationship did not emerge due to skewed self-assessment. This could be exacerbated by the cultural factors discussed above. In any case, the relationship between technology anxiety and *perceived* versus *actual* technological fluency should be investigated more deeply.

Finally, the study addressed the issue of gender differences with regard to CEW fluency. In 1994, Shashaani showed that there is a relationship between socio-economic status, parents' sex-role stereotyping and the gender gap in computing as the sex-role stereotypes held by parents has a strong effect on children's stereotyping. Overall, the parents in Shashaani's study considered computing a male domain. Since then, gender stereotypes continue to see technology as more "male" dominated in Western cultures (Brosnan & Lee, 1998), and research continues to show that this gender stereotype is shared by women who overall think of themselves as less scientifically oriented (Tsai, Lin, & Tsai, 2001) even though sex was not significantly related to technology preparedness of college freshmen (Sax, Ceja, & Teranishi, 2001). Such an attitude may lead to women pursuing scientific goals less (Eccles, 1987). Though a causal relationship between stereotypes and choice of career may be difficult to show, Trauth (2002) did show that socio-cultural aspects certainly did affect women's choices of career. Generally accepted gender stereotypes could be considered part of socio-cultural aspects.

Results of the study at hand showed no significant differences between women and men with regard to *actual* CEW fluency performance. However, the study also showed that male subjects rated/*perceived* their own computer and web fluency higher than did women. Since there were no actual gender differences, these results show that the gender stereotype indeed prevailed even for subjects themselves as could be predicted based on previous research. Related research (Bunz, 2007) also shows that women *perceive* themselves to have technology-related skill, but these skills are relationship- and communication-focused abilities that take place via computer-mediated communication. Men, on the other hand, *perceive* themselves to have skills in the more technical aspects of technology use, such as installing software. With this distinction between "soft" and "hard" skills, women and men seem to perceive their skills along societal gender stereotypes. Thus, more initiatives are needed to educate both genders, and to increase women's confidence and attraction to technical/technology-related hobbies which could contribute to narrowing gender gaps in technology careers.

Overall, the study at hand presents an important contribution to the field of technology-mediated communication. Results support the characterization of CEW fluency as a digital divide factor that may be overcome not by focusing on skill development, but instead on anxiety reduction. The study also continues previous work, striving for a clearer distinction between the concepts of fluency, experience, competency, and literacy. Finally, the study helps to establish the CEW fluency scale as being robust to computer anxiety, and – at least with the current sample – to overcome common self-report survey concerns, as scoring on the scale was not affected by direct exposure to technology. Future studies in

this area of interest should continue to strive at identifying underlying fluency factors so that potentially, a fluency index could be developed that predicts a person's fluency of using an unknown technology based on the characteristics of the technology and the person. With such an index, personalized training programs could be devised which may increase employee morale and productivity while reducing company costs. Similarly, these issues may also warrant consideration from technological innovators who are designing, developing, and then introducing new technologies into public use, hoping for critical mass adoption.

Acknowledgement

This research was supported by a grant from the Office of Research and Sponsored Programs at Rutgers University.

Appendix A. Computer-email-web packet

Participant ID: _____
 Yahoo username: _____
 Yahoo password: _____

This packet has two (2) parts, an applied part, and a questionnaire part. All instructions are contained in this packet. Please complete the applied part first before going on to the questionnaire part. Though this packet may seem thick, you will probably be able to move through it fairly quickly.

Part 1: Applied part

Please read each step carefully and then complete it to the best of your ability. It is not necessary to do them all in order and you may skip steps if you are unable to complete them. Steps grouped together within the blocks are linked together and may be dependent on previous steps within the same block. Checkboxes are provided for your convenience and may help you keep track of completed items.

-
1. What is the current time? (*use computer clock at bottom right corner of screen for all questions concerning time*) _____
 2. Create a folder on the desktop called "StudyFolder"
 3. Open the "Fluency Folder" located on the computer's desktop
 4. Save or send file "Marshmallow" to the floppy disk provided
 5. Rename file "Alligator" to "Crocodile"
 6. Delete file "Marshmallow" from the desktop folder
 7. Open document "Listserve Question"
 8. Add your participant ID from page 1 to the top of the document
 9. In one or two sentences at the end of the document describe the difference between an address book and a Listserve
 10. Print the document on the printer called "paxal\CIL 119 HP Laser Jet 9000" and retrieve your printout from the printer in the hallway

11. Save the document as “Listserve Answer.doc” to the “Fluency Folder” on the desktop
 12. Open the Internet Explorer Web Browser
 13. Change the Bookmark/Favorite “NASD Prevent Tick Bites Prevent Lyme Disease” To “CDC – Lyme Disease”
 14. Go to www.google.com
 15. Use search functionality to find the official Tour de France webpage and go to that page
 16. Write down the name of the host server in the space provided
 17. Click on “[Revivre le Tour 2003](#)” at the top left. Click on “[Version anglais. Canal le Tour – Oln](#)” on the right side. Save the first paragraph of text, starting with “And then there were five”, to the “Fluency Folder” under a new file name
 18. Save an image/photograph to the “Fluency Folder”
 19. Go to www.yahoo.com
 20. Click on the mail icon
 21. Sign on to Yahoo mail using the username and password provided at the top of page 1
 22. Open the message from Scare Crow
 23. Write down the message in the space provided
 24. Delete the message from Scare Crow
 25. Open message from Munchkin Mayor
 26. Create a folder called “Politics”
 27. Place the message from Munchkin Mayer in the folder “Politics”
 28. Open the message from Wicked Witch
 29. Block future messages from this sender
 30. Create a signature file that says “There’s no place like home”
 31. Open the message from Lullaby League
 32. Open the attachment. Save it to “Fluency Folder” on the desktop, keeping the same file name
 33. Write down the content of the attachment in the space provided
 34. Reply to Lullaby League
 35. Insert the message, “I need a nap”
 36. Send the message
 37. Open the message from Toto Too
 38. Forward to ozscarecrow03@yahoo.com
 39. Send the message
 40. Start a new message with the subject line “Attachment”
 41. Attach the file “Listserve Question” (in the “Fluency Folder”)
 42. Send the message to ozscarecrow03@yahoo.com
 43. Close the web browser
 44. What is the current time? _____
-

Please leave your computer terminal on. Do NOT try to sign off. Do NOT try to shut down the computer.

Make sure that you have retrieved your printout.
This completes the applied part of the study.

Please turn to the next page and follow the directions for the questionnaire part of the study.

Part 2: Questionnaire

What time is it now? _____

The following questions are about how comfortable you are with using a computer. Please circle the best answer choice for each question.

A1. *Question 1 of CARS*

1	2	3	4	5
strongly disagree	disagree	neutral	agree	strongly agree

etc.

The items of the CARS have been omitted here for copyright reasons. The scale was published by the authors in [Heinssen et al. \(1987\)](#).

If I asked you to perform certain tasks with the computer, email, or the web, how much thought would it require from you to perform these tasks without help, right now? Please circle the best answer for each question.

For example, if you would only stop for a brief moment and then perform the task without problems, you may want to choose “4, a little thought.” If you kind of remembered how to do the task, but it would require you to figure out how to do the task rather than really knowing it, you may want to choose “2, a fair amount of thought.” If you don’t really know what the question is asking about or you know you cannot do it, you may want to choose “1, a great deal of thought”, etc.

C1. For me, printing a document on a specified printer other than the default printer would require. . .

5	4	3	2	1
no thought	a little thought	some thought	a fair amount of thought	a great deal of thought

[Note: Items C2 through W15 were rated on the same 5-point Likert-type scale.]

C2. For me, opening a previously saved file from any drive or folder would require. . .

C3. For me, saving a file would require. . .

C4. For me, saving a file in a specified drive/folder would require. . .

C5. For me, saving on a floppy disk would require. . .

C6. For me, using the computer hard drive would require. . .

C7. For me, moving files between drives and folders would require. . .

C8. For me, deleting unwanted files would require. . .

C9. For me, creating new folders would require. . .

C10. For me, renaming files would require. . .

C11. For me, saving a document as a template would require. . .

C12. For me, formatting a floppy disk would require. . .

C13. For me, switching a computer on would require. . .

C14. For me, recognizing when it is appropriate to use the “save as” function instead of the “save” function would require. . .

- C15. For me, switching between currently open applications would require. . .
 - C16. For me, beginning a new document based on a template would require. . .
 - C17. For me, restarting a computer would require. . .
 - C18. For me, beginning a new document in an unfamiliar software would require. . .
 - E1. For me, opening new email messages to read them would require. . .
 - E2. For me, deleting email messages would require. . .
 - E3. For me, sending an email message would require. . .
 - E4. For me, forwarding an email would require. . .
 - E5. For me, opening a file attached to an email would require. . .
 - E6. For me, accessing an unfamiliar email program would require. . .
 - E7. For me, saving an attached file would require. . .
 - E8. For me, blocking unwanted email senders from sending me mail again would require. . .
 - E9. For me, attaching and sending a file with a message would require. . .
 - E10. For me, using the address book to find an address would require. . .
 - E11. For me, creating my own Listserve would require. . .
 - E12. For me, setting mail preferences, i.e. “save sent emails”, would require. . .
 - E13. For me, using mail message settings, i.e. “important”, would require. . .
 - E14. For me, creating a signature file for outgoing email messages would require. . .
 - E15. For me, differentiating between a list of addresses in the Address Book and a Listserve would require. . .
 - E16. For me, replying to an email would require. . .
 - E17. For me, creating folders for saving mail would require. . .
 - E18. For me, creating an address in the address book would require. . .
 - E19. For me, using a Listserve to send email would require. . .
 - W1. For me, finding information on a specific topic online using a search engine like Yahoo or Google would require. . .
 - W2. For me, using Internet email such as Yahoo, or Hotmail would require. . .
 - W3. For me, understanding what elements of websites are hypertext links usually would require. . .
 - W4. For me, opening a web address directly by typing the URL in the appropriate place would require. . .
 - W5. For me, adding bookmarks/favorites of useful websites would require. . .
 - W6. For me, setting up a dial-up account to log on to the Internet would require. . .
 - W7. For me, turning on or off auto load images on websites would require. . .
 - W8. For me, creating a professional-looking website would require. . .
 - W9. For me, editing bookmarks/favorites, i.e. changing their default name, would require. . .
 - W10. For me, saving images off web pages to a disk would require. . .
 - W11. For me, using the “back” and “forward” buttons of a web browser to move between pages would require. . .
 - W12. For me, saving text contents off web pages to a disk would require. . .
 - W13. For me, identifying the host server from a web address would require. . .
 - W14. For me, using advanced search techniques in search engines would require. . .
 - W15. For me, using a browser such as Netscape or Internet Explorer to navigate the web would require. . .
-

Please answer just a few demographic questions by circling the best answer where appropriate, or filling in the requested information.

D1. What is your gender?

Female Male

D2. On your last birthday, how old were you? _____

D3. What type of operating system do you usually use? (circle one)

PC/Windows Mac/OS Unix Other

D4. In a typical month, how often do you use Yahoo email?

1	2	3	4	5
never	1–2 times	3–4 times	more than once a week	Daily

What time is it now? _____

Place the packet, the printout, and the floppy disk next to your computer on top of each other.

Go to the researcher in order to get paid.

This completes the study.

Thank you for your participation.

References

- Baracat, B., & Marquie, J. C. (1994). Training middle-aged for new computer technology: A pilot study using SDT in a real-life word-processing learning situation. In J. Snel & R. Cremer (Eds.), *Work and aging: A European prospective*. Amsterdam: Taylor & Francis.
- Barbeite, F. G., & Weiss, E. M. (2004). Computer self-efficacy and anxiety scales for an internet sample: testing measurement equivalence of existing measures and development of new scales. *Computers in Human Behavior*, 20, 1–15.
- Beckers, J. J., & Schmidt, H. G. (2001). The structure of computer anxiety: a six-factor model. *Computers in Human Behavior*, 17, 35–49.
- Bertot, J. C. (2003). The multiple dimensions of the digital divide: More than the technology 'haves' and 'have-nots'. *Government Information Quarterly*, 20, 185–191.
- Bozionelos, N. (2001). Computer anxiety: Relationship with computer experience and prevalence. *Computers in Human Behavior*, 17, 213–224.
- Brosnan, M. (1998). *Technophobia: The psychological impact of information technology*. London: Routledge.
- Brosnan, M., & Lee, W. (1998). A cross-cultural comparison of gender differences in computer attitudes and anxieties: The United Kingdom and Hong Kong. *Computers in Human Behavior*, 14, 559–577.
- Bunz, U. (2003). Growing from computer literacy towards computer-mediated communication competence: Evolution of a field and evaluation of a new measurement instrument. *Information Technology, Education, and Society*, 4(2), 53–84.
- Bunz, U. (2004). The computer-email-web (CEW) fluency scale – Development and validation. *International Journal of Human-Computer Interaction*, 17(4), 477–504.
- Bunz, U. (2007). *A gender-focused meta-analysis of computer-email-web fluency and CMC Competency Studies*. Presented at the 55th annual International Communication Association conference, New York.
- Carlson, R. D., & Grabowski, B. L. (1992). The effects of computer self-efficacy on direction-following behavior in computer assisted instruction. *Journal of Computer-Based Instruction*, 16, 6–11.
- Charness, N., Schumann, S. E., & Boritz, G. M. (1992). Training older adults in word processing: Effect of age, training technique, and computer anxiety. *International Journal of Technology and Aging*, 5, 79–106.
- Chou, H. W. (2001). Effects of training method and computer anxiety on learning performance and self-efficacy. *Computers in Human Behavior*, 17, 51–69.

- Chou, H. W., & Wang, T. B. (2000). The influence of learning style and training method on self-efficacy and learning performance in www homepage design training. *International Journal of Information Management*, 20, 455–472.
- Chua, S. L., Chen, D. T., & Wong, A. F. L. (1999). Computer anxiety and its correlates: A meta-analysis. *Computers in Human Behavior*, 15, 609–623.
- Clarke, C.T. (1991). *Rationale and development of a scale to measure computer-mediated communication apprehension*. Unpublished doctoral dissertation, Kent State University, Kent, Ohio.
- Colley, A., Gale, M., & Harris, T. (1994). Effects of gender role identity and experience on computer attitude components. *Journal of Educational Computing Research*, 10, 129–137.
- Committee on Information Technology Literacy. (1999). *Being fluent with information technology*. Washington, DC: National Academy Press.
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19, 189–211.
- Compeau, D. R., Higgins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly*, 23, 145–158.
- Cullen, R. (2001). Addressing the digital divide. *Online Information Review*, 25, 311–320.
- Decker, C. A. (2002). Computer preparedness: A study of computer use self-efficacy among DECA students in Kentucky. In S. P. Shohov (Ed.), *Trends in cognitive psychology*. Hauppauge, NY: Nova Science Publishers, Inc.
- Delgoulet, C., Marquie, J. C., & Escribe, C. (1997). Training older workers: Relationships between age, other trainee characteristics, and learning anxiety. *Arbete & Halsa*, 97, 70–78.
- Dunning, D., Johnson, K., Ehrlinger, J., & Kruger, J. (2003). Why people fail to recognize their own incompetence. *Current Directions in Psychological Science*, 12(3), 83–87.
- Durndell, A., & Haag, Z. (2002). Computer self efficacy, computer anxiety, attitudes towards the internet and reported experience with the internet, by gender, in an East European sample. *Computers in Human Behavior*, 18, 521–535.
- Durndell, A., Cameron, C., Knox, A., & Stocks, R. (1997). Gender and computing: West and East Europe. *Computers in Human Behavior*, 13, 269–280.
- Eccles, J. S. (1987). Gender roles and women's achievement-related decisions. *Psychology of Women Quarterly*, 11, 135–172.
- Ehrlinger, J., & Dunning, D. (2003). How chronic self-views influence (and potentially mislead) estimates of performance. *Journal of Personality and Social Psychology*, 84, 5–17.
- Farenga, S. J., & Joyce, B. A. (1999). Intentions of young students to enroll in science courses in the future: An examination of gender differences. *Science Education*, 83, 55–75.
- Fox, S. (2001, September). Wired seniors. A fervent few, inspired by family ties. Retrieved July 23, 2004 from <http://www.pewinternet.org>.
- Fox, S. (2004, March). Older Americans and the Internet. Retrieved July 23, 2004 from <http://www.pewinternet.org>.
- Geissler, J. E., & Horridge, P. (1993). University students' computer knowledge and commitment to learning. *Journal of Research on Computing in Education*, 25, 347–365.
- Gordon, M., Killey, M., Shevlin, M., McIlroy, D., & Tierney, K. (2003). The factor structure of the Computer Anxiety Rating Scale and the Computer Thoughts Survey. *Computers in Human Behavior*, 19, 291–298.
- Grosshandler, D. J., & Grosshandler, E. N. (2000). Constructing fun: Self-determination and learning at an afterschool design lab. *Computers in Human Behavior*, 16, 227–240.
- Harwood, J. (2004). Relational, role, and social identity as expressed in grandparents' personal web sites. *Communication Studies*, 55, 300–318.
- Hattie, J. (1990). The computer and control over learning. *Education*, 110, 414–417.
- Heinssen, R. K., Glass, C. R., & Knight, L. A. (1987). Assessing computer anxiety: Development and validation of the computer anxiety rating scale. *Computers in Human Behavior*, 3, 49–59.
- Honey, M., & Bennet, D. (1994). No girl is an island: Girls in science and technology often feel alone. (Mentoring would be part of a solution.). *Electronic Learning*, 13(8), 16–18.
- Hong, W., Thong, J. Y. L., Wong, W., & Tam, K. (2002). Determinants of user acceptance of digital libraries: An empirical examination of individual differences and system characteristics. *Journal of MIS*, 18(3), 97–124.
- Kelly, C. L., & Charness, N. (1995). Issues in training older adults to use computers. *Behavior & Information Technology*, 14, 107–120.

- LaLomia, M. J., & Sidowski, J. B. (1990). Measurements of computer satisfaction, literacy, and aptitude: A review. *International Journal of Human-Computer Interaction*, 2, 231–253.
- Levine, T., & Donitsa-Schmidt, S. (1998). Computer use, confidence, attitudes and knowledge: A causal analysis. *Computers in Human Behavior*, 14, 125–146.
- Lin, H. (2000). Special feature: Fluency with information technology. *Government Information Quarterly*, 17, 69–76.
- Loges, W. E., & Jung, J.-Y. (2001). Exploring the digital divide: Internet connectedness and age. *Communication Research*, 28, 536–562.
- Marakas, G. M., Yi, M. Y., & Johnson, R. D. (1998). The multilevel and multifaceted character of computer self-efficacy: Toward clarification of the construct and an integrative framework for research. *Information Systems Research*, 9, 126–163.
- Marcum, J. W. (2002). Rethinking information literacy. *Library Quarterly*, 72, 1–26.
- Marquie, J. C., Jourdan-Boddaert, L., & Huet, N. (2002). Do older adults underestimate their actual computer knowledge? *Behavior and Information Technology*, 21(4), 273–280.
- McIlroy, D., Bunting, B., Tierney, K., & Gordon, M. (2001). The relation of gender and background experience to self-reported computing anxieties and cognitions. *Computers in Human Behavior*, 17, 21–33.
- McLester, S. (1998). Girls and technology: What's the story? *Technology & Learning*, 1(3), 18–36.
- Miura, I. T. (1987). The relationship of self-efficacy expectations to computer interest and course enrollment in college. *Sex-Roles*, 16, 303–311.
- Moffatt, M. (1989). *Coming of age in New Jersey: College and American culture*. New Brunswick, NJ: Rutgers University Press.
- National Telecommunications and Information Administration, U.S. Department of Commerce. (1999). Falling through the net: Defining the digital divide. Retrieved September 4, 2004 from <http://www.ntia.doc.gov/ntiahome/fttn99/FTTN.pdf>.
- Nowak, K., & Krmar, M. (2003, June). Improving computer efficacy and perceptions of technology related careers in the classroom: A case study. Paper presented at the annual conference of the International Communication Association, San Diego, CA.
- Pomper, G. (1986). *The political state of New Jersey*. New Brunswick, NJ: Rutgers University Press.
- Potosky, D. (2002). A field study of computer efficacy beliefs as an outcome of training: The role of computer playfulness, computer knowledge, and performance during training. *Computers in Human Behavior*, 18, 241–256.
- Rainer, R. K., Laosethakul, K., & Astone, M. K. (2003). Are gender perceptions of computing changing over me? *Journal of Computer Information Systems*, 43, 108–114.
- Reynolds, D. W. (2007). Linguistic correlates of second language literacy development: Evidence from middle-grade learner essays. *Journal of Second Language Writing*, 14, 19–45.
- Rhodes, L. A. (1986). On computers, personal styles, and being human: A conversation with Sherry Turkle. *Educational Leadership*, 43(6), 12–16.
- Richter, T., Nauman, J., & Groeben, N. (2000). Attitudes toward the computer: Construct validation of an instrument with scales differentiated by content. *Computers in Human Behavior*, 16, 473–491.
- Rosen, L.D., & Weil, M.M. (1992). Measuring technophobia. A manual for the administration and scoring of the Computer Anxiety Rating Scale, the Computer Thoughts Survey and the General Attitude Toward Computer Scale. Chapman University, USA.
- Sax, L. J., Ceja, M., & Teranishi, R. T. (2001). Technological preparedness among entering freshmen: the role of race, class, and gender. *Journal of Educational Computing Research*, 24, 363–383.
- Schumacher, P., & Morahan-Martin, J. (2001). Gender, internet and computer attitudes and experiences. *Computers in Human Behavior*, 17, 95–110.
- Shashaani, L. (1994). Socioeconomic status, parents' sex-role stereotype, and the gender gap in computing. *Journal of Research on Computing in Education*, 26, 433–451.
- Smith, B. L., Caputi, P., Crittenden, M., Jayasuriya, R., & Rawstorne, P. (1999). A review of the construct of computer experience. *Computers in Human Behavior*, 15, 227–324.
- Smith, B. L., Caputi, P., & Rawstorne, P. (2000). Differentiating computer experience and attitudes toward computers: An empirical investigation. *Computers in Human Behavior*, 16, 59–81.
- Stanley, L. D. (2003). Beyond access: Psychosocial barriers to computer literacy. *The Information Society*, 19, 407–416.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52, 613–629.

- Torkzadeh, G., & Koufteros, X. (1994). Factoral validity of a computer self efficacy and the impact of computer training. *Educational and Psychological Measurement*, 54, 813–921.
- Torkzadeh, G., Pifughoeft, K., & Hall, L. (1999). Computer self-efficacy, training effectiveness and user attitudes: An empirical study. *Behavior and Information Technology*, 1(4), 299–309.
- Torkzadeh, G., & Van Dyke, T. P. (2002). Effects of training on Internet self-efficacy and computer user attitudes. *Computers in Human Behavior*, 18, 479–494.
- Trauth, E. M. (2002). Odd girl out: an individual differences perspective on women in the IT profession. *Information Technology and People*, 15, 98–118.
- Tsai, C., Lin, S. S. J., & Tsai, M. (2001). Developing an Internet attitude scale for high school students. *Computers & Education*, 37, 41–51.
- Venkatesh, V., & Davis, F. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, 27, 451–481.
- Vician, C., & Davis, L. R. (2002). Investigating computer anxiety and communication apprehension as performance antecedents in a computing-intensive learning environment. *Journal of Computer Information Systems*, 43, 51–57.
- Warschauer, M. (2002). Reconceptualizing the digital divide. *First Monday*, 7(7), 1–15.
- Watt, D. H. (1980). Computer literacy: What should schools be doing about this? *Classroom Computer News*, 1(2), 1–26.
- Whitely, B. (1997). Gender differences in computer related attitudes and behavior: A meta analysis. *Computers in Human Behavior*, 13, 1–22.
- Wong, D., Packard, B., Girod, M., & Pugh, K. (2000). The opposite of control: A Deweyan perspective on intrinsic motivation in “After 3” technology programs. *Computers in Human Behavior*, 16, 313–338.