The purpose of this research was to develop an instrument to assess people’s fluency with the computer, e-mail, and the Web (CEW fluency). Such an instrument, tapping into digital divides, could fill the existing void that exists between previously developed computer literacy or experience scales and the ever faster development of Internet technology. The research was conducted in 2 stages. The first study (N = 284) tested 52 Internet fluency items. A principle component factor analysis with varimax rotation resulted in 21 remaining items in 4 constructs: computer fluency (α = .85), e-mail fluency (α = .89), Web navigation (α = .84), and Web editing (α = .82). The 4-factor solution accounted for more than 67% of the total variance. Correlation analysis showed that there was no multicolinearity of items. The second study (N = 143) aimed at testing the CEW Fluency Scale for reliability and validity. Participants completed a 77-item questionnaire containing the CEW Fluency Scale, the Computer Use Scale (Panero, Lane, & Napier, 1997), items from the Georgia Tech WWW survey (GVU, 1998), and demographic items. The 4 constructs of the CEW Fluency Scale held up in the reliability analysis, as Cronbach’s alphas were as follows: computer fluency (α = .72), e-mail fluency (α = .75), Web navigation (α = .64), and Web editing (α = .79). Correlation analysis showed that comfort with the computer or the Internet, or satisfaction with one’s skills, correlated highly with the CEW fluency items. Regression analysis revealed that duration of Internet usage and level of expertise as defined by the Georgia Tech WWW survey were the strongest predictors of CEW fluency, R = .614, adjusted R² = .368, F(2, 131) = 39.643, p < .001. Overall, preliminary support for the scale’s reliability and validity was found.

1. RATIONALE

Within a few short decades, Internet and related technologies were developed, diffused, and adopted by large portions of the developed world. However, even within developed countries such as the United States, parts of the population were and are...
excluded from the excitement and hype of Internet technologies. The broadening gap soon became known as the “digital divide,” a phenomenon not unlike the knowledge gap discussed by Tichenor, Donohue, and Olien (1970). Originally, the digital divide was defined solely by access to technology (or not), but soon researchers and practitioners realized that many other factors influenced which side of the digital divide a person would fall on. Some of these factors include gender, language, race, socioeconomic factors, attitude, education (Clark & Gorski, 2002a, 2002b; Cullen, 2001; Gorski & Clark, 2001, 2002), and of course, computer literacy. Whereas measuring demographics such as gender and education level is fairly straightforward, and even socioeconomic factors can be conceptualized fairly easily, measuring computer literacy turned out to be a rather complex task.

Of course, conceptualization and measurement of any set of skills is extremely difficult. It should not be surprising therefore that scholars, researchers, and practitioners interested in assessing computing/technological understanding and skills have long been challenged to develop measurement tools that adequately capture and assess components of these skill sets. A few years ago, a national level board of scientists and practitioners in the United States was formed to make some sense of this developing area. In their response to this challenge, the Committee on Information Technology Literacy (CITL; 1999) of the National Research Board issued a report, Being Fluent With Information Technology. In this monograph, the Committee focused on fluency and distinguished it from other commonly used terms including literacy and competency. According to the report, fluency is “a term connoting a higher level of competency” (CITL, 1999, p. 2). Some of the differences between fluency and competency are first, that fluency entails a lifelong learning process; second, that fluency implies personalization of skills on levels of sophistication; and third, that fluency is composed of three kinds of knowledge: foundational concepts, contemporary skills, and intellectual capabilities. This concept has been adopted by others. For example, Lin (2000) discussed components of fluency and argued that they can be applied to personal, workforce, educational, and societal contexts.

Previous research has developed measuring instruments for computer literacy, computer experience, computer expertise, computer knowledge, and so forth. However, humans’ social and technological environment is constantly changing as information technology (IT) becomes ubiquitous, as Hoffman and Blake (2003) pointed out, and apart from specific computer skills required by some experts (programming, operating system knowledge, hardware expertise, etc.), most people’s daily environment (in developed countries) now demands a rather broad, far ranging IT skill set that has not been necessary in the past. Foremost among these fluencies are “information seeking” and “information dissemination” skills including e-mail use and the ability to effectively utilize the World Wide Web (Web). It is critical to develop measures that adequately tap this increasingly important set of competencies.

Thus, the purpose of this study was to develop an instrument to assess people’s ability to use these information seeking and dissemination skills, including skills that involve computer use, e-mail, and effective use of the Web. This instrument was not designed to be another computer, literacy experience, expertise, or knowledge scale. Instead, cues were taken from the recent CITL monograph, and researchers attempted to assess more general fluency skills. In addition, although computer fluency, e-mail fluency, and Web fluency can be expected to be related,
this study presumed that e-mail and Web fluency were not necessarily subsumed by computer fluency. Specifically then, the purpose of this study was to develop a general and useful measure, the Computer–Email–Web (CEW) Fluency Scale. Application of the CEW fluency scale may help narrow digital divides through personalized training programs.

2. LITERATURE

Over the last few years, a considerable body of literature has developed to describe computer usage and attitudes toward computers, computer anxiety, computer stress, or perceptions of computers (e.g., Bear, Richards, & Lancaster, 1987; Coover & Goldstein, 1980; Crable, Brodzinski, & Scherer, 1991; Durndell, Macleod, & Siann, 1987; Edwards, 1957; Gardner, Discenza, & Dukes, 1993; Harrison & Rainer, 1992; Heinssen, Glass, & Knight, 1987; Hudiburg, Brown, & Jones, 1993; Igbaria & Chakrabarti, 1990; Kay, 1993a; Loyd & Gressard, 1984; Maurer, 1994; Nickell & Pinto, 1986; Pope-Davis & Twing, 1991; Woodrow, 1991). This broad array of research has been multidisciplinary and has incorporated a wide variety of perspectives and topics. However, at its foundation, the research described in this article is directed at influencing a person’s ability to use a computer efficiently.

In this study, I was less interested in people’s reservations toward technology and more in their own perceptions of their ability or fluency in using the computer for e-mail communication and information access. Hence, the scales I review here focus more on computer expertise, experience, competency, or literacy.

Educators have been aware of the need to develop a concept of computer literacy for a long time (Molnar, 1978; Watt, 1980), but this awareness has not resulted in a unanimous definition of the concept. In the computer and technology context, literacy has been defined and described repeatedly. According to Rhodes (1986), an individual is computer literate when he or she is able to use the computer to satisfy personal needs. After reviewing the literature (e.g., Independent Schools Association of the Central States, 1985; Johnson, Anderson, Hansen, & Klassen, 1980; Levin, 1983; Longstreet & Sorant, 1985), LaLomia and Sidowski (1990) concluded that the definition of computer literacy varies depending on the study, but it usually includes one or more of the following factors: programming and operating skills, knowledge and awareness of computers, and positive attitude toward computers. Watt (1980), as cited in Levine and Donitsa-Schmidt (1997), defined computer literacy as the “collection of skills, knowledge, understanding, values, and relationships that allow a person to function comfortably as a productive citizen in a computer-oriented society” (Watt, 1980, p. 3). With this definition, Watt came close to the definition of information fluency (CITL, 1999) discussed earlier.

Along with numerous definitions, conceptual and theoretical discussions (e.g., Cheng, Plake, & Stevens, 1985; Ganske & Hamamoto, 1984; Kay, 1990; Levinson, 1986), there is a growing body of literature that has assessed computer experience, expertise, competency, or literacy statistically (e.g., Anderson, Hansen, Johnson, & Klassen, 1979; Bitter & Davis, 1985; Born & Cummings, 1994; Bunz, 2003; Gabriel, 1985a, 1985b; Montag, 1984; Parasuraman, 2000). Good overview reviews can be found in LaLomia and Sidowski (1990), Miller, Stanney, and Wooten (1997), Moroz

To provide an overview of instruments related to the development of the CEW fluency scale, Table 1 provides a brief description of 12 computer literacy and competency measures. Interestingly, only two of the scales listed here include one or two items regarding e-mail and/or the Internet, and only one of them (Bunz, 2003) investigated Internet technology in more depth. This shows a clear need to develop an instrument that taps into Internet technology related skill sets more succinctly.

From the review of these existing scales, a need can be perceived. Literacy, the ability to read and write, used to make an important positive difference to a person’s social and economical status within society. As times have changed, the need for literacy still exists but has evolved into a need for fluency with IT. Computers, e-mail, and the Web are here to stay, and fluency with these technologies will affect not just people’s chances of getting good jobs but also their standing within the entire social environment as Fortner’s (1995) notion of excommunication, and Schmitz, Rogers, Phillips, and Paschal’s (1995) article on the public electronic network (PEN) and the homeless in Santa Monica have shown.

The PEN study in particular is a good example of the multidimensional nature of the digital divide. Although providing access may bridge some people’s exclusion from online information, the end result of providing access can be an influence on broader societal issues that are only marginally related to access to information (Bertot, 2003; Katz, Rice, & Aspden, 2001). As Warschauer (2003) argued, due to its multifaceted nature, there is no single overriding factor that will close the digital divide. However, developing people’s fluency, IT, and computer skills is a prerequisite for any of the other efforts that may follow. Through developing fluency, students, for example, can gain motivation to continue their technological development, which will bring them lifelong advantages (Marriott, 2002; Snyder, Angus, & Sutherland-Smith, 2002). The CEW Fluency Scale allows educators to test for foundational skills in three IT areas—the computer, e-mail, and the Web—and to develop personalized training programs.

3. SCALE DEVELOPMENT

The items for the CEW Fluency Scale were originally developed as an internal, organizational, assessment instrument at UNITEC Auckland, New Zealand, and were adapted for this research with permission. The original instrument grouped its items into three categories (computer, e-mail, Internet) that were adopted for this research. To evaluate the suitability and clarity of the original 46 items, 32 participants in seven groups of 3 to 6 people were asked to identify possibly “confusing” questions and to add “missing” questions. Items identified as confusing were then reviewed. In one case, the term hard disk was changed to “hard drive.” In three

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1The original items were developed by Mark Northover, formerly at UNITEC Institute of Technology, Auckland, New Zealand and presented at the CAUSE conference in 1997, as well as included in the internal competency manual at UNITEC, Auckland. For more information, contact either Mark Northover at mark.northover@aut.ac.nz or Richard Elliott at relliott@unitec.ac.nz
Table 1: Overview of Computer Experience, Expertise, Competency and Literacy Instruments

<table>
<thead>
<tr>
<th>Name</th>
<th>Source and Description</th>
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<tbody>
<tr>
<td>Cassel Computer Literacy Test</td>
<td>(Cassel &amp; Cassel, 1984) This test consists of 120 multiple-choice items that are designed to measure a user’s understanding of computer functionality. The items are divided into six subtopics including computer development, technical understanding, computer structure, information processing, information retrieval, and communication systems. Miller, Stanney, and Wooten (1997) criticized that there is no reliability or validity data known about the Cassel Test.</td>
</tr>
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</table>
| Standardized Test of Computer Literacy (STCL)            | (Montag, Simonson, & Maurer, 1984; Torardi, 1985) This instrument consists of 80 multiple-choice items determining a user’s level of computer literacy. This test is divided into three subsections including computer applications, computer systems, and computer programming. The overall reported reliability for this scale is a coefficient alpha of .86, with a subscale reliability for the Computer Applications measure of a coefficient alpha of .75. 

Computer Literacy Test (Simonson, Maurer, Montag-Torardi, & Whitaker, 1987) Developed together with the Computer Anxiety Index (CAIN), the literacy instrument consists of 80 multiple choice items in three subsections including computer systems, computer applications, and computer programming. The reported reliability for this scale is .86. The CAIN scale consists of 26 items and reports an alpha of .90. Simonson et al. successfully applied the Computer Literacy Test to establish validity. |
| Computer Aptitude, Literacy, and Interest Profile        | (Poplin, Drew, & Bable, 1984) The instrument purports to measure a person’s level of computer literacy, aptitude, and interest in computer technology using one subtest each for interest and literacy, and four for aptitude. The reliabilities range from a coefficient alpha of .75 to an alpha of .95 depending on the age group tested. |
| Computer Literacy Examination: Cognitive Aspects         | (Cheng, Plake, & Stevens, 1985) The scale focuses specifically on high school students’ cognitive knowledge about computers. This scale consists of 39 multiple-choice questions and reports an overall coefficient alpha reliability of .87. |
| Windows Computer Experience Questionnaire                | (Miller et al., 1997) This is a comparatively short measurement instrument consisting of only 13 items. Miller et al. rotated these items into four factors, accounting for 67.2% of variance and reporting a coefficient alpha reliability of .74. |
| Computer Understanding and Experience Scale              | (Potosky & Bobko, 1998) The instrument is a self-report measure of computer experience. The scale consists of 12 items that were rotated into two factors, technical competence and general competence. A number of the items used actually refer to tasks more commonly performed by network administrators or computer specialists than the average computer user, such as “recovering deleted or lost data,” “writing computer programs,” or “using a mainframe computer system.” This scale also includes one question about e-mail, “I know what e-mail is,” without going into more specific details of actual usage of this technology. |

(continued)
Table 1 (Continued)

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<tr>
<th>Name</th>
<th>Source and Description</th>
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<tr>
<td>Subjective Computer Experience</td>
<td>Scale consists of a total of 62 Likert-type questions. Thirty-one of these questions assess the way people interpret their experiences with computers. The remaining 31 Likert-type items, based on Fishbein and Ajzen (1975), were used to assess behavioral beliefs, outcome evaluation, and global attitude toward e-mail in three subscales. The scales don't assess various technical e-mail functions. Instead, questions cover issues such as whether e-mail is a convenient method of communication or provides access to relevant information. Rawstorne et al. report a coefficient alpha of .68 for the Behavioral Beliefs subscale, and a coefficient alpha of .81 for the Outcome Evaluation subscale.</td>
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<tr>
<td>Computer Self-Efficacy Scale</td>
<td>The instrument measures perceptions of respondents' capabilities regarding specific computer-related skills and knowledge. This scale consists of 32 items that were rotated into three factors including beginning-level computer skills, advanced-level computer skills, and mainframe computer skills. The reported reliabilities, respectively, were alphas of .97, .96, and .93. Murphy et al. concluded among other things that women hold lower self-efficacy beliefs than men. This scale was later changed by Torkzadeh and Koufteros (1994), who added a fourth factor, computer file and software management. Reliabilities for all four factors were still above .90.</td>
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<tr>
<td>Computer Use Scale</td>
<td>The scale measures four dimensions of the different ways in which people use computers. The scale combines 26 items to measure computer use with 36 items of the Bloomberg-Erickson-Lowery Computer Attitude Task Scale (Erickson, 1987) for measuring computer attitudes. Panero et al. reduced the items to 18, which they divided into four subfields, including computer enthusiasm, efficiency in work, entertainment, and communication (which consisted only of two questions). The reported reliabilities for these four fields are between coefficient alphas of .71 and .87.</td>
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<tr>
<td>Computer Ability Survey</td>
<td>The survey assesses and predicts an adult learner's ability to use computers. The scale consists of 22 items. Total scale internal reliability is .96. The coefficient alphas for the subscales are .94 for Software/Awareness, .93 for Programming, and .89 for Perceived Control.</td>
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<tr>
<td>Unnamed scale</td>
<td>This scale has not been named by Levine and Donitsa-Schmidt. It consists of several subscales, including a subscale concerning attitudes. The subscale of interest is called Perceived Computer Knowledge. Here, 11 items measured students' perceived knowledge of computers and related issues. The subscale coefficient alpha was reported at .90. A copy of the subscale obtained from Levine and Donista-Schmidt shows that the scale includes a question on Internet databases and e-mail, asking students to identify their level of knowledge about these items and their intensity of desire to know more about these items.</td>
</tr>
</tbody>
</table>

*aInterestingly, both the STCL and the Cassel Scale use the term literacy, but survey rather technical components of computer usage. The use of this term may be connected to the date of publication of these scales, as computer use in the 1980s was much more dependent on understanding the underlying programming structure of both hardware and software than it is now.*
cases, confusion arose because of double-barreled items. In each case, the second component was removed from the question and either deleted or turned into its own item. In a number of cases, participants identified an item to be confusing. However, confusion admittedly rose out of not knowing what a certain computer function was rather than not understanding the item. Participants generally confessed, “I have never heard of this.” This was particularly the case with items relating to templates and distribution lists, which were retained for the time being.2 This process led to a total of 52 revised items to be used in the scale development.

The first step in the scale development process consisted of gathering data to conduct a factorial analysis, reducing items, and finding subconstructs within the general topic of fluency. In the second step, I tested the shortened scale for reliability. I discuss each step separately.

4. STUDY 1

4.1. Method

The total sample for Study 1 consisted of 284 students enrolled in the Basic Public Speaking Course at a large Midwestern university. No gender or age demographics were assessed for this sample, which presents certain limitations. However, every semester, between 20 and 30 sections of the public speaking course are offered at this specific university with an average enrollment of 25 students per course. It is probable that the gender and age demographics of the participants in Study 1 were similar to the demographics assessed of participants in Study 2 in which slightly more women (57%) than men participated, and most participants were between 20 and 21 years (63%). All students at the university had access to computer, e-mail, and Internet technology through the numerous university computer laboratories and public terminals.

Description of the CEW Fluency Scale

The term fluency was used to avoid negative connotations that could arise out of the implied opposites of terms such as expertise, experience, competency, or literacy. Instructions on the questionnaire stated, “There is no correct answer. We are not interested in how well you do, but only in what you can do.” The questionnaire consisted of seven introductory questions asking about self-perceived skill level in using computers, e-mail, and the Internet; importance of performing well using computers, e-mail, and the Internet; and completed number of courses or seminars related to computers. The remaining 52 items were divided into three subscales

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2Drawing the distinction between an unsuitable item and an item that a participant is not familiar with—possibly due to lack of expertise—is directly related to a line of research investigating and correlating participants’ perception of their skills with their actual abilities to perform the same tasks in an applied laboratory situation. Research doing such a comparison with the CEW Fluency Scale is currently in process. This line of research was supported by Geissler and Horridge (1993) in their research on university students’ computer knowledge and by Smith et al.’s (1999; see also Smith, Caputi, & Rawstorne, 2000) distinction between subjective and objective computer experience.
based on their classification in the original UNITEC Auckland instrument: 19 items for computer skills, 18 items for e-mail skills, 15 items for Internet skills. All items began with the words “I can …” followed by the task and followed by the answer options, a 4-point Likert scale (Very well, well, not so well, and not at all).

Research Design and Method of Analysis

Basic frequencies, including means, standard errors, modes, and standard deviations, were assessed for all items. Coefficient alphas were determined for the items of each subscale and for the overall scale consisting of 52 items. A principal-component factor analysis with varimax rotation was used to determine the factor validity. Finally, a correlation matrix was used for the remaining 21 items and between the four resulting factors to demonstrate internal validity of the CEW Fluency Scale.

4.2 Results

Basic Frequencies and Internal Reliability

On a 7-point Likert scale ranging from 1 (very low) to 7 (very high), participants’ self-rating of their computer skills fell into an average to high ranking (85.2%). Their rating of their e-mail skills fell into a high to very high ranking (62.0%). Their rating of their Internet skills also fell into a high ranking (61.9%). These results are not surprising considering that college students overall and students at this university in specific have easy access to computer and Internet technology. Many instructors even require the use of e-mail as part of the course curriculum.

A large majority (75.7%) had completed at least one (43.3%) or at least three (32.4%) computer-related courses. Participants consistently reported that knowing how to use a computer well was important or very important (92.6%), that knowing how to use e-mail well was important or very important (89.4%), and that knowing how to use the Internet well was important or very important (92.9%). The overall internal reliability for all 52 items of the CEW Fluency Scale was very high (α = .96).

Computer skills. The overall mean for the items measuring computer skills was fairly high at 3.88 (SD = .27; possible M range = 1–4). This means that overall, participants believed they could perform the given computer skills very well. Not surprisingly, participants rated their skills highest on the question, “I can switch a computer on” (M = 3.94) on a 4-point scale ranging from 1 (not at all) to 4 (very well). Participants rated their skills lowest on the question, “I can format a floppy disk” (M = 3.15) on the same 4-point scale. The internal reliability of the subscale was very high (α = .93). After the factor analysis, the remaining computer items still showed high internal reliability (α = .85).

E-mail skills. The overall mean for the items measuring e-mail skills was also high at 3.83 (SD = .38; possible M range = 1–4) on the same 4-point scale used to measure computer skills. This means that overall, participants believed they could per-
form the given e-mail skills well to very well. Participants rated their skills highest on the question, “I can read new mail messages” ($M = 3.91$) on the same 4-point scale. Participants rated their skills lowest on the question, “I can create a signature file” ($M = 2.73$) on the same 4-point scale. The internal reliability of the subscale was also very high ($\alpha = .92$). No items were deleted to increase this alpha. After the factor analysis, the remaining e-mail items still showed high internal reliability ($\alpha = .89$).

**Web navigation and Web editing.** The overall mean for the items originally measuring Internet skills was 3.43 ($SD = .59$; possible $M$ range = 1–4) on the same 4-point scale used to measure computer skills. This means that overall, participants believed they could perform the given Internet skills just slightly better than well. Participants rated their skills highest on the question, “I can use ‘back’ and ‘forward’ to move between pages” ($M = 3.92$) on the same 4-point scale. Participants rated their skills lowest on the question, “I can create a Web site” ($M = 2.43$) on the same 4-point scale. The internal reliability of the entire Internet subscale was high ($\alpha = .92$). Factor analysis later showed that this subscale really consisted of two scales, the Web Navigation subscale and the Web Editing subscale. After the factor analysis, the remaining items for the new Web Navigation subscale showed high internal reliability ($\alpha = .84$) as did the items for the new Web Editing subscale ($\alpha = .82$). Basic frequency and reliability data is represented by Table 2.

**Factor Analysis**

Following Pedhazur and Pedhazur Schmelkin (1991), different factor rotations were run. However, only the principle component, varimax rotation, factor analysis resulted in a sensible solution. It revealed a four-factor solution, splitting the previously termed Internet Skills subscale into two different subscales, Web Navigation and Web Editing. The remaining two factors were Basic Computer Skills and Basic E-mail Skills. The varimax rotation factor loadings greater than or equal to .40 are shown in Table 3. Each item loaded clearly except for Items 47 (“I can identify the host server from the Web address”) and 49 (“I can use ‘back’ and ‘forward’ to move between pages”), which showed moderate loadings on other factors. To achieve this loading, 31 items were deleted for double loading, two- or three-item factors, or other conceptual reasons such as multiple items (see Table 4 for deleted item listing). The four-factor solution accounted for more than 67% of the total variance.

**Correlation Between Subscales**

Correlations between the subscales and the total scale were high and not surprising given the nature of this scale. The Computer and the E-mail subscales correlated with the total scale at the .75 level. The Web Navigation and the Web Editing subscales correlated with the total scale at the .83 level.

Correlations between the subscales varied from .38 (E-mail Skills with Web Editing) to .60 (Computer Skills with Web Navigating). The correlations were thus low to medium, which supports the conceptual framework in that these skills were
related but separate from each other. Table 5 shows the correlations between the subscales. Interitem correlations between the 21 items in the four factors generally supported previously reported results.

4.3. Discussion

The purpose of Study 1 was to identify statistically clean subscales of the CEW fluency scale. Originally, items were divided into three subscales: Computer Skills, E-mail Skills, and Internet Skills.

The principal-components factor analysis rotated into four factors: Computer fluency, E-mail fluency, Web navigation, and Web editing. Alpha coefficients of all four subscales showed high internal subscale reliability. In addition, results from the principal-components factor analysis and correlations showed strong internal validity for the total scale. Results showed that the subscales were related to each other at a medium level, yet warranted differentiation from each other and the
skills they measured. This also implies that using e-mail and Web use are viewed separately from computer skills. These skills are related but separate, and thus, this new scale is not simply a new computer experience, expertise, or literacy scale.

From a theoretical perspective, special attention should be placed on the separating of the Internet skills subscale into two subscales, Web Navigation skills and Web Editing skills. Although not predicted, these results were reasonable. It is possible that a person may have Web navigation skills without Web editing skills. One could argue that the split among Internet skill items into two different Web subscales represents its own digital divide. Being able to navigate the Web has become a taken-for-granted skill in future employees such as college students. However, students who also master the more advanced skills of Web editing including Web site design can be assumed to have an advantage over applicants who do not, at least in technology-related careers. From a different perspective, it could be argued that students who either took classes to learn more applied technology skills such as Web editing skills or learned these skills on their own volition have more of a penchant for tackling and solving complex and applied tasks, have more vision, and show more initiative, thus making themselves more desirable to future employers yet again. So, the Web Navigation and the Web Editing subscales possibly measured an

<table>
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<th>Subscale</th>
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<tr>
<td>1</td>
<td>8.9</td>
<td>42.3</td>
<td>42.3</td>
</tr>
<tr>
<td>2</td>
<td>2.3</td>
<td>10.8</td>
<td>53.1</td>
</tr>
<tr>
<td>3</td>
<td>1.7</td>
<td>8.0</td>
<td>61.1</td>
</tr>
<tr>
<td>4</td>
<td>1.3</td>
<td>6.2</td>
<td>67.3</td>
</tr>
</tbody>
</table>

Note. Only factor loadings ≥ .40 are included in table.
Table 4: Deleted Item Listing

Items deleted due to double loading (a minimum of .2 difference between loadings had to be observed)
15. I can save a file in a specified drive/directory.
18. I can format a floppy disk.
19. I can rename a floppy disk.
20. I can use the hard drive.
23. I can switch between currently open applications.
24. I can rename files.
25. I can delete unwanted files.
30. I can save an attached file.
33. I can attach and send a file with a message.
35. I can block unwanted e-mail senders.
36. I can create folders for saving mail.
37. I can use message settings, e.g., “important.”
38. I can set preferences, e.g., “save sent e-mails.”
39. I can create a signature file.
41. I can create an address in the address book.
42. I can use the address book to find an address.
48. I can use hypertext links on World Wide Web pages.
50. I can add bookmarks of useful sites.
53. I can use advanced search techniques in search engines.
56. I can turn on/off auto load images.
57. I can use a dial-in account to log on to the Internet.

Items deleted for conceptual reasons, such as two- or three-item factors, multiple items, or problematic wording
11. I can begin a new document based on a template.
13. I can save a file.
17. I can save on a floppy disk.
21. I can create folders/directories.
22. I can copy or move files between drives and directories.
40. I can explain the difference between address book and distribution list.
43. I can create my own distribution list.
44. I can use a distribution list to send e-mail.
59. I can use Internet e-mail such as Yahoo, Hotmail, etc.

Table 5: Correlations Between Computer–Email–Web Fluency Subscales
Study 1

<table>
<thead>
<tr>
<th>Scale</th>
<th>Total Scale</th>
<th>Computer Skills</th>
<th>E-Mail Skills</th>
<th>Web Navigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1.00</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Computer Skills</td>
<td>.75</td>
<td>1.00</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>E-mail Skills</td>
<td>.75</td>
<td>.59</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Web Navigation</td>
<td>.83</td>
<td>.60</td>
<td>.53</td>
<td>1.00</td>
</tr>
<tr>
<td>Web Editing</td>
<td>.83</td>
<td>.43</td>
<td>.38</td>
<td>.56</td>
</tr>
</tbody>
</table>

Note. All correlations significant at the $p < .01$ level.
Internet-skill related digital divide. Students completing the CEW Fluency instrument during their time in college may use results to their own advantage and build up strength in areas of previous weakness so that an administration of the CEW Fluency Scale or a similar instrument during a job interview process will not lead to negative consequences for the student applicant. Administering the CEW fluency scale repeatedly over a period of time during which technology training takes place may help close the digital divide, or at least keep it from widening in a student population.

4.4. Limitations

There are two main limitations to the development and testing of the CEW fluency scale at this stage. First, the participants were drawn through a convenience sample from a generic population. College students are not representative for the entire population of computer, e-mail, or Web users. They possibly have better technology access than many others do. On the other hand, their experience with computer technology often is more related to word processing and other simple tasks. This leads to the second limitation. Overall, many of the items deleted through the factor analysis required slightly more advanced skills or represented more complex tasks than the remaining items. Other related skills, such as programming, network tasks, or computer maintenance skills, were not included from the beginning. It is thus quite possible that the items remaining in the CEW Fluency Scale present more of a baseline measure. The scale may not be appropriate to measure advanced CEW skills. Research is needed to expand the CEW Scale with items of a larger variety and different difficulty levels and to test the CEW Scale with participants from a more varied population.

5. STUDY 2

The purpose of Study 2 was to test the CEW Fluency Scale for reliability and validity. As described in more detail following, the questionnaire combined the CEW Fluency Scale with items from two other sources to create a larger, technology-related context. Adding additional measurement instruments also allowed comparing the CEW Fluency results to related instruments, establishing its content validity. Finally, to address issues of the digital divide, it helps to have more than one source of information, as the digital divide in itself is a complex concept.

5.1. Method

The questionnaire of the second study was administered to 143 students of the same population as described in the Methods section for Study 1. Participants were not allowed to participate in Study 2 if they had participated in any previous part of this research study. Slightly more women (57%) than men (43%) participated in this study. Most participants were between 20 and 21 years (63%) with a range from 19 years to 31 years. The participants of this study were enrolled in a wide variety of academic
majors. Most students were enrolled in the College of Liberal Arts and Science (37%), the School of Business (16%), the School of Journalism (14%) or the School of Education (13%). Although all students have access to Internet and Web technology at the university, almost 9% reported that they never use the Web from school. Twenty-seven percent reported using the Web from school on a daily basis, and 35% reported using the Web from school on a weekly basis. Interestingly, 75% of the sample reported using the Web from home, which speaks for a wide diffusion of Internet technology in the homes of this sample and possibly comparable samples of college students in the United States, an indication that the access digital divide may be closing among college students, although other digital divide factors may still prevail.

**Description of the CEW Fluency Questionnaire**

The five page questionnaire used during Study 2 consisted of a total of 77 items (see Appendix). Of this total, 21 items belonged to the CEW Fluency Scale developed during the previous study, arranged on a 5-point Likert scale ranging from 5 (very well) to 1 (not at all). Eighteen items belonged to the Computer Use Scale (CUS; Panero et al., 1997), arranged on a 5-point Likert scale ranging from 5 (very frequently) to 1 (never). Of the remaining 38 items, 30 were taken from the Georgia Tech WWW User Survey (GVU, 1998). Eight items, assessing basic demographics and comfort with computers and the Internet, were added by me. Most of these 38 questions were arranged on 5-point Likert scales with the exceptions of questions about major, gender, year of birth, number of computer classes, frequency of browser use, number of hours of browser use, Web use, and Web tasks performed.

**Research Design and Method of Analysis**

Basic frequencies, including means, standard errors, modes, and standard deviations, were assessed for all items. Coefficient alphas were determined for the items of each subscale and total scale of the CEW Fluency and the CUS Scales. A correlation matrix was used to assess how each item or each subscale related to the subscales of the CEW Fluency Scale and to the total scale. I discuss correlations between individual items of the CEW Fluency Scale and other items where appropriate. Finally, I employed regression analysis to investigate the interrelation of the highly correlated variables.

**5.2. RESULTS**

**Basic Frequencies and Internal Reliability**

Slightly more than half of the sample (54%) reported having used the Internet for 4 to 6 years. Another 29% had been using the Internet for 1 to 3 years. Thirteen percent reported having used the Internet for more than 7 years. During this time, participants had enrolled in comparatively few computer classes, courses, or seminars, with 22% having been enrolled in only one class, and 24% having been enrolled in
two classes. Ten percent had never enrolled in any computer class. Participants accessed the Web mostly from home on a daily basis (75%). Most participants (46%) opened a Web browser between one and four times a day, whereas spending an average of only 2 to 4 hr per week (36%) using a Web browser. This indicated that participants used the Web mostly for quick tasks rather than prolonged projects.

Participants indicated that they used the Web for a wide variety of purposes. The majority (85%) used it for educational purposes, entertainment (61%), information gathering (57%), communication (50%), or simply for wasting time (51%). Interestingly, only about a third (36%) used the Web for shopping, and hardly anyone was required to use the Web at work (16%).

A 12-question cluster taken from the Georgia Tech WWW User Survey asked whether participants had done specific tasks on the Web or Internet. A participant’s level of expertise was determined by the number of tasks he or she had completed. According to this calculation, 39% of the sample were classified as “novice,” and 42% were classified as having had “intermediate” skills. Another 13% were classified as having “expertise,” and only 7% of the sample were classified as “experts.” The two tasks performed by most participants were the use of an online chat or discussion (73%) and ordering products (66%) despite the earlier question that established that only 36% of the sample used the Web for shopping. Even though only 10% reported never having taken a computer class in an earlier question, in this cluster of questions, 78% reported not having taken a seminar or class about the Web or Internet. Possibly, computer- and Web-related classes must be differentiated.

Overall, participants felt somewhat comfortable (44%) or very comfortable (45%) using computers. Equally, participants felt somewhat comfortable (36%) or very comfortable (56%) using e-mail. Participants were generally somewhat satisfied (62%) with their current skills for using the Internet.

**CEW Fluency Scale.** Respondents assessed their CEW fluency to be “very well” (62%) or “well” (34%). The overall mean for fluency was 4.5 ($SD = .45$; possible $M$ range = 1–5). They judged their computer fluency to be “very well” (87%). The overall mean for the items measuring computer skills was 4.8 ($SD = .11$; possible $M$ range = 1–5). They judged their e-mail fluency to be “very well” (86%). The overall mean for the items measuring e-mail skills was 4.8 ($SD = .11$; possible $M$ range = 1–5). They judged their Web navigation abilities to be “very well” (73%). The overall mean for the items measuring Web navigation was 4.6 ($SD = .11$; possible $M$ range = 1–5). In the subscale of Web Editing, the results were less unanimous, as 32% judged they could perform those skills “very well” and equally 32% judged they could do “well,” 23% “okay,” 12% “not so well,” and 1% “not at all.” This trend resulted mostly from a wide-spread distribution on the question “I can create a Web site.” The overall mean for the items measuring Web editing skills was 3.7 ($SD = .20$; possible $M$ range = 1–5).

The overall internal reliability for the entire Fluency Scale was high ($\alpha = .89$), although lower than during the previous study (previously $\alpha = .96$). The internal reliability coefficients for the subscales all were lower than during the previous study but still acceptable. The internal reliability for the Computer subscale was .72 (previously $\alpha = .85$), for the E-mail subscale it was .75 (previously $\alpha = .89$), for the Web navigation subscale it was .64 (previously $\alpha = .84$), and for the Web editing subscale...
it was .79 (previously $\alpha = .82$). This study provided moderate reliability support for the CEW Fluency Scale.

**CUS.** Overall, participants reported that they performed the tasks described by the CUS “sometimes” (50%) or “frequently” (38%). The overall mean for computer use was 3.2 ($SD = .62$; possible $M$ range = 1–5). Participants reported that they “rarely” (49%) performed tasks categorized as expressing enthusiasm. The overall mean for the items measuring enthusiasm was 2.3 ($SD = .89$; possible $M$ range = 1–5). Participants reported that they “frequently” performed efficiency tasks (55%). The overall mean for the items measuring efficiency was 4.1 ($SD = .57$; possible $M$ range = 1–5). Participants “sometimes” (34%) or “frequently” (31%) performed entertainment tasks. The overall mean for the items measuring entertainment was 3.3 ($SD = 1.02$; possible $M$ range = 1–5). Finally, participants reported they used a network for communication tasks “sometimes” (30%), “frequently” (29%), or “very frequently” (28%). The overall mean for the two items measuring communication was 3.4 ($SD = 1.09$; possible $M$ range = 1–5).

The internal reliability for the CUS was high ($\alpha = .86$). The internal reliabilities for the subscales were similar to those reported by Panero et al. (1997). The Enthusiasm subscale showed high reliability at .83 (reported $\alpha = .87$). The Efficiency subscale showed acceptable reliability at .63 (reported $\alpha = .82$). The Entertainment subscale showed high reliability at .83 (reported $\alpha = .77$). Finally, the Communication subscale, consisting of only two items, showed acceptable reliability at .66 (reported $\alpha = .71$). This data supported the original study and provided reliability for that study.

**Correlation Analysis**

Correlations between the CEW subscales and the total CEW Fluency Scale were high. The Computer, E-mail, and Web Navigation subscales correlated with the total Fluency Scale at the .85 level; the Web Editing subscale correlated at the .86 level. Correlations between the subscales varied from .56 (Computer with Web Editing) to .78 (Computer with Web Navigating) as represented in Table 6. These correlations were higher than in the previous study, possibly because there were fewer items contained in each subscale than before.

Additional correlations were also calculated between the total Fluency Scale and its subscales and the other questions and subscales used on the questionnaire. Overall, few correlations reached a medium level (.41–.67), although they were usually highly significant. Specifically, perceived comfort with the computer or the Internet or satisfaction with one’s skills correlated highly with CEW Fluency items. Table 7 represents those correlations.

I point out some specific correlations here. First, by comparison, participants’ perceived comfort level with computers correlated highest of all items (.66) with the CEW Fluency Scale and also correlated highly with all subscales. This may seem counter to the claim that computer fluency is separate from other fluencies. However, several aspects need be considered. The question asked about self-evalu-
ation and perceptions and included the words “in general.” There is little way of
knowing how participants interpreted the question. To many people, computers
nowadays implies the Internet; to others, the term implies only using word pro-
cessing. Thus, although this correlation is interesting and should be investigated
further, it does not prove the initial hypothesis wrong.

Some correlations were not surprising, such as the comparatively high correla-
tion between communication and E-mail fluency (.50), as e-mail is a communica-

Table 6: Correlations Between Computer–Email–Web Fluency Subscales
Study 2

<table>
<thead>
<tr>
<th>Scale</th>
<th>Total Scale</th>
<th>Computer Skills</th>
<th>E-Mail Skills</th>
<th>Web Navigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1.00</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Computer Skills</td>
<td>.85</td>
<td>1.00</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>E-Mail Skills</td>
<td>.85</td>
<td>.74</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Web Navigation</td>
<td>.85</td>
<td>.78</td>
<td>.73</td>
<td>1.00</td>
</tr>
<tr>
<td>Web Editing</td>
<td>.86</td>
<td>.56</td>
<td>.59</td>
<td>.57</td>
</tr>
</tbody>
</table>

Note. All correlations significant at the p < .01 level.

Table 7: Correlations Between Computer–Email–Web Fluency and Other
Questions and Scales

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Comp.</th>
<th>Email</th>
<th>Web_Nav.</th>
<th>Web_Edit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q4</td>
<td>.51**</td>
<td>.34**</td>
<td>.42**</td>
<td>.43**</td>
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<tr>
<td>Q5</td>
<td>.40**</td>
<td>.27**</td>
<td>.37**</td>
<td>.34**</td>
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<tr>
<td>Q11</td>
<td>.29**</td>
<td>.20*</td>
<td>.24**</td>
<td>.25**</td>
</tr>
<tr>
<td>Q13</td>
<td>.22**</td>
<td>.11</td>
<td>.21*</td>
<td>.17*</td>
</tr>
<tr>
<td>Q14</td>
<td>.47**</td>
<td>.33**</td>
<td>.35**</td>
<td>.35**</td>
</tr>
<tr>
<td>Q15</td>
<td>.66**</td>
<td>.57**</td>
<td>.60**</td>
<td>.61**</td>
</tr>
<tr>
<td>Q16</td>
<td>.56**</td>
<td>.44**</td>
<td>.54**</td>
<td>.49**</td>
</tr>
<tr>
<td>Q17</td>
<td>.55**</td>
<td>.48**</td>
<td>.51**</td>
<td>.50**</td>
</tr>
<tr>
<td>Enthus.</td>
<td>.41**</td>
<td>.29**</td>
<td>.41**</td>
<td>.37**</td>
</tr>
<tr>
<td>Effic.</td>
<td>.42**</td>
<td>.47**</td>
<td>.35**</td>
<td>.37**</td>
</tr>
<tr>
<td>Entertain.</td>
<td>.30**</td>
<td>.28**</td>
<td>.32**</td>
<td>.27**</td>
</tr>
<tr>
<td>Comm.</td>
<td>.37**</td>
<td>.36**</td>
<td>.50**</td>
<td>.30**</td>
</tr>
<tr>
<td>CUS</td>
<td>.55**</td>
<td>.47**</td>
<td>.53**</td>
<td>.46**</td>
</tr>
<tr>
<td>Access</td>
<td>.37**</td>
<td>.22**</td>
<td>.36**</td>
<td>.28**</td>
</tr>
<tr>
<td>Instead</td>
<td>.31**</td>
<td>.30**</td>
<td>.29**</td>
<td>.29**</td>
</tr>
</tbody>
</table>

Note. Fluency = Total CEW Fluency scale; Computer = Computer subscale; Email = E-mail subscale; Web_Nav. = Web Navigating subscale; Web_Edit. = Web Editing subscale; Q4 = How long have you been using the Internet?; Q5 = How many computer classes, courses or seminars have you attended throughout your lifetime?; Q11 = On average, how often do you use a WWW browser?; Q13 = What do you primarily use the Web for?; Q14 = Which of the following (Internet tasks) have you done?; Q 15 = How comfortable do you feel using computers, in general?; Q16 = How comfortable do you feel using the Internet?; Q17 = How satisfied are you with your current skills for using the Internet?; Enthus. = Enthusiasm subscale of Computer Use Scale (CUS; Panero, Lane, & Napier 1997); Effic. = Efficiency subscale of CUS; Entertain. = Entertainment subscale of CUS; Comm. = Communication subscale of CUS; Access = How frequently do you access the Internet to find the following kind of information?; Instead = How frequently do you use the Web instead of doing one of the following activities?

*p < .05. **p < .01.
tion medium. Another example is the length of time using the Internet and its correlation with Web editing fluency (.51). Newcomers to the Web are less likely to engage in Web site design and similar activities right away.

The question regarding people’s satisfaction with their Internet skills correlated comparatively high with e-mail fluency (.51) and Web navigation fluency (.50) but not as high with Web editing fluency (.44), which supported the preceding argument.

Finally, interestingly, pure frequency of Internet access to find a variety of kinds of information did not correlate highly, not even with the Web Navigation fluency scale (.28). There might be a difference between people’s motivation and their fluency.

**Regression Analysis**

To examine some of the highly correlated items more closely, regression analysis was conducted. Regression analysis revealed that duration of Internet usage and level of expertise significantly predicted CEW fluency, $R = .614$, adjusted $R^2 = .368$, $F(2, 131) = 39.643$, $p < .001$. An additional 15.6% of variance was explained by participants’ perceptions of their comfort level with the computer and the Internet and their satisfaction with their current skills, $R = .736$, adjusted $R^2 = .524$, $F(3, 128) = 15.410$, $p < .001$. Finally, 1.8% of the variance was explained by participants’ computer use according to the CUS, $R = .750$, adjusted $R^2 = .542$, $F(1, 127) = 6.016$, $p < .05$. Participants’ perceived comfort level with the computer was the strongest predictor of CEW fluency, $\beta = .221$, $t(127) = 2.092$, $p < .05$; adjusted $R^2 = .542$; $F(1, 127) = 6.016$, $p < .05$. CEW fluency was also predicted by the length of time participants had been using the Internet, $\beta = .196$, $t(127) = 2.814$, $p < .05$ and their computer use according to the CUS, $\beta = .186$, $t(127) = 2.453$, $p < .05$. Thus, although items were highly correlated to the CEW Fluency Scale, they still made individual contributions to explaining its variance.

**5.3. Discussion**

This study sought to continue the validation process of a new measure of computer, e-mail, and Web fluency (CEW Fluency). The sample consisted of student volunteers enrolled at a large U.S. Midwestern university.

Based on the Georgia Tech (GVU, 1998) survey instructions, participants in this study were ranked into experience categories depending on the number of Internet- and Web-related tasks they had performed. According to this ranking, most participants were classified as novices or as having intermediate Web skills. Participants reported using the Internet for no longer than 6 years and had taken two or fewer classes on either computer or Internet related topics. A large majority of participants in this sample accessed the Internet from home on a daily basis, and from school at least on a weekly basis. As can be expected in a sample drawn from a student population, most participants used the Web for educational or information gathering purposes. Specifically, participants indicated they used the Web mostly for online chat or discussion or for ordering products.
Participants reported their self-assessed CEW fluency to be very high, especially regarding computer, e-mail, and Web navigation fluency. Web editing fluency was reported at a slightly lower level, mostly due to a wide variation regarding participants’ ability to create a Web site. Reliabilities of the subscales were within acceptable range. Correlations between the subscales were fairly high. The CUS (Panero et al., 1997) used in this study resulted in slightly lower yet acceptable reliabilities than reported by Panero et al. This could possibly be due to the homogeneity of the student sample.

CEW fluency scores were correlated to a number of demographic variables including gender, major, or ability to access the Internet from home without significant results. However, a variety of interesting findings did emerge.

Overall, results indicated that the longer participants had been using the Internet, the greater their overall CEW fluency. Results indicated that participants had to be classified at least at an intermediate level of Web expertise according to the Georgia Tech WWW use survey classification to have higher CEW fluency. Results also indicated that there was no statistical difference between experience and expertise with regard to Web editing fluency. Overall, the more comfortable participants felt with computers or the Internet, the higher their reported CEW fluency. One exception to this overall trend was that only participants who felt very comfortable with the computer reported high Web editing fluency. Also, only participants who felt very comfortable with the Internet reported high computer fluency. No systematic trend was found for the relation between Internet comfort level and participants’ Web navigation fluency. Participants reported that they must feel at least somewhat satisfied with their current Internet skills to report high CEW fluency. Equally, participants who used computers frequently on the CUS (Panero et al., 1997) reported higher CEW fluency.

Regression analysis revealed that despite being highly correlated, participants’ perceived level of comfort using a computer, the length of time they had been using the Internet, and participants’ computer use according to the CUS all made independent contributions to the variance explained in CEW fluency.

Because the measures utilized in the investigation used self-report, results might not be surprising. Participants who felt like they had more experience and a higher comfort level may have tended toward self-reporting higher CEW fluency. Along those lines, research comparing self-reported CEW fluency to actual ability to perform CEW tasks in a laboratory situation is currently under way. In addition, further studies may be needed to expand the CEW fluency scale to include more sophisticated items beyond the baseline measure it now provides. It might also be necessary to develop and test an expanded version of the scale with participants other than university students. At this point, this study provided preliminary support for the CEW Fluency Scale.

6. CONCLUSION

In the beginning of the article, I reviewed digital divide concepts and a variety of issues and scales in the field of computer experience, literacy, and competency. A void was perceived, as only one of the reviewed scales (Bunz, 2003) contained more
than one or two items related to Internet technology. The purpose of this research was to develop a measurement instrument that could fill this void. The studies discussed in this article resulted in a reliable and valid 21-item instrument, the CEW Fluency Scale, which breaks down into four subscales: Computer skills, E-mail skills, Web Navigation skills, and Web Editing skills.

The importance and applicability of the CEW Fluency instrument is high. As with other nonrepeated measurement instruments, results from this scale provide only a snapshot at one point in time. However, using the CEW Fluency Scale in various contexts provides insight into the effects that technology has had and will have on society. Literacy, the ability to read and write, is still important, but fluency with technology has surpassed literacy as an emergent skill. Research on the digital divide has shown clearly that those with more technology skills have advantages such as better job opportunities and higher socioeconomic status. Although the CEW Fluency Scale provides only a foundational baseline measurement instrument, it can be argued that those who do not score highly on this scale are likely to be on the disadvantaged side of the digital divide. At least three areas can be identified to which CEW fluency can be applied along digital divides: individual, organizational, and policy.

From an individual/interpersonal perspective, an objective assessment and understanding of one’s CEW fluency may alleviate some of the stress associated with learning new technologies and using those technologies to interact with others. Those who experience anxiety and stress when confronted with modern technology can possibly underestimate their own skill levels. Research comparing perception of one’s skills and actual skill level is currently under way. For the individual, a high score on the CEW Fluency Scale can raise these people’s self-esteem and even motivate them to learn about new technologies. Even those people who score lower will now have a concrete plan of action, as they can use the tasks outlined in the scale as concrete indicators of skills to acquire. From an individual perspective, the scale can thus be used for self-assessment and can lead to increased motivation and possibly better interpersonal interactions through computer-mediated communication technology.

From an organizational perspective, employees’ CEW fluency and openness to new technologies is of great interest. Organizations often implement new technologies into the organizational work flow and intend to diffuse those technologies. However, diffusion may fail when employees choose not to adopt the technologies. Failed adoption has two negative consequences for the organization: expenses incurred during the implementation of the technology and continuing inefficiency in work processes that the new technology was supposed to have eliminated. The original items of the CEW Fluency Scale were derived from an internal organizational assessment tool that most likely was designed for measuring employee fluency and anticipating how much training would be required when implementing a new technology.

Finally, policymakers, especially within education, might find the concept of CEW fluency of interest, as it helps measure the depth of digital divides. The three kinds of knowledge defined by the CITL (1999) were foundational concepts, contemporary skills, and intellectual capabilities. Even within the 21 items of the CEW Fluency Scale, one can find these three kinds of knowledge. An example of a foundational concept would be, “I can switch a computer on,” or “I can begin a new
Without these fundamental skills, one will not be able to use CEW technologies. Examples of contemporary skills would be those tasks that constitute everyday CEW activities such as, “I can use the ‘reply’ and ‘forward’ features of email,” or “I can use search engines such as Yahoo or Alta Vista.” Finally, intellectual capabilities would describe tasks that are not necessary for the use of CEW technologies but are used for personalizing these technologies. Examples include, “I can edit bookmarks,” or “I can use ‘save as’ when appropriate.” Thus, even within the CEW Fluency Scale, which is more of a baseline measure, three types or levels of knowledge can be identified across the three main technologies (computer, e-mail, Web) investigated. Policymakers can target each one individually to keep divides from broadening, or they can even begin to close digital divides. These examples show the applicability of the CEW Fluency Scale and related scales to everyday life.

Regarding generalizability of the scale, it is important to remember two things: First, the scale was developed using a participant pool of undergraduate students at a large Midwestern university and therefore may not be generalizable to all people of all ages and levels of education. Second, technology develops rapidly, and fluency with this technology does too. It is quite possible that the CEW Fluency Scale as it stands now represents more specifically a “basic fluency,” requiring more advanced versions to be developed. The need for these and similar scales is unquestionable.

To conclude, the purpose of this project was to develop a new scale based on existing literature and computer literacy and expertise scales. The CEW Fluency Scale differs from the existing scales because it incorporates e-mail and Web items. Support was found that e-mail and Web skills are to be differentiated from computer skills. Thus, the CEW Fluency Scale can be differentiated from existing scales. More research is needed to establish, test, and evolve this instrument, but I have presented preliminary support for its reliability and validity.

REFERENCES


The following questionnaire, including the beginning note, was used during Study 2, for which results are discussed in the article. The CEW fluency items were items 18-38. The items drawn from the Georgia Tech WWW survey were items 6-14, and 57-77. Items 1-5, and 15-17 were added. Items 39-56 were taken from Panero, Lane, and Napier (1997). They are not included here.
Please note:

By completing this questionnaire, you are agreeing to participate in this research study. You must be above the age of 18, and can NOT have participated in a previous “Internet Fluency” study. You are also acknowledging the receipt of an information sheet informing you of the purpose of this study, and the researcher’s name and contact information.

Internet Fluency

The purpose of this study is to assess your perceptions and use of the computer, email, the World Wide Web and the Internet. Please read each question carefully before filling in or choosing the appropriate answer choice.

1. What is your major? _______________________
2. Please circle your gender: male female
3. What year were you born? ___________
4. How long have you been using Internet (including using email, gopher, ftp, etc.)?
   ______ Less than 6 months
   ______ 6 to 12 months
   ______ 1 to 3 years
   ______ 4 to 6 years
   ______ 7 years or more
5. How many computer classes, courses, or seminars have you attended throughout your lifetime? ___________

How frequently do you access the World Wide Web (WWW) from the following locations?

<table>
<thead>
<tr>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>&lt; Once a month</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. From home?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>7. From work?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8. From school?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9. From public terminals?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>10. From other locations?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

11. On average, how often do you use a WWW browser? By this, we mean using your browser for a specific set of tasks or activities. We do not mean how many times you launch your browser per day.
   ______ More than 9 times/day
   ______ 5 to 8 times/day
   ______ 1 to 4 times/day
A few times a week
Once a week
Once a month

12. On average, how many hours a week do you use a WWW browser?
0 to 1 hours/week
2 to 4 hours/week
5 to 6 hours/week
7 to 9 hours/week
10 to 20 hours/week
21 to 40 hours/week
Over 40 hours/week

13. What do you primarily use the Web for? (Please check all that apply.)
Education
Shopping/gathering product information
Entertainment
Work/Business
Communication with others (not including email)
Gathering information for personal needs
Wasting time
Other

14. Which of the following have you done? (Please check all that apply.)
Ordered a product/service by filling out an online form
Made a purchase online for more than $100
Created a Web page
Customized a Web page for yourself (e.g. MyYahoo, CNN Custom News)
Changed your browser’s “startup” or “home” page
Changed your “cookie” preferences
Participated in an online chat or discussion (not including email)
Listened to a radio broadcast online
Made a telephone call online
Used a nationwide online directory to find an address or telephone number
Taken a seminar or class about the Web or Internet
Bought a book to learn more about the Web or Internet

15. How comfortable do you feel using computers, in general?
Very comfortable
Somewhat comfortable
Neither comfortable nor uncomfortable
Somewhat uncomfortable
Very uncomfortable
16. How comfortable to you feel using the Internet?

_____ Very comfortable
_____ Somewhat comfortable
_____ Neither comfortable nor uncomfortable
_____ Somewhat uncomfortable
_____ Very uncomfortable

17. How satisfied are you with your current skills for using the Internet?

_____ Very satisfied – I can do everything that I want to do
_____ Somewhat satisfied – I can do most things I want to do
_____ Neither satisfied nor unsatisfied
_____ Somewhat unsatisfied – I can’t so many things I would like to do
_____ Very unsatisfied – I can’t do most things I would like to do

The following questions are about a variety of computer, email and web-related tasks. Please read each question carefully and circle the appropriate number according to the scale below.

<table>
<thead>
<tr>
<th>Task</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. I can print a document.</td>
<td>very well 5</td>
</tr>
<tr>
<td>19. I can open a Web address directly.</td>
<td>very well 5</td>
</tr>
<tr>
<td>20. I can use search engines such as Yahoo or Alta Vista.</td>
<td>very well 5</td>
</tr>
<tr>
<td>21. I can use “save as” when appropriate.</td>
<td>very well 5</td>
</tr>
<tr>
<td>22. I can use the “reply” and “forward” features for email.</td>
<td>very well 5</td>
</tr>
<tr>
<td>23. I can save text contents off Web pages to a disk.</td>
<td>very well 5</td>
</tr>
<tr>
<td>24. I can identify the host server from the Web address.</td>
<td>very well 5</td>
</tr>
<tr>
<td>25. I can read new mail messages.</td>
<td>very well 5</td>
</tr>
<tr>
<td>26. I can delete read email.</td>
<td>very well 5</td>
</tr>
<tr>
<td>27. I can send an email message.</td>
<td>very well 5</td>
</tr>
<tr>
<td>28. I can save images off Web pages to a disk.</td>
<td>very well 5</td>
</tr>
<tr>
<td>29. I can open an email program.</td>
<td>very well 5</td>
</tr>
<tr>
<td>30. I can edit bookmarks.</td>
<td>very well 5</td>
</tr>
<tr>
<td>31. I can open a previously saved file from any drive/directory.</td>
<td>very well 5</td>
</tr>
<tr>
<td>32. I can open a file attached to an email.</td>
<td>very well 5</td>
</tr>
<tr>
<td>33. I can restart a computer.</td>
<td>very well 5</td>
</tr>
<tr>
<td>34. I can begin a new document.</td>
<td>very well 5</td>
</tr>
<tr>
<td>35. I can use a browser such as Netscape or Explorer to navigate the World Wide Web.</td>
<td></td>
</tr>
</tbody>
</table>

The following questions are about a variety of computer and network uses. The term “network” is defined as any kind of interconnected computer system, including the Internet, email, the World Wide Web, Telnet, online services, bulletin boards, etc. Please read each question carefully and circle the appropriate number according to the scale below.
36. I can create a Website. 5 4 3 2 1
37. I can switch a computer on. 5 4 3 2 1
38. I can use “back” and “forward” to move between pages. 5 4 3 2 1

[Items 39-56 were deleted from this questionnaire for publication purposes. They can be obtained from Panero, Lane, and Napier (1997).]

How frequently do you access the Internet to find the following kind of information?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>&lt; Once a month</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>39. To access newsgroups?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>40. To access online news?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>41. To access information about commercial products/services?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>42. To purchase commercial products/services?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>43. To access reference materials?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>44. To access research reports &amp; projects?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>45. To access financial information?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>46. To access health/medical information?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>47. To access online chat groups?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>48. To access online job listings?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>49. To access online home/rental listings?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>50. To access online telephone listings?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>51. To access online maps?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

How frequently do you use the Web instead of doing one of the following activities?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>&lt; Once a month</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>52. Instead of watching TV?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>53. Instead of talking on the phone?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>54. Instead of sleeping?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>55. Instead of exercising?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>56. Instead of reading books/magazines/newspapers?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>57. Instead of going to the movies?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>58. Instead of going out/socializing?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>59. Instead of doing household work?</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

This completes this survey.
Thank you for your participation.