ABSTRACT: Computers are involved in many facets of daily life, and studies have shown computers to be effective tools in aphasia rehabilitation. However, the degree to which speech-language pathologists (SLPs) use computers in aphasia management is unclear. This study surveyed SLPs to determine patterns and frequency of computer use associated with aphasia rehabilitation. The survey was distributed to SLPs in health care settings through e-mail and traditional mail. Surveys were analyzed for frequency and patterns of computer use in direct therapy and for other related purposes. Responses were received from 107 SLPs. Survey results indicated that SLPs use computers more often for indirect or supplemental purposes than for direct therapy. When SLPs implemented computers in direct treatment, the amount accounted for less than 25% of the total session time. Identified barriers to using computers include a lack of access and lack of training. Training for using computers in aphasia management occurs most often after graduate school through continuing education or self-study.

In conclusion, results indicated that computer-based treatment of aphasia is being implemented to varying degrees and more often for supplemental and administrative purposes than for direct therapy. Additionally, SLPs generally perceive computers as useful and important but not critical to successful outcomes.

KEY WORDS: aphasia, computers, telemedicine, language, speech-language pathologist, rehabilitation

For an individual with aphasia, language difficulties often adversely impact speaking, listening, reading, and writing and create limitations that can prevent successful return to family, occupational, and social roles. Many different treatment approaches to aphasia rehabilitation have been used by speech-language pathologists (SLPs), and aphasia treatment practices have evolved as technology has become more widely available for use in therapy. Additionally, health care professionals have been encouraged to increase the efficiency and effectiveness of interventions in shorter and shorter rehabilitation periods (Ottenbacher et al., 2004). Decreased funding for rehabilitation coverage has caused professionals to consider flexible means of service delivery and ways to expand therapy more extensively into the home environment. Using technology such as computers in aphasia therapy presents an exciting opportunity for SLPs to explore an alternative or supplementary treatment mode. The use of technology also offers an opportunity to improve the efficiency and accuracy of documentation and other clinical management tasks.

EMERGING TRENDS

SLPs have used a wide range of computer-based technology for many years, including augmentative communication devices, laptops, and various software packages for language treatment. PC-based speech analysis systems such as...
the IBM SpeechViewer and the Kay Elemetrics Computerized Speech Lab, Visipitch, and Nasometer are used routinely in clinical practice for the treatment of a variety of speech, language, and reading disorders. With expansion of the Internet, the use of electronic mail, and the availability of affordable computer systems, computers are being used by more individuals at home, school, and work and are an important part of everyday life for individuals of all ages (Elman, 2001). Accordingly, computer-based treatment of aphasia is a mode of intervention that SLPs should be exploring as a means of improving service delivery (Katz & Hallowell, 1999).

Supplemental and administrative uses of computers in rehabilitation and speech-language pathology are numerous. Software programs have been designed to track treatment outcomes, generate daily treatment notes, complete electronic billing, and perform language sample analysis. Many employers now provide computer access and require that certain tasks be performed electronically. Medical facilities and public schools commonly provide employee communication via e-mail, and some facilities use computer-based training for documenting and maintaining annual competencies (Davis & Copeland, 2004). SLPs use e-mail and listservs to contact other professionals and peers for resources and support. Web sites like those of the American Speech-Language-Hearing Association (ASHA), National Aphasia Association, National Association on Deafness and other Communication Disorders, National Stroke Association, and American Heart Association provide SLPs and consumers access to needed information about communication disorders via the Internet.

Computer-based resources for use in treatment by SLPs are available through a variety of vendors. Currently, computer software is available to address auditory comprehension, reading and writing, naming, visual–perceptual, and other related language and cognitive skills. In computer-assisted treatment sessions, the SLP or paraprofessional facilitates an individual with accessing and responding to computer-generated treatment stimuli (Katz, 2001). Individuals with aphasia who cannot attend therapy sessions with the SLP due to distance or lack of funding may be able to complete computer-based treatment programs in the home environment.

**BENEFITS OF COMPUTER USE IN SPEECH-LANGUAGE THERAPY**

Although existing studies on this topic have varying levels of rigor and control, the many benefits of computer-based therapy have been demonstrated. Customized home programs using software programs have been found to be cost effective and to improve the language skills of individuals with aphasia (Mortley, Wade, Davies, & Enderby, 2003), as well as their reading and writing skills (Katz, 2001). Computer-based treatment provides for increased practice opportunities that promote gains in language performance (Kinsey, 1986; Loverso, Prescott, & Selinger, 1992; Mortley et al., 2003; Wallesch & Johannsen-Horbach, 2004). Katz and Wertz (1997) demonstrated in a randomized, clinical trial that computer-based reading treatment led to improvements in other language skills for individuals with aphasia.

Aftonomos, Steele, and Wertz (1997) studied individuals with chronic aphasia who used a computer-based treatment system to determine if gains in spoken language beyond spontaneous recovery could be demonstrated. Results showed that verbal language performance in the experimental population increased after using a computer-based treatment program in individual therapy sessions with an SLP. Other studies have also reported improvement in the skills of clients with chronic aphasia following computer-based treatment programs in spoken language (Laganaro & Venet, 2001; Weinrich, 1997), in reading comprehension (Crerar, Ellis, & Dean, 1996; Katz & Wertz, 1992, 1997), in naming ability (Bruce & Howard, 1987), and in auditory comprehension (Fitch & Thomas-Cross, 1983). Evidence also suggests that individuals with aphasia who use voice recognition software may be able to improve their functional written language skills (Bruce, Edmundson, & Coleman, 2003; Wade, Petheram, & Cain, 2001).

Petheram (1996a) found that individuals who were provided with a computerized home program interacted with the system at about the same intensity and duration as was spent in a session with the SLP. These individuals received little training and no direct supervision. Individuals with aphasia report benefits from computer programs such as autonomy, flexibility in scheduling, and being able to type rather than write (Petheram, 1996a, 1996b). Many people are comfortable with using computers in their homes, and this may increase the intensity of their practice (Mortley et al., 2003; Petheram, 1996a, 1996b). Using computers at home decreases the need for travel, allows immediate feedback, may improve motivation, and provides flexibility in access modes (Kinsey, 1986; Weinrich, 1997). Computer-based home therapy may also decrease the demands placed on caregivers in implementing home programs (Wallesch & Johannsen-Horbach, 2004). Internet access allows contact with other individuals with aphasia, families, and additional support resources. Individuals with aphasia can learn how to use the Internet with accessible materials, tutoring, and adaptations to the computer (Egan, Worrall, & Oxenham, 2004). The evolution of virtual reality technology and its increased availability to consumers improves the interactive aspect of computer-based treatment.

**POTENTIAL DRAWBACKS OF COMPUTER-BASED TREATMENT**

Research is ongoing for determining the efficacy of computer use in aphasia rehabilitation (Katz, 2001; Weinrich, 1997; Wertz & Katz, 2004), and SLPs must determine the most effective software programs, the precise timing of intervention, and the optimal amount of computer-based treatment for each individual. Not all clients will be receptive to using computers or will benefit from...
using this technology in their rehabilitation. As with any technology, a learning curve is involved, and some rehabilitation professionals are not comfortable using computers. Ethical issues may arise with computer-based treatment if SLPs provide software or Web sites without appropriate clinical evaluation and teaching. No uniform guidelines for the provision of online therapy services exist, and issues such as state licensure requirements when interstate services are provided are currently being addressed.

SLPs are the driving force behind computer-based therapy and must establish a diagnosis, create a treatment plan, and design and modify computer-based tasks for individuals with aphasia (Katz, 2001; Loverso et al., 1992; Mortley et al., 2003; Weinrich, 1997). Computers cannot perform many of the skilled roles of SLPs, nor can they replace elements of face-to-face communication or provide individualized facilitation or moral support. In some cases, computer-based activities are not motivating for the person with aphasia (Wallesch & Johannsen-Horbach, 2004), and computers may not be available to individuals of lower socioeconomic status (Egan et al., 2004; Elman, 2001). The current Internet system and most Web sites are not accessible for many individuals with disabilities (Pinkett, 2001). Elman (2001, p. 896) stated that those individuals without Internet access will in the future be “isolated and disadvantaged.” Currently, there are no standardized educational requirements for SLPs, and evidence-based practice standards have not been established. ASHA has recently published recommendations for basic clinical computing competencies that SLPs should demonstrate (Cochran, 2004, 2005). These competencies place an expectation on SLPs to evaluate their knowledge levels and determine how they can integrate technological resources into their unique situations and practice settings.

Most SLPs reported preparing and creating homework materials for clients. Time available to assess progress and accuracy on home programs was reported as limited. The authors concluded that using computer-based systems that could track accuracy and record progress more often would allow additional practice opportunity and feedback to the client and SLP. In subsequent work, Petheram (1992) explored the use of computers in home programs including potential barriers, important features of computer systems and software, and expected amount of use. SLPs reported a high interest level in using computers but indicated concerns about usability, training resources, and the potential negative impact on the therapeutic milieu.

Although computers are accepted and necessary tools in daily work, school, and home life, it is unclear to what extent SLPs use this technology with individuals with aphasia. This project sought to identify practice patterns related to computer use by SLPs responsible for rehabilitation of individuals with acquired aphasia. A survey (see Appendix) of SLPs working with individuals with aphasia was completed. Information was obtained about SLP use of computers in treatment and indirect activities; specific skills targeted with computer-based therapy; and demographic information, including geographic location, years of experience, and length of time in practice. Beliefs regarding the quality of clinical outcomes when using computer-based treatment were also solicited.

### METHOD

#### Survey Instrument

The survey instrument was mixed format, with multiple-choice, yes–no, and open-ended questions, and all items were related to various aspects of the use of computer-based technology in aphasia rehabilitation (see Appendix). Survey questions were developed by the researchers through a review of the literature regarding current trends in aphasia management and technological trends in speech-language pathology and other allied health fields. Needs assessments at state and local conferences yielded requests for training and information on integrating computers into rehabilitation for aphasia, and a survey was determined to be a means of reaching a broader sample of SLPs to identify needs and current usage patterns. The survey questions were reviewed for content validity by practicing SLPs with at least 5 years of experience in medical settings. On the basis of their review and input, revisions were made by the authors to more closely reflect current practice patterns in medical speech-language pathology.

#### Procedures

Survey distribution was accomplished through both electronic and traditional mail. The survey was distributed by e-mail to several communication disorders listservs and to each state association with a request to distribute the survey to the membership. The survey was also accessible...
by downloading a file from one of the researcher’s professional Web site. Additionally, the survey was mailed to a randomized national sample of 500 SLPs. These ASHA-certified SLPs were employed in hospital or other health care settings. Respondents could identify themselves or remain anonymous when they returned their surveys.

**RESULTS**

A total of 107 responses were returned. The total return rate cannot be calculated because the number of users with access to the survey by electronic means could not be determined. Results should be interpreted with the small sample size in mind. Respondents were highly experienced with aphasia management, with 92.3% having from 5 years to more than 20 years of experience working with individuals with aphasia. More than 50% (59.6%) of respondents had more than 20 years of work experience as SLPs, and all respondents were ASHA certified. More than half (55.7%) reported that individuals with aphasia made up 10%–50% of their caseloads. All health care practice settings sampled were represented in the responses (see Table 1).

The majority of respondents had some preprofessional knowledge of computers, and the primary sources of training were self-study and mentoring (see Table 2). SLPs reported that graduate programs infrequently provided training on computer use in treatment activities.

Respondents reported using computers to target a variety of communication skills, including verbal expression, reading, writing, and auditory comprehension (see Table 3).

More than half of the SLPs (51.4%) reported that they used computers in aphasia treatment sessions; however, computers were typically used for 25% or less of actual treatment time. The ways in which SLPs reported using computers on a daily basis included software packages for treatment, games, Internet access, and augmentative communication. A majority of respondents (84.8%) asked clients about premorbid computer use when obtaining case history information. Nearly all SLPs (94.8%) reported using computers to supplement direct treatment through home programs, working with a paraprofessional, or independent computer time (see Table 4). Respondents also reported frequent use of computers for administrative tasks like billing (60%), documentation (72%), and materials preparation (80%).

Although the sample size was small, 91.3% of all SLPs who responded reported that they were very comfortable or somewhat comfortable using computers in aphasia treatment (see Table 5).

Most SLPs had Internet access in their therapy room (68.4%), whereas 14.7% had Internet access only in a common area shared with other rehabilitation staff, and 16.8% had no Internet access at work. The majority of SLPs (77.2%) reported that they used the Internet in client

| Table 1. Practice settings of the speech-language pathologists (SLPs). |
|---------------------------------|------------------------|
| Practice setting | Percentage of respondents |
| Acute hospital | 22.3 |
| Rehab hospital | 16.0 |
| Outpatient rehab | 13.8 |
| University clinic | 11.7 |
| Private practice | 11.7 |
| Home health | 6.4 |
| Skilled nursing | 5.3 |
| Long-term care | 2.1 |
| Other | 10.7 |

| Table 2. SLPs’ primary training related to the use of computers in therapy. |
|---------------------------------|------------------------|
| Primary training | Percentage of respondents |
| Self-directed learning | 36.2 |
| Mentor | 33.3 |
| Continuing education | 20.3 |
| University course | 10.2 |

| Table 3. Skills targeted with computer-based training. |
|---------------------------------|------------------------|
| Skill | Percentage of respondents |
| Reading | 45.9 |
| Word finding | 40.2 |
| Writing | 37.4 |
| Cognitive skills | 31.8 |
| Auditory comprehension | 29.0 |
| Verbal expression | 25.2 |
| Activities of daily living | 15.9 |
| Other | 13.1 |

**Note.** Total percentage is greater than 100 because respondents identified more than one skill.

| Table 4. Supplemental uses of computers in aphasia treatment. |
|---------------------------------|------------------------|
| Home Client Online Paraprofessional practice free time service treatment | |
| 43.7% | 27.5% | 17.8% | 5.8% |

| Table 5. SLPs’ confidence level using computers in aphasia treatment. |
|---------------------------------|------------------------|
| Very comfortable | Somewhat comfortable | Somewhat uncomfortable | Avoid use |
| 44.7% | 46.6% | 5.8% | 2.9% |
management for tasks such as researching a disorder or developing materials. SLPs reported various reasons for not using computers in aphasia treatment, with the predominant reason (54.1%) being a lack of access to the technology, followed by “other” reasons (18%) and client preference (13.1%), as demonstrated in Table 6.

Despite accessibility issues, survey respondents were interested in increasing their use of computers in therapy for individuals with aphasia, with 44.4% indicating that they planned to integrate technology more often in the future (see Table 7).

The perception of the SLPs in our survey was that computers are helpful tools but are not critical for client success, as 79% reported that computers were “beneficial but not essential.”

**DISCUSSION**

Two issues appear worthy of consideration. First, the extent to which computers were used directly for treatment was limited due to lack of accessibility and knowledge, even though research supports such use as effective in improving the communication skills of individuals with aphasia. Computers have become an integral component of work and home life for many, as well as a recreational activity and a means to obtain information. Computer literacy and use is required by business and academics. SLPs need adequate computer skills in order to stay abreast of their clients’ knowledge and to aid them in school and work reentry. However, SLPs seem to feel that computers are helpful but not necessarily essential in the treatment of aphasia. This perception may exist because SLPs are confident that other methods of service delivery are effective, or because of complacency, lack of knowledge of available technology, or inflexibility. It could be argued that being able to use a computer effectively is an essential skill in a technologically driven society. Health care

![Table 6 Reasons SLPs report nonuse of computers in aphasia treatment.](image)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percentage of respondents</th>
</tr>
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<tbody>
<tr>
<td>No access</td>
<td>54.1</td>
</tr>
<tr>
<td>Client preference</td>
<td>13.1</td>
</tr>
<tr>
<td>Dislike software</td>
<td>9.8</td>
</tr>
<tr>
<td>No training</td>
<td>4.9</td>
</tr>
<tr>
<td>Other</td>
<td>18.0</td>
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</tbody>
</table>

![Table 7 Projected future use of computers in aphasia treatment.](image)

<table>
<thead>
<tr>
<th></th>
<th>More often</th>
<th>Unchanged</th>
<th>Less often</th>
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<tr>
<td></td>
<td>44.4%</td>
<td>47.5%</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

administration is becoming more electronic, which will inevitably affect rehabilitation professionals with the expansion of computerized documentation, billing, and chart maintenance.

Computer use by individuals with aphasia may improve outcomes through additional opportunities for practice. Computer applications of therapy tasks at home may also increase generalization to real-world tasks and promote increased independence, especially for those who used computers in premorbid activities. Although computers cannot replace the SLP, they are a powerful tool for SLPs to explore and incorporate into a comprehensive rehabilitation plan for clients with aphasia. SLPs must design, plan, and monitor all therapeutic tasks, including those using computer technology. Additionally, there are intangible benefits of computer use in rehabilitation, such as increased autonomy, connectedness, self-worth, and recreation. For these reasons, SLPs can confidently target the habilitation or rehabilitation of computer skills as a functional endpoint of treatment for many individuals with aphasia. Improving the quality of life for individuals with aphasia is the ultimate goal when implementing technology in clinical interventions (Petheram, 2004).

Of further interest is that although a majority of SLPs reported using computers for some nonclinical activities such as administrative tasks, materials preparation, and Internet use, many SLPs in health care settings lack access to computer-based aphasia treatment equipment and software. Lack of training and funding were the most frequently cited reasons for this gap. Generally, increased use of technology can be expected to improve skill level, proficiency, and frequency of use. SLPs without readily accessible computers are less confident in their skills and report that they are less likely to use technology in clinical settings and applications.

SLPs require support and preparation to use technology proficiently, ethically, and effectively. Obtaining equipment and training is the responsibility of both the employer and the SLP, who should advocate for necessary resources (Cochran, 2004, 2005). Few SLPs in our survey received training on computer-based therapy during graduate school, and most gained skills informally on the job. Therefore, survey results indicate a need for academic programming and continuing education to increase exposure to technology and to the advantages it may offer in clinical service delivery. SLPs can use mandatory continuing education requirements as an impetus and opportunity for expanding their knowledge and expertise in these areas.

Further research related to the use of technology by individuals with aphasia will allow speech-language pathology as a profession to determine which areas of rehabilitation respond best if at all to computer-based or computer-assisted therapy. Additional investigations regarding the use of technology by SLPs will help to determine best practices such as use in clinical applications. The concept of a digital divide has been defined broadly as the gap between those who have accessibility to new technologies and those who do not (Pinkett, 2001). Results of the current study reveal the possibility of such a divide in this area of the clinical practice of speech-language
pathology. The challenge for the profession is to keep the divide narrow and to build a bridge across it.

REFERENCES


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APPENDIX: COMPUTER USE IN THE TREATMENT OF APHASIA: A SURVEY OF TRENDS

1. Do you provide services to individuals with acquired aphasia?
   ❑ Yes ❑ No

2. If yes, how long have you been providing care for individuals with aphasia?
   ❑ < 1 year ❑ 1–5 years ❑ 6–10 years ❑ 11–20 years ❑ > 20 years

3. What percentage of your caseload is devoted to the evaluation and treatment of individuals with aphasia?
   ❑ <10% ❑ 10%–25% ❑ 26%–50% ❑ >50%

4. Do you use computers during therapy sessions for individuals with aphasia?
   ❑ Yes ❑ No

5. If you answered “no” to the previous question, please indicate your primary reason:

6. Do you obtain specific case history information regarding an individual’s premorbid use(s) of computers?
   ❑ Yes, always ❑ Sometimes ❑ No

7. In what percentage of the cases of aphasia you treat do you use computers directly? (Computer is accessed for some purpose during the treatment sessions)
   ❑ <25% ❑ 25%–50% ❑ 51%–75% ❑ >75%

8. Do you use software specifically designed for use with individuals who have aphasia?
   ❑ Yes ❑ No

9. If you answered “yes” to the previous question, please list the software products you use:

10. Do you use voice/speech recognition software (IBM Speechviewer™, Visipitch™, Dragon Naturally Speaking®, etc.) for treating individuals with aphasia?
    ❑ Yes ❑ No

11. Do you use computers as augmentative communication devices for individuals with aphasia?
    ❑ Yes ❑ No

12. If you answered “yes” to the previous question, please list the devices you use:

13. Do you provide treatment for individuals with aphasia via telehealth arrangements such as videophone, teleconferencing, or simultaneous online activities?
    ❑ Yes ❑ No

14. Do you access the Internet during treatment sessions and use information from select sites for therapy purposes?
    ❑ Yes ❑ No

15. If you use the computer during individual therapy sessions, what types of activities involve the computer? (Check all that apply)
    ❑ Auditory comprehension training ❑ Reading skills training
    ❑ Word finding activities ❑ Writing skills training
    ❑ Verbal expression training ❑ Activities of daily living training
    ❑ Cognitive retraining ❑ Other: ______________________________

16. When you use computers directly during treatment, which best describes your typical session?
    ❑ Use of the computer is the only treatment activity.
    ❑ Use of the computer accounts for >50% of treatment time.
    ❑ Use of the computer accounts for 25%–50% of treatment time.
    ❑ Use of the computer accounts for <25% of treatment time.

17. Which of the following best describes the billing arrangements used when computers are used in therapy?
    ❑ The per-session charge is no greater when computers are used in the treatment session.
    ❑ The per-session charge is increased when computers are used in the treatment session.
    ❑ There is an additional charge when computer treatment is used (regular session + additional fee).
    ❑ Other: ______________________________
    ❑ I am not involved in the billing process.
18. Do you assign a paraprofessional to work on computer-based activities with individuals who have aphasia in addition to your direct treatment sessions?
   - Yes
   - No

19. Do you set up the computer for individuals with aphasia to work on activities during free time?
   - Yes
   - No

20. Do you train individuals with aphasia and/or their family members to use the computer for home practice activities?
   - Yes
   - No

21. Do you recommend any online treatment services to individuals with aphasia?
   - Yes
   - No
   If so, which do you recommend?

22. In what percentage of the cases of aphasia you treat do you use computers indirectly? (Computer is used for documentation, information gathering, family education)
   - < 25%
   - 25%–50%
   - 51%–75%
   - >75%

23. Do you use the computer to prepare therapy and home practice materials?
   - Yes
   - No

24. Do you use the computer to document evaluations and/or treatment sessions?
   - Yes
   - No

25. Do you use the computer to enter billing information?
   - Yes
   - No

26. Do you conduct Internet searches to assist you in managing difficult cases of aphasia?
   - Yes
   - No

27. Do you recommend select Internet sites to families to provide them with additional information regarding aphasia?
   - Yes
   - No

28. Do you subscribe to listservs related to aphasia?
   - Yes
   - No
   If you subscribe to listservs, please respond to the following:
   How often do you read messages posted to the listserv?
   - daily
   - 2–3 times/week
   - once/week
   - monthly
   - less often than monthly
   How often do you post questions or responses to the listserv?
   - daily
   - 2–3 times/week
   - once/week
   - monthly
   - less often than monthly
   Which listservs do you subscribe to?

29. Which best describes the primary training you have had regarding the use of computers? (Check only one)
   - University courses
   - Continuing education seminars
   - Online training courses
   - Software tutorials and instruction manuals
   - Mentoring from colleague

30. What type of computer system do you use to provide treatment? (Check one)
   - PC stand alone
   - PC in a network
   - Laptop
   - Type: __________________

31. Which arrangement allows you access to the Internet where you provide clinical service? (Check one)
   - I have a computer with Internet access in my treatment room/clinical setting.
   - I share a computer with Internet access at work with other coworkers.
   - I do not have Internet access at work.

Continued on next page
32. What types of Internet connection do you use? (Check one)
- 56K modem
- DSL/Cable modem
- T-1 line
- Wireless connection
- I don’t know

33. I am a (Check one)
- Student clinician
- SLP Assistant
- Clinical Fellow
- Certified SLP

34. How long have you been a practicing SLP?
- < 1 year (student clinicians/CFY)
- 1–5 years
- 6–10 years
- 11–20 years
- > 20 years

35. Which best describes your primary clinical practice setting? (Check one)
- University clinic
- Private practice
- Acute care hospital
- Rehabilitation hospital
- Skilled nursing facility
- Outpatient rehabilitation facility
- Long-term care facility
- Home health care
- Other ________________________________

36. What is the geographic location of your practice? (Enter U.S. state or country where you practice.)

37. Which statement best describes your level of proficiency with computers?
- I am very comfortable using computers.
- I am somewhat comfortable using computers.
- I am somewhat uncomfortable using a computer.
- I avoid using computers.