The Vocational Training Facility

An Interactive Learning Program to Return Persons With Physical Disabilities to Employment

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This paper describes the results of the program-development phase of the Vocational Training Facility (VTF) taking place at the Palo Alto Veterans Affairs Medical Center Rehabilitation Research and Development Center. The VTF staff has developed a self-paced, multimedia curriculum comprised of adapted training packages, interactive videos, and additional training and testing materials designed to teach entry-level desktop publishing and reasonable accommodation skills to individuals with spinal cord injuries. The curriculum is taught via the Macintosh™ computer to allow independent, "hands-off" access to training materials. Each student is given an integrated workstation that is equipped with the Desktop Vocational Assistant Robot (DeVAR); a set of low- and high-technology assistive hardware, software, and devices; and ergonomic furniture and adaptations customized to fit individual learning and access needs. Each student completes a 12-week, full-time training program followed by a 3-month internship with a local corporate sponsor. This paper summarizes the evaluation results of the VTF program by the first nine students, with spinal cord injuries ranging paraplegia to high-level quadriplegia, who have completed the program.

Keywords: Vocational training; Assistive technology; Multimedia; Reasonable accommodation; Spinal cord injury; Competitive employment

Individuals with disabilities encounter significant problems in finding and retaining competitive employment, despite the passage of recent civil rights legislation (International Center for the Disabled, 1986; Bowe, 1990, 1992). A gap still remains between the intent of laws, such as the Americans With Disabilities Act (ADA), and the actual implementation and enforcement in the corporate world. This gap is reflected in statistics related to employment. Of the estimated 18 million Americans with disabilities in the working-age population, 67% are unemployed (International Center for the Disabled, 1986; LaPlante, Miller, and Miller, 1992). Two-thirds of these individuals

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WORK 1994; 4(4):270-278

have stated that they would like to be working but were prevented from doing so due to problems with disability-related services (transportation, attendant care, housing, insurance), environmental access, societal discrimination in hiring persons with disabilities, and a lack of job-skill attainment opportunities that would make them "equally qualified" (International Center for the Disabled, 1986; Congressional Report on P.L. 101-336, 1990).

Statistics related to the employment of persons with spinal cord injuries show that 88% do not return to work after the injury (Stripling, Fonseca, Tsou, et al., 1983). This high unemployment rate corresponds to an estimated annual loss of more than 3.4 billion dollars in wages alone (Stover and Fine, 1986). Since injuries occur most frequently to individuals between the working ages of 16 and 30, and since these individuals are expected to live a relatively normal life span, returning to competitive employment is an important life goal (Young, Burns, Bowen, et al., 1982; Stripling, Fonseca, Tsou, et al., 1983).

In 1990 the Rehabilitation Research and Development Center (RRDC) at the Palo Alto Veterans Affairs Medical Center was awarded a 3-year Merit Review Grant from the Department of Veterans Affairs to address the barriers of physical access and job-skills training. The goal of this project is to develop and evaluate a Vocational Training Facility (VTF) that will teach computer skills to individuals with spinal cord injuries. By the end of the project, a total of 18 students with injuries ranging from paraplegia to high-level quadriplegia will have participated in training and follow-up vocational activities such as internships.

The VTF integrates rehabilitation robotics technology, computer-access devices, and a multimedia curriculum to teach computer skills in desktop publishing. Desktop publishing involves the use of computers to create newsletters, brochures, manuals, reports, and advertisements. Students attend a 3-month, full-time training program that takes place at the lab in the RRDC. Although the primary goal of the VTF project is to develop and test a vocational curriculum, its ultimate success will be measured by the effect this program has on the vocational outcomes of the students.

BACKGROUND

The VTF program was created in response to technology advancements, civil rights legislation, and employment trends. From the technology perspective, the VTF is based on past research cosponsored by the Palo Alto Veterans Affairs Medical Center RRDC and Stanford University (Leifer, 1981; Hammel, Hall, Lees, et al., 1989). Specifically, each of the three VTF workstations is equipped with the Desktop Vocational Assistant Robot (DeVAR). DeVAR is a fourth-generation robotics workstation designed to provide manipulation assistance to individuals who would otherwise require the assistance of a human attendant for task performance.

Concurrent with the robotics research, assistive technologies for persons with disabilities were becoming increasingly available. Initially, DeVAR combined industrial robotics technology with voice recognition, environmental control, and adaptive computer-access hardware and software as part of a tabletop workstation. This workstation was capable of performing daily living tasks such as preparing a meal, getting a drink, brushing the teeth, washing the face, and shaving with an electric razor (Lees, Crigler, Van der Loos, and Leifer, 1988; Hammel, Hall, Loos, et al., 1989). Subsequent research and development focused on vocational applications. Based on results of clinical evaluation studies and on feedback from consumers with disabilities (Hammel, Hall, Lees, et al., 1989), DeVAR's task repertoire was expanded to include tasks such as paper management, floppy disk insertion, mouthstick retrieval, and phone operation. DeVAR was placed in the office of a senior analyst programmer with high-level quadriplegia for a period of 2 years to evaluate its performance. The system was shown to be capable of replacing the employee's attendant for two 4-hour periods per day during a 40-hour week (Hammel, Van der Loos, and Perkash, 1992). The VTF represents the next step in applying previous robotics and assistive technology research to the arena of vocational training and job placement of persons with severe physical disabilities.

The VTF program was also created in response to the growing national movement to establish

civil rights for people with disabilities, especially in the area of vocational access. Legislation such as the Rehabilitation Act of 1973 and the Amendments of 1986 (Congressional Report on P.L. 99-506, 1973, 1986) and the 1990 ADA (Congressional Report on P.L. 101-336, 1990) guaranteed equal access to employment. Still, research has shown that there is a lack of qualified job applicants with disabilities (Cunconan-Lahr, 1991). Surveys show that, on average, people with disabilities have less education than their nondisabled peers (Bowe, 1992). In fact, 41% of adults with disabilities do not have a high school degree (Bowe, 1992). Among persons with spinal cord injuries, 77% have a high school degree or less (Stripling, Fonseca, Tsou, et al., 1983). Within this information age, being equally qualified requires not only a high school-level education but also the ability to operate a variety of technologies on a daily basis. The VTF program was developed in response to this need for applicants skilled in computer operation.

Finally, the VTF was designed according to current employment trends. The VTF training curriculum was based on a needs assessment that identified the content area, job skills to be taught, and the employment market for these skills. Subject matter experts from Silicon Valley computer companies were asked to identify the technical skills that would enable VTF graduates to successfully compete for jobs after training. Desktop publishing was chosen as the primary job skill to be taught for a number of reasons. Reports from the Department of Labor predicted that computer-based publishing would be a growing area of employment (Department of Labor, 1988-1989). Desktop publishing jobs are available in a variety of settings, including low-end copy shops, high-quality print shops, service bureaus, large companies with in-house publishing departments, and freelance consulting businesses operated within the home. Subject matter experts from Silicon Valley computer companies predicted that salaries for entry-level desktop publishing jobs start at $20,000 per year, with opportunities to increase salary given experience and advanced training in areas such as graphic design, illustration, animation, slide production, and multimedia.

Desktop publishing jobs also require mid-level computer operation skills that can be taught in a relatively short period of time to persons with little or no computer experience, as opposed to the advanced skills and aptitudes required in computer programming or computer-aided drafting and design jobs. Many existing vocational training programs focus on teaching either high-level computer programming or low-level data-entry skills and are not accessible to students with severe physical disabilities.

Desktop publishing work also requires the ability to produce high-end, quality products, in contrast to low-end data-entry jobs that require the ability to produce large quantities of work in a short period of time. The VTF project chose to target a mid-level skill that tapped into the individual's cognitive and creative abilities rather than data-entry speed.

Based on the needs assessment and input from subject matter experts in the field of desktop publishing, an interactive curriculum was designed to teach computer operation and desktop publishing skills to students with spinal cord injuries. This curriculum was incorporated within a 3-month vocational training program.

PROJECT DESCRIPTION

The VTF grant project is comprised of three phases: 1) development of an interactive curriculum; 2) job-skills training with a group of 18 students with spinal cord injuries; and 3) evaluation of the program. This article describes results from Phase 1.

Curriculum

The VTF curriculum includes adapted application training packages, interactive videos on adaptive access and the desktop publishing process, and additional training and testing materials. The VTF curriculum contains seven modules:

1. Adaptive access and robotics technology
2. Basic computer skills
3. Word processing
4. Graphics

5. Desktop publishing
6. Desktop presentation
7. Job skills

Before developing any training materials, a number of commercial training packages were evaluated. The following packages were chosen: Teach Yourself Word (Kahn, 1992) for Microsoft Word 5.0™ instruction, and the Discover Series for teaching FreeHand™ (Aldus, 1991), PageMaker™ (Aldus, 1991), and Persuasion™ (Aldus, 1989). Criteria for selection of these materials were the quality of the training and the vendor's willingness to allow the training material to be adapted for students with physical disabilities. For example, all paper-based training and reference materials were received in or converted to electronic format to allow "hands-off" access via the computer and assistive technologies. Vendors granted separate licensing agreements to adapt the original materials.

Since there were no existing commercial training packages available to teach adaptive computer access and the overall desktop publishing process, the VTF staff designed and developed three interactive videos and accompanying software. HyperCard™, a Macintosh™ application, was used to develop the computerized instruction and interactive video interface.

Curriculum support materials, including a set of assignments, performance assessments, and technical skills tests, complete the training package. As part of the training, each student also creates a portfolio consisting of completed assignments. This portfolio can then be shown to internship supervisors and prospective employers.

Learning Environment

The VTF classroom includes three accessible workstations that are equipped with commercial computer equipment, educational software and hardware, and assistive technologies (Figure 1). Macintosh II fx computers with 160 megabyte hard drives, 16 megabytes of RAM, and 19-inch color monitors are used to simulate a realistic desktop publishing work environment. External cartridge drives allow students to store their individual work and assitive software. Radius TV™, a video interface board, and a laserdisc player are used to play video on the application monitor in a movable, resizable window. The software interface and computer-access technologies provide independent control over the video operation.

Each workstation is also equipped with a set of assistive technologies, ranging from low-technology typing aids, mouthsticks, trackballs, adjustable keyboard holders, and modular furniture to high-technology equipment, such as an ultrasonic headpointer, tongue-touch keypad, and a voice-recognition unit. Adaptive software, including macros, key latching, word prediction, abbreviation expansion, and keyboard emulators, are available to provide alternative access to the keyboard and to increase productivity. BSR-X10™ environmental control units are used to operate on/off appliances. DeVAR provides manipulation assistance in performing daily living, vocational, and educational tasks.

Training Program

The job-skills training portion of the VTF program is organized into a three-step process: 1) pretraining, which includes screening and evaluation; 2) skills training, which provides access and job-skills training; and 3) posttraining, which includes internship placement and follow-up vocational transition services.

Pretraining. *Initial screening and recruitment.* Students are recruited from local spinal cord injury centers, independent living centers, university and community college systems, consumer-based disability agencies, and the California Department of Rehabilitation. The VTF grant established specific criteria for entry into the program. Potential students are required to have a primary diagnosis of spinal cord injury, medical stability, no conflicting psychological diagnoses or history of head injury, a high school degree or GED equivalent, ability to speak and read English, and ability to communicate verbally to use voice-controlled technology. Also, students are assessed for aptitude, interest, and motivation to return to work; however, they are not required to have had any prior computer or work experience. Finally, students are expected to have reliable

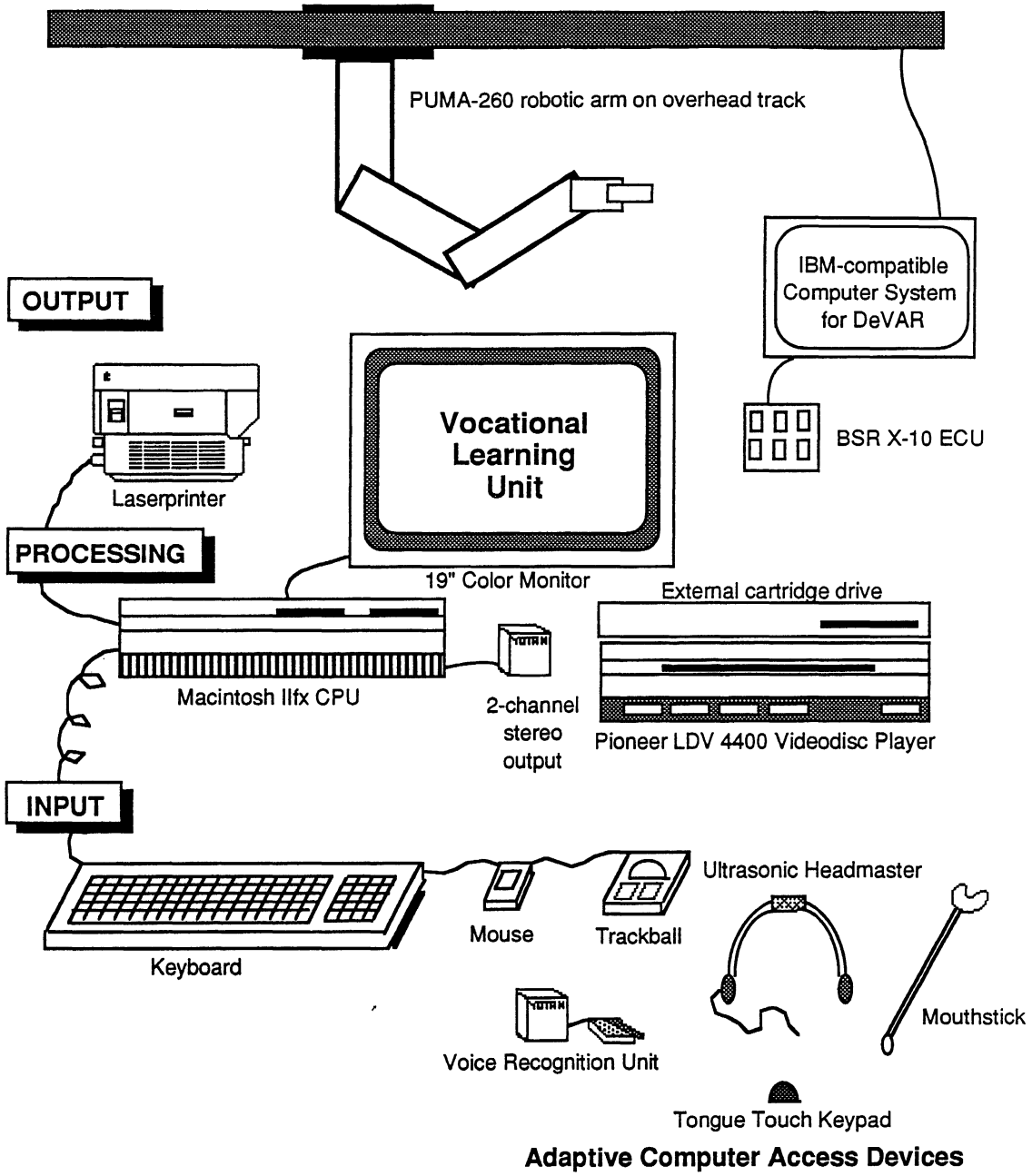

Figure 1. Each Student Is Given an Integrated Workstation with a Set of Components to Access the Interactive, Multimedia Training Curriculum and to Provide Reasonable Accommodation.

housing, transportation, and attendant care for the duration of the program. These resources are arranged in conjunction with local social service and consumer-based agencies.

Reasonable accommodation assessment. Before starting the training, an occupational therapist and a rehabilitation engineer conduct a reasonable accommodation evaluation with each student. A

machinist is available at the RRDC to produce customized adaptations. These professionals design initial workstation and adaptive access accommodations that are then modified throughout the program according to student feedback and recommendations. Students are able to practice using various combinations of assistive hardware and software devices over the course of the 3-month training. This practice provides them with the opportunity to choose the optimal solution upon completion of the program.

Technical skills training. *Reasonable accommodation training.* Students receive training on the use of assistive computer hardware, software, and input devices via interactive tutorials and hands-on practice. Training on the development of reasonable accommodation strategies, such as job restructuring, task reallocation, and flexible scheduling, is also provided. For example, the staff work with students to develop strategies for scheduling and working with attendant care in the workplace.

Technical skills training. Each student receives 12 weeks of technical training. Three students are trained during each session to ensure individualized attention and access to equipment. This training takes place 4 to 5 days a week, 32 hours per week, to simulate the work environment. The training is primarily designed to be self-paced. A teacher is available for problem solving, review, and guidance.

Course content involves training on the following primary Macintosh computer applications: Microsoft Word, PageMaker, Persuasion, FreeHand, and PhotoShop™. Students are taught to use telecommunications software, file-transfer software, Macintosh utilities, and computer equipment such as laser printers, scanners, modems, and fax machines. By the end of the training, students are able to publish professional documents, including newsletters, catalogs, data sheets, and annual reports.

Eighteen students are scheduled to complete the VTF training. To date, 12 students have been admitted to the VTF: three are currently participating in the technical training and nine have successfully completed that portion of the program.

Individual counseling and case management. Throughout the program, VTF staff work closely with each student to provide vocational counseling related to disability dynamics, communication skills, reasonable accommodation, and the employment reentry process. Based on the needs of individual students, referrals are made to other local agencies for additional psychological and vocational rehabilitation counseling.

Posttraining. *Transitional placement.* Upon successful completion of the initial 3-month training, students are given a choice of placement activities designed to complement their strengths and interests. The VTF staff arrange internships and identify advanced educational opportunities. Contracts to participate in these activities are coordinated in conjunction with the students, Department of Rehabilitation counselors, and corporate sponsors. Of the nine students who have successfully completed the training, four are now participating in internships, two are continuing their education, one is competitively employed, and two have chosen to pursue other opportunities.

Job search and placement counseling. VTF staff members are available for consultation regarding résumés, cover letters, interviews, and reasonable accommodation negotiations during and after the internships. Students are also referred to vocational counselors at local agencies for additional job-search and job-placement services.

Research and Evaluation

The end goal of the VTF grant project is to evaluate the effectiveness of the training program by measuring the performance of the curriculum and of the students. The goals of the curriculum evaluation are to understand how a multimedia curriculum performs in a classroom setting, how well this curriculum imparts content knowledge, and how flexible the system is in allowing for hands-off access to students with disabilities. The goal of the student evaluation are to measure the students' technical skill levels and to track their progress toward re-entry into the work force.

Curriculum performance. To evaluate curriculum performance, the VTF electronically tracks the reliability of the software and hardware

delivery system, student and teacher usage patterns, and the effectiveness of the content delivery. The application TimeLog™ is used to record a student's interactions with the Macintosh computer, including time spent within each application, file management, and system operation data. Data are collected in the form of detailed history lists and saved as a separate file for each student. Observation sheets are used to chronicle system software and hardware failures and repairs.

Student performance. To evaluate content knowledge, each student receives a desktop publishing test at the beginning and end of the training portion of the program. This 40-item, multiple-choice test was developed by the VTF staff, since no other comprehensive knowledge tests were available through universities or other training programs (Hammel, J., unpublished observation, 1990).

During training, knowledge of vocabulary is evaluated through the use of computerized multiple-choice tests administered at the end of each content section. Since DTP jobs rely heavily on the creation of products, student performance is also evaluated through periodic performance assessments. These assessments require students to demonstrate technical skill competence through the creation of real-world products, including resumes, cover letters, company stationary, logos, newsletters, and catalogs.

To provide an independent measure of student performance at the end of the training, an agency specializing in temporary job placement was contracted to administer PageMaker and Microsoft Word application skills tests. Results of these tests provide an objective measurement of the student's technical ability as well as recommendations to internship sponsors for future skill development.

In addition to quantitative measurements of performance, the staff is also conducting a qualitative comparative case study that explores the process of vocational transitioning for each of the students. Students are interviewed before entering the program and again after each transition point on the way to gainful employment. Teachers serve as participant observers, recording and analyzing students' daily interactions with other students, VTF staff, RRDC staff, family, friends, significant others, and rehabilitation professionals. Data collected from this study will be used to evaluate the effectiveness of the VTF program and to develop a grounded theory related to the employment re-entry process for persons with spinal cord injuries.

CONCLUSIONS

The VTF is a technical-skills training program designed to prepare individuals with spinal cord injuries for careers in desktop publishing. To teach these skills, the VTF uses an interactive multimedia curriculum that can be independently accessed and operated through the use of robotics and adaptive computer-access technology.

The VTF project plans to complete the evaluation of the program with 18 students. To date, 12 students have participated in the program; nine students have successfully completed the training. The project is currently exploring the possibility of packaging and marketing the training curriculum, replicating the program in other facilities, expanding the training to address the needs of a more diverse group of students and disseminating information about the process of vocational adjustment and transition for individuals with disabilities.

ACKNOWLEDGMENTS

VTF research is funded through a Merit Review Grant from the Rehabilitation Research and Development Unit of the Department of Veterans Affairs, with additional core support from the Palo Alto, California Veterans Affairs Medical Center RRDC. The authors would like to thank the staff at the Palo Alto Veterans Affairs Medical Center RRDC and Spinal Cord Injury Center and the VTF students for their participation in and assistance with the development and evaluation of the VTF.

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