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Computer Access for Students with Disabilities: An Adaptive Technology Laboratory

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Introduction

The number of students with disabilities who are studying or want to study at a university is increasing. These students are searching for the most "independent" and "normal" college experience possible. In order to make this a reality, students with visual, orthopedic, and learning disabilities must have access to computers which meet their needs i.e., computers that use the latest adaptive technology. Although this technology exists, it is rare to find it in use on many university campuses. Students with disabilities who have experienced adaptive technology on an individual basis, through their contact with state departments of rehabilitative services, know just how much adaptive technology can facilitate the educational process. This technology, which permits equity of access, has helped to reassure people with disabilities that they can attempt a university education with minimal accommodation. In fact, it has attracted many of them to the major of computer science.

Problem

It is difficult to gather statistics on the population of students with disabilities, because unless they identify themselves, or are obviously identifiable i.e., physically challenged, the university is not permitted to seek them out for identification purposes. Students are often embarrassed to identify themselves as having a disability and often set themselves up for failure by denying the help that they need.

In our division, which consists of the departments of Biology, Chemistry, Mathematics, and Computer and Information Science we have two computer science majors and three chemistry majors who are physically challenged. Those students who are in wheelchairs suffer both upper and lower body impairment. Others who have identified themselves are a student who is partially hearing impaired, a blind student and several who have learning disabilities. In addition, we have recently admitted two students identified as having low vision.

Currently, through the University Learning Center, we have documented 45 students with some form of disability. We estimate another 35 who regularly use the center but who have not been evaluated. In addition, the Science and Math lab within the Learning Center is servicing 10 to 15 students a week. These students comprise over two percent of our undergraduate student population.

Our university has a VAX lab, and four PC labs which are networked. These labs are for general university use. Unfortunately, the present platforms are not equipped with adaptive devices although these labs have handicap access. It is ironic that handicap access means that you can get your wheelchair through the door, but you cannot fit it underneath the worktable!

Undergraduate majors in computer science, are required to complete a fifty-eight credit liberal arts core in addition to their majors. More and more of the university curriculum is involving courseware. Students write papers on wordprocessors, use English courseware, spreadsheets, MathCad, and statistical programs. In fact, the use of computer technology has become a de facto course requirement outside as well as inside the computer science curriculum. At present, students who are physically challenged work with the help of personal attendants. This situation is unrealistic if we are trying to empower these students, foster independent learning and enable them to take their place in the work force.

Solution

An Adaptive Technology Laboratory, staffed with support personnel, both special education and technical, provides students with disabilities the tools with which to perform their work. It enriches their learning experience and substantially improves the support given these students in compliance with Section 504 of the Rehabilitation Act of 1973 [5]. More importantly, it enables them to develop the necessary independence that leads to increased productivity, self-esteem and ultimately access to careers in computer science.

Developing the Project

Developing an Adaptive Technology Lab, recognizes as important the full inclusion of people with disabilities in all aspects of campus life, including computer use. It advances the skills of undergraduate students with disabilities who want to use computers, creating an independent learning

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environment and, as a result, new employment possibilities for them in the future.

Students with disabilities at our university who are interested in pursuing a degree in computer science now have the opportunity to do so with full access to computing resources. In addition, adaptive technology is a relatively new field. An adaptive technology facility affords our computer science majors with an interest in this area, an opportunity to develop some research projects. It can also be used by the education department to train teachers in the use of adaptive technology for their students with special needs.

I became interested in the area of Adaptive Technology through contact with several students who were physically challenged. One young woman had such severe arthritis that she could barely type at the traditional keyboard -- this was in a class that was fifty percent hands-on. I had a visually impaired student in a major course who had to have a personal assistant type in his programs and write out his examinations. I have two students whose wheelchairs won't fit underneath traditional computer worktables. There were many obstacles to a "normal" university education for these students. This situation was very troubling to me. What message were we sending? While certain accommodations were being made, they seemed inadequate. The adaptive tools existed, yet we, as a university, did not have them. After consulting with my colleagues, who were turning to more and more courseware in their various disciplines, I realized that there was a pressing university-wide need to serve this population in a more effective manner.

I became formally aware of adaptive tools at a Computers In Society Conference at Southern Connecticut State University (SCSU) where a workshop was given on equity of access. In 1992, I attended a NerfCom workshop on Adaptive Technology given by the Director of the Adaptive Technology program at SCSU. It seemed as if the people who were most active in this field were special education teachers who were grappling with the basics of computer technology. I arranged a conference with Barbara Heinisch, the Director of the Program and a professor in the department of Special Education at SCSU. At the time, their facility was small, but what I saw on my tour convinced me that I needed to find funding to establish an adaptive facility on our campus. I watched a four-year old child with no arms who was confined to a wheelchair use a Macintosh with a headpointer to draw pictures. I watched a student with low vision use a screen enlarger to read the paper he was writing for a history course.

Determined to make this happen for our students, I went to our Grants Office to try to find funding sources for this project. For three years, I wrote to foundations, tried a public/private state grant, looked to national education grants, all to no avail. Most of these sources believed that the university should have this technology readily available. Unfortunately, as we all know, this is usually not the case. Because of the way the law is written, however, universities can get away with minimum accommodations for its disabled population [2]. I needed to take a more direct approach. I applied for and was successful in obtaining an Instructional Laboratory Improvement Grant (ILI) from the National Science Foundation to fund the laboratory.

Now, our computer science majors using adaptive technology and our current network, can work on the adaptive stations to complete assignments for their major courses as well as those of their core courses. This Adaptive Technology Laboratory affords students with disabilities the opportunity to take examinations on computer within an approved location. It provides the scientific community with graduates of this population, who are prepared to work independently with the latest tools either in graduate schools or in the workplace.

An additional benefit is that our majors with disabilities have volunteered to work as tutors in the University Learning Center. Our non-disabled majors who work there have contact with and hopefully become sensitive to the needs and rights of the disabled population. This lab, however, reaches further than the computer science students on our campus, because it is open to any student with a disability.

Creating the Laboratory

There were two steps in creating this laboratory: finding a space and ordering the necessary equipment. The proposed site of this lab is in the basement of the library within the University Learning Center, which has elevator access. Furthermore, students in this location have contact with the staff who have been trained in special education. The Director of the Math and Science Laboratory and the Director of the University Learning Center as well as tutors are available to students on a daily basis.

Although we chose to create this lab within the University Learning Center, it could have been created elsewhere. Most of the adaptive tools run on either Macintoshes or IBM 486 and above, making it quite easy to adapt any existing lab to one which includes adaptive technology. The one advantage of our choice is the availability of the special education tutors who can evaluate a student's needs and work with him/her to select the appropriate adaptive tool.

To this end, the staff of the University Learning Center are using the Adaptive Technology Lab Startup Kit [1] published by the staff of the Adaptive Technology Laboratory at Southern Connecticut State University. The kit contains protocols for gathering information about a

student to aid in decision making for planning evaluations. It offers a format for actually conducting an evaluation to determine the most appropriate hardware and software for each student. Using the developed intake and evaluation forms to collect data, staff will ascertain the appropriate hardware and software for an individual. Lab aides and student volunteers as well as staff will be trained on the adaptive devices

For equipment, we ordered a combination of Mac's and IBM's because required courseware runs on both and we wanted students who were trained on or had a preference for a particular platform to have access to it. There are adaptive tools for each platform. We also ordered a 17" monitor for those students who work better seeing the full text on screen After consulting with the head of the University Learning Center, I decided to focus our initial purchases in the areas of ergonomics, alternative input, adaptations for the visually impaired and aids to the learning disabled. Students with these disabilities had the most pressing needs on our campus.

Ergonomics

The lab is equipped with two adjustable height work tables which can be cranked up and down to accommodate wheelchairs and 6 chairs which have adjustable arms and backs for students who need extra support or have back problems . The *Lexmark Select-ease Keyboard* splits in the middle and can be angled into various positions to accommodate those with carpal tunnel syndrome or other arthritic conditions.

Alternative Input

The *Advanced Magic Wand Keyboard* for IBM's is a miniature electronic keyboard for people who have a limited range of motion. Students hold a stylus and use very small motions to type on this keyboard. *Stingray* is a small trackball with programmable acceleration, click lock ability and two large buttons. It works on a Mac. *My-T-Mouse* is a mouse controlled on-screen keyboard, for the IBM. There is both a Windows and DOS version. *Head Mouse* and *Tracker* are headpointing devices for alternative input. They allow the students to manipulate the keyboard with slight head movements. These work in conjunction with *Magic Cursor*, *On-screen Keyboard* and *Telepathy* (word prediction software) which all are known as *Doors 2*. *WiVik Onscreen Keyboard* is a movable on-screen keyboard for the IBM which enables the user to enter text into Windows 3.1 applications with any pointing device including mice, trackballs, joysticks, touchscreens, pens and headpointing devices. *WREP* provided word prediction and abbreviation expansion powers. *Power Secretary* provides speech input to the Mac and *Dragon Dictate* provides the same to the IBM. *Click It* on the Mac provides easy access to menus, dialogue boxes, windows and scroll bars without using a mouse. It also provides speech output of text and menus. *Intellikeys* is an input device and membrane keyboard that works on both the IBM and Mac (different cables). It includes 6 overlays and allows you to set up the keyboard in ways that accommodate the disability of the student. e.g., alphabetical order.

Adaptations for the Visually Impaired

The *Spectrum Jr.* is a full color video magnifier that allows the user to adjust the magnification and color of the text or graphics that he/she is reading. It is a free standing scanner. *ZoomCaps Key Labels* are enlarged keyboard character labels that come in white on black and black on white. They help with the visibility of characters on the keyboard. *Magic Deluxe* is a Screen enlarger program that works on the IBM. It can magnify text 2,4,6,8, and 12 times and is adjustable. Students with visual disabilities will also be served by voice input (*Dragon Dictate*).

Learning Disabilities

Students with learning disabilities (LD) are served by computer software that does word prediction and organization. They are also greatly aided by on-line dictionary and reference software. Word prediction software includes *HandiWord for Windows*, *Doors2* and *Co-Writer*. It tries to predict what word the student is searching for in formulating a particular sentence. This software offers word suggestions as soon as the student types a letter. The student can also customize the word list. Students with LD usually have a lot of trouble with the organization of ideas. *Inspiration* for the Mac and IBM is a graphical outlining tool which allows students to brainstorm, diagram and write. The student is able to create diagrams, flow charts and outlines and can switch easily between graphical and text format. It allows them to add note reminders to their graphical charts which can be used later when writing their papers. This tool interfaces nicely with word processor programs. *Day to Day Notepad* on the Mac also is an outlining tool. For reference software, the *American Heritage Dictionary* 3rd edition and *Microsoft Bookshelf* which contains seven resources on one CD: *Dictionary, Roget's Thesaurus, World Almanac, Atlas, Book of Quotations, Columbia Encyclopedia, People's Chronology*, were ordered.

Most of these items have a sole vendor, but it was productive to call each vendor because most equipment had come down in price between the writing of the grant and its funding. Several new products were also on the market and prices could be negotiated. There were excellent educational discounts.

Impact on the University

There are several financial arguments to be made in favor of university support for funding this type of laboratory. The laboratory, when established, can become the center of assessments for local school districts and rehabilitative services which want their students evaluated on certain software and hardware. The laboratory can also become the site for training sessions for student teachers, teachers and businesses which all serve the disabled population.

Conclusion

Although it may not be possible for every computer laboratory on campus to be equipped with adaptive tools, there should be at least one networked facility where students with disabilities are able to access campus technology. This is especially critical for students with disabilities who want to major in computer science. It is our responsibility as educators to recognize and advocate for the rights of these students to become independent learners via adaptive technology.

Bibliography

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[5] The Rehabilitation Act of 1973 (sections 504,508).