Return to Menu

THE MICROCHIP REVOLUTION
IMPROVING OPPORTUNITIES FOR STUDENTS WHO HAVE DISABILITIES

TABLE OF CONTENTS

INTRODUCTION

I recently spoke to a ninety year old woman whose vision had deteriorated markedly. Our conversation was instigated by an aunt of similar vintage. It largely involved an exploration of solutions for problems brought about by her vision loss. As we talked, a comment was made about the marked changes which had occurred during her lifetime. She reflected, "Changes which we could not have expected." I silently contemplated the very marked technological changes which have occurred within my rather shorter lifetime - changes which have the potential to benefit people in a broad range of circumstances.

We will briefly look here at technological developments which have had a marked effect on education. While these changes have affected students generally, we will focus on their impact on students who have disabilities. We will then explore some of the possibilities for the near future (I am not brave enough to contemplate beyond that).

This will not be just an abstract contemplation. I will use our provision of resources at OTEN-DE (Open Training Education Network - Distance Education) to illustrate what we believe to be an effective use of current technology. One of the issues which will be highlighted is the increasingly blurred distinction between adaptive and mainstream equipment.

We will conclude by looking at some of the challenges for both educators and students who have disabilities in the current climate. This climate includes the sometimes bewildering rate of technological change. Importantly, it also includes social, economic and political factors.

FROM PENCILS TO PCS

I will not attempt to document all of the technological developments over the past two decades or so. This is partly because a summary of even those which have directly affected education would be exceedingly long and boring. It is also because I suspect most people are fairly well acquainted, at least in general terms, with the types of options which are now broadly available. After a brief look at the impact of advancing technology on education generally, though, I will consider in more detail its impact on educational opportunities for those who have disabilities.

It would be an overstatement to say that computers have replaced pencils in the classroom. It is true, however, that computer-based equipment has become a very important part of education, from primary through to tertiary levels. Apart from anything else, a great number of vocational areas demand computer literacy.

Perhaps one of the most notable developments over the past two decades or so, however, is personal access to computers. That IBM called its then new machine the Personal Computer in 1981, was perhaps far more apt than could have been recognised at the time. It was also, incidentally, hard to contemplate then that by the turn of the century vastly more powerful machines THAN THAT DESKTOP UNIT could be carried in a pocket.

To place this discussion at a personal level, when I did my honours year in 1982, every student had access to some sort of word processor. Any one candidate who did not have such access would have been substantially disadvantaged compared to peers. I will return to that point later. Less than two decades later, my two children use computers regularly at school (one in primary and one in high school). They also use our (you've guessed it) personal computer to prepare assignments. With access to several encyclopaedias on CD-ROM and to the vast store of information on the INTERNET, information abounds. And the word processor is vastly more powerful and easy to use than the one WITH WHICH I prepared my honours theses.

Growth of Adaptive Equipment

Even over the past two decades alone, there has been a marked increase in the range and power of adaptive equipment. My definition of adaptive equipment is fairly broad, being either items made specifically for use by people who have disabilities or broadly available products which have been adapted/modified in some way to meet particular needs. This includes the use of purpose-written software on standard computers, a point I will return to shortly. While reflecting on personal experience, I will discuss further the equipment I used during my honours year. In preparation for what I knew would be my most challenging academic year, I forsook my trusty portable electric typewriter and bought the then new Versabraille. From the outside, it looked like a large lunch box and, when carried, felt as if it was loaded with bricks. Its twenty-cell Braille display was, however a major leap forward both in terms of reading/writing and getting access to computers. That machine cost $7,500. Much more powerful options (in terms of performance, weight/size and features) are now available for less cost, even in dollar terms.

Over the same period, availability of synthetic speech has gone from non-existent to crude, to quite good but expensive, to quite good and inexpensive. This has major implications for people who have a broad range of disabilities. Those who can benefit include individuals with severe vision loss, literacy problems and oral communication difficulties. Importantly, synthetic speech has found its way both onto standard computers and into specialised devices.

The sheer computer power which has become available has made possible the development of some very useful tools for students who have disabilities. The following are just some examples of what has been achieved.

* Hearing aids and cochlear implants have become much more "intelligent". While by no means replicating normal hearing, modern aids provide substantial benefit to some people who have a hearing loss.
* The Miniguide is an extremely compact mobility aid for blind people. Its small size, considerable power and low cost are achieved through use of a tiny integrated circuit board (not to mention some very thoughtful work by Greg Phillips, its inventor).
* A wide variety of augmentative communication devices for people who have oral communication difficulties is now available. There are examples of both purpose-built units and adaptation of regular computers. Output options include visual displays, synthetic speech and digitised speech (digitised speech is recorded human speech which is then stored electronically).
* For people who have severe physical disabilities, a variety of options is now available for operating computers. Very briefly, these include keyboard, mouse or mouse equivalent (including head mounted devices), various switch configurations and speech input. Especially in the case of speech input, huge strides have been made within the past decade, largely driven by mainstream commercial interest. Cost has reduced dramatically, while power has markedly increased. It has certainly not reached the stage where the keyboard is obsolete and can still prove frustrating, but further improvements seem inevitable.
* There have been some very useful developments for people who, for any of a host of reasons, have literacy difficulties. Again, there are purpose-built devices and software which runs on standard computers. Facilities include intelligent spell checking and synthetic speech output. Given the huge benefits synthetic speech has brought to those with severe vision loss, it has perhaps been under-utilised as an aid to those who, for other reasons, have trouble with printed material.

Given the availability of such useful technology, there is much scope for people who have even quite severe disabilities to perform very competitively. However, for this potential to be realised, several factors must be in place. Firstly, the most effective equipment must be available to the student. As I touched on earlier, a student who has a disability is at a major disadvantage to non-disabled peers if access to equivalent tools is denied. While it is obvious that the necessary financial resources must be available to allow provision of these tools (they often cost more than mainstream equipment), issues are more complicated than just money. Even if money were no object, there is the very crucial issue of which item(s) will best suit an individual's needs. This requires that information about available options is

available to the student. Imperatively, if instruction in use of equipment, is needed, it must be available.

The issues discussed in the previous paragraph can present real challenges to those of us who provide resources to students who have disabilities. With both mainstream and adaptive technology changing so rapidly, it is impossible to be fully aware of all possible options. However, it is our duty to do all we can to stay abreast of developments. It is not reasonable to make equipment - even the most carefully selected equipment - available and assume students will be able to come to terms with it independently.

Nor does what I have just said absolve students from responsibility. To get the most out of current technology, most of us will invest substantial time and effort and will endure at least some frustration. Those who use, for example, screen readers or speech input systems can attest to this.

Later in this discussion, I will speculate on possible changes in technology and their likely impact on students who have disabilities. Firstly, however, I will use what we do with current technology at OTEN-DE by way of providing resources for those students.

THE OTEN-DE MICROCHIP EXPERIENCE

Before examining the increasing use of computer power generally and its implications for students who have disabilities specifically, a brief look at the traditional distance education model is warranted. Printed, paper-based learning material is posted to the student. The student, having read the learning material, completes prescribed assignments. Each assignment is posted back, where teachers provide comment and assessment. The student is provided with feedback and the result of the assessment is recorded. Notably, learning material provided in this manner can be extremely bulky, an issue which will be discussed in more detail shortly.

Computers have become increasingly involved in this process. They are, of course, essential for maintenance of student records. They have also become central to preparation of printed learning material. That is where we become interested. Printed, paper-based material does not suit everyone. Not surprisingly, those with severe vision loss are prime candidates for material in alternate formats. However, over the past eight years, we have found a far greater market for other than paper-based notes.

In 1992, we began providing a small number of vision impaired OTEN-DE students with learning material on computer disk. In that format, material could be read with screen reading or large print software. The major challenge at that time was to transfer files from Apple Macintosh to IBM compatible format. Extensive experience on our part and improved conversion software on both platforms have largely resolved those issues. We became, though, victims of our own success. At the same time as numbers of vision impaired students began to swell, other students recognised the relevance to them of learning material on disk, rather than paper. One group which showed interest was those who had severe physical disabilities. As mentioned earlier, learning material on paper can be very bulky and it can present major difficulties for those who lack the strength to cope with heavy items. Some students can also get a more comfortable working position with a computer screen, compared to a bulky wad of paper. They therefore prefer to have their study material provided on computer disk. Time does not permit a more thorough discussion here of benefits of learning material in alternate formats. A more detailed discourse is available in Using TQM to Provide Learning Material in Suitable Formats to Distance Students with Disabilities, a paper I wrote for the ARATA Conference in 1997.

We are currently in the process of refining the presentation of learning material delivered electronically. The major technical issue is how to provide material which more accurately maintains the original format. Ideally, a student using material on a computer should be able to locate - say - page 53 or Chapter 4 as easily as one using a conventional document. Unfortunately, this is not always the case. We are currently investigating such formats as HTML and PDF, both of which have some benefits and drawbacks. Provided a student has INTERNET access, learning material can be delivered via that vehicle. Due to the large size of some files, however, it is not always an appropriate option. We are therefore moving towards putting learning material onto CD-ROM and posting the disk to the student. This is an especially useful option when large amounts of graphics are involved. With the wider availability of CD-ROM drives on computers and the relatively low cost of equipment necessary for producing the disks, it should also result in greater efficiency generally.

The Internet

As mentioned in passing earlier, the INTERNET has a great deal to offer students. This is especially true for many students who have disabilities and, for those undertaking distance education it is even more important. It offers access to a great deal of information. It is also a very effective communication tool, especially for those who do much of their studying in isolation.

At OTEN-DE, we began a pilot project in 1992 to allow students with disabilities to communicate with each other and with staff via email. The system we then used

was not especially easy to use and allowed contact only within the small group. For those reasons, student acceptance was limited, but the potential was demonstrated.

In 1999, we moved to an INTERNET-based service, with dramatic results. There are two major components to the facility. The first is that students who cannot afford their own INTERNET account are provided with one, with limited hours of access each month. The second is an email list, called the OTEN-DE Disabilities Access List. This is open to students who have disabilities who have an email address. We have been expanding membership of the Access List gradually over the past year or so and now have over 25 participants. Traffic is quite heavy and enthusiasm is high. Students use the List for mutual support, both in relation to study and their disabilities. Photographs, sound files and light-hearted banter are exchanged regularly.

The Equipment Pool

Talk of INTERNET and, for that matter, computer access is of cool comfort to those students who cannot afford a suitable computer. The problem is exacerbated for those who require adaptive hardware or software to make a computer useful. To go some way towards resolving this problem, OTEN-DE has established a pool of equipment to be used by students who have disabilities. Partly in an effort to discourage dependency and largely due to budgetary constraints, equipment is often loaned on a short-term basis, with a process of rigorous review. Because demand far outstrips supply, requests are stringently prioritised and, unfortunately, a lengthy waiting list exists.

Despite some practical difficulties and frustrations for both staff and students, the program has yielded many positives. Importantly, some students who would not have otherwise been competitive have been very successful. They have, at the same time, been developing those all-important skills I mentioned earlier. Often, availability of suitable equipment has also allowed a reduction or elimination of tutorial support. Feedback from students on effectiveness of specific mainstream and adaptive equipment is also helpful to staff. This allows us to make more informed comments when discussing options with other students.

THE FUTURE

I do not regard myself as a futurist, so will not be making expansive predictions. There is also much to be said for the notion promoted by the famous psychologist, Fritz Perls, of focussing on the present, rather than dwelling on the past or worrying about the future. In providing resources to students who have disabilities, especially where technology is involved, there is merit in trying to be aware of likely impending

changes. Otherwise, both staff and students can find themselves expending much energy in dealing with unexpected demands. I remember clearly the anxiety expressed by many who use screen readers when Microsoft Windows began to overtake DOS as the dominant operating system on PCs. There was a considerable hiatus while tiny companies played a frantic game of catch-up, trying to produce screen readers which could interpret what is a much more visually oriented environment. A current example is a problem within some Institutes of TAFE NSW due to the move to Windows NT on all computers. To meet the needs of some students, much more expensive adaptive software is required. For others, the software is simply not available. I will conclude, then, by looking at some short-term technological and social issues.

It would be nice to predict that the dizzy spiral of more powerful computers and even more power hungry software will substantially slow. As one who purchases equipment from a quite small budget, I find it very frustrating when perfectly good hardware is rendered obsolete due to more demanding software. The frustration is tempered when the new software offers real benefits to us mere mortals, something which is all too often far from obvious. On the other hand, it is clear that the power of current computers has resulted in real benefits to those who have a wide variety of disabilities.

Despite my concerns, the power race is likely to continue apace. One area which is likely to benefit directly is that of speech input. The progress which has been made in this area since I attended the launch of Dragon Dictate in 1992, costing $13,000 or so, is substantial. Largely because there are significant commercial reasons, systems should become less demanding of users and give more in return. Coupled with quite tiny computers, speech input technology should yield very real benefits to those who cannot use a keyboard effectively. This is not to say that manual input to computers will become a thing of the past. Very good keyboards can be quite compact. I believe they can be housed in even small computers effectively, especially if some clever engineering is employed.

Palmtop computers, due to their small size and considerable power, have much to offer. It is quite feasible that a variety of methods of instructing the machine, depending on user preference and/or circumstances, could be used. These include keyboard, pen and speech input. One feature which, to my knowledge, has not yet found its way into mainstream palmtops is synthetic speech. For quite selfish reasons, I would like this to occur. Given the gradually wider acceptance of synthetic speech, this may happen. It is now possible for people to have email read via synthetic speech while - say - driving. Again, as with speech input, commercial interests may improve access for those with vision loss.

It is also reasonably safe to predict that the large companies at the forefront of the technological charge will be more attentive to the needs of people who have disabilities in the future. This is partly because, in some countries, there are effective legislative requirements. It is also because of the effectiveness of public pressure. It is important, then, that the pressure is maintained. There also seems to be the beginnings of an awareness of the commercial benefits of applying universal design principles. That is, producing a product which meets the needs of the broadest possible range of people (see www.design.ncsu.edu/cud). As well as increasing the available market for the product, universal design also ensures that it is more useful to everyone.

CONCLUSION

That this Conference takes place is largely because the needs of tertiary students who have disabilities was recognised. That recognition resulted in an increase in formal structures in tertiary institutions, especially during the 1980s and early 1990s. Over recent years, diversion of funds away from public education has seen these services come under increasing threat. It is crucial that we continue to help educational administrators and politicians appreciate the very real social and economic costs of people with disabilities not receiving adequate education. By adequate, I mean the same opportunities as other students.

I commented earlier on the importance of students having access to relevant equipment and receiving suitable instruction in its use. This issue is crucial for school students for, if they leave school without the necessary skills, tertiary study involves considerable remedial work on top of studies. This, in turn, puts them at a distinct disadvantage to peers. This does not excuse those of us working in the tertiary sector. For many reasons, students will enrol in our institutions who require help with adaptive technology and suitable resources should be available. It is important that we continue to strive to provide those resources by both staying abreast of technological developments and influencing social attitudes and policy. That includes encouraging students who have disabilities in their academic pursuits. They should be aware that this may involve frustrations beyond those experienced by other students, due to various factors. These can include attitudes by others towards them, the need to deal with study material developed without sufficient thought, having to master sometimes complex technology and perhaps the disability itself.

Some important gains have been made, both technologically and socially, over the past two decades. We can be sure that the microchip revolution is far from over and that more dramatic (and hopefully positive) changes will occur. Substantial effort on

the part of students who have disabilities, their families and those working towards their interests, are required for the social environment to remain positive.