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ABSTRACT

This paper reviews selected research projects which focus on creating learning environments for special education, including those for handicapped, disadvantaged, and gifted children. Technologies that are applicable for gifted, retarded, blind or visually impaired, and deaf or hearing impaired students are discussed, as well as those for students who have poor motor coordination or communication difficulties. Appendices include information on the following technologies: computers, microcomputers, videotapes, videodiscs, the Kurzweil reading machine, and microcommunicators. (LLS)

Province of British Columbia
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DISCUSSION PAPER 02/81

INSTRUCTIONAL TECHNOLOGY FOR SPECIAL NEEDS

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TABLE OF CONTENTS

PREFACE

1981 is the International Year of the Disabled. The range of human disability is enormous and both its causes and its consequences may be physical, mental or social. Those of us who rarely come into contact with disabled persons, often assume that advances in medical science have all but negated the problem - and therefore society's responsibilities. This is far from the truth.

In a recent address to the World Health Organization, Mr. Robert Muller confirmed that the United Nations views the number of handicapped people as an issue of global proportions. The following figures attest to the scale of this issue:

1. As of 1980, there are 450 million handicapped persons in the world.

2. In the western world, 250,000 people are killed and 7,5 million are injured each year, as a result of automobile accidents. Most of these accidents involve young people.

3. In certain countries such as France, 50% of all handicaps are due to automobile accidents.

4. 10% of <u>all</u> children born today have slight brain damage.

The aim of the United Nations in what it refers to as "a very accute world-wide problem", is to reduce the number of handicapped through supporting policies of prevention. The fact remains however, that social and educational agencies, including schools, must respond to the needs of disabled children on a daily basis. While the goal of prevention is something to strive for, it is decisions made at the local level which often determine the kind of life-style and potential which a handicapped child might achieve.

There is a good case for viewing the school as a therapeutic agency in its treatment of children, in that the materials and methods used with a pupil are geared to perceived ability to cope. Coping behaviour itself is determined by mental or physical ability, sometimes both - and either of these may be "below the norm", or "superior". A misplaced "diagnosis" of a student, may well be educationally disabling, whether that student is brain-damaged or gifted.

The beginning of the Year of the Disabled is a good time to look at the role of education in creating a learning environment for the handicapped, disadvantaged or gifted child. Although this paper looks at only a very small portion of the possibilities, it is hoped that some of the ideas presented here may result in new and successful teaching/learning strategies.

INTRODUCTION

It has generally been the case in education that an instructional resource or teaching method developed to help overcome a particular learning disability has found, except in very specialized cases, a useful adaptation in the regular classroom. Examples include various approaches to word recognition (visual, phonetic, contextual), high interest-low-level learning materials and combinations of visual/auditory presentation to meet individual learning styles.

Given this situation, we should probably expect a large variety of teaching methods to be available to meet the requirements of special needs children - many of whom are in the public schools system, some in special classrooms or special schools, a smaller percentage in residential schools or institutions, and a few who receive very limited education under special arrangement. Unfortunately, even if these approaches are known and tested, it is very difficult to put them into effect, largely because the greater the need, the greater the degree of personal attention and individualization required. Educating special needs children, therefore, becomes highly labour-intensive and because the cost of operating public schools must be rationalized across the whole range of students, a special program for even a few hours a day may be difficult to justify in terms of cost.

Other educational problems proliferate. A child on a limited program does not receive the same kind of reinforcement and supplementary curriculum as the "regular" student. With longer time periods between lessons, progress is bound to be slow and with the one-to-one attention that is a necessary requirement for the education of these children in the first place, there may not be any incentive to learn and explore creatively on their own - even if this is possible.

The severely handicapped child may require a very different set of learning experiences. Perhaps his or her goals involve learning to communicate, to take care of themselves or to perform simple tasks. To these children, the social setting of the classroom is extremely important, so that a totally individualized approach would not entirely meet their needs. On the other hand, because no two children have quite the same needs, individualization is still the key to a successful program.

The capability now exists to apply new instructional technology to special education in a way which has never before been possible. Some of this technology is still in the planning stage but much of it (particularly microprocessor applications) is already available and special hardware (equipment) and software (programs) are in the process of development. One source of ideas for specialized computer application is presented in Appendix 1.

Two notes of caution are in order. First, there is no claim that technology can overcome all the problems of special needs children. The day is fast approaching, however, when technology will enable these children to achieve more from an educational program than has previously been possible. Second, the kind of technology discussed here, does not include audio-visual aids. Although microcomputers and videodiscs do employ graphics and audio features, they require the active participation of the student on an interactive basis and do not employ a passive, visual approach. This interactive characteristic of the new technology, which makes it a unique resource, is being widely recognized as of special benefit to those with learning disabilities of all kinds. One such project already underway is outlined in Appendix 2.

This paper is not a long one because research takes time and the technology to enable the research is relatively new. On the other hand, the projects described here constitute only a sample of what is being done; an enormous number of possibilities lie ahead. Some speculation on future applications therefore seems appropriate.

THE CASE FOR TECHNOLOGICAL RESOURCES

The following excerpts are taken from the Report of the United States House of Representatives Committee on Science and Technology, released in June, 1979. *

> ---a microelectronic revolution is underway which very likely will make personal computers commonplace ---introducing unique educational opportunities.
>
> ---the psychological, sociological and political implications of the diffusion of computer technology are at best only vaguely understood and are not being studied or planned for in any comprehensive manner.
>
> Federal funding policies should include a focus on the potential of microcomputers towards facilitating the education of individuals with severe handicaps ---. Gifted students (must) also be seen as ideal clientele.

As a benchmark for our own efforts in British Columbia, the report coincided with the beginnings of the first provincial-level investigation into researching various approaches to the instructional uses of microcomputers, as part of comprehensive planning for educational use. But in order to plan ahead, this first stage must lead to an appreciation of the unique, special-purpose applications of microprocessor technology.

One of the researchers quoted later in this paper (Sewell: 1980), states:

> One of the criticisms which has been raised in the past concerning CAI has been the cost of the hardware involved. The emergence of microprocessors largely negates this criticism. We estimate that a microcomputer system similar to the one (used in our research with the profoundly deaf) would cost in the region of $1,500 to $2,000 which would include a random-access slide projector. For such an outlay a school would have access to a machine with many of the advantages associated with sophisticated computer technology.

* U.S. Government Printing Office. Washington, 1978.

This kind of cost is insignificant in the total costs of educating a handicapped child and even less significant when it is realized that one machine can be utilized by a number of children on a daily basis, for both individual and group instruction (as in the above example) and for any number of classroom management and administrative chores, over and above its instructional potential. Add to this the degree of learning independence it creates for the child (whether or not handicapped), its ability to provide enjoyment and motivation as well as computer literacy as incidental side-benefits and the flexibility it creates for teachers, and one wonders why a microcomputer is not available for every child in a special needs situation.

Some of the reasons for lack of availability are the following. First, parents and educators have been trained to be suspicious about instructional technology, often with good reason. They recall early efforts at computerized instruction using older main-frame devices which sometimes resulted in a nightmare of breakdowns, slow responses and limited applications, plus enormous cost. Parents, in general are somewhat cynical about the effort and expense of earlier years to provide television, slide projectors, film projectors and (later) video cassette recorders, along with movie camera equipment and all manner of "visual aid" material (there is speculation that much of it now gathers dust or is hauled out in desperate situations, notably Friday afternoons, although this is often far from the truth). In short, there is an inherent disbelief that technology can do anything to really promote the <u>educational</u> goals of the school.

This is indeed a difficult barrier to overcome, for both the microcomputer, and its close relative the forthcoming videodisc machine, use video display screens (shades of television); can be loaded with diskettes or tapes for "instant" tutorials (shades of tape-recorders and record-players) and can be hooked up <u>via</u> telephone to mainframe data sources (shades of problems with first generation computers). The microcomputer however, is quite remote from the "visual-aid"; its key characteristic lies in interaction between user and machine, that is, it is not used on a "passive basis", but requires continuous response from the student.

Second, technology is often seen as a solution in itself. The best example of this viewpoint is evidence by the question: "Will technology replace the teacher?" The fact that this question is even asked indicates that someone has a basic misunderstanding of educational technology - it is never a solution - it <u>is</u> a resource. To be a successful resource, it must be manipulated <u>by</u> the teacher <u>for</u> the student in a context created by the teacher to meet particular learning objectives.

Third, while the cost of putting the necessary equipment in the hands of the teacher is low, initial development costs are high. This is because rapid developments in the hardware industry (which makes the machinery available) have reduced costs very quickly. On the other hand, in order to get to the point where a teacher can use a microcomputer for the special needs of a student group, a careful study must be undertaken to determine just what these needs are in terms of curriculum and how the curriculum can be transferred to, and augmented by, microcomputer-based instruction. Following this, specialized programs have to be designed and developed, a highly labour intensive process. At JEM Research for example, it has been determined that a ratio of 200:1 (two hundred hours of programming time to produce one hour of microcomputer-based instruction) is a fairly accurate ratio. This varies, of course, with the complexity of the courseware - use of audio, graphics, variety of detailed responses, and so on - along with the provision of classroom management (record-keeping) capabilities.

This is not quite as bad as it sounds. One hour of microcomputer instruction, in fact, covers alot of ground when time for student reading, response and back-tracking is accounted for. Nevertheless, the major costs of this sort of exercise are "front-end" and there is a considerable time-lapse between putting up the money and the visible result in the classroom. It cannot be emphasized too strongly, however, that with the total cost of special education in British Columbia put at $84 million for 1980, the expense of putting special needs technology into operation appears to be of little consequence.

Finally, there is evidence of a belief that public education as it is now conducted has "bottomed out"; that there is nothing new (just variations on old themes) and that it has made all the 'progress' it is possible to make. An understanding of the new technology undercuts this view, for it is totally different from any other resource. So different, in fact, that the research described in this paper is presented in the confidence that the educational possibilities it represents will not only be commonplace in the future, but far more refined and effective.

STARTING WITH THE CHILD

LOOKING AT SPECIAL NEEDS

Every child has special needs and, generally, school systems try to cope with the broadest recognizable range of these needs within the limits imposed by the legal requirement that they provide formal education. The children who _visibly_ fall outside this range, represent only a small percentage of the total, and given better health care, along with early recognition of physical and mental symptoms, their numbers may well decrease over time. However, there are less visible groups, whose needs are also acute - the learning disabled and the socially disadvantaged, for example - whose needs impede their educational progress. The very gifted child (as defined by high I.Q. or by display of a special natural skill or telent) may be handicapped by lack of a special environment. Some educational writers have estimated that up to one quarter of students may not (or cannot) be adequately served by the average school system.

Both the disabled student and the disadvantaged student grow up to face problems in the workplace. The Public Service Commission of British Columbia uses the following definitions:

> A _disabled_ person is limited significantly and persistantly in the performance of normal activities because of a physical or mental handicap.
>
> A _disadvantaged_ person is limited in gaining employment because of social disadvantages.

The Commission estimates that _ten percent_ of the working age population is disabled to some extent and therefore limited in the kind of work they can do. That one child in the average classroom, therefore, who "stands out" because of a very obvious disability, is actually representative of an enormous number of consequential but less obvious disabilities, the social and economic significance of which is long-term and far-reaching.

In order to progress through school a child "needs" critical levels of intelligence, sight, hearing, motor co-ordination and communications skills. Where one or more of these characteristics falls below the critical level (or where one or more is so acutely developed that the child's surroundings do not provide the necessary stimulas), some sort of compensatory action must be taken to enable full participation in the education program. A number of these compensations are very simple and ordinary - the provision of eyeglasses, hearing aids or courses of special exercises for example. Making available good track facilities for the "born athlete" may also be considered as compensatory action.

There comes a point, however, when what the child brings to the school situation requires a drastic manipulation of the environment for education to take place. This involves, first, a very different set of expectations and learning outcomes from those applied to other children. Second, such students usually have to "learn" one or more of the basic ingredients for normal living - to "see", to communicate, and so on.

Because he or she may not be able to respond to a group situation, both the conduct and management of programs for the special student are very different from that of the regular classroom. The key feature of special education, is the dependence of the child on the teacher. This dependence has both positive and negative elements; positive, because it is the child's dependence on, and trust in, the teacher which enables learning to take place and negative because at some point, the child must develop independence (or a degree of it) as an educational goal. It is the introduction of independent learning into special education, often at very early stages, which forms the basis for the recognition that new technological applications will become the major teacher/student resource in the majority of compensatory programs.

INTELLIGENCE

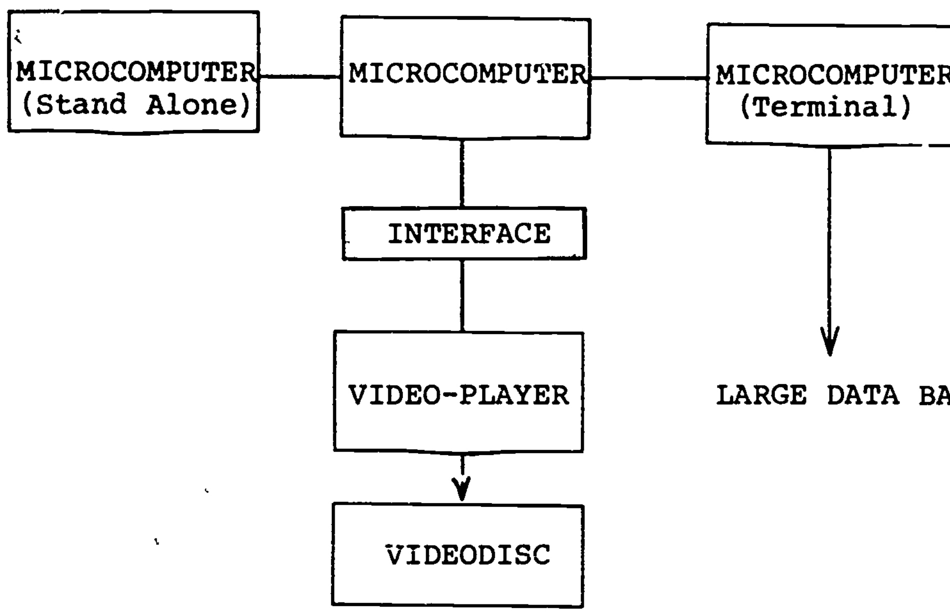
Over the years, public school systems have had to account for wider and wider ranges of mental ability in their pupil clientele. Unfortunately for the administration of education, this wide range is as likely to occur in one classroom, as it is across an entire province or state. It was this sparse distribution of gifted children which prompted researchers at Stanford University to utilize computer terminals to meet their special needs. In this particular case, "gifted" children were classified as Level 1 (those with an I.Q. of 135 and above, as measured) and Level 2 (those with an I.Q. of 165 and above, as measured). The use of computer terminals not only effectively overcame problems of distance and time, but special skills and talents could be identified.

Expansion of the same project to using microcomputers, allowed the gifted children to:

1. experience an enriched program in their own locality;
2. experiment with different forms of expression;
3. assist other students with remedial work;
4. design and develop new applications.

Another electronic resource is the videodisc, which can provide interactive, teacher-independent instruction. Random access capability and large storage capacity are features which will increase the possibilities for instructional use; in addition, the equipment is portable, reliable and easily maintainable. While videodisc equipment is available, it may be some time before technical specifications and cost effectiveness meet the requirements for general instructional use. In the meantime, however, applications are being discussed - particularly those of a diagnostic and remedial nature (see Appendix 3).

Existing video tapes can already be made interactive, using the microcomputer. A simple interface card links the two machines and allows a video-tape to become a tutorial, a diagnostic tool or an instrument for review and reinforcement (see Appendix 4). Once these interactive tapes have proven their worth in field tests, the entire interaction program can be transferred to videodisc at a later date. The progression in classroom technology therefore, is as follows:



This presently available technology not only allows teachers to meet the needs of more pupils, but allows the use of test scoring and management systems for mastery tests which are now available through publishers (Appendix 5, for example). This use of technology as a diagnostic resource is an important feature.

The Vocational and Rehabilitation Research Institute of Alberta in co-operation with the University of Calgary, is involved in a large project which looks at computer assisted learning for the mentally retarded. This research is being conducted by Dr. M.J. Hallworth and Professor Ann Brekno, both of the University of Calgary. The premise underlying this work, is that such persons may be educated to considerably higher levels of performance than has generally been assumed. The highly structured curriculum includes coin recognition, shopping, budgeting and banking. A computerized pre-reading and reading program for the adolecent mentally retarded is being successfully used.

It has been found that computer assisted learning is of immense value to the retarded child and adult, provided the programs are developed specifically to meet their requirements. For example, courseware should demonstrate ideas at a very concrete level and reinforcement may be very different from that used in the regular classroom. Visual reinforcement is also important. In the Calgary case, a slide projector is used in conjunction with the computer terminal. An alternative, is the intelligent video-tape approach mentioned earlier.

The use of technical aids to enhance or account for mental ability in school settings, may not directly relate to the delivery of instruction, but may improve the student's environment to the extent that instruction is more effective. An example is a study conducted at the Diagnostic Education Centre, University of Houston, Texas, which looked at the effects of stress and muscular tension on the learning capability of learning-disabled children. Using an Autogen 1500 Electromyographic Machine, four boys who met the criteria for special classes, were taught muscle relaxation through bio-feedback techniques. After ten minutes of visual feedback at each session, the boys then practiced handwriting under supervision. All the boys learned to control muscular tension and to reduce errors in school work. A higher degree of self-control and conscientiousness was also noted. In short, bio-feedback relaxation training resulted, in this case, in more efficient school coping ability over a wide range of activities. Positive behaviour changes were described by teachers and parents as 'dramatic'.

SIGHT

The invention of braille in 1834 was, for many years, the only "technical" resource available to teachers of the blind. In more recent times, two factors have helped to reduce the dependence of blind persons on braille and related touch systems. One is the availability of a variety of devices which utilize new technology to enable a closer approximation to normal communications skills for the blind, along with faster response time. These devices are undergoing continual improvement.

The second factor in a reduction in the numbers of totally blind children. While total blindness still occurs as the result of accident or sometimes from birth, it should be remembered that legal blindness does not necessarily mean "totally blind". An individual is legally blind (that it, is officially registered as blind) if he or she has 20/200 vision, or less in both eyes. Such a person is often able to mask some of the effects of this condition reasonably well - ride a bicycle, read with the use of an extra-strong magnifying glass and move around with confidence in familiar areas. Consequently, the emphasis on the education of the blind has shifted to what is termed education of the "partially sighted", or sometimes, "visually impaired". This overall reduction in the severity of a handicapping condition has important implications for broadening the educational options available for those who suffer from it.

Blind students were probably the major beneficiaries of the invention of the tape-recorder which enabled them to record classes and lectures and to take advantage of libraries of taped material (the University of British Columbia's Crane Library for the Blind, is an example). But material has always been severely limited, particularly for those requiring specialized texts.

The next generation of technological resources tended to emphasise the integration of blind people into the work-place, at the same time having implications for the older student. The Kurzweil Reading Machine converts printed materials - books, magazines, letters and reports - into spoken English. It reads most styles and sizes of type. Using microprocessor advances, the machine is now being adapted for numerous applications (Appendix 6). The Optacon, perhaps the next well-known reading device for the blind, converts a picture of the printed letter into tactile form to be "read" by the user. Although the principle behind the Optacon is an old one (based on braille), it is portable and inexpensive and is used widely in British Columbia where totally blind persons are employed.

A variation of the Kurzweil Reading Machine is the "Text-to-Speech-System", a more sophisticated spoken word output device. The Speech Plus Talking Calculator is of direct application to schools and is used by blind children in the classroom.

A device presently under development by JEM Research in co-operation with the University of Victoria and under a grant from the National Research Council, is the Voice-Activated Learning System which shows promise in a number of areas, from regular language instruction and drill to work with the blind and other handicapped persons. Basically, the system allows the user to elicit responses from a microcomputer using voice alone. The response is also in voice form. The totally blind person would, of course, not use the screen output, but would be able to get immediate response in testing and practising recall skills, such as those required in learning a second-language. At present, the device is being programmed to respond to young children at the elementary level (Appendix 7).

Another technological resource under discussion at JEM, involves programming a microcomputer to instruct children who have very limited vision. Manipulation of the paddles attached to the equipment allows the child to enlarge the print image on the screen to the point where he or she can comfortably read a passage without interrupting sequence or meaning. Alternatively, individual letters, syllables or words can be enlarged, either by the student or pre-programmed by the teacher, to drill specific reading skills. (The same concept is, of course, useful in other subject areas.) The major benefit of the device is that it will allow individual students to proceed on their own, without the presence or direct supervision of the teacher.

An experiment with teaching severely handicapped children to write at the Australian National University (Macleod and Proctor) has also had spin-off benefits for blind students. The children trace letters with a light pen on a computer screen, following a guide outline. Auditory feedback signals deviations from the guidelines. One advantage of this approach is that the learner is able to self-correct his or her writing actions. In a series of pilot trials, three students who had not learned to sign their names as a result of conventional teaching, were able to do so fluently within one to four hours.

HEARING

The education of deaf children is limited by language deprivation and also, one suspects, by the ongoing arguements over the methodology of teaching the deaf - to use or not to use sign-language? to learn to lip-read or not? Fortunately, the application of technological resources to the teaching of the deaf does not involve these clashes of opinion, although it does stress maximum use of any hearing ability which the student possesses.

When deaf children learn to speak, their sentences are short and simple, they have a limited vocabulary and a great deal of trouble understanding syntax, that is, they have no way of internalizing the common language rules which others take for granted. To overcome some of these problems, one experiment utilizing computer-aided instruction for the deaf (Sewell: 1980)* had the following objectives:

1. Linguistic information is presented in meaningful contexts, rather than in isolation.

2. The possibility of error, and consequently the probability of producing the correct response, can be controlled. In addition, learning tasks need to be sufficiently flexible so that they match and challenge the individual child's competence if any progress is to be maximized.

3. There is immediate, accurate feedback and evaluation of response.

4. The child is involved in some degree of productive (rather than mainly receptive) language use, in which language strings (sentences) can be produced and evaluated.

5. Sentence construction, in such situations, needs to be smooth and rapid, rather than slow and labourious, to be effective as ongoing language use.

6. The language material developed needs to be aimed at the deaf, meeting both their motivational and linguistic needs.

* Department of Psychology, University of Hull, U.K.

7. The user should be able to use the material without supervision. This both allows the student to work at his or her own speed and also permits the teacher to maximize available teaching time. Also, in order to encourage the child to work without supervision, the material needs to be of sufficient interest to the child to be motivating.

8. In order to meet the requirement for immediate feedback, either a microcomputer or a machine not involved in heavy-time-sharing should be used. The advent of microprocessors makes the provision of such systems a reasonable proposition.

The system to meet these requirements is being developed in the psychology department at the University of Hull, England. Photographic slides are prepared, showing the children in their everyday activities and sentences are developed to match the activities shown in the slides. A computer program entitled JUMBLE is used to manipulate the sentences (re-arrange words or phrases) and the user reorganizes the jumbled sentences into acceptable grammatical form. The process is displayed on a video-unit linked to a keyboard and the program provides the teacher with a print-out, listing the frequency of error occurrance and documenting progress.

The sentences can be used in a variety of ways and it is easy to develop new material. The student manipulates the words by pressing the key which corresponds to the first letter of the word to be erased or moved. As sentences become more complex, more than one word is likely to begin with the same letter, so the use of a touch screen or light pen is now being considered.

In conjunction with the video unit, a computer-controlled random access slide projector is used, linking the child's photographed experience with the display of words. This not only acts as a motivational device, but is used to convey the meaning of new vocabulary. A variation has been developed in which slides and video display of vocabulary are used to test comprehension. Multiple choice answers are displayed in jumbled form and the child must actively contruct the correct response.

The preliminary report on the evaluation of this project, states in part:

> Without exception the children involved in the project (aged between nine and fourteen years) have reacted favourably. They have experienced no difficulty in understanding the nature of the 'unjumbling' tasks, and have responded to those tasks with enthusiasm. The level of sentence complexity they have mastered is beyond that initially believed possible by their teachers.

Other important effects of the system are, first, that it produces no evidence of boredom (which is often a problem in the education of the deaf), the children work without supervision (releasing the teacher for individualized instruction), they are able to graduate to quite difficult levels of language competance and in one thirty-minute session 'obtain more experience of language manipulation than they would in several hours in the normal classroom situation'.

A computer based speech-training aid for the deaf, which takes various forms involves pitch extraction and simultaneous visual display of vocal output. Basically, the microcomputer is programmed with the 'correct' pronunciation of a number of words (within an acceptable pronunciation range). As the child repeats the word, a diagramatic representation of the pronunciation appears on the screen. The diagram of the satisfactory pronunciation may be shown at the top of the screen, so that the user can continually check pronunciation (visually) in coming closer to the model. This enables continuous practice/ response for the deaf, or partially deaf child.

Lauren Sandals, at the University of Manitoba, Department of Educational Psychology, has been using the computer as an adjunctive teaching resource tool in a residential school for the deaf, from kindergarten through grade twelve. 150 students took part in the initial experiment, based on hierarchies of learning skills in language arts and mathematics. (This enables each student to progress at his or her own pace, without repetition). The study found that severely and profoundly deaf students were able to work independently on the computer terminal and that the system is a practical means of reinforcing the academic skills of deaf students.

Apart from the compensatory benefits of microcomputer-based instruction for the deaf, therefore, the regular instructional benefits are equally important. The interactive nature of computerized learning materials allows the deaf student to make progress beyond that normally possible in a classroom environment.

MOTOR CO-ORDINATION

One of the major drawbacks to applying technological solutions to problems involving poor motor co-ordination, is that a fairly high level of eye-hand co-ordination is required merely to operate an on-off switch, let alone use a keyboard. The adaptive qualities of microprocessor technology, however, have produced a number of actual and possible approaches to alleviating the problems of children with severe motor disabilities.

The Autocom, a device already on the market, is a microprocessor which fits in the lap tray of a wheelchair and allows a child with very little motor control to communciate through a printed message.

The Voice Activated Learning System, mentioned in the last section, requires no tactile contact on the part of the severely motor-disabled child, that is, if the child is able to communicate with sound, he or she can interact with the machine. This enables such students to become independent of their disability in a learning environment even for just a short time each day.

A proposal put forward some time ago involves using the computer on two fronts to promote the education of the motor-disabled child. First, the computer is used to recognize and record the patterns of movement of the child and to use this information to establish a channel of communication between the child and the computer. Second, because the computer is now able to respond to a specific set of movements, the child is able to control the computer and manipulate information for educational purposes. This solution applies to the severely disabled; much as a voice-activated device at present works best for the voice which originally programmed it, a movement-activated device will respond best to the person for whom it is developed. However, in cases where a common medium of activities can be found, one such device can respond to a number of individuals, representing a wide range of handicaps. An example of this, is the activation of a microcomputer by eye-movement, which has been possible for some time, but still requires refinement.

For the child who is less severely disabled, or who can be trained to use specific gross movements a touch-screen may be the answer. The touch-screen is already available on the market, but new enough that little work has been done on it. For British Columbia, JEM Research is presently doing some preliminary evaluations of the screens' potential application to the education of the handicapped.

The screen represents a grid which fits over the standard video-monitor or television screen utilized with a microcomputer. The user responds to the computer by touching a particular part of the grid superimposed on the screen. The touch, in turn, activates the computer, eliciting a response, or moving the program on to the next stage. Incidentally, while the touch-screen obviates the need to use a keyboard, it may well be the preferred method of computer activation for regular classroom use. Children and adults who use microcomputers tend to constantly touch the screen, even when they are skilled keyboard operators. (Teachers and parents who are constantly removing sticky finger marks, will attest to this!)

For the student who partially overcomes a motor-disability, but needs constant practice to improve eye-hand co-ordination, or for very young children who have difficulty with co-ordination skills, much of the available courseware is of great value. One example is a colourful and attractive program in which the user manipulates both paddles - one of which controls the movement of a frog, the other a butterfly. The movements of the frog, which jumps up and down to varying heights, can be made to co-incide with the butterfly which flies across the screen (again, at varying heights). A score is kept of the number of times perfect co-ordination is achieved, resulting in the frog "catching" the butterfly. The game requires a high-level of skill and adults sometimes find it frustrating, but children love it and can develop competance with practice. This is one reason why so-called "computer-games" should never be dismissed out of hand as having no educational value. Many of them, in fact, teach or drill the most fundamentally useful skills to the handicapped student and also to the immature or very young child in the regular classroom.

As with any handicapping condition, the microcomputer is able to extend the experience of the motor-disabled child and help to compensate a little for the drawbacks placed on his or her educational achievement where appropriate. The integration of the child into the regular school program can be assisted, largely because a measure of teacher-independence can be achieved. More importantly, because of new technology the means exist for the child, if only in a very limited fashion, to express ideas and feelings and participate in a broader curriculum.

COMMUNICATION

Special needs technology is simply an alternative method of communication - via keyboard, voice, touch or movement - in a manner which enhances the educational process. Thus, all the projects in this paper have something to do with creating, improving or speeding up the ability of a special needs student to interact with his or her environment, that is, communication. But, while some children are able to substitute more primitive methods of making themselves understood, others are in a position where communication of any kind was (until quite recently) virtually impossible.

Not long ago, readers of Life Magazine (Vol.3#1, Jan.1980) were treated to a portrait of Bill Rush, a journalism student at the University of Nebraska and the victim of a congenital brain disorder (athetoid cerebral palsy) which prevents him from walking, using his hands or speaking. Rush has a head-controlled wheel-chair and can communicate with a headstick consisting of a foot-long piece of copper tubing worn on his forehead with which he can point to letters or words on a board placed across the arms of his wheelchair. Over the telephone and talking with friends in his room, he can use a computerized voice synthesizer, made for him by a computer science student. It is the voice synthesizer which has enabled Bill Rush to approximate a kind of 'normal' communication with others. His multiple handicaps could have branded Bill Rush as retarded; but in fact he is not retarded - he is the only one of his family ever to attend university.

Innovations such as this tend to capture the public imagination, largely because the people who benefit have such enormous and visible difficulties to overcome, that their sudden ability to participate in society (that is, their ability to interact with others), almost turns them into different people, both to themselves and to those around them. But there are others whose communications difficulties are less obvious; the child who is mildly retarded, maladjusted or autistic does not stand out, except in the classroom where inability to communicate because of these conditions prevents a normal educational experience.

Howe (1979) asks the question: 'Why should we bother to use a computer to teach children with communications difficulties?' The answer is that there is a small but growing body of evidence which suggests that computer-based schemes may succeed where conventional teaching methods have failed. Howe attributes the success of early experiments with computer based communications skills to three factors:

1. Children find the computer familiar and exciting, untiring and predictable; in fact it has all those qualities which many people lack, but are of proven value in teaching children who experience learning difficulties.

2. In order to work with a computer, teachers must produce a precise definition of a task and an effective procedure for executing it. Neither the computer, nor the special needs child has the ability to interpret a teacher's wishes or intentions, unless they are made absolutely clear. This in itself is a useful exercise for the teacher.

3. The teacher can take advantage of the computer's capacity to handle complex teaching procedures with which he or she could not cope under ordinary group or class teaching conditions; for example, those tasks requiring continuous feedback of information to individual children in response to their actions.

In Australia, severely handicapped children learn to write by tracing lines with a light-pen on a computer screen. Incorrect lines (or sequences of movement) are ignored, but correct ones show up on the screen, reinforcing the child's visual learning of shape and form.

At Edinburgh University, handicapped children are taught word-attack skills through a computerized phonics program using a pressure sensitive screen. Results show that the skills are transferred to the classroom (where the computer is not available).

Computer programming itself is a valuable communication tool because it explains every step of how information is made to appear on the screen. This takes the child through a step by step process of, for example, presenting and computing a mathematical problem. It teaches the child to break down the problem into manageable parts; as a means to simplifying, analysing and reconstructing it into meaningful form.

Work with autistic children, using the "turtle" developed by Pappert at M.I.T. in which depression of a button causes the turtle to carry out certain activities on the screen, has resulted in cases of spontaneous speech from otherwise non-communicative children.

Howe also reports the case of an eleven year old dyslexic boy who made no progress in remedial classes, but given the opportunity to learn computer programming was able to understand the logic of the computer language well enough to teach others.

An important effect of this kind of result is the growth in confidence and self-esteem generated by the success achieved in interacting with a computer. To paraphrase one writer in the area; people used to object that computers would depersonalize education - there is nothing more de-personalizing than not being able to communicate.

Perhaps the most well-known symbolic device to aid in the communication of the severely handicapped, is that developed by Bliss. The 256 Bliss Symbols represent a variety of subjective and objective life experiences, which a non-verbal, severely handicapped child may wish to communicate. Up to five hundred and twelve symbols can be operated by a child who becomes competent in the system, by dividing each of the "messages" into two parts. One advantage of the system is its flexibility. A severely disabled child only has to activate a large -push button which causes a scanner to move along each line of symbols. Release of the button at the desired message, causes it to be recorded so that a series of "messages" can be built up into a "conversation". For the less disabled, a joystick can be used to move the scanner in any direction. By coupling a computer and a speech synthesizer to the display matrix, a speech generating system is formed to supplement the visual display. This is important in emphasizing the relationship between the symbol, the concept it represents and the spoken word for the concept. By specifying a sequence of concepts and recording them in the computer, the child is able to put the whole sequence together and formulate whole "thoughts" using language. The Bliss symbolic display presently being evaluated with special needs children by the National Research Council at the Ottawa Crippled Childrens' Treatment Centre, is designed as a stand-alone portable unit and is self-contained in a small case.

It is the severely handicapped, non-verbal child who presents the greatest problem to the world of education. Without means of communication, it is often impossible to assess the level of learning capability of the child; even assuming that the means to implement that learning are available. Technology can tackle this problem in two parts - first by providing a stimulus and secondly by providing the means for reaction - making both assessment and communication possible. As Appendix 8 reveals, it costs only $50.00 to convert an Apple microcomputer into a communications device for the severely disabled.

A variety of scanning devices is available for non-verbal children in British Columbia. They range from scanning for letters and phrases, to linking of concepts, as in the Bliss system. For adults, scanners are often linked to a typewriter which can be operated with a foot-pedal or by a joystick. In fact, a whole range of technological aids which can help handicapped adults and children either control their environment or communicate is on display at the Kinsman Rehabilitation Centre in Vancouver (see Appendix 9).

Computer controlled rehabilitation for aphasics (those who have a defect in, or loss of the power of expression by speech or writing) is underway in France and Belgium.* Students type dictated words which are displayed on a screen if correct. Letters not typed in correct sequence are not displayed, thus avoiding visual reinforcement of wrong selections. Results of this training show a positive carry-over into writing in that frequency of mis-spelled words and erroneous sequencing of letters, is considerably reduced.

A unique method of communication developed in Oregon is not primarily for interactions among students but for enhancement of information <u>about</u> students in a residential treatment program. The children involved were classified as "disturbed"; consequently, a fair number of social workers, therapists, educators and so on are involved in their treatment. By computerizing type and frequency of the anti-social behaviour observed by all of these specialists, a much clearer profile of an individual's progress and problems is possible.

* Reported in the Journal of Speech and Hearing Disorders. 45(1) Feb. 1980.

Apart from specific disorders which inhibit communications, increasing amounts of money are being allocated in British Columbia to the teaching of English as a second language, for both immigrants and refugees. The total for these categories in 1980 (both Special Education program estimates and direct grants) was over nine million dollars. In the educational context, therefore, ignorance of the primary language of communication is a severe learning handicap which absorbs a significant portion of the educational budget. An inhibiting factor in the progress of E.S.L. students is that they are faced with learning three languages.

(i) so-called "peer-group" English, with which they interact on a day-to-day basis and pick up quite quickly;

(ii) more formal spoken English, which they need in order to communicate effectively with teachers and prospective employers;

(iii) "academic" English - the language required in written form, in order to pass exams and gain formal admission to post-secondary education, fill-out employment applications or write resumes.

The key to successful E.S.L. programs is constant reinforcement, geared to the individual - an expensive commodity in a traditional teaching atmosphere. The development of microcomputer based courseware will allow an individual approach, enabling a large number of students to undertake unlimited drill and practice and allowing teachers the flexibility to concentrate on special problems. One possible technological resource for meeting the needs of both adult and child immigrants is described in Appendix 10.

THE VIEW FROM THE BOTTOM

From the bottom of the ladder, the view is fuzzy and indistinct if you are legally blind; silent and forbidding if you happen to be deaf; threatening - even terrifying - if you never learned to communicate. You cannot hope to grasp the rungs of the ladder if motor co-ordination is your problem, neither can you describe what you see if your mental powers have not provided you with the ability. On the other hand, if you are gifted, the view is one of frustration, because it releases so many new ideas without the means to express them.

If we have the means to assist these children to work their way up the educational ladder, some would say that we have a moral obligation to do so, and do it immediately. But, of course, it is not quite that simple. Obligation to these children who more closely approximate the so called 'norm' must be met; their numbers require the bulk of educational resources. A large amount of special needs research must take place before the programmers do their programming and the vendors install the machines and universities must train (or retrain) teachers in effective methods of using technology.

However, we can make a start in a small way; taking one group at a time, studying their needs and working with teachers to provide the necessary training and courseware. We can also take advantage of the work done elsewhere to provide almost "instant applications" in similar situations.

Canadian research in the area of special needs technology is receiving international attention. British Columbia, with its head start in the instructional use of microcomputers, is in a unique position to capitalize on its early entry into the field. If the momentum continues, we could - in the education of special children - become Canada's prototype province. However, if new technology provides part of the solution to the problems of special education, it also requires a new approach; the past no-longer provides a complete guide to the future.

Meanwhile, for those whose education is difficult, slow and sometimes seems futile, there is some light at the top of the ladder.

APPENDIX 1

SPECIAL TECHNOLOGY FOR SPECIAL CHILDREN

SEEING THE COMPUTER AS 'EYEGLASSES'

Brian Durell

Special Technology for Special Children by E. P. Goldenberg. University Park Press, 233 East Redwood St., Baltimore, Maryland 21202. $12.95(US).

Reviewed by A. B. Durell.

A lot of junk mail comes across my desk in a month. A fair percentage of that junk is contributed by publishers sending out unsolicited books and announcements of books in which I have little or no interest. I seldom pay much attention to the 'little' publishers who won't send examination copies but something in a mailing from University Park Press caught my eye. I broke a long-standing rule and sent off a money order for a copy of "Special Technology for Special Children". I do not regret that decision.

The book is not a microcomputing book, but I think that it has much to say to those of us who are interested in the effective use of micros in schools. For one thing, there is a great need to look beyond the realm of the gifted student and use the power of microcomputing in the service of the less able, as well. As the title suggests, this book is specifically addressed to special education situations. That does NOT mean that it will be of interest only to teachers of special education classes.

Goldenberg's theme is "computer as prosthesis" but the theme was better expressed for me when he spoke of "the computer as eyeglasses". That wording of the theme got home to me, as I am virtually blind without my spectacles.

The book is divided into four sections:

1. Special Education

This section gives background both on the general nature of special education and on typical uses of computers in educational settings. An eloquent plea is made not so much for correcting deficiencies as for enriching human experience. Computers are seen not as tools for teachers but as vehicles for children to make contact with their world.

2. Special Children

Three chapters look at the nature of cerebral palsy, deafness, and autism. There is an effective interweaving of theory and the experience of individual children. The theory is presented in a provocative manner which draws the reader into feeling that there has to be a better way of providing for those with motor, cognitive and perceptual handicaps.

3. Special Technology

Much of the work described involves use of the LOGO language which is well-suited to placing the control of a computer into the hands of a child. Some of the ways in which that control is given to handicapped children makes fascinating reading. CARIS Project work is also described. CARIS has a specific curriculum aimed at teaching reading. Approaches from both orientations can suggest creative ways of using microcomputers and should be likely to spur others on to finding more ways of opening up new worlds of experience to the handicapped.

4. Research Needs

In good academic fashion, the final section of the book looks to the future. Certainly there is a great deal of room for work beyond that described in the book. In Goldenberg's work, no child had more than 12 hours of computer use. However, the brief experiences described suggest that creative use of computers will do much to improve the lot of the handicapped and help them to experience much fuller lives.

If you are looking for something beyond arithmetic drill and practice or cute simulation games, this book may provide the spark to ignite your creative microcomputing fire.

(Brian Durell is Associate Professor of Educational Psychology at the Faculty of Education, University of Toronto.)

APPENDIX 2

LEARNING DISABILITIES PROJECT

LEARNING DISABILITIES COMPUTER DEMONSTRATION CENTER PROJECT

SOURCE: BUREAU OF EDUCATION FOR THE HANDICAPPED - HEW

AMOUNT OF FUNDS: $120,000 / yr. (3 YEARS)

OBJECTIVE:

To test the appropriateness of tutorial computer aided instruction with learning disabled students

ACTIVITIES:

- DEVELOP APPROPRIATE LANGUAGE ARTS COURSEWARE
- TEST COURSEWARE WITH STUDENTS IN BURNSVILLE
- EVALUATE PROJECT

(SOURCE: MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM)

APPENDIX 3

SPECIAL VIDEODISC APPLICATIONS

VIDEODISC NEWS August 1980 VOL. 1 #8 p.3.

Psychology Panel

QUESTION PRESENTED: How could interactive programming be used as:

A) A diagnostic tool?
B) A tool for socialization of sociopathic personalities?
C) A tool for counselling in general?
D) A tool for dealing with the problems of aging?
E) A training tool for dyslexics?

Ideas for using the videodisc as a diagnostic tool include using ink blots, still frames, and moving images as projective devices. Early viewer responses could trigger a branching operation which would tailor subsequent programming to specific personality types. The development of standardized projective material which could be administered uniformly by the apparatus, thereby eliminating the effect of a live interviewer's possible bias or subjective style was suggested. Another suggestion was that a videodisc used as a counselling tool might have factual material tailored for each user's par ·u· r problem in negotiating with the environment.

Discs could provide the client with images of the consequences of behavioral choices. Presumably, these behavioral choices could be performed vicariously as part of the interactive program, and the consequences could be branched, moving to sequences which would flow from the particular choice.

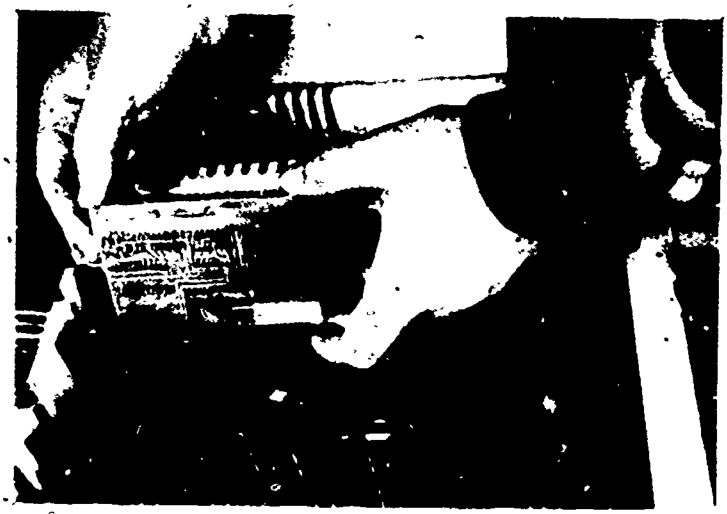
The videodisc is particulary suited for community mental health work, especially where the total privacy of the exchange might allow the user to deal with otherwise embarrassing problems such as domestic violence, sexual dysfunction, etc.

In answering the specific needs of the aged, the disc might provide standardized programming on coping with loss of a spouse, healthcare, social security regulations. One might add that an interactive, videodisc, general reference library would be a help to those who are immobilized, once this technology becomes affordable by private users.

For teaching dyslexics, the possibility for combining reading and non-reading matter might increase learning motivation. The interactivity and large storage capacity would allow a student to, for example, choose among many spellings, call up words that rhyme or look similar, and view a full range of different remedial reading approaches geared to his/her individual rate of learning and specific difficulty.

APPENDIX 4

INTELLIGENT VIDEO TAPE INSTRUCTION



jem's new interface card

JEM Research has recently developed an interface card that will allow an Apple Computer to interface to Sony Betamax video cassette recorders, model SLO-320 and SLO-323. The interface card (see photographs) enables a low cost video lecture to be supplemented by computer aided instructional material.

The Sony recorders have the capability of selectively searching for and playing specific segments of a video tape with the use of the RM-300 or RX353 auto search controllers. By replacing the controllers by an Apple with the JEM interface card, a lesson can be programmed to selectively search for, and play, segments of the video lecture at appropriate places in the lesson.

If a student wishes to review a lesson, for example, the computer can control the presentation of the material and also ask questions at the end. If the student answers incorrectly, the computer can rewind to, and play, the segment of the program pertaining to that question. This capability gives the student increased confidence that he or she is really learning the material.

JEM Research is prepared to collaborate in the development of suitable programs or to supply the interface cards to people who wish to develop their own lessons.

jem's

Apple to video-tape interface card

Last month we announced the development of an interface card for the Sony Betamax recorder-players. A similar interface has now been developed, produced and tested at JEM Research to interface the Apple to the Panasonic NV8200 Video Cassette Recorder and the NV8170 Player. These Panasonic machines are equipped for auto-search access and the new JEM interface will enable the development of educational programs using video-tape tutorials and diskette programmed exercises and reviews. We have been asked to interface some foreign language video tapes to appropriate lessons. It is expected that the results of this work and the availability of the programs with video-tapes can be described in the next issue of "micro-scope". Meanwhile we will be pleased to demonstrate the Apple video-tape interface and to supply the interface plug-in circuit boards to teachers and other interested users.

APPENDIX 5

MASTERY TEST MANAGEMENT SYSTEM

Scoring and Management System for the Woodcock Reading Mastery Tests and the Apple II Computer

by Steven J. Schultz

This system is designed to handle all the figuring, plotting, table accessing and record keeping associated with this widely used diagnostic reading test. This fully integrated system of eleven programs and related files is linked by a menu. The user simply chooses an operation from the list by number to achieve these functions:

1. Computes and displays subject's grade placement, grade scores, percentile rank and relative mastery.

2. Graphs the subject's grade placement against the five subtests and total reading scores in a high-resolution format.

3. Stores and retrieves one-hundred student records for pretest and posttest scores.

4. Deletes a student's record by name for the pretest and posttest files. All file entries can also be cleared.

5. Averages subtest and total reading scores for all students in the pretest and posttest files.

6. Displays the names of all the students filed along with their pretest and posttest total reading scores.

7. If a printer is available, a hard copy can be produced by functions 1, 5, and 6.

This scoring and management system is one of the most sophisticated educational programs presently available for microcomputers. The size of the programs and files is an indication. When one-hundred student records are filed, this software consumes about one-hundred bytes of memory (100k). This software package requires an Apple II computer with 32k memory, single disk drive and Applesoft BASIC. If the disk version of Applesoft is used, 48k memory is needed.

APPENDIX 6

KURZWEIL READING MACHINE

KURZWEIL READING MACHINE UPDATE

Number One Winter 1980

Paperwork Made Easier for Blind Employees, Students: New refinements in the KRM 3 program now make reading and comprehension of typical typewritten documents such as letters, memos, photocopies, bibliographies, and exam papers much easier for visually handicapped employees and students.

First, the KRM user can press a "type" key, which alerts the machine that the text to be read is typewritten rather than printed. A special program goes into effect which permits the KRM to read typewritten material as accurately as printed material, despite the many problems often associated with optical recognition of typescript — uneven line of type, broken letters, faded imprint, and degraded photocopies.

There is also a command which enables the KRM to read the entire page from edge to edge, no matter how much of the page is blank. This acts as an automatic search, locating dates, addresses, page numbers, multiple choice answers, and any other text that may be separated from the body of the copy.

These and other improvements to the Kurzweil computer program (see below) are contained on an easy-to-use, plug-in cassette. The cassette is provided free of charge to all KRM 3 owners as part of Kurzweil's policy of regularly updating existing KRM 3 systems.

KRM Gives Voice to Computers: A new Speech Output System (SOS) converts the KRM 3 to a talking computer terminal at the touch of a button. With SOS, blind employees and students can now have the same access as their sighted colleagues to computer information normally displayed on video terminals or printed out on paper.

This computer voice output capability should open up new vocational possibilities in such places as data processing departments, financial institutions, reservations offices, and customer service departments, in which the ability to read such computer information is a must. It will also greatly facilitate research efforts of blind students, scientists, lawyers, and other professionals who need access to computer information.

The KRM user normally hears voice output from the KRM's computer, which translates print into spoken words. The SOS system, instead of reading print, stores the output from the external computer in the KRM memory and produces the spoken word from there. Since the output is stored in the KRM electronic memory (which, in the SOS mode, stores a full page of text), the KRM can use the whole range of controls, including 'spell' words, 'locate' and 'repeat' lines, and voice modulation, to ensure full comprehension.

KURZWEIL
COMPUTER
PRODUCTS

Kurzweil Computer Products, Inc. 33 Cambridge Parkway Cambridge, Massachusetts 02142 · (617) 864-4700

THE KURZWEIL READING MACHINE

The Breakthrough in Providing Library Services for the Blind

The Kurzweil Reading Machine as a Communications Vehicle in Library Settings

The Kurzweil Reading Machine has been called the most valuable rehabilitation aid since the invention of Braille. The KRM III is a compact device (26" x 26" x 18") consisting of an optical scanner, mini-computer and keyboard with speaker. The KRM III rapidly reads ordinary print aloud in easily comprehended synthetic speech, at rates up to 250 words per minute - about twice the rate of human speech. The omni-font characteristic of the scanner enables the machine to read materials such as correspondence, magazines, journals and books as they exist in the real world, with all the vagaries of type fonts and ink and paper combinations.

Using the control panel, the user can employ a variety of reading options, such as scanning at high speed and slowing the rate when desired to concentrate on material of special interest, as well as instructing the machine to spell words, repeat words or lines, and to enunciate punctuation and capitalization. The flexibility of the KRM III is opening libraries' vast collections to the blind segment of our population for the first time in history. Furthermore, the machine allows the blind members of our population equal and immediate access to printed material and the privilege of reading when they wish to and in privacy, enabling them to remain as well informed as their sighted peers.

Population Served by the Kurzweil Reading Machine

There are approximately 3,000,000 blind and physically handicapped people residing in the United States who currently qualify for library services according to the standards set by the Library of Congress. A broader definition of the terms "visually and print-impaired" to include people suffering from neuromuscular or neurological disorders, and dyslexia, substantially increases the number of potential users of reading machines. It is estimated that up to 15% of our population is handicapped to the extent that significant benefit would be achieved by making these machines accessible and available in libraries. The installation of reading machines reflects a growing movement to make library facilities fully available to handicapped persons in general, and to blind individuals in particular.

User Purposes and Applications for the Kurzweil Reading Machine

Reading Machine use tends to fall into four distinct categories: pursuit of educational goals, professional and job-related reading requirements, vocational training and rehabilitation, and recreational and personal reading. There are examples of each type of use at existing library sites.

--In California, two library interns recently taught themselves to use the KRM by reading the instruction manual with the machine, obtaining a great deal of personal satisfaction through an enjoyable learning experience.

--In Albany, a scientist and inventor who has been blind since infancy, is using the machine to help him complete his doctoral studies in biophysics at Rensselaer Polytechnic Institute. Also a clinical hypnotherapist, he reads books on biofeedback and hypnosis techniques with the KRM.

--In New York City, a retired labor economist whose special interest is Judaica, enjoys his avocation by reading English transliterations from Yiddish and Hebrew with the machine.

--In Colorado, a young woman used the machine to do her reserve reading when working towards her master's degree in music. She also was able to prepare her book report independently by using the machine, and reports that it was an excellent aid in the study of phonetics and speech pathology.

--Another Colorado user is reading computer manuals with the KRM. He edits and re-reads them, and simultaneously records the volumes for future reference.

--In Virginia Beach, two blind library assistants are now able to work directly with printed material for the first time. These women's job dimensions have expanded dramatically; one woman has the KRM read to her while she proofreads Braille transcriptions.

--A student with cerebral palsy is able to read his college textbooks without the aid of a reader by using the KRM.

--In Weymouth, dyslexic students are improving their independent reading skills using the KRM as a tutorial aid. As the machine reads aloud, the student follows along and reinforces his comprehension of the printed material. The students' ability to control the reading process and participate actively in the experience seems to increase their motivation level.

Scheduling KRM Use in Library Settings

Library programs generally consist of scheduling users for two-hour blocks of time. Set weekly periods may be booked for students and regular users who have other schedules they must adhere to. Some blind members of the community prefer to arrange their time on a more flexible basis. Recruiting users has been done through agencies and organizations for the blind and by radio and through other publicity media.

Impact of Computers in Producing More Services at a Lower Per Capita Cost

The Kurzweil Reading Machine has some practical advantages over alternative means of making printed materials available to the visually impaired. Braille and Talking Books are expensive to produce (Leon Uris' Exodus costs $93.20 in Braille; The Godfather costs approximately $175.00 to produce in Talking Book form), and also present storage problems. Exodus consists of eight volumes and would require about three feet of shelf space. Furthermore, the time lapse involved in transcribing material into these forms is a factor that must not be overlooked. The wait for The Godfather to be recorded and made available for circulation was two years. Finally, it can cost as much as $200.00 a week for a blind professional to be assisted by a sighted reader in keeping up with mail and journals, and the reader may be less convenient and less reliable than the Kurzweil Reading Machine.

As the Machine's character recognition capabilities are enhanced and expanded (for example, identification and automatic spelling of acronyms), the improved software cassettes are made available by Kurzweil. Programs such as those for reading foreign language material will be made available in the future. These and other improvements will be made in the software; thus the machine will not become obsolete.

Methods by Which the Kurzweil Reading Machine may be Obtained by Libraries

The Kurzweil Reading Machine has already been acquired by over 50 libraries. Funding possibilities for the Kurzweil Reading Machine include Federal monies available through the Office of Education and the Library Services and Construction Act. Innovative programs addressing the issue of handicapped services with sound problem-solving methods are given priority. There are also funds available through private foundations.

New York State recently created a law (Chapter 660, Laws of 1979) which will place a Reading Machine in each of the 22 public library systems within the state. The funds for this measure were allocated by the Higher Education Commission. Other resources include agencies and organizations for the blind, which can also provide statistics and other pertinent information, and Lions Clubs and other civic organizations with a special interest in the blind.

We provide our customers with full training and support services, and would be happy to assist you in planning as you consider the possibility of a Kurzweil Reading Machine for your library. For further information, please contact Bernice Broyde, Marketing Manager, at (617) 864-4700.

February 15, 1980

APPENDIX 7

VOICE ACTIVATION AND SPEECH RECOGNITION

Voice Activation and Speech Recognition

JEM Research and the University of Victoria Linguistics Department are collaborating in two areas of research relating to the use of computers in the study of speech recognition. The work is being largely funded by contracts from the National Research Council and the Royal Canadian Mounted Police.

The work for the National Research Council relates to the use of microcomputers in public schools for computer assisted instruction. Under the contract, utterances by children's voices have been analysed and synthetic voices developed which will enable any child in a representative group to activate the computer with a given set of commands. The work for the R.C.M.P. is concerned with speaker identification, verification and authentication for security purposes.

The use of the microcomputer to assist children in language arts and speech training is a powerful method to achieve results with patience and discoverable rewards. The microcomputer can be programmed to present simple graphical displays of the spectral energy of an utterance. By changing the inflection of the voice a pupil could attempt to match the pattern of an acceptable accentation. Such a method could be used to help students with speech or hearing difficulties to improve their accents with languages or to improve their accent in speaking their native language.

The work being undertaken at JEM Research in voice recognition by microcomputers is being directed along these lines and specific orientation to meet current needs would be a valuable spur to this work.

APPENDIX 8

AVAILABLE DEVICES FOR THE NON-VERBAL, SEVERELY DISABLED

Microcommunicator

The Microcommunicator can transform your Apple II or Apple II Plus into a communications device for the severely physically disabled who cannot speak, write or type. A single keystroke by finger or mouthstick will display any sentence chosen from 60 or more programmed sentences, which can be changed by the user at any time. Messages of up to 100 words and phrases can be constructed for display or printout (optional) by double keystroke selections of a built-in vocabulary that exceeds 1600 sentence-building words, phrases and suffixes. The system, which requires a single-disk drive and monitor, is available with adult or children's vocabulary. Price is about $40.

Grover & Associates, Creekside Center, Suite D 116, 7 Mount Lassen Drive, San Rafael, CA 94903. Reader Service number 495.

Paralytics 'talk' with computer

CHAPEL HILL, N.C. (AP)—A doctor has developed an experimental computer program that will allow a paralyzed, speechless invalid to use any type of remaining motor ability, such as blinking an eye, to "talk" by using a video terminal.

"The possibilities are really staggering," said Dr.Joseph Conn, a resident at North Carolina Memorial Hospital's Family Practice Center.

He said his system, which is being readied for use in clinical studies, "can take the lowest level of motor ability that a person has and turn that into words and symbols and control over his environment. It could dramatically alter the lives of tens of thousands of people right now."

Conn said his system uses existing home computers that sell for about $400. Controls on the computers, he said, can be modified to allow access that will fit an individual's particular disability.

Some invalids control the computer by blinking an eye. Others can do it by biting a control. But, Conn said, programs can be developed to do "just about anything the imagination flows to. It can change the capabilities (of invalids) in the blink of an eye."

Individuals using the system can write out messages on the computer's video terminal and, with other household items hooked in, can turn on the television set, change the channel, turn on the lights, summon help in emergencies and adjust the thermostat.

THE ARGUS [illegible]

APPENDIX 9

HOW TECHNICAL AIDS CAME TO THE FOUNDATION

(Reproduced by Permission of the
Kinsmen Rehabilitation Foundation)

The beginning of the Technical Aids Program lacks high drama, but the effects of this program on the lives of many severely handicapped people can be described as dramatic and even revolutionary.

The evolution of this program owes much to Kinsmen Rehabilitation Foundation Executive Director Ed Sherwood. After extensive rehabilitation work in England and Africa, Sherwood came to Canada in 1959 to work with the Saskatchewan Council for Crippled Children and Adults.

There he first became aware of the work of Reginald Maling, who was then developing highly sophisticated electronic controls for severely disabled individuals in England.

Put simply, this type of equipment utilized contemporary technology to permit persons with severely decreased mobility, such as paralysis resultant from crippling disease, spinal injury, or brain damage, to do simple things for themselves.

Now they could operate television or radio, use the telephone, put on the electric light (giving them some personal control over their environment) or communicate through a keyboard system.

They could do this by using what physical function remained to them, however minimal it might be, to operate a switch or operate a keyboard which in turn activated a programmed electronic circuitry.

Also in production by another British organization was the PILOT (Patient Initiated Light Operated Telecontrol) system, a design that utilized the head movement of a severely handicapped person to direct a beam of light onto a photoelectric panel.

On joining the Kinsmen Rehabilitation Foundation as Patient Care Supervisor in 1971, Sherwood's early contact with KRF patients who were severely disabled from polio and other causes brought the realization that for them, rehabilitaion was still confined to providing basic medical and personal needs.

HOW TECHNICAL AIDS CAME TO THE FOUNDATION. "IMAGE" - B.C. NEWS.

(Reproduced by kind permission of the Kinsman Rehabilitation Centre.)

The beginning of the Technical Aids Program lacks high drama, but the effects of this progam on the lives of many severely handicapped people can be described as dramatic and even revolutionary.

The evolution of this program owes much to Kinsmen Rehabilitation Foundation Executive Director Ed Sherwood. After extensive rehabilitation work in England and Africa, Sherwood came to Canada in 1959 to work with the Saskatchewan Council for Crippled Children and Adults.

There he first became aware of the work of Reginald Maling, who was then developing highly sophisitcated electronic controls for severely disabled individuals in England.

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Recalling what he had learned of new possibilities from the dramatic advances in electronic technology now available in Britain, he also realized that at the Foundation he was in an environment favorable to doing something about it.

His conviction became a dynamic part of what was to be virtually a renaissance period in rehabilitation. Around the same time on the national scene, Walter Dinsdale, whose son was disabled and who had already begun his championship of the physically handicapped, was also taking an active interest in these developments in Britain, particularly in the work of Maling.

Sherwood persuaded the manufacturers of the PILOT equipment to come to Canada, the KRF making the necessary arrangements.

In Vancouver, a demonstration of PILOT at the G.F. Strong Rehabilitation Centre was witnessed by Foundation President, Fred King, and members of his Board.

King was a man imbued with the same blend of practicality and vision as first President Bruce Grey (Governor of Kinsmen District Five, King had been influential in having the Foundation adopted as a District project in 1968) and with the agreement of his Board, the decision was made. The Foundation would embark on a technical aids program.

In the meantime, Dinsdale had been in touch with Maling, the inventor of the POSSUM. Under the aegis of the Candian Rehabilitation Council for the Disabled, of whose technical aids Committee he was a member, and with the assistance of the Federal government, he arranged for a team to come to Canada, demonstrating Maling's system.

In Hamilton, Ontario, the team was reinforced by Margret Perry, then at the Chedoke McMaster Rehabilitation Centre, but who in Britain had been associated with Reginald Maling's organization.

When the team came to British Columbia in autumn, Perry was with it. There the KRF hosted the POSSUM group and organized demonstrations of their equipment, and there, incidentally, Perry made her first acquaintance with the Foundation of which she was to become Director of Programs two years later, in 1973.

When in July 1972 the new program the first of its kind in Canada, was instituted at the KRF, POSSUM was chosen for the first venture into this new field of technical aids. The PILOT System, in any case, subsequently went out of production.

During 1972-73, five controls (two environmental, two typewriter controls, and one expanded keyboard arrived at KRF. The Foundation proclaimed its commitment to technical aids by demonstrating these aids at the annual meeting of the Canadian Paraplegic Association, at the Workers' Compensation Board's "International Symposium on the Rehabilitation of the Industrially Disabled", and at the District Five Kinvention in Kelowna in May 1973.

Since the initial placement of electronic controls was to be on an extremely limited basis, it was obvious that an intensive study of possible recipients had to be made.

This study was undertaken by a Patient Selection Committee initiated by the KRF on which a number of agencies were represented.

Dr. Buckler of the Vancouver General Hospital, Dr. Pinkerton of the G.F. Strong Rehabilitation Centre, Wendy De Trey of the Domiciliary Occupational Therapy Service (D.O.T.S), and others helped the Foundation in its selection process.

During 1973 the Committee developed criteria for the evaluation and placement of POSSUM and other available electronic controls.

The first priority was to find a severely disabled person who had been living at home for some time. Such a patient would provide an opportunity to evaluate changes brought about by the the installation of electronic controls.

Need, motivation, and home environment had to be carefully assessed before supplying such aids, since this type of equipment would alter the lifestyle of not only the patient, but his or her family.

The first paitent chosen for installation of A POSSUM was the late Mrs. Jo Kelly, who had at that time been confined to bed for eight years, a victim of muscular atrophy, a form of paralysis that had left her with just the ability to move her head.

Alone for up to eight hours a day while her husband was at work, she had virtually no access to help except from friends or the apartment manager on their occasional visits.

At this stage, the resources of the B.C. Chapter of the Telephone Pioneers of America were called upon. Composed of members with long service with the telephone company, the Pioneers applied their expertise in electronics to installation, modification, and maintenance of equipment for the KRF's new program.

Along with the re-structuring of the Foundation at this time, the addition of a director capable of dealing wtih and developing the technical aids program became an evident need. Margret Perry joined the KRF in 1973 where her first task was to start the service delivery aspect of the new Technical Aids Program.

Over the next two years, the program developed under Margret Perry's direction and with the valuable assistance of the B.C. Chapter of the Telephone Pioneers of America.

In August 1974 the Foundation had organizaed and hosted a highly successful international Workshop-Seminar on Electronic Controls.

Delegates to the seminar came from the United States, England, Switzerland, Germany and other countries, allowing for communication across national boundaries about the latest developments in electronic controls.

Among the delegates was Steve Egerton of Maling Rehabilitation Systems, who in 1976 joined the Foundation as Technical Aids Supervisor.

Much of his expertise and ingenuity was to be concentrated on devising special individually-designed switches to enable the severely disabled patient to use whatever physical movement remained — it could be only head movement, the restricted use of a limb or fingers — to activate the electronic circuitry.

During 1974 as well, the first TOSC (Touch Operated Selector Control) units arrived at KRF. Designed by a Toronto man, Bud Cairns, himself a quadriplegic, it was produced with the assistance of federal government funding and the co-operation of Bell Telephone.

The system operates generally on the same principles as POSSUM and performs similar functions,, but for practical and economic reasons this Canadian-designed and manufactured equipment is now the workhorse of the Foundation's Technical Aids program.

National recognition of its pioneering work in the establishment of sophisticated electronic aids into Canada, came to the Foundation in 1975 in the form of the Readers' digest "Canadian Rehabilitation Award", virtually the "Oscar" of rehabilitation and given for the most outstanding contribution in the field. But this was an accolade to an impressive debut rather than a verdict on final performance.

Mrs. Jo Kelly made rehabilitation history in 1973 when she received the very first electronic technical aid of its type to be in operation with a severely disabled person in Canada.

Since then the Foundation's Technical Aids Program has, certainly in relation to progress in the rest of the country, surged ahead. By 1977 over fifty units were placed with physically handicapped persons in B.C., giving them a degree of independence which, only a short time ago, would have been unimaginable.

By the end of February, 1980, the number of technical aid placements had reached 203.

APPENDIX 10

THE PERSONALIZED LANGUAGE LEARNING CENTRE

A PERSONALIZED APPROACH TO SECOND LANGUAGE LEARNING

1.2 NARRATIVE

1.2.1. BACKGROUND

Second language learning falls into four major categories.

i) Cultural Renewal

Members of specific ethnic cultures often feel that their distinctive history is being eroded by the levelling processes imposed by modern life. Teaching, learning and passing on the language through which the culture is best transmitted to future generations, has become an acceptable pattern in the re-awakening of ethnic identity. Examples include native Indian dialects, Hebrew, Cantonese and Mandarin.

ii) National Identify

The teaching of French in Canada is of special significance, in that for many Canadians learning French is a matter of national, rather than cultural concern. Because fluency in both official languages is felt to open the way to more job opportunities as well as being of particular value in specific careers, both the opportunity and the desire to learn French has increased in English-speaking areas of the country.

iii) Academic Requirements

Academic requirements constitute the 'traditional' reason why individuals learn a second language. While the importance of language requirements has tended to decrease, knowledge of a language other than one's own is still felt to be an important supporting factor for entry into higher education or particular professional school programs.

iv) Life Skills

> The major reason for learning a second language in Canada, particularly British Columbia, is for participation in everyday life. The language in question is English, which is necessary for the immigrant or the refugee to learn, in order to participate in the society which they have adopted, or which has adopted them.

This new approach to second language learning is directed primarily at the fourth category - Life Skills. For the new Canadian, learning English is a survival skill. His/her choice of employment, social life and community contribution is severely limited by the inability to communicate in the language of the majority.

The people of the province also have a practical interest in enhancing the ability of new Canadians to learn English quickly and easily, simply because of cost. Learning a language requires an individual, personalized approach, including a great deal of dialogue between teacher and learner, immediate feedback and constant reinforcement - in other words, a costly and time-consuming process. The cost of E.S.L. training in British Columbia for 1980 (for immigrants and refugees) was close to ten million dollars, and is expected to rise dramatically; a significant portion of the total education budget.

Meanwhile, as the immigrant population increases, the number of source countries continues to grow. Not only do speakers of different languages have different kinds of problems in learning English, but the range of cultural sophistication is considerable, rendering traditional approaches inappropriate.

For example, two hypothetical cases may be considered. First, the immigrant from a modern, urban, western or eastern European environment brings with him or her a number of prerequisites by which reasonable success in learning English can be anticipated:

i) interest in, and knowledge of, western culture;
ii) at least a basic education;
iii) facility with writing, reading and reasoning;
iv) basic job skills;
v) a first language which probably includes some "westernized" terminology;
vi) probably an introduction to an established ethnic community in Canada which will assist assimilation.

Second, the immigrant or refugee from a third-world or south-eastern location is likely to arrive with a very different skill set:

i) little knowledge of Canadian life and culture;
ii) possibily no formal education;
iii) probably no experience with written symbols in the form of formal writing skills;
iv) unable to read his/her own language and therefore deprived of self-help activities involving translation;
v) no job skills which are useful in Canada;
vi) probably very little in the way of ethnic support.

The 'culture shock' of being faced with learning <u>via</u> teaching as opposed to learning <u>via</u> assimilation, is itself a barrier to successful E.S.L. training.

In most cases, sponsoring individuals or agencies assist with the social, cultural and employment assimilation of the new comer. Hence, we hold certain expectations of the new Canadian - that he or she will become employed, socially competent and financially independent as soon as possible. These expectations are realistic in terms of the federal and provincial costs of assimilation programs; but they are <u>unrealistic</u>, if the learning of English - the most important assimilation factor of all - must rely on traditional approaches.

1.2.2 REQUIREMENTS

In order to account for the range of differences which now characterize, the E.S.L. learner population and to anticipate the expectations of funding agencies, the approach to E.S.L. training should accomodate the following requirements.

i) It should start with the level of the learner.

That is, there should be some method of assessing the learner's language and cultural readiness, so that instruction may begin at an appropriate level.

ii) Positive reinforcement must be an integral part of the program.

Praise and encouragement are essential, particularly in the beginning stages, but will only be effective in the learner's own language.

iii) Immediate feedback and drill should be available, with or without the presence of the teacher.

Ideally, the student would be able to practice his/her language learnings at times other then those scheduled for lessons.

iv) The program should be both orally and visually based.

In most cases, the oral approach will be essential, particularly for south-east Asian peoples with little or no formal education. Parallel visual reinforcement will help to make the transference to the written word.

v) The subject matter used as a vehicle for language learning should also introduce the learner to social skills and characteristics of Canadian life.

In order to interact successfully in their new society, learners may have to "know" things that were unnecessary in their own country (use of public transportation and handling money, are examples). Such situations, and the related terminology, can form the basis of a language program.

vi) E.S.L. training should be able to accomodate individual schedules.

The problems of a new life are compounded when language training is confined to set periods. Because individualization is an essential component of effective training, this should be extended to include availability of teaching in a variety of locations and at flexible times.

To summarize, E.S.L. programs should meet the following objectives:

i) -to assess the starting level of the learner;

ii) -to supply positive reinforcement in the learners' own language;

iii) -to provide immediate feedback, drill and practice, whenever required;

iv) -to combine oral and visual stimuli;

v) -to include necessary aculturation;

vi) -to accomodate individual needs and schedules.

In short, an E.S.L. program to be assured of maximum success should be as personalized as possible.

1.2.3 THE PERSONALIZED LANGUAGE LEARNING CENTRE

The advent of the inexpensive personal computer (the microcomputer) with its potential for the field of education and training, offers the possibility of making enormous strides in the teaching of English as a second language. The requirements set out in section 1.2.2 constitute just some of those possibilities. Further, microcomputer-based instruction offers the opportunity for a new approach to instruction,

The following scenario demonstrates how a PERSONALIZED LANGUAGE LEARNING CENTRE might operate, to the maximum benefit of new Canadians - and others.

The centre is located appropriately in an area of high immigrant population. It is open sixteen hours a day, for which two or three experienced teachers are assigned proportionally.

The centre contains between fifteen and twenty microcomputers (initially - depending on need), each of which has a printer and monitor, and a library of application software (courseware) on diskette .

With a minimum amount of modification, the microcomputers are adapted to operate on a very small number of keys. No technical expertise is necessary for either teacher or learner. In addition, the machines may be voice activated.

The new student requires a very brief portion of the teachers' time for an introduction to the microcomputer. Using an introductory diskette, the microcomputer identifies the language of the learner and refers him/her to the appropriate program.

The program in the users own language, assures not only the required level for beginning English, but also the users' general literacy. Teaching is geared to this assessment.

At the end of each session, the teacher is able to obtain a print-out of the lesson and discuss this with the student. The print-out assists the teacher to diagnose needs and supplement the programs. In this manner progress in continually monitored.

As the student progresses, the program gradually reduces reliance on his/her first language and adapts automatically to individual pace.

Because the microcomputers are always available and have "endless" patience, the student is able to maintain far more active dialogue and practice than would be possible with the teacher alone. Availability of lessons no longer depends on class scheduling and flexibility enables the user to fit in his training with other commitments.

The teacher is able to concentrate on one-to-one student needs, as diagnosed, and to more effectively manage the program. Diagnosis and reporting are automatically accounted for, reducing adminstrative time. The choise between oral and visual approaches is redundant, because the microcomputer responds both visually and orally.

The one-time cost of developing courseware - based on linguistics, educational and psychological research - and of supplying the equipment necessary for the delivery of the programs, is more than offset by the reduction in program operating costs and in the success ratio of those who rapidly reduce their dependence on sponsoring agencies versus those whose dependence is long-term, due to poor language capability.

In summary, the PERSONALIZED LANGUAGE LEARNING CENTRE enhances E.S.L. training, because it can perform the following on a non-labour intensive basis.

IDENTIFY FIRST LANGUAGE

ASSESS LEVEL - LANGUAGE
- LITERACY

RECORD PROGRESS

ADJUST TO INDIVIDUAL PACE

PERSONALIZE, FOR EACH USER

DIAGNOSE NEEDS

ASSURE INSTRUCTIONAL AVAILABILITY

REDUCE COSTS