Action Read
COMMUNITY LITERACY CENTRE

Literacy and Adaptive Technology Project

A one-year field test of text-reading software with adult literacy learners.

August 2001 - August 2002

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Charitable No. BN 13365 2214 RP 0001

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Funding for this project was generously provided by Human Resources and Development Canada's National Literacy Secretariat & the Ontario Ministry of Training, Colleges and Universities.

Overview

Action Read Community Literacy Centre is a non-profit charitable organization that has been providing literacy and numeracy tutoring for educationally disadvantaged adults in Guelph, Ontario since 1987. Many of the adults who have accessed the Centre's services over the years face a wide range of learning challenges - including learning disabilities and visual, auditory, physical, emotional, and mobility issues - which make individualized learning essential. Accordingly, the Centre's staff and volunteers have had to seek out a variety of learning resources.

While many adults in the program expressed interest in working with computers, some were unable to do so without assistance because of major physical or mental challenges which inhibited their access to computer learning. These restrictions, combined with an awareness of improvements in available software and donations of computer equipment, raised among Centre staff the prospect of adding adaptive technology learning tools to the Centre's offerings. In pursuit of this prospect, a successful application was made to the National Literacy Secretariat and the Ontario Ministry of Training, Colleges and Universities for a project which would: (a) field test text-reading software with adult literacy learners, and (b) make recommendations regarding the various software packages and their applicability for people working in the adult literacy field. This website describes the implementation and findings of the Literacy and Adaptive Technology Project, a one-year study which began September 2001.

Introduction

Rationale


"Reading and writing my own work, I never thought I could do it."

Adult literacy organizations work with people who tend to be difficult to teach. Many of these individuals have been through the school system and have failed because their specific learning needs were not met. Among the severe barriers to learning experienced by these people, which generally could not be overcome by remedial methods alone, are:

- learning disabilities
- attention deficit disorder
- low vision
- long-term illness
- side effects from medication
- low self-esteem
- limited social skills
- physical disabilities
- mental health issues

Software that uses speech synthesis to read aloud from any text source appears to offer some learners a bridge over these barriers. The Literacy and Adaptive Technology Project, therefore, was designed to investigate new text-reading software packages and to make recommendations on their suitability for specific applications in the adult literacy field. The central component of the project was field testing with a group of 13 adults who experienced a variety of learning needs and disabilities. In order to assess the learning needs of the group members and to select the most appropriate technology for each of them, a learning disabilities specialist provided ongoing consultations and training sessions. Also, to enhance its scope and effectiveness, others in the region (both individuals and groups concerned with learning disabilities and special needs for adults) were invited to form partnerships with the Centre for the project.

Objectives

The project was created to field test text-reading software with adult literacy learners, and make recommendations regarding the various software packages and their applicability for people working in the adult literacy field.
Specifically, funding was provided to:

1. Research learning technology, then select and acquire the best resources
2. Field test specific technology with a group of Action Read's adult learners who had a variety of special learning needs, then evaluate their progress and compare it with the results which they achieved with previous remedial efforts
3. Develop local community partnerships between people and groups that are concerned with learning disabilities and special learning needs for adults in Guelph and Wellington County

4. Train staff and literacy partners in Wellington County on selected adaptive technology that would be suitable for the variety of special learning needs that are regularly encountered
5. Share the results of the project with literacy providers across Ontario and Canada through a brief on-line report, which includes specific recommendations for which technology works best with which audience.

Methodology

Participants

Advisory Committee. The Advisory Committee was responsible for devising strategies for each phase of the project and to advise on problems as they arose in their implementation. The Advisory Committee consisted of a Learning Disabilities Specialist, and the Executive Director of Action Read.

Project Coordinators. Working in consultation with the Advisory Committee, the Project Coordinators pulled together resources from a variety of agencies, suppliers, and individuals, to serve the needs of the project in a dynamic and flexible way. The Project Coordinators brought to the project a diverse range of skills needed to fill the following roles:

- Administrator - ensure that the project objectives were met.
- Researcher - investigate and acquire adaptive software and hardware.
- Mentor - train tutors and provide guidance when obstacles are encountered.
- Technician - to keep the computers running and troubleshoot software and hardware problems.
- Teacher - supplement the work of tutors and help keep learners motivated.
- Trainer - teach staff of Action Read and other literacy organizations to use adaptive technologies effectively.
- Writer - prepare summaries and interim reports and the final report.

The Project Coordinators were Maryanne Kaay (August 2001 to December 2001) and Miguel Calvin (December 2001 to August 2002).

Tutors. Volunteer tutors were recruited to work directly with learners. There were typically two tutors for every three learners at any given session.
They were selected according to several criteria:

- Patience and familiarity with learning disabilities
- Verbal communication skills
- Computer savvy
- Ability to motivate and encourage

Learners. Action Read has approximately 90 active learners at any time. Of these learners, those who had made slow progress since coming to Action Read, or who had evidently reached a plateau, were considered as potential participants for the field test. From among those being considered, an initial group of 10 learners was selected according to the following criteria:

- Suspected learning disability
- Comprehension level higher than sight-reading level
- Evidence that standard remediation had been only minimally successful
- Ability to work somewhat independently
- Experience with, or interest in computers
- Eagerness to participate

As the field test proceeded other learners came forward and asked to be included. They were accommodated as spaces became available. Eventually, 13 learners, each of whom made a minimum eight-week commitment, participated in the field test.

Resources

Computer Lab. Some of our computer hardware was donated, some was bought with funds granted by the Ontario Ministry of Training, Colleges and Universities. Donated 200 MHz pentium computers successfully ran text-readers during the first months of the project, and were just as stable as newly purchased 800 MHz pentium IIIs, although they were slower. One computer was connected to a scanner. Every computer was equipped with headphones, and a printer was shared over the network. Each learner had exclusive use of a computer for each session. Learners' files were stored on a shared network drive for easy retrieval at any workstation.

"It's taught me to learn more independently, using the software. I never really edited my work before."

Software. The process of selecting software for the field test was two-fold. First, a list of possible software options was compiled through: (a) an Internet search, (b) consultations with other literacy organizations, and (c) a visit to the Literacy Lab at Conestoga College in Kitchener, Ontario. Second, the manufacturers of various software programs were contacted and asked to provide samples which could be tested to ensure compatibility with the Centre's existing equipment (hardware and software).

Subsequent to this process six software packages were purchased for use in the field test. Detailed descriptions of each of these packages can be found in the Discussion section of this report, under the subheading *Software Evaluation*. Brief descriptions are provided here:

> **Kurzweil 3000** can read aloud virtually any electronic file or scanned document, (with Scan & Read), using synthetic speech. It also incorporates research, outlining, and writing tools including word prediction.
> **Write:OutLoud** is a speaking word processor with simple formatting tools.
> **Co:Writer 4000** does an excellent job of predicting a typist's next word, and provides spoken feedback.
> **Read & Write** is a text-reader with additional features and a friendly interface.
> **ReadPlease** is a simple, straightforward, inexpensive text-reader.
> **Zoom Text Level 2** features synchronized magnification, high contrast options, and control interface reading, and text-reading.

The software falls into three loosely defined categories.

1. **Text-readers** use a computer synthesized voice to read aloud any onscreen text selected by the learners.
2. **Word prediction software** presents typists with a short list of words which changes as they type. Writers can select a word from the list at any time and the typing will be completed by the computer. Words presented in the list are based on a combination of criteria: (a) the first letter typed, (b) each subsequent letter typed, (c) grammar rules, and (d) previous writing by the same typist. Two of the text-readers, Kurzweil 3000 and Read & Write, had this ability. One dedicated word prediction program, Co:Writer, was included in the study because it gives audio feedback to the typist using the same voice synthesis technology as text-readers.
3. **Word processors** allow writers to produce computer-generated text. One specialized word processor, Write:Outloud, which provides audio feedback to the typist, was included in the study. Industry-standard word processors - WordPerfect and MS Word - also were used in the field test.

In addition, ZoomText Level 2, a dedicated magnifier with some text-reading capability, was used to help visually impaired learners participate in the project.

Process

Establishing a Baseline

To form a baseline for the project, data were gathered in the areas of reading and writing using the Literacy and Basic Skills (LBS) Learning Outcomes Matrix developed by the Ontario Ministry of Training, Colleges and Universities. The five LBS levels cover approximately Grades K-9. Upon completion, learners would be prepared for a Grade 10 credit program. Under this system, levels for reading, writing, and numeracy are assessed separately, since adults typically are at different levels in each of these areas.

"I would like to eventually own my own business. This software would help me with business letters."

Unassisted reading levels were taken from learners' recent LBS assessments. Learners were presented with a progression of print materials from symbols and individual letters, to wordlists, to complete written documents. Their abilities to decode and understand the materials were assessed with attention paid to the possibility that learning disabilities were affecting the results.

Unassisted writing was assessed according to LBS criteria using a writing exercise "Letter from Kelly", (see *Examples* below). Each learner was given as much assistance as necessary to read and understand the letter and was then left to respond unassisted, using pen and paper.

Learner Projects

To field test the software, learners were asked to select a topic of interest to research. These personal projects harnessed people's personal motivation and acted as the catalyst for using the software. During mini-workshops tutors were taught the basics of all six programs and encouraged

to explore the details with their learners. In this way learners were able to try out and comment on all the programs. They could then switch freely from program to program as they wished. Software manuals were available to any who asked, but were rarely needed.

A Project Guide was developed to help learners create an outline for their projects and to give them a place to collect information as they found it. It gave learners a structure within which to work and helped them break their projects into smaller pieces which could then be tackled one at a time. The Guide, which most learners found helpful, was based on a standard essay-writing methodology. Four of the learners needed more direct help with their projects; they were able to make progress within a straightforward question-and-answer format.

Field test Assessment

The intent of the project was to determine:

> (a) if text-reading software can help adult literacy learners, and
> (b) the strengths and weaknesses of different software packages in providing such help.

In the field test, a methodology for answering the first question - Can text-reading software help adult literacy learners? - was relatively straightforward. Learners' unassisted reading and writing skills were assessed (and assigned a numeric value) at the start and end of the test. If there were substantial changes in the results, then the conclusion could be drawn that the text-reading software had been helpful. An appropriate methodology for the second question - What are the strengths and weaknesses of applying each software package tested to the specific needs of adult literacy learners? - was somewhat more difficult. Since a numeric value could not be assigned to each package, anecdotal data had to be collected. Accordingly, everyone who worked on the field test was encouraged to comment on the software: learners expressed specific likes and dislikes; tutors reported crashes and glitches; and, the Project Coordinator collated the information and determined what worked best for whom. The results can be found below in the section *Software Evaluation*, and in the Software Comparison chart.

Measurement

Baseline assessments were compared to assessments of learners' reading and writing abilities taken at the end of the field test. *Unassisted sight-reading levels* -- levels of reading without accommodations of any kind -- were compared to *assisted reading levels* -- the highest level of material successfully read and understood, with the assistance of text-reading software. *Unassisted writing levels* -- levels of writing completed by learners using a pen and paper, without assistance -- were compared to *assisted writing levels* -- the levels of writing completed with the assistance of text-readers, spell-checkers, grammar-checkers, and, in some cases, word-prediction software.

Findings

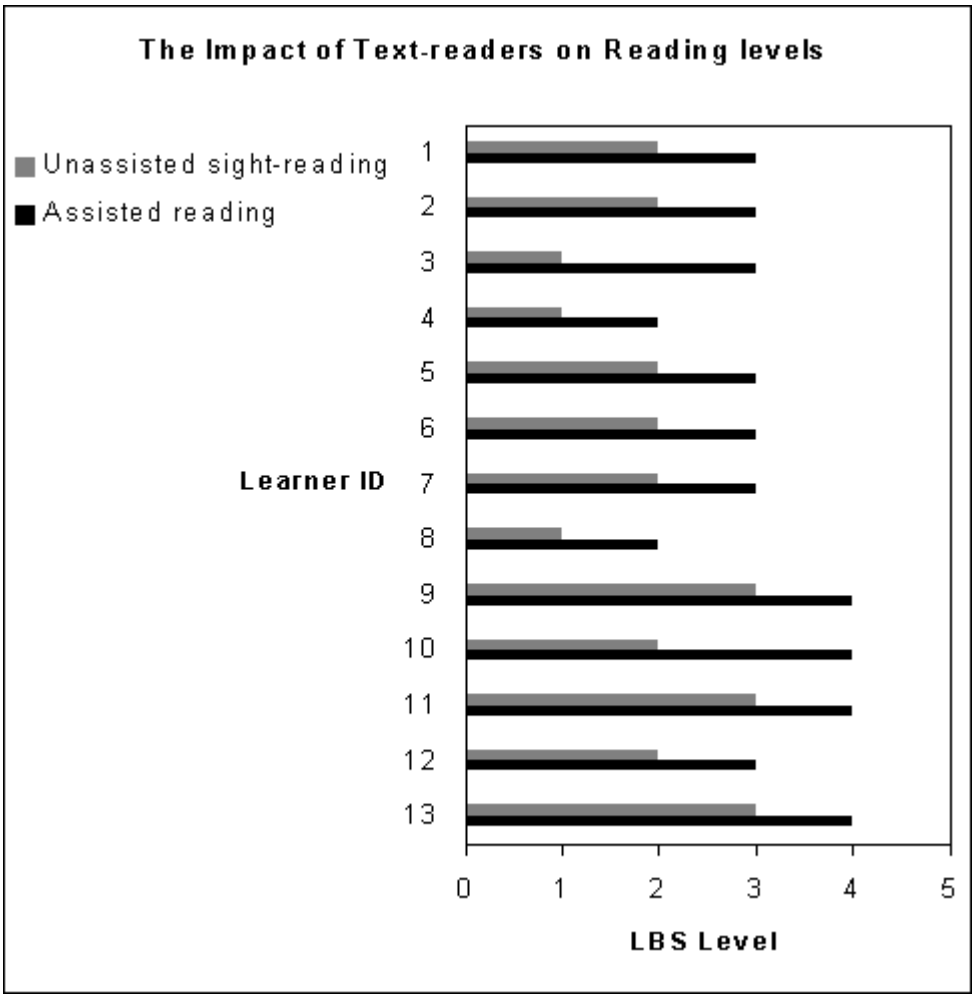
In the charts below learners are represented by randomly assigned numbers in order to preserve their anonymity. The data collected during the field test clearly show improvement for all learners. Reading improved by one or two levels in all cases, with an average improvement of 1.2 levels. Improvements in writing level were less dramatic; these averaged 0.6 levels. Average hours enrolled was 28.5, more than double the 12 hours to which learners originally committed.

Learner ID	1	2	3	4	5	6	7	8	9	10	11	12	13
Unassisted sight-reading	2	2	1	1	2	2	2	1	3	2	3	2	3
Assisted reading	3	3	3	2	3	3	3	2	4	4	4	3	4
Unassisted writing	2	2	2	1	2	2	2	2	3	2	3	2	3
Assisted writing	3	3	3	2	3	3	2	2	3	3	3	3	3
Enrolled hours	56.0	24.0	36.0	16.0	11.5	19.5	20.0	32.0	37.5	26.0	32.5	16.0	43.5

No correlation was found between enrolled hours and degree of improvement. Learners 3 and 10, for example, saw their reading assessments increase by two LBS levels when using the software. Their hours enrolled were 26 and 36, not far from the median of 28.5 hours. All other learners improved their reading by one level. This result implies that, after initial training, time spent using the software does not affect the degree of improvement attained. However, those who spent the most hours enrolled in the project have shown the greatest inclination to continue using the software independently since the field test ended.

Reading

All of the text-readers we tested either highlight or display each word as it is spoken. Learners worked with tutors to find materials relevant to their projects. Text-readers facilitated the search by reading out menu items, Internet links, and so on. Once a substantial block of text was identified, it could be read aloud by the software. Learners were able to access a much wider range of material than would have been possible with their sight-reading skills alone. After only a few hours of experience, most learners were able to use the software with only minimal assistance. Thus, tutors were able to concentrate on helping the learners to sift and collect information.



Most learners initially found unassisted reading so difficult that frustration and fatigue were limiting factors. Text-readers greatly increased the volume of text they could read in a given time and increased the level of material which they could access. All of the learners in the field test had been enrolled at Action Read for at least one year -- and all took a major leap forward with the accommodation provided by the software. In this study, text-readers clearly were shown to be helpful to literacy learners.

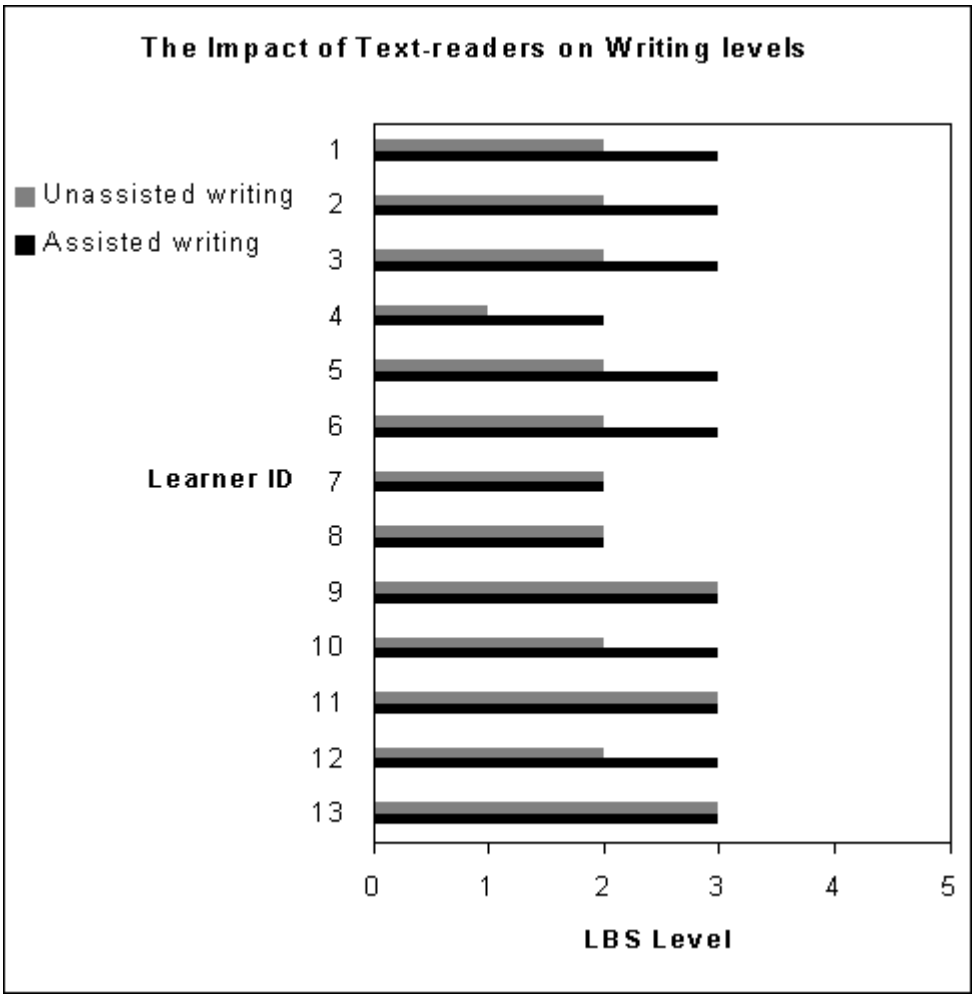
It might, indeed, be possible for some learners to realize permanent benefits to their unassisted reading skills from the increased volume and levels of materials read with the assistance of text-readers. However, the relatively short duration of this field test made it difficult to assess permanent gains. Further study clearly is warranted.

Writing

Some learners found typing very difficult and laborious. For these learners, tutors took dictation and typed exactly what learners said. Learners then were able to listen to their own writing read aloud by text-reading software and to decide if any changes were needed. This feedback allowed learners to write better, more complex sentences. And, as their confidence increased, some of them gradually took over their own typing.

Word prediction software was used by some learners to make typing easier for them and to reduce the need for dictation. Word prediction software was not central to the field test; but, by facilitating writing, it did help some learners to demonstrate their understanding of the materials they had read.

Learners with better typing skills used text-readers to review their work while editing.



As with sight-reading, frustration and fatigue limit unassisted writing. Using adaptive software to assist writing may lead to long-term gains through easier, more rewarding practice. Again, the potential for permanent gains of this kind was outside the scope of the field test, but should be further studied.

Examples

The benefit of text-readers was seen very soon after learners were introduced to them. The following side-by-side comparisons of two learners' "Letter from Kelly" exercises to their final projects illustrates the leap forward typically taken by participants.

Learner 5 participated in the field test for only 11.5 hours, yet she accessed text a full level higher than her sight-reading skill level of 2. Her “Letter from Kelly” shows her limited writing abilities:

Letter from Kelly

QS

754 Queen Street
Kingstown, ON
K2K 4X8

June 23, 2000

Dear Kelly,

It must be at least three years since we've written to each other. How are you doing? How is your family? I'm fine, especially now that I've moved to my new apartment. Did you notice the new address at the top of this page? I've been very busy moving in here and fixing the place up.

I'm enjoying summer in the city. There are a lot of people playing music on the main street, and it's nice to stop and listen to them for a while. I even drop a bit of change into their hats when I can spare it. I also go fishing in the river not far from here but I haven't caught anything yet.

I want to let you know that next time you come to town you're welcome to stay at my place because now I have an extra bedroom. It would be fun to go fishing, go out for a meal or just simply hang around and chat.

Write soon and let me know how you and your family are doing, and when you plan to come and visit.

Cheers, Robin

Your Reply:

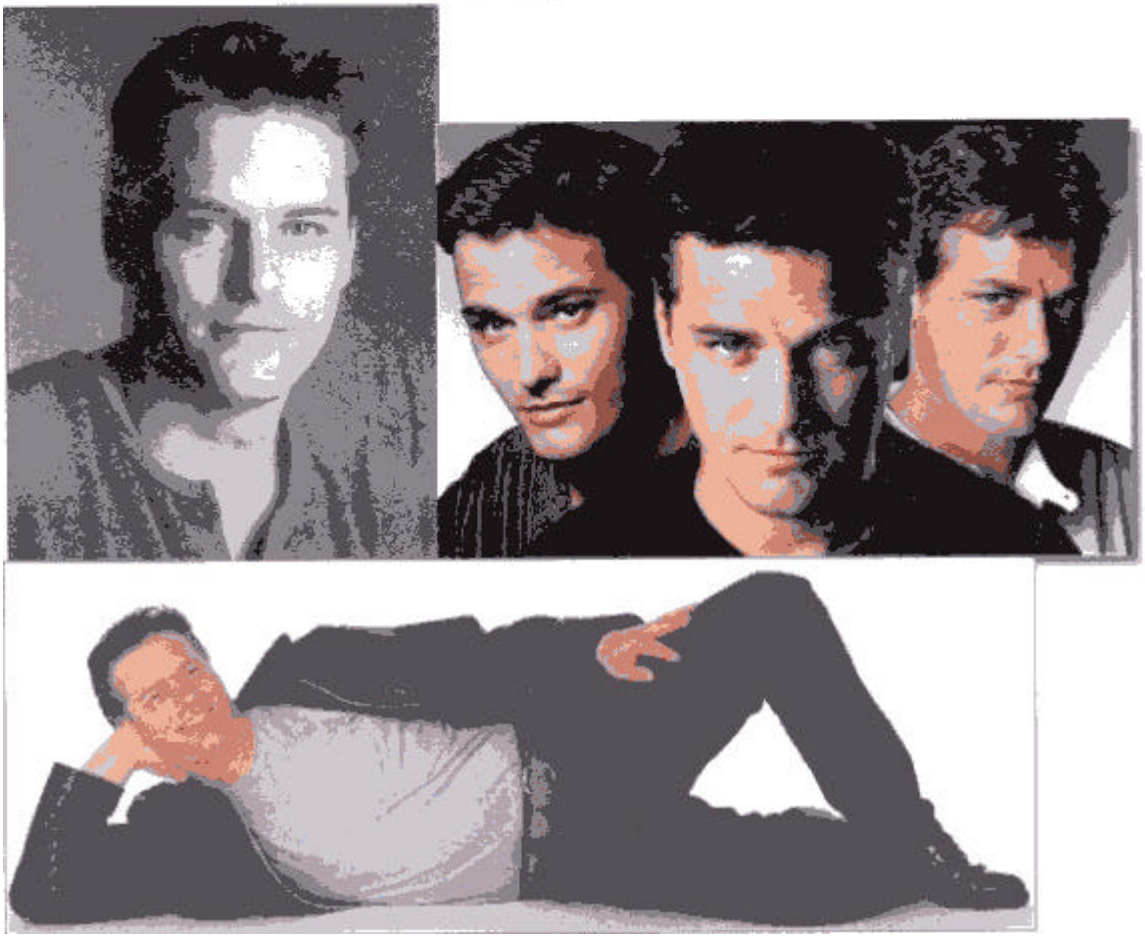
I no it has Ben ~~so~~ so long sanc the last Letter I an doing fine and my family is doing fine. So ~~wat~~ what is your new apartment is nice and cosey and big. I am glad You are ~~en~~enjoying summer in the city. I also go fishing to with my day we cot lots of fish. I woub love to come and viset you a you new apartment with ~~my~~.

Using a text-reader to read about her subject and to help her to edit her writing, learner 5 produced this brief bio of her favourite actor. The contrast with her handwritten work is striking:

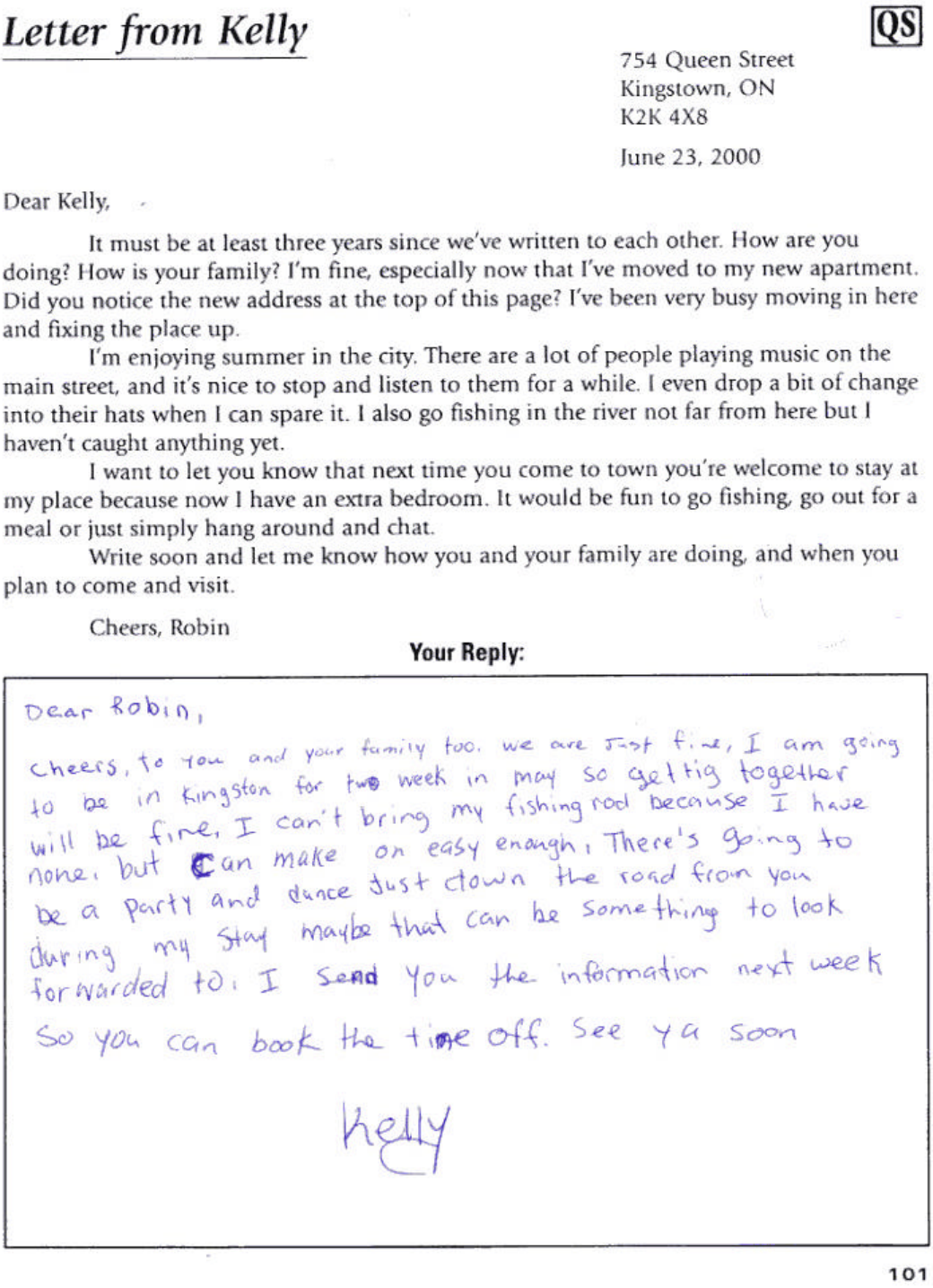
Paul Michael Gross

Paul Michael Gross was born on April 30,1959 in Calgary. Alberta Canada. Paul gross is the elder son of a tank commander. His father's name is Bob and his mother's name is Renee. Paul lived in such places as Canada, England,Germany,and the USA once his father retired. They moved back to Canada in the 1970's. In 1973 at the age of 14 his drama teacher inspired him to start acting and then he started acting in T.V. commercials. After Paul graduated from Earl Haig Secondary School, in Toronto, he enrolled in the University of Alberta located in Edmonton graduating with a degree in Drama.

I found out a lot more about Paul Gross and it was inspiring.
I found his web site easy to find (www.paulgross.org) and easy to bring stuff up



Learner 13 demonstrated a good grasp of the content of the "Letter from Kelly" and answered it creatively, but her limited writing skills are evident:



Letter from Kelly

QS

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K2K 4X8

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I'm enjoying summer in the city. There are a lot of people playing music on the main street, and it's nice to stop and listen to them for a while. I even drop a bit of change into their hats when I can spare it. I also go fishing in the river not far from here but I haven't caught anything yet.

I want to let you know that next time you come to town you're welcome to stay at my place because now I have an extra bedroom. It would be fun to go fishing, go out for a meal or just simply hang around and chat.

Write soon and let me know how you and your family are doing, and when you plan to come and visit.

Cheers, Robin

Your Reply:

Dear Robin,

Cheers, to you and your family too. we are just fine, I am going to be in Kingston for two week in may so getting together will be fine, I can't bring my fishing rod because I have none. but can make on easy enough. There's going to be a party and dance just down the road from you during my stay maybe that can be something to look forwarded to. I send you the information next week so you can book the time off. See ya soon

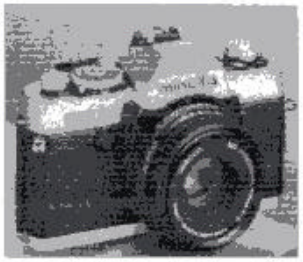
Kelly

101

Learners can really show off their knowledge of a topic when given access to text-reading tools. Learner 13 is an avid, self-taught photographer. Her computer skills advanced during the field test to the point where she is now teaching other learners to use the adaptive software. Her project, which was laid out in MS Publisher, made use of most of the adaptive programs at various points in its creation. The improvement in her writing and presentation is clear:

By Cheryl (CC)

All photography taken by Cheryl. CC Who started taking pictures in 1999.



This is my camera with a 55 mm lens

Butterfly eating nectar @ Silvercreek Park

My Camera the Minolta XG 1

Designed in 1978, it was a spin off of the Minolta XG 7.

Filters

For the Single Lens Reflex (SLR) camera, the best thing is a polarizing filter. It's the most versatile filter.

It helps keep the glare from water or a window from overexposing the film.

It can be used to darken a sky or cut through haze. It can be used for both black and white and color film. I have two filters: a polarizing, and a green one, which I bought at the pawn shop for five bucks each regular $25 and up. The best thing to do is just go out side and start shooting.

Lenses

There are hundreds of lenses for hundreds of cameras. I have a 135 mm telephoto lenses and a 55 mm lens. Both the duck and the butterfly were taken using the telephoto lens. Some lens are inexpensive and others are very expensive. Buying from a pawn shop is a good way to get a $150.00 lens for $50. Just try it out first to make sure there are no scratches or cracks on or around the lens.

Film

Choosing film can be a challenge. You can go with a cheep film that costs about $3.00 or go with a expensive film that costs about $8.00 and up. I use the 400 ISO fun pack of 6 rolls for about $15.00 at Wal-Mart. This film doesn't need a flash.

Films vary according to their ISO number. ISO indicates the film speed - its sensitivity to light. The higher a film's ISO number the "faster" it is; thus, an ISO 400 film is faster than a ISO 100 film. ISOs go from 60 right up to 1600 - so have fun and experiment.

By making the entire written world available to literacy learners, text-readers open up a wealth of real-life learning opportunities. To illustrate this potential, the Employment Group at Action Read, beginning with Human Resources and Development Canada's "Essential Skills" web site, conducted job searches and self-assessments. Learners -- many of whom were using the adaptive software for the first time -- selected jobs they would like to have, used text-readers to read the descriptions and skills inventories, and then produced a self-assessment of their readiness for the jobs. Excerpts from one self-assessment, by a learner not involved in the field test, are shown here:

I can:

- read newspapers and newsletters to stay abreast of economic and industry trends.
- read industry publications to determine business opportunities through market research.
- Read promotional materials to get ideas for marketing as well as sales and service.
- read statistical reports, such as Statistics Canada information
- reference phone books to obtain phone and address information
- check purchase orders for completeness, accuracy of substitutes and to ensure that the product has been received or shipped as ordered.
- use a day-timer to record appointments and subsequently reference the
- information to verify scheduled meeting dates and times
- make checklists to ensure that required tasks have been completed
- calculate prices using a formula.
- prepare payroll.

I need to practice how to

- Read manuals, product information brochures, warranties and guarantees to evaluate products and services as well as provide customer service.
- read contracts for equipment leasing.
- read statistical reports, such as Statistics Canada information
- reference phone books to obtain phone and address information
- check purchase orders for completeness, accuracy of substitutes and to ensure that the product has been received or shipped as ordered.
- use legend information, street indexes, and map co-ordinates to locate addresses on city maps and choose driving routes.
- use a day-timer to record appointments and subsequently reference the information to verify scheduled meeting dates and times
- reference database printouts in order to manage inventory
- interpret blueprints in order to build, maintain or renovate office facilities.
- monitor income expense sheets in order to track income and expenses
- interpret information contained in complex tables and financial data represented

  as graphs with multiple plots and scales. Use amortization and interest rate tables
- interpret plots representing rate of return projections.
- assess advertising displays such as advertisements, posters and window displays

Discussion

Benefits of Text-reading Software


"I think everybody should do this project. Everyone could benefit."

Research and Note Taking. The computer interface comes with a wealth of tools for collecting information from various sources and, ultimately, for summarizing topics. Even simple word processors can be used to "cut and paste" information from web sites, encyclopaedias, and scanned documents into a rough outline from which learners can work to create their own writing. Kurzweil 3000 takes this ability a step further with built-in "highlight" and "extract" tools which can be used to select the most important information from a sea of text and isolate it for further study.

Motivation to Produce. Extracted highlights can be a starting point for writing. As learners' own words progressively replace collected quotes, a sense of accomplishment develops. The text on the screen is always clear and legible, and it looks good when it is printed out. Many learners are unhappy with their own handwriting and reluctant to show hand-written work to anyone, so they miss out on well-deserved praise. Computer print-outs look much better and learners are always eager to take home copies of the day's work.

Easier Editing. Self-editing is always a difficult process; writers (at all levels of literacy) tend to skip over their own errors and to fill in missing words subconsciously when re-reading their work. And for learners struggling to read and write, editing can be an insurmountable task. Many learners find that listening to their work read back to them by the computer helps them to find errors and omissions they otherwise would have missed. While it is true that these learners likely could ask someone to read their work aloud to them, many of them do not feel confident enough to expose their early drafts in this way. And besides, the computer does not complain about reading something back ten times in a row!

Multi-Sensory Learning. Receiving information through multiple channels can be of great benefit to learners. Text-readers offer learners a clear connection between text and speech. Learners can listen to a text repeatedly, while watching each word being highlighted or appear as it is spoken, and thus learn to read it back. This echo-reading helps them learn to read through audio-visual reinforcement.

Supporting Visually Impaired Learners. With Zoomtext, visually impaired learners are able to access the Internet, electronic encyclopaedias, e-mail, etc. When used in combination with scanning technology, Zoomtext can make any printed matter accessible. Text reading software reduces the fatigue experienced by visually impaired learners when reading large volumes of text.

Increased Independence. The experiences of one learner illustrate the independence possible with the use of text-readers. This particular learner had joined the project on his own initiative because he was interested in computers. He had no computer skills at all; even the keyboard was unfamiliar to him. Reading was a great struggle for him and writing was nearly impossible. Using Kurzweil 3000, he was soon able to read any electronic or scanned text that he could find, up to the limit of his comprehension. He would work with a tutor to find something to read and set it up for reading

(a 5 -10 minute process). After that, he used the mouse and keyboard controls to listen to his chosen information at his own pace. He usually listened to a given text three times through. He then was provided with a set of questions to answer from the text. The questioning showed him, and the tutor, whether he understood the content of his reading. In a two-hour session, he typically needed a tutor's attention for a total of only 30 - 40 minutes (10 to get him started, and 20 - 30 to guide him through the question-and-answer process). With this technology, one experienced tutor can simultaneously help two, three, or even more learners -- learners who essentially cannot read on their own -- to access the world in a new way.

Building Confidence. As part of the intake process, attempts were made to obtain a writing sample from each learner as early on in the process as possible. The sample was elicited from the "Letter from Kelly" exercise in which learners either read or had read to them a fictional letter, which they were left alone to answer, as best they could, with pen and paper. One learner was very reluctant to write the letter; however, after fifteen hours of participation in the project, his confidence had improved to the point where he felt able to take on this challenge. He wrote a clear and concise answer to the letter with only a few errors. He later said that the letter was the first hand-written document he had completed in years.

"It really opened my eyes to what I can do. I was really impressed with the outcome. I wrote a list of things I wanted to do. I feel I can do more of them now."

Employability. Adults who become comfortable with the software will have a better chance of finding and maintaining employment. More work needs to be done to make employers aware of the need for this adaptive technology in the workplace to allow adults with learning disabilities and other learning barriers to access text in a work environment.

Learners have demonstrated great enthusiasm for using the software and exploring the world through the printed word. After the field test had been completed, several learners continued to work on expanding and refining their projects. The idea of using the adaptive software to work on well-defined projects was embraced by the participants and learners continue to visit the lab every day to look for information on many subjects.

Software Evaluation

As a part of the field test, all learners were introduced to all software programs. Favourites, however, soon emerged and are reflected in the assessment below. Software was assessed by observation using the following criteria: (a) features, (b) popularity with learners, (c) ease of independent use, (d) technical flaws, and (e) cost.

Kurzweil 3000 v5.00 can read aloud, using synthetic speech, virtually any electronic file on a computer or the Internet. The Scan/Read version adds the ability to scan and then read any type-written document. A click of the mouse positions the cursor and reading will begin from that position when the play button is clicked. Words are highlighted as they are read, thus making tracking easier. Unfamiliar words can be broken down into syllables using the syllabification tool and defined using a built-in electronic dictionary. Unfortunately, the dictionary definitions are difficult for many learners to decipher. The built-in word processor is limited to RTF file format,

but it does provide speak-as-you-type feedback and is simple to use. It also has word prediction capability, but this feature is not as user-friendly as Co:Writer. Font and size of text in the word prediction box cannot be adjusted, and it requires two keystrokes to select a word from the prediction list (as opposed to the one needed in Co:Writer). Text highlight and extraction tools are unique to this program and were very useful to learners. There is extensive control over menus, colours, fonts, and voices, and learners create accounts on which to save their own preferences. Scan/Read need only be available at one scanner-equipped workstation since scanned text is easily transferred to any read-only workstation for reading. Although this version can read directly from web pages without the need to select a block of text, it is not compatible with Internet Explorer V.6 or above. Kurzweil 3000 V.7.00, which was released recently, is more compatible and, among other improvements, can work with .doc files. Unfortunately, however, this version came out too late to be included in the field test. Despite the shortcomings noted above, this is an excellent program and its diverse features more than offset the price. A licence for one Scan/Read black & white station and four Read-only stations costs about $3000. A single license for the Read-only version is $398, and Scan/Read black & white is $1752. All prices are in Canadian dollars as of July 2002. Manufacturer: Kurzweil Educational Systems, Inc., www.kurzweiledu.com, info@kurzweiledu.com.

Write:OutLoud 3.0 is a speaking word processor with simple formatting tools. Its primary feature is speak-as-you-type audio feedback. Learners can choose to have each word, sentence, or paragraph read back to them as it is completed. It can also be used as a simple text-reader by cutting and pasting text into it. Unfortunately, this program has several significant problems. While the Backspace key works as expected, for example, the Delete key does not work at all. The proprietary file type (.WOL) makes it difficult to transfer completed writing to other programs without losing formatting. The Ariel font does not print out properly; it comes out looking like Courier with variable spacing. All other fonts seem to work well; but, since Ariel is the standard Windows font, it is needed for operations such as "cut and paste." The program gives an audio-visual alert when a word is typed incorrectly; however, the spell-checker is not able to check a specific word alone (it must check the whole document every time). Limited features and many flaws make this program hard to recommend. $158 Manufacturer: Don Johnston Inc., www.donjohnston.com, info@donjohnston.com.

Co:Writer 4000 v4.03 does an excellent job of predicting a typist's next word. As the user adds letters, the predictions change to reflect the narrowing range of possibilities. The user can choose from the list of predictions at any point in the process, and even hear each word spoken, before having the software finish typing it out. Separate accounts can be set up for each learner to keep track of individual writing styles and to adapt predictions accordingly. Grammatical rules also can be included in the prediction parameters. This program is most helpful to learners who know what they want to say but have difficulty typing; it is regularly used by learners with serious fine motor control problems. Learners who find spelling difficult may also benefit if they usually can get at least the first few letters of each word right and, more importantly, if they can recognize the right word when they see and/or hear it. When used with MS Word 2000 it produces garbled text, although it works perfectly with Wordperfect 9.0. As typing skills improve, this program becomes less useful because the learner types faster than the computer can predict. Nonetheless, this is the best word prediction program tested in the study. $520 Manufacturer: Don Johnston Inc., www.donjohnston.com, info@donjohnston.com.

Read & Write 5.0 is a text-reader that also checks spelling, corrects mistakes, and predicts. It will

operate within any Windows application, including word processing, spreadsheets, databases, desktop publishing, e-mail, and the Internet. This text-reader is chosen by many learners, apparently because the animated onscreen characters give it a friendly, playful air. However, learners have complained that, because the text box scrolls line-by-line, instead of by larger blocks, when it is full, reading long passages can be particularly tiring. The dictionary uses complex language and is not very complete. Word prediction does not work well with WordPerfect: (a) when a word is chosen from the prediction list, the preceding space is removed by Read & Write, leaving everything jumbled up together; and (b) the word read-back appears to just give back keystrokes. Read & Write does, however, work better with MS Word. ScreenReader, a more compact program containing only the text-reader with its onscreen characters, is available for $68, ($18 if downloaded), but preliminary testing found glitches in it. If these problems were addressed, ScreenReader could be an excellent alternative for those needing only text-reading. Although the flaws in Read & Write are substantial, its popularity with learners shows the importance of a good interface, and this criterion should be considered in any software selection process. It is also important to note that a newer version is available, which might be better. $349 Manufacturer: textHELP!, www.loriens.com, info@texthelp.com.

"Peedy helped me to read a lot of stuff"

ReadPlease 2002 is a simple, straightforward document reader. It comes in two versions. The free version can read aloud -- only from the beginning -- any text that is pasted into its text window. The commercial version adds the ability to read any selected text (by hitting ctrl-c) and can start reading from anywhere in the text. A minor concern is that reading speed is controlled by a slider, but the words-per-minute rate is not displayed. For its low cost and ease of use, this program is a winner. Free, or $80 for the commercial version, ReadPlease Plus, with additional features. Manufacturer: ReadPlease Corp., www.readplease.com.

ZoomText Level 2 v7.06 features synchronized magnification, high contrast options, and control interface reading. Designed for low-vision users, Level 2 speaks all onscreen text and echoes typing. Screen reading includes menus and controls, but is complicated to use for content; learners often end up using a text-reader along with this program. Crashes have occurred when printing via a network with ZoomText running on the printer-server. This problem, however, can be overcome by restricting its use to machines other than the printer-server. ZoomText is an excellent, simple-to-use program, but it is expensive. The Level 1 version does not include the problematic screen reading function, and is available for about half the cost, but it was not tested in this project. Alternatively, the magnification tool built into Windows is free, but very limited. Budget will likely dictate choice. $719. Manufacturer: Ai Squared, www.aisquared.com, sales@aisquared.com.

Corel WordPerfect 9.0 is an industry-leading word processor with two features that are particularly useful for teaching literacy -- continuous Spellcheck and Grammar check. With Spellcheck, spelling errors are immediately underlined in red. The user can right-click on the word to bring up a list of possible correct spellings from which to choose. The list also can be made visible as a menu item, a feature which is not available in MS Word. With Grammar check, grammatical errors are underlined in blue (to distinguish them from spelling errors). A description of each error is available by using the "Grammatik" tool to check the document. The descriptions

are sometimes obscure, but they do provide a "heads-up" to learners that something might be wrong with what they have written. Read & Write's word prediction feature did not work well with WordPerfect. In all other respects, WordPerfect is an excellent program.

MS Word 2000 is the industry standard word processor. It has spelling and grammar checking features similar to Wordperfect, but does not display alternate spellings in the menu bar. It does not work with Co:Writer 4000. Thus choice of word processor must be made in concert with choice of adaptive software.

Internet Explorer 5.5 was used throughout the project. The menu bar was set to include a button controlling text size. A customized start page was developed to make it easier for learners to access web sites of particular value to them, and to avoid distracting advertisements found on commercial start pages (such as MSN.com). Because Kurzweil 3000 V.5.0 (the version available for the field test) was not compatible with Internet Explorer 6.0, upgrading Explorer was not an option for this study. Kurzweil 3000 V.7.0 is now available, and is reportedly more compatible with newer versions of Explorer.

Windows 98 Operating System Interface was customized to suit learners' needs: folders were set to open with one click instead of two, screen font size was increased, and mouse movement was slowed down. Screen resolution was adjusted for each learner. Setting the screen to 640x480 allowed learners with mild visual impairment to work without using ZoomText. Most learners were comfortable with the 800x600 setting on 15" monitors and 1024x768 on 17" monitors.

Process Evaluation

Training: In the first weeks of the field test, learners were guided through group exercises to learn how to use each program. It soon became apparent that this method of training was not very effective. Learners became frustrated when they fell behind the group, or were bored and distracted when they raced ahead. In the latter weeks of the study, introductions to new software were handled one-on-one. This process was more successful.

Computer Lab Layout: The lab was set up to form a rough square with computers around the outside of the room. Learners sat on the inside of the square, facing outwards. With this layout, they could talk to one another easily, without obstructions, just by turning slightly, yet there were no visual distractions in their forward field of view. Learners were able to speak up to help each other, and tutors were able to help two learners at a time by sitting between them. The open lines of communication facilitated by the lab layout seemed to encourage the enthusiasm of the participants.

Group Learning: By the time most learners reach Action Read, they have become accustomed to being excluded, undervalued, and overlooked. This project provided these learners with a different perspective: it took their disabilities and made them a criteria for entry, a reason to be included. People like to be a part of things, and this project was no exception. Giving individual attention in a group setting lets learners benefit from the comments and insights of their peers and still receive the personal attention they need.

Conclusion

Text-reading technology is a useful adjunct to traditional literacy-teaching tools. It includes interactive learning tools that encourage independent learning and increase motivation. Learners gain access to text beyond their sight-reading level and are thus limited only by their ability to comprehend it. Learners benefit from: facilitated research and note-taking, enhanced motivation, easier editing, multi-sensory learning, improved access for visually impaired and learning disabled students, and increased confidence. This cluster of benefits has long term implications for improved independence, employability, mental and physical well being.

Recommendations

Based upon the results of the field test, the Literacy and Adaptive Technology Project recommends that:

1. literacy organizations commit to offering adults computer based learning opportunities;
2. staff and tutors be trained to use text-reading software and to select the most appropriate program for each learner;
3. software use should be accompanied by group or individual support; text-reading software does not obviate the need for personal attention;
4. literacy organizations commit funding to the acquisition and maintenance of computer workstations and adaptive software;
5. text-reading software should be seen as one of the core acquisitions for programs serving learners facing multiple learning barriers;
6. literacy programs seek out partnerships with Learning Disability Associations and special needs labs in colleges and universities to ensure that they are being kept up to date on the best techniques for educating adults with major learning disabilities, and to share costs where possible;
7. literacy organizations advocate for text-reading software to be made available in schools, and on all public-access computers, to accommodate all learning needs and in employment situations;
8. funders recognize and support computer-based learning opportunities for adult learners;
9. an evaluative on-line list of adaptive and assistive software be created and updated regularly to help organizations and individuals make informed purchasing decisions, and;
10. the public be made aware of free text-reading software, such as ReadPlease.

The costs are manageable and the benefits are clear. Lets make them available to as many people as possible.

Epilogue

"It just makes things easier"

The eight-station computer lab is now an integral part of Action Read. Learners use the computers for a wide variety of tasks. Learner-tutor pairs increasingly are making use of the text-readers and other adaptive software. Orientation on the new technology is provided for all new tutors as part of tutor training. Adaptive technology is now considered in the development of training plans for new learners. Staff or volunteers are available during most open hours to provide assistance to learners as they explore the web, read and write e-mails, research health and employment issues, and practice their literacy skills in a variety of ways.

United Way
Agency

Literacy and Adaptive Technology Project

Appendix A - Software Summary

A brief description of each piece of software and hardware field-tested in the project.

Text-Reading Software

Kurzweil 3000 v5.00 can read aloud, using synthetic speech, virtually any electronic file on a computer or the Internet. It can read directly from web pages without the need to select a block of text. The Scan/Read version adds the ability to scan and then read any type-written document. A click of the mouse positions the cursor and reading will begin from that position when the play button is clicked. Words are highlighted as they are read, thus making tracking easier. Unfamiliar words can be broken down into syllables using the syllabification tool and defined using a built-in electronic dictionary. Text highlight and extraction tools are unique to this program and were very useful to learners. There is extensive control over menus, colours, fonts, and voices, and learners create accounts on which to save their own preferences. Scan/Read need only be available at one scanner-equipped workstation since scanned text is easily transferred to any read-only workstation for reading. Kurzweil 3000 V.7.00, which was released recently, is more compatible and, among other improvements, can work with .doc files. Unfortunately, however, this version came out too late to be included in the field test. Despite the shortcomings noted above, this is an excellent program and its diverse features more than offset the price.

Preferred audience:	All, very diverse capabilities
Levels:	All
Learner challenges:	Low sight-reading level, visual processing, leaves out words, spelling errors, grammar
Cost:	$399 (Read only), $1795 (Scan & Read), A licence for one Scan/Read black & white station and four Read-only stations costs about $3000
Limitations:	Font and size of text in the word prediction box cannot be adjusted and two keystrokes are required to select a word from the prediction list. The dictionary definitions are difficult for many learners to decipher. The built-in word processor is limited to RTF file format. This version is not compatible with Internet Explorer V.6 or above, although v7 is.
To Order:	Kurzweil Educational Systems, Inc., www.kurzweiledu.com, info@kurzweiledu.com.

Write: OutLoud 3.0 is a speaking word processor with simple formatting tools. Its primary feature

is speak-as-you-type audio feedback. Learners can choose to have each word, sentence, or paragraph read back to them as it is completed. It can also be used as a simple text-reader by cutting and pasting text into it.

Preferred audience:	Low literacy with higher comprehension
Levels:	1-3
Learner challenges:	Visual processing, leaves out words, spelling errors, grammar, visually impaired
Cost:	$158
Limitations:	While the Backspace key works as expected, for example, the Delete key does not work at all. The proprietary file type (.WOL) makes it difficult to transfer completed writing to other programs without losing formatting. The Ariel font does not print out properly; it comes out looking like Courier with variable spacing. All other fonts seem to work well; but, since Ariel is the standard Windows font, it is needed for operations such as "cut and paste." The program gives an audio-visual alert when a word is typed incorrectly; however, the spell-checker is not able to check a specific word alone (it must check the whole document every time).
To Order:	Don Johnston Inc., www.donjohnston.com, info@donjohnston.com.

Co: Writer 4000 v4.03 does an excellent job of predicting a typist's next word. As the user adds letters, the predictions change to reflect the narrowing range of possibilities. The user can choose from the list of predictions at any point in the process, and even hear each word spoken, before having the software finish typing it out. Separate accounts can be set up for each learner to keep track of individual writing styles and to adapt predictions accordingly. Grammatical rules also can be included in the prediction parameters. This program is most helpful to learners who know what they want to say but have difficulty typing; it is regularly used by learners with serious fine motor control problems. Learners who find spelling difficult may also benefit if they usually can get at least the first few letters of each word right and, more importantly, if they can recognize the right word when they see and/or hear it. This is the best word prediction program tested in the study.

Preferred audience:	Low literacy with higher comprehension. Limited fine motor skills
Levels:	1-3
Learner challenges:	Leaves out words, spelling errors, vision deficits, grammar, fine motor control
Cost:	$520
Limitations:	When used with MS Word 2000 it produces garbled text, although it works perfectly with Wordperfect 9.0. As typing skills improve, this program becomes less useful because the learner types faster than the computer can predict.
To Order:	Don Johnston Inc., www.donjohnston.com, info@donjohnston.com.

Read & Write 5.0 is a text-reader that also checks spelling, corrects mistakes, and predicts. It will operate within any Windows application, including word processing, spreadsheets, databases,

desktop publishing, e-mail, and the Internet. This text-reader is chosen by many learners, apparently because the animated onscreen characters give it a friendly, playful air. Although the flaws in Read & Write are substantial, its popularity with learners shows the importance of a good interface, and this criterion should be considered in any software selection process. It is also important to note that a newer version is available, which might be better. ScreenReader, a more compact program containing only the text-reader with its onscreen characters, is available for $68, ($18 if downloaded), but preliminary testing found glitches in it. If these problems were addressed, ScreenReader could be an excellent alternative for those needing only text-reading.

Preferred audience:	All
Levels:	All
Learner challenges:	Low sight-reading level, visual processing, leaves out words, spelling errors, vision deficits, grammar, fine motor control
Cost:	$349
Limitations:	Because the text box scrolls line-by-line, instead of by larger blocks, when it is full, reading long passages can be particularly tiring. The dictionary uses complex language and is not very complete. Word prediction does not work well with WordPerfect: (a) when a word is chosen from the prediction list, the preceding space is removed by Read & Write, leaving everything jumbled up together; and (b) the word read-back appears to just give back keystrokes. Read & Write does, however, work better with MS Word.
To Order:	textHELP!, www.loriens.com, info@texthelp.com.

ReadPlease 2002 is a simple, straightforward document reader. It comes in two versions. The free version can read aloud -- only from the beginning -- any text that is pasted into its text window. The commercial version adds the ability to read any selected text (by hitting ctrl-c) and can start reading from anywhere in the text. For its low cost and ease of use, this program is a winner.

Preferred audience:	Low literacy with higher comprehension
Levels:	All
Learner challenges:	Leaves out words, grammar, vision deficits
Cost:	Free, or $80 for the commercial version with additional features
Limitations:	Reading speed is controlled by a slider, but the words-per-minute rate is not displayed.
To Order:	ReadPlease Corp., www.readplease.com.

Other Software

Zoom Text Level 2 v7.06 features synchronized magnification, high contrast options, and control interface reading. Designed for low-vision users, Level 2 speaks all onscreen text and echoes typing. This software is used by Learners with vision difficulties. ZoomText is an excellent, simple-to-use program, but it is expensive. The Level 1 version does not include the problematic screen reading function, and is available for about half the cost, but it was not tested in this project.

Alternatively, the magnification tool built into Windows is free, but very limited. Budget will likely dictate choice.

Preferred audience:	Visually impaired
Levels:	All
Learner challenges:	Vision deficits including contrast and colour perception problems.
Cost:	$719
Limitations:	Screen reading includes menus and controls, but is complicated to use for content; learners often end up using a text-reader along with this program. Crashes have occurred when printing via a network with ZoomText running on the printer-server.
To Order:	Ai Squared, www.aisquared.com, sales@aisquared.com.

Corel WordPerfect 9.0 is an industry-leading word processor with two features that are particularly useful for teaching literacy -- continuous Spellcheck and Grammar check. With Spellcheck, spelling errors are immediately underlined in red. The user can right-click on the word to bring up a list of possible correct spellings from which to choose. The list also can be made visible as a menu item, a feature which is not available in MS Word. With Grammar check, grammatical errors are underlined in blue (to distinguish them from spelling errors). A description of each error is available by using the "Grammatik" tool to check the document. The descriptions are sometimes obscure, but they do provide a "heads-up" to learners that something might be wrong with what they have written. Read & Write's word prediction feature did not work well with WordPerfect. In all other respects, WordPerfect is an excellent program.

MS Word 2000 is the industry standard word processor. It has spelling and grammar checking features similar to Wordperfect, but does not display alternate spellings in the menu bar. It does not work with Co:Writer 4000. Thus choice of word processor must be made in concert with choice of adaptive software.

Internet Explorer 5.5 was used throughout the project. The menu bar was set to include a button controlling text size. A customized start page was developed to make it easier for learners to access web sitesof particular value to them, and to avoid distracting advertisements found on commercial start pages (such as MSN.com). Because Kurzweil 3000 V.5.0 (the version available for the field test) was not compatible with Internet Explorer 6.0, upgrading Explorer was not an option for this study. Kurzweil 3000 V.7.0 is now available, and is reportedly more compatible with newer versions of Explorer.

Windows 98 Operating System Interface was customized to suit learners' needs: folders were set to open with one click instead of two, screen font size was increased, and mouse movement was slowed down. Screen resolution was adjusted for each learner. Setting the screen to 640x480 allowed learners with mild visual impairment to work without using ZoomText. Most learners were comfortable with the 800x600 setting on 15" monitors and 1024x768 on 17" monitors.

Hardware

SmartCat Touchpad enables learners with mobility difficulties to access computer resources with greater ease. It works very well and is used routinely.

Cost:	$129
Limitations:	None
To Order:	Cirque Corp., www.cirque.com

Scanner: A scanner is required to take advantage of scan & read in Kurzweil 3000. Our Epson Perfection 1640 SU has been trouble free. It features 1600 x 3200 resolution at 42 bits. Most scanners come with basic optical character recognition, (OCR), software.

Cost:	$400 (adequate scanners can be bought for $100 or so)
Limitations:	None
To Order:	Epson, www.epson.com

Computer: One must have a computer to use this software. Systems need not be very powerful; any Pentium II or higher with a sound card will be fine in most cases. Check with the manufacturers for minimum system requirements. Keep in mind that using several programs together will require a more powerful system.

Apple Macintosh systems have not been included in the project but these manufacturers may be able to help, and some text reading ability is built into the Mac OS.

Appendix B – Software Comparison Chart

Text Reading Software Used in the Field Test							
Attributes	**Kurzweil 3000**	**Write:OutLoud**	**Co:Writer**	**Read & Write**	**ReadPlease**	**ReadPlease Plus**	**ZoomText**
Version tested	5.00	3.0	4.03	5.0.3696	1.10.06	1.10.06	7.06
Price (single workstation)	$399 to $1,795 *	$158	$520	$349	Free!	$80	$719
Text to speech							
web	y			y	cut & paste	y	
text doc	cut & paste	cut & paste		y	cut & paste	y	
scanned doc	y						
other programs	cut & paste	cut & paste		y	cut & paste	y	
highlight speech	y	y	y		y	y	
typing echo	y	y	y	y			y
Organizational tools							
highlighters	y						
notes	y						
extract tool	y						
Comprehension tools							
dictionary	y	y	y	y			
thesaurus	y	y	y	y			
Writing Tools							
word processor	y						
word prediction	y		y	y			
spell check	y	y	y	y			
typing echo	y	y	y	y			y
read back	y	y	y	y	y	y	y
Low vision features							
full screen zoom							y
high contrast							y
background colours	y	y	y	y	y	y	
text colours	y	y	y	y	y	y	
text size	y	y	y	y	y	y	y
font	y	y	y	y	y	y	
Learner friendliness							
LBS levels	all	2 - 5	1 - 3	all	all	all	all
overall usefulness	excellent	good	good	good	good	very good	excellent
Learner challenges							
visual processing	y	y		y	y	y	y
low sight reading level	y			y	y	y	
leaves out words	y	y	y	y	y	y	
vocabulary	y	y	y	y			
spelling	y	y	y	y			
grammar	y	y	y	y			
visually impaired	y	y	y		y	y	y
fine motor control			y				
* $399 for Read-only (cannot scan), $1795 for Scan & Read (black & white). Prices are as quoted on manufacturers' web sites and are subject to change.							

Literacy and Adaptive Technology Project

Appendix C – Project Guide

Learners Name:

Part 1 - Research

What is your Topic? (What do you want to learn about?)

What do you want to find out about it? Write at least three questions, or areas of interest.
1

2

3

4

Part 2 - Writing

What have you found out about each part of your topic? Cut and paste information you find on the web or in other sources. Keep each question separate.
1

2

3

4

What pictures or examples can you use to help explain or illustrate what you found out? (find 2 to 5)

Summarize what you found out.

Conclusion. What did you learn about your topic?