

FANSHAWE COLLEGE

Essential Skills Online: A Consortium Approach

Fanshawe College: Summary Report

Robert C. McEwan, Duane Wilson

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The role of computer technology in supporting the academic success of vulnerable learners who are upgrading their trades-related skills was the focus of this project. The evidence is that computer technology has the power to open up learning by mitigating the barrier of print language, by compensating for weak cognitive processes, and by providing alternative routes to knowledge. A human-technology approach to distance learning improves the opportunity for vulnerable learners to successfully upgrade their trades-related skills through distance education.

Executive Summary

In this project we investigated the ways in which computer technology can enhance the quality of learning for apprentices, pre-apprentices or unemployed workers who have been identified as vulnerable learners. A total of 270 individuals who exhibit significantly weak reading comprehension or written language skills participated in this project.

The focus in stream 1 of the project was on the role of technology in accommodating the academic needs of two groups of apprentices: one group who worked full-time but attended the college for the in-school portion of their training, and one group of full-time college students who were also registered as apprentices. While both groups viewed the huge volume of textual material that they were expected to read as being a major barrier to success, the full-time workers (as opposed to the full-time students) were generally less able to make use of computer technology and were less satisfied by the accommodation provided by that technology. We hypothesize that this outcome can be explained in terms of differences: in experience and confidence in using computer technology, in the amount of time which the two groups could devote to learning the technology, and in the differences in their perceived needs as students.

In the Technology-Accommodation model of assessment and intervention, technology is used both as a tool for assessment and as a tool for accommodation. First, the current level of the student's skills in reading, written language, and mathematics are measured using all the aids (including their current use of technology) within the student's repertoire. Then, new adaptive technologies are introduced and an estimate is taken of the effect which these new technologies could have on the student's skill levels. If the new technologies look promising, a cycle of training, evaluating, recalibrating and re-evaluating begins. At all times, the process is evaluated using real materials and success is measured in terms of differences in the real world of the individual. This is an evolving cycle that is constantly adapting and changing and that may continue as long as the student is in the college. The evidence from this project is that the technology-accommodation approach has merit as a process for assessment leading directly to intervention for this population of students.

In Stream 2 of this project, the focus was broadened to include the question of how technology can be used to increase the success of vulnerable learners using distance education as their vehicle for upgrading their trades-related academic skills. We found that web conferencing software designed for educational use offers a way of circumventing the very real barrier which keyboard communication causes for vulnerable learners. It was also evident that the technology-accommodation approach can be used effectively within a web conferencing environment. This approach requires that the tutor – in addition to being a subject expert – must have skills in technology, coaching, and supportive counselling.

The evidence collected in this project supports the view that the technology-accommodation model and the human-technology approach to distance education are effective approaches to addressing the barriers which apprentices and other vulnerable learners experience in attempting to improve their trades-related academic skills. We recommend that these techniques should be subjected to a research test using standard statistical procedures and design.

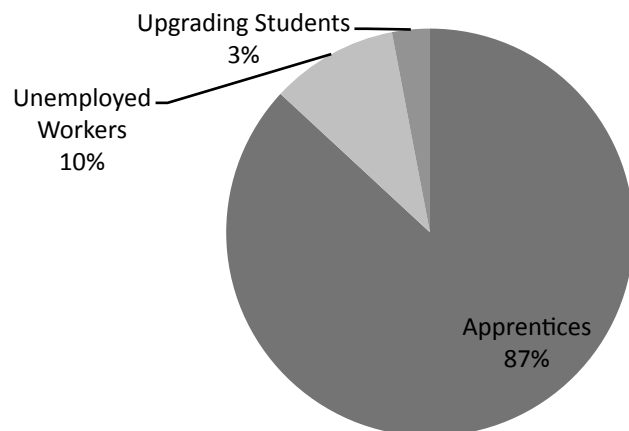
Goal of the Project

The goal of the Fanshawe College component of the *Essential Skills Online: A Consortium Approach* project was to investigate ways in which computer technology could be utilized to improve the access to essential academic skills of vulnerable learners who are apprentices or potential apprentices.

Section 1: Participants in the Project

As can be seen in Figure 1, 87% of the participants in this project were registered apprentices representing a variety of trades. The second group of participants was unemployed workers who were using the *Essential Skills Direct* curriculum as a way to upgrade their trades-related skills. The smallest group representing 3% of the participants in this project, were upgrading their academic skills with a goal of qualifying as apprentices. The characteristics of each of these groups will now be described in more detail.

Figure 1: Percentage of Apprentices, Unemployed Worker & Upgrading Students



Category 1. Participants in the Project: Apprentices (N = 232)

Motive Power Apprentices.

While other apprentice groups, including electricians, carpenters, and plumbers were represented in the Fanshawe project, the majority of the participants came from the motive power trades and include automotive service technicians, truck and coach technicians, and agricultural service technicians. With some variations, training for the motive power apprentices is offered in two basic formats. Those in the traditional block release format work as paid apprentices, only coming into the college for one block of (typically) 8 weeks each year. In the post-secondary format of training, the individual is enrolled both as an apprentice and as a full-time college student. In this latter format, the apprentice completes the full in-school portion of training (often with a co-operative training component) prior to seeking full-time employment. In contrast to the block release apprentices, the post-secondary apprentices are typically younger having come directly from secondary school, and their academic skills, and particularly their familiarity with computers and technology, is greater. While the post-secondary apprentices live in the immediate vicinity of the college, many of the block release apprentices drive long-distances each day to attend classes.

ECE & DSW Apprentices.

The second group of apprentices participating in this project is in the Early Childhood Education (ECE) or Developmental Services Worker (DSW) programs. Unlike the Motive Power Apprentices, those in the ECE and DSW programs were largely female. Typically they have full-time jobs, and they are attending school either because of changes in government regulations, or to advance their job opportunities. The ECE workers attend evening classes, some of which are offered as online courses blended with in-class lectures. In contrast, the DSW apprentices travel from long distances to the college one day a week. Their classes are delivered in a traditional lecture format. The training and instruction format used for these apprentices is shown in Table 1.

Table 1: The Training Format and Instruction Format of the Principle Apprentice Groups Participating in the Project

Apprentice Group	Training Format	Teaching Format
Motive Power (automotive, truck, farm equipment)	Block Release (e.g., full-time in college annually for 8 wk. session)	Combination of lectures and laboratory work
Early Childhood Education (ECE)	Evening Courses	A blend of lecture courses and online courses
Developmental Services Worker (DSW)	One day per week for 14 weeks	Lecture
Post-secondary motive power	Full-time day school with 18 week semester	Combination of lectures and laboratory work

Category 2. Participants in the Project: Unemployed Workers (N = 27)

Figure 1 shows that 10% of the participants are under/unemployed workers. With the collapse of the automotive industry during the recent downturn in the economy, many of these workers became unemployed. They were using the *Essential Skills Direct* curriculum to upgrade their skills and for strengthening their job resumes. While some of this group had completed a secondary school graduation diploma, others were preparing to write the General Education Diploma (GED) examination.

Category 3. Participants in the Project: Upgrading Students (N = 8)

The final category of participants is a small group made up of individuals who are upgrading their trades-related academic skills as a step toward entering an apprenticeship. These students are in a pre-apprentice auto body repair program, a trades-related upgrading program, or they are studying from home.

Section 2: Characteristics which make the Participants Vulnerable Learners.

In spite of their heterogeneity, each of the participants is a vulnerable learner in that they exhibit significant weakness in at least one of the following domains:

1. Cognitive Learning Style

The cognitive style of large numbers of these students meets the definition of a learning disability. The disability manifests itself as significant difficulty in understanding and using oral language, in decoding and/or comprehending print language, in organizing and/or sequencing materials, or in committing information to long-term memory storage. Although we do not have reliable estimates of the number of apprentices who have a learning disability, we believe that a significant number of persons who select the trades as a profession do so because their visual/kinesthetic skills are stronger than their language skills. Unlike their success on the job, these people have difficulty learning in the traditional classroom lecture format.

2. Academic Skills

As outlined above, weak reading, written language and mathematical skills may be the result of learning disabilities. Poor teaching, family disruption, a lack of educational opportunity, and second language learning can also result in weak academic skills. A number of apprentices in the ECE program, for example, experience significant difficulty with the reading and written language expectations because their basic education was in a different language. Textbooks filled with technical language or written assignments requiring formal, academic English are particularly difficult for these apprentices.

3. Student and Study Skills

Many of these students report that they have difficulty sitting for long periods, they do not know how to take good notes from lectures, and they have difficulty using textbooks effectively. They do not know how to study efficiently and they have difficulty memorizing material. Often, they complain that their reading comprehension is weak. The heavy dependence on textbook learning and self-study was new for many of the participants, for some, it was because they had been out of formal education for many years, and for others, it was because their previous education had not prepare them for this type of learning.

4. Life Stressors and Distractors

With the exception of the post-secondary apprentices, the majority of the participants in our research are older than most college students. They have stressors in their lives that are potentially serious and these stressors serve as ongoing distractors that interfere with concentration, focus, and ultimately with the person's accessibility to learning. Sometimes these stressors are related to their past educational experiences that taint their current self-concept and self-confidence as learners. There are also ongoing stressors in the form of family difficulties and financial problems. For some apprentices, their very employment depends on being successful in the in-school component of their training. All of these factors act as serious barriers to academic success and explain why these individuals are classified as vulnerable learners.

Section 3: Technology as a Tool of Accommodation

In this project there were two interrelated streams of enquiry. The focus in the first stream was on the ways in which adaptive software could support the learning of individual apprentices, or groups of apprentices, as they attempted to access, understand, store, and express knowledge. In addressing this issue we developed and evaluated a five-step model of assessment and accommodation. This Technology-Accommodation model is based on two general principles.

Technology-Accommodation Model

The first principle recognizes that severe reading and writing deficits – such as those experienced by many individuals with learning disabilities – are lifelong conditions, and because of this, it is more productive to accommodate those conditions rather than to attempt to remediate them. While there are exceptions to this generalization, such as individuals who have been denied adequate educational opportunities, the focus in the technology-accommodation model is on accommodation as opposed to remediation.

The second principle underlying the technology-accommodation model is that technology can be a powerful compensatory tool for weak cognitive processes. A hand-held device can act as an external organizer for the disorganized student, for example, and text-to-voice software can change print language into aural language thus making it accessible for students who have difficulty decoding print.

The technology-accommodation model of support includes five basic steps. First we give a brief description of the five steps and then we will illustrate the application of this model to various situations dealing with vulnerable learners. In some situations, such as with the ECE women, or with the Block-Release apprentices, only some aspects of the model are applied. In other situations, such as in the case study with John, the Post-secondary apprentice, or with Peter, the aspiring chef, the complete five steps of the model are followed.

The Five Step Technology-Accommodation model

Step 1: Background Information.

A brief review of the student's educational experiences establishes the level of courses taken in secondary school, whether a learning disability has been diagnosed, and other factors that may impact on the apprentice's ability to perform successfully in their current study. This step is firmly grounded on the "here and now" in the apprentice's life and can be completed quickly.

Step 2: Strengths and Weaknesses.

While some students can articulate their academic needs, other students find it very difficult to describe their learning strengths and weaknesses. For this latter group, a brief informal evaluation using real materials taken from their academic program can be extremely helpful in establishing their relative strengths and weaknesses in reading, mathematics and written language.

Step 3: Assessment of Technology Experience, Skills and Potentials.

The third step involves an assessment of the student's experience, skill levels, and attitudes toward computer technology. In this step, technology is used as an assessment tool, with the focus being not only on the current strategies which are being used, but also on the potential benefits of new strategies. Many apprentices who are weak spellers are unaware that the word prediction feature on the Google Search Engine is a much more efficient strategy than the traditional approach of using a paper dictionary to correct misspelled words. The introduction of this new strategy may result in a dramatic improvement in the apprentice's spelling.

Step 4: Prescription, Training, Practice.

In the next step the student and the technologist collaboratively explore ways in which technology could accommodate the student's needs. This is a multi-faceted step involving a hypothesis, training, practice, evaluation cycle that may run over time and involve ongoing consultations and adjustment until the new technology is thoroughly tested and integrated into (or is rejected from) the student's repertoire of learning skills.

Step 5: Application and Maintenance.

In this stage the student applies the technology to whatever curriculum he/she is studying. As the content and the demand of curricula change, so too, will

the types of technology which are used to accommodate those needs. Built into the model, therefore, is the expectation that this process is cyclical and ongoing.

We will now discuss these issues in relation to three groups of apprentices: the Block Release (B-R) apprentices, the Post Secondary (P-S) apprentices and the Early Childhood Education (ECE) apprentices.

Group 1: Technology as an Accommodation Block-Release Apprentices.

In an informal survey conducted at the beginning of the project, the primary need for accommodation expressed by the B-R Apprentices was to gain access -- in the sense of being able to read with comprehension—to the print material presented during the course.

Response 1: Provide access to text-to-voice technology in a 24 hour computer laboratory within the college

Hypothesizing that text-to-voice software would provide the needed access to print materials for individuals who self-identified as having reading problems, we offered individual training sessions with text-to-voice software. We provided a copy of the textbooks in alternate format and offered unlimited access to the laboratory with ongoing training and technical support. In spite of wide publicity, it quickly became evident that B-R apprentices – for many reasons – would not respond to support offered in this format. Almost no one showed up to ask for training or to use the publically-available computers. Among the reasons given for not making use of the computer laboratory were: a full classroom schedule, home responsibilities, unfamiliarity with computers, and skepticism that computers could help. Unsaid, but likely true, was an unwillingness to self-expose vulnerability in a public computer laboratory.

<p>Lesson 1: The format in which a service is offered can act as a significant barrier.</p>

Response 2: Develop a loan and training service

In response to Lesson 1 we purchased a bank of laptops computers, installed them with adaptive software, and offered a loan service in which individuals could borrow a computer for the length of time they were in the college. Hypothesizing that B-R apprentices need a “here-and-now” form of support we reduced the first three steps in the Technology-Accommodation model to a brief interview leading directly to the training and practice step in the model. Each borrower was given an individual, one-hour training session on using the Kurzweil 3000 program as a text-to-voice reading tool. The major study

skills tools (e.g., colour highlighters, sticky notes, extracting text), the writing and editing tools (e.g., spell check, word prediction, inserting pictures) and the language tools (e.g., word definitions, vocabulary lists) were also trained in this session. Each apprentice left this 90 minute assessment, training and practice session with a laptop computer for his/her home use and a copy of their textbooks in alternate format. (It should be noted that the alternate format copy of the text was produced from a copy of the apprentice's purchased textbook.) A technologist was available five days a week during office hours on a drop-in basis, and borrowers were encouraged to return if they encountered any technical problems or if they wanted to learn additional study techniques.

Effectiveness of the Loan/training Service

We evaluated the effectiveness of this one-stop, in-and-out form of accommodation in three ways: in the number of computers which were borrowed during the project, in a survey in which the participants rated the service, and in an analysis of how the computers had been used by the apprentices.

1. Number of computers borrowed

Over the course of this project which lasted three years apprentices borrowed computers 171 times. This number includes the repeat borrowers, many of whom phoned ahead to reserve a computer each time they returned to the college for the in-school portion of their training. The number of repeat requests and the number of laptops which were loaned out was taken as an indication that there was a need for this type of intervention and that it was serving the needs of at least some of the apprentices.

2. Survey Results

Each borrower was asked to complete a survey rating the impact which the technology had on their functioning in four domains. As can be seen in Table 2 the greatest positive impact was reported to be in the domain of increased independence with 75% of the respondents saying that the intervention increased their ability to learn independently. A somewhat smaller percentage said that the project increased their confidence in using computers and their knowledge of computers. Slightly more than half of the apprentices said that their academic knowledge was improved as a result of the project.

Table 2: Responses to Questions on Survey on the Effectiveness of the Accommodation: Block Release Apprentices

In comparison to my skills before I participated in this project:				
	# of responses	worse	The same	better
My knowledge of computer programs is	59	0%	31%	69%
My confidence in using computers is:	59	0%	34%	66%
My ability to learn independently is:	59	2%	24%	75%
My academic knowledge is:	57	0%	44%	56%

3. *How the computers were used*

As a measure of the way in which the apprentices actually used the loaned computers, we selected, at random, 27 of the computers as they were returned and calculated the number of hours the computer had been used as a reading machine (i.e., the text-to-voice application) and the number of times in which the study, language, and writing tools had been used.

Figure 2: Number of hours Text-to-Voice Software Used

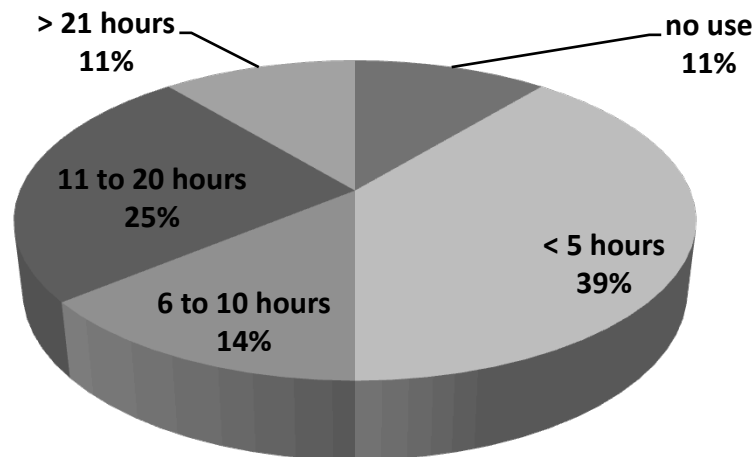


Table 3: Use of Study, Language, and Writing Tools on Loaned Computers by Block Release Apprentices

Number of Times a:	Mean	Median	Mode	S.D.	Min	Max
study tool was used	3.52	0	0	7.95	0	30
language tool was used	1.18	0	0	3.22	0	15
writing tool was used	5.67	0	0	18.3	0	95

Discussion: Effectiveness of the Loan/training Service for Block-Release Apprentices

The fact that 171 computers were loaned out, suggests that a large number of apprentices anticipate having difficulty coping with the heavy reading load which is part of their in-school training. And, as can be seen in Figure 2 about one-half of the returned computers show that the text-to-voice software had been used for six or more hours during the loan period. Surprisingly, on approximately 11% of the computers, there was no evidence that the text-to-voice function had ever been opened.

As shown in Table 3, it is evident that apprentices did not make extensive use of the language, study, and writing tools which were available on the computers and on which they had received some training. While some

apprentices made good use of these tools as can be seen by the maximum use column, a majority opened less than 5 times the study tool (i.e., 85%), the writing tool (i.e., 81%) and the language tool (i.e., 93%).

These results suggest that the technology as it was experienced in this situation was highly successful for some apprentices, but only moderately successful for others. There are several possible hypotheses for this result.

Hypothesis 1. There was not enough training provided.

Each borrower received a minimum of one hour of direct training on how to use the computer software as a reading machine and as a study aid. Despite the offer of ongoing support and training in how to use the different study techniques, very few apprentices utilized this extra support. It would appear that the payoff was not seen as great enough to warrant the time needed to learn, and to become proficient with the computer applications.

Lesson 2: The process of learning new technologies can be seen as a barrier. "I do not want to learn something new to learn something new." A comment made by an apprentice

Lesson 3: To be used effectively adaptive software must be overlearned to the point of automaticity

Hypothesis 2. Text-to-voice technology is an accommodation for only some types of reading difficulties

A difficulty in reading text can be the result of different causes. If a person's internal language and oral language are intact, for example, and the problem is one of translating the visual symbols of print into their auditory equivalent, then text-to-voice software can be very effective. However, if the person has fundamental difficulties in language production, in understanding word meaning, or holding sequences of language in short-term memory, then the simple fact of hearing the words may not be enough to improve comprehension. This difference in types of disability may explain why the software worked well for some, but not for others.

Lesson 4: Differences in learning style determine the effectiveness of computer technology.

Hypothesis 3. The format in which block release training is provided for apprentices is a barrier to learning and using new technologies. New technologies take time and practice to learn and to integrate into one's study repertoire. Many apprentices, especially those with ongoing learning

problems, do not come with the platform skills needed to learn new technology quickly, especially in a fast paced and demanding environment such as that of the block release format. It is quite likely that those apprentices who needed the technology most were those who were least able to learn it in the format in which it was offered.

We now turn the discussion to the second group of apprentices who participated in this project, those who were full-time students as well as being fully registered apprentices. Typically, these apprentices spend 32 weeks of in-school training, followed by 16 weeks of on-the-job training, and a final 16 weeks of in-school training.

Group 2: Technology as an Accommodation Post-Secondary Apprentices

When asked to identify the greatest barriers to success in their programs, post-secondary (P-S) apprentices invariably nominate three factors: the vast amount of print material which they must read and understand, their need to write lab reports and other material using conventional written language, and third, their ability to make study notes while listening to lectures.

In exploring how computer technology could be used to reduce the barriers of print language for these apprentices, we found that post-secondary apprentices had several distinct advantages over the block-release apprentices. First, as many of the P-S apprentices come directly into the college from secondary school, their recent experience in secondary school with computers makes them less skeptical about the promise of technology, and less hesitant to try new technologies. As full-time students in a college program, apprentices who have a documented disability and who can show financial need, have access to a bursary which they can use to purchase computer equipment for their own use. This gives P-S apprentices a huge advantage over the B-R apprentices who do not have access to this form of support. Third, because their apprenticeship program is spread over at least a full academic year, the P-S apprentices have the advantage of time which they can use to test out equipment, and to practice new techniques, all factors which lead to better long-term integration of new skills into their learning repertoire.

Lesson 5: In comparison to B-R apprentices, P-S apprentices are better able to participate in technology-accommodation approach with its repeated assessment, prescription, training, and testing cycle.
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Case Study: John The Technology-Accommodation Model of Support

This case study of John (a pseudonym) will illustrate the five steps of the Technology-Accommodation model. It will demonstrate both the power and the limitations of technology in reducing the barriers which could prevent skilled persons from successfully completing the in-school portion of their apprenticeship training.

Step 1: Background

This 21 year old man, who is registered as post-secondary apprentice in a motive power program, was first diagnosed with a learning disability while in elementary school. The school system in the rural community where he grew up accommodated his disability by modifying the curriculum and giving him exam accommodations, but there is no evidence that he was ever in a special education class, or that he received specific remediation and training around his disability. Currently, he is living with a relative in an apartment. He says that he has enough money to get through the year, and that there are no other concerns that will interfere with school.

Step 2: Establish Academic Needs: Strengths and Weaknesses

John said that he has trouble reading and writing. He says that he is good with his hands and in seeing things. He wants to be a licensed mechanic and feels that he will be successful if he can get through the school portion. John believes that he can learn the material but he cannot read the textbook, and because much of his learning and the testing of his knowledge will depend on his ability to decode print language, he is justifiably concerned. Based on his fluency with oral language, it is possible that the difficulty which he is experiencing extends beyond decoding print and producing written language, and is likely language based, involving his knowledge of words and his ability to express ideas.

Reading Comprehension

A recently assigned reading from his textbook was used to test his ability to decode the words. This is shown below in this passage he was unable to read aloud approximately 13% of the words (shown as “stroke-throughs” below). With this number of errors, his comprehension completely broke down and he was unable to explain the meaning of the passage.

“Personal computer software packages are available to help you properly interpret scope patterns and set up various types of lab scopes. These also

contain an extensive waveform library that you can quickly refer to and find what the normal waveform of a particular device should look like.”

Written Language

The passage below, taken from an email from the student, illustrates the difficulty which he experiences in translating his thoughts to paper.

“my rents came back from Florida thats week. They bran a bag of oranges that they got back from Florida. The oranges was not that good, its not that hot there so the oranges did not grow that good.”

Lesson 6 : An assessment should be brief and should focusing on basic skills using real materials

Step 3: Technology Assessment

Although John’s experience with computer technology was limited to games, telephones, and using some applications, he was positive about the potential of technology to help him. He liked the idea of using state-of-the-art, hand-held applications and he certainly was prepared to try new techniques. This willingness to use new technologies had strict limitations, as can be witnessed in his reaction to the Intel Reader. When he used the Reader in the laboratory he acknowledged that it had excellent features, but in the end, he rejected using it because its size (he believed) would draw attention to him and to the fact that he had a disability.

Lesson 7: “I can’t use it because it is too big.” Even when potentially helpful, technology will be rejected if it is viewed as being disability-specific.

In this step in which we used technology as an assessment tool we returned to the paragraph from the textbook above (i.e., the one in which John could not read well enough to comprehend). He was shown how a voice-to-text application could allow him to hear the words which he previously could only see. When technology allowed him to hear as well as see the paragraph, his comprehension increased dramatically. The key was the word *scope*. Once John was able to connect the printed word *scope* with the aural word *scope*, the passage became meaningful and he was able to explain that “this software program makes it easier to read the waveform.” It was clear the technology had the potential to improve his reading comprehension.

Lesson 8: When used as an assessment tool, technology can be used to measure both current functioning levels and potential functioning levels.

Step 4: Prescription. Training, practice, and ongoing support: a cyclical process

The prescribing, training, testing, and adjusting cycle in which technology is applied to a variety of identified issues was repeated many times for John. Here are some examples of how this student used technology as an accommodation.

Dictionaries and Visuals. For individual words which he did not understand even when he had heard them pronounced, John became adept at applying the voice-to-text software to hear the dictionary meaning of the word. The internet also would provide him with pictures of objects.

Internet Videos, online encyclopedias, and other internet features are valuable tools in aiding reading comprehension for apprentices such as John, who commented “ Words don’t seem as good as actually seeing something.”

Technology and written language

In an English assignment, taken as part of the apprentice program, he was required to write a short response to passage in which the author argued that the voting age should be raised. John wrote:

“That young adult don’t pay much atensh in palatichis theys days. Young adult from 16-20 will be working or gagating high school so they will not keep up day on palatics. The people that are in high school will be doing there study’s and the people working will be more inshid in hanging out with friends.”

1. voice-to-text software.

Even after training and practice, John was forced to reject voice-to-text software as being unsuitable for him. Voice-to-text software requires some verbal fluency, and an ability to recognize transcription errors. Because John could not put words together into complete sentences without several false starts and mispronunciations, and because he could not recognize whether the resulting transcription was accurate, this software did not work for him.

2. Other technology supports.

Writing sentences was a time-intensive, laborious task for John. With technology, however, he was able to improve the quality of his work to the degree that the intent of his written communication – while not perfect – was comprehensible. When the green or red underlines provided by his word processing package warn him that he has spelling and grammar errors, he first tries to correct the misspelled word by playing with various combinations of the existing letters. If that technique is unsuccessful, he changes his strategy and moves to a word prediction software where he hopes to recognize the correct word. He might also try to Google it to see if its word prediction feature is helpful. Very often his spelling is so far from being correct—as can be seen in the example below -- that he cannot possibly find (or recognize) the word he wants. As a further complication the red underlines which appear to warn him of a spelling mistake, sometimes incorrectly identify acronyms or names as being misspelled. This leads to a circuitous – and frustrating – search for the correct spelling.

In spite of the difficulties, with these technology supports John was able to improve the paragraph above to this extent:

“Young adult don’t pay much attention in politics these days. Young adults from 16-20 will be working or graduating high school so they will not keep up to date on politics. The people that are in high school will be doing their studies and the people working will be more interested in hanging out with friends.”

However, there were limitations on how far he could push the technology. Very often his spelling is so far from being correct that he cannot possibly find (or recognize) the word he wants. Here is an explanation of the process provided by a tutor who worked with him:

“For the sentence ‘The school uses a strict schedule’, John will type ‘The’ and then attempt to spell ‘school’. He will check the spell checker against his spelling. If he has used ‘sc’ to start, he may find the word in the list. If he recognizes it, he will choose it, and move on to the next word. If he has started the word with something else (‘sh’ or ‘sk’) he will see that the word is not on the list. He will then try multiple ways of spelling, checking the spell checker each time, until he asks how to spell it. Then he moves on to the next word ‘uses’. He would likely spell this as ‘ews’, unless he has memorized it or used it earlier in the essay. The process with the spell checker will repeat. Despite all the interruptions, John is able to keep his sentence in mind and tries to complete it. He then moves on to the next sentence, showing remarkable patience and fortitude, although it is quite exhausting for him to write the whole essay. “

Lesson 9: There are limits to the extent which technology can substitute for weak cognitive processes.

Step 5: Maintenance

John's program ran for two years. In that time, he continued to explore ways in which technology could help to compensate for his serious difficulties in language processing. He had the motivation to test out new techniques, he has the self-confidence to seek help, and he had the perseverance and patience to overcome the hurdles and frustrations which he encountered. He was fortunate in that he qualified for a bursary which allowed him to purchase his own computer equipment which was a huge motivating factor in helping him practice and integrate the techniques into his repertoire. John also had the intellectual capacity to master the theoretical content of his program, and he had selected to enroll in a field which suited his learning style and coincided with his interests, both powerful enablers for success. From a grade point average of 1.59 in his first semester, John completed the certificate level program, and then enrolled in a diploma program from which he graduated with a 3.11 grade point average in his final semester.

Lesson 10: The Technology-Accommodation model is an effective tool for using technology as an accommodation for vulnerable apprentices. Its strength is in its ability to respond to individual needs; its weakness is in its dependence on the hypothesis-practicing-testing cycle which takes time and person power.

Notetaking: An Ongoing Problem Without a Satisfying Solution

A total of 41 of the students in the P-S Apprentice cohort, self-identified as having severe difficulty creating a good set of lecture notes. A traditional recommendation is to record the lecture using a digital recorder. The theory is that the student can then make their study notes by re-listening to the lecture. Our experience in working with vulnerable learners, however, suggests that the problem is often much more complex than it appears, and a digital recorder is not an effective tool for this purpose. Very often these learners have difficulty picking out the important details, organizing the information and storing that information in written form. Most orally presented material, especially in lectures, is full of superfluous material and the message itself may be unclear. A student who has spent 2 hours struggling to understand a lecture is not likely to spend another two hours re-listening to that same lecture especially when he/she lacks the skills to create useful

study notes. A digital recorder in which the quality of the sound reproduction is often of poor quality is not an efficient tool. There are also commercial transcription services which will produce a paper copy of the oral lecture. While these services produce accurate verbatim reproductions of the lecture, for vulnerable learners the problems of using the paper copy are similar to those outlined above for digital recorders.

In the end, our solution to helping the students access good study notes was to hire a notetaker who attended all the classes, who created a good set of study notes based on the lectures, and then sent the study notes electronically to each student. This low-level technological response was highly effective for one group of students – those whose language comprehension and reading skills are not impaired. (As will be pointed out below, additional technology is needed for students who cannot read the classroom notes.) In spite of the fact that the notetaker option is expensive and does not promote independent skill development, it does remain the best option currently available to address the problem of how to create good study notes from lectures.

Table 3: Does Notetaking Help?

Question Stem: When I get a good set of notes from the notetaker:	% who checked “better” on a Lickert Scale*
My knowledge of the subject material is	100%
My confidence as a student is	87%
My ability to learn independently is	100%

*Based on the results of 15 participants

Lesson 11: Many vulnerable learners have difficulty learning from a lecture format. Technology can provide a verbatim record of the lecture but that does not provide the synthesis and organization that vulnerable apprentices need.

Group 3: Technology and Accommodation ECE Women

While the Technology-Accommodation model is typically designed for dealing with individuals, in this case it was applied to a group of apprentices who shared a common set of needs and were facing a common set of barriers.

Step 1. Background

Because of upcoming changes in regulations governing the qualifications needed to work in childcare facilities, this group of 11 women is taking courses leading to a diploma in Early Childhood Education. The course which is of concern in this discussion, is offered only in an online format.

Step 2: Establish Learning Needs

In addition to being intimidated by the demands of an online course and the content of the course, a number of these women faced added barriers. Several had been educated in a different language, they all had full-time jobs with major home and family responsibilities, and they had all been out of school for many years. Finally, the curriculum which they faced is filled with technical language, and all of their assignments needed to be written using standard academic format and language.

Step 3: Assessment of Technology Experience, Skills and Potentials

When they enrolled in the course these women had almost no experience using computers. They did not know, for example, how to sign on to their courses, how to correspond using email, or how to use the basic word processing functions. Furthermore, computers are intimidating. While these apprentices all had a computer at home, they seldom used it. The home computer was seen as belonging to their husband or their children.

Step 4. Prescription, Training, Practice

Establish Study Group.

Because of the low computer literacy skills, the urgency of the situation, and the similarity of the learning needs (assignments were already overdue) the researchers organized a study group which met weekly in a computer laboratory in the college. This was feasible because the women all lived within the geographical area of the college. While the group was designed to be a multi-purpose group including a tutoring component, the initial task was to address the pressing problem of how to navigate the learning management system, and how to perform basic computer operations including how to open a document, use email and submit class assignments. These access skills were taught directly in a group. Every member of the study group was also given continuous access to the computer laboratory. This allowed them to come together as a group, or to work independently using fully functioning equipment equipped with a variety of supportive software including word prediction, voice-to-text, and text-to-voice software. Once the technology

learning curve lessened, the subject matter experts assumed the responsibility of providing support in the course content. This wrap-around service which included a combination support system of a subject expert and a technologist was essential the success of these apprentices.

Teach “Essential-Only” skills.

These students did not have time, energy or desire, to learn and practice any computer skills that are not absolutely essential and transferable to the curriculum issues they faced. The research team analyzed the minimum number and lowest complexity of the computer skills needed to complete their assignments. Reference sheets were created as needed and students were given lots of repetition and practice. Other short-cuts were devised. For example, when several students had ongoing difficulty finding their way to the weekly assignments we provided them with memory sticks on which the assignments were already loaded.

Lesson 12: Short-cuts, and menus are legitimate forms of adaptive accommodations for vulnerable learners
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Step 5: Application and Maintenance

Through the remainder of the course, the technologist set aside a drop-in time each week where students could come with their computer-related problems. He was also available by appointment or by telephone to address questions of a technical nature, such as questions involving word processing functions. He also helped when students “lost” a computer file or when they wanted to scan material. Equally important, but often forgotten, is the cheerleading and coach role which the technologist often performs for vulnerable and insecure learners.

Conclusion: ECE Women

This example of the ECE women demonstrates the limited role which technology can play in supporting vulnerable learners especially when there exists a wide gap between the skills of the participants and the demands of the task. The need for a realistic task analysis with a realistic and flexible response to the presenting problems of the learner is highlighted in the example of the ECE apprentices. This example also highlights the importance of the human contact in supporting and sustaining vulnerable learners who must use technology to improve their trades-related skills.

Summary: Stream 1

Technology has a central role to play in providing appropriate accommodation for vulnerable apprentices who are upgrading their trades-related skills. Nonetheless, there are clear limitations, cautions and guidelines that must be considered:

1. Because of the highly stressed and intense format in which the in-school component of apprenticeship training is offered, apprentices who will only use technology which they see as having a very direct benefit to them. For apprentices such as those in the block release or the ECE programs, technology must meet the test of being “Just enough and just-in-time”.
2. Software applications are time-consuming to learn, to practice and to integrate into one’s repertoire. To be really useful, they must reach the level of automaticity.
3. When the goal of the assessment is to improve the academic functioning of the vulnerable learner (as opposed to making a diagnosis of disability) the Technology-Accommodation model of assessment and support has distinct merit.
4. The limitations of technology as an academic accommodation should be acknowledged. Technology can translate symbols into their auditory equivalent, for example, and it can provide ready access to alternate explanations. Technology can also provide applications that help with the storage and organization of knowledge; however, technology cannot synthesize complex lectures, and it cannot “teach” comprehension.

Section 4: Distance Education

In the second stream of this project, the focus shifted to distance education and the question now became one of how technology could support the academic needs of vulnerable learners who were using distance education as their vehicle for upgrading their trades-related skills. The issue was whether the Technology-Accommodation approach could be combined with video conferencing software to create a virtual learning environment in which a tutor/mentor supports disadvantaged learners studying at a distance. The video conferencing program chosen was a commercially available program Elluminate Live whose features include web cams, white boards, application sharing and file transfers.

The feasibility of the approach which is labelled a human-technology model of distance tutoring was evaluated in three formats:

Format 1: Post-secondary apprentices using a combination of face-to-face lectures and distance support.

Format 2: Unemployed workers using Essential Skills Curriculum and distance education; and

Format 3: Pre-apprentices upgrading their skills at a distance.

Format 1: Blended Model

Here the traditional lecture format of presenting information, was supplemented with distance group-tutoring using web conferencing technology. For students, who are experiencing difficulties with the lecture material, the professor provides periodic after-hours tutoring assistance using video conferencing software. The periodic distance education tutoring sessions regularly attract between twenty and thirty students who use their home computers to sign into these evening support sessions. While most of these post-secondary apprentices had their own equipment with which they could access the tutor sessions from home, the researchers loaned equipment to any who needed it. As can be seen in Table 1, over 90% of the students say that distance tutoring increases their knowledge in the subject material, and over 87% say that they are more confident as a result of the extra tutoring. It is evident that students respond positively to the use of technology when it directly supports their identified learning needs.

Table 4: Responses from P-S Apprentices who Participated in the Web Conferencing Tutoring Project

In comparison to my skills before I participated in the project _____	# of responses	Worse	Same	Better
		%	%	%
My knowledge of the subject material is:	40	0%	7.50%	92.50%
My confidence as a student is:	40	0%	12.50%	87.50%
My ability to learn independently is;	42	9.50%	21.40%	69%
My ability to use web conferencing software for learning is:	40	0%	10%	90%

Format 2: Distance Education Accommodation (DEA) bundles

While the P-S apprentices generally had access to their own computer technology, this was not the case with the under/unemployed workers or the pre-apprentices who will be discussed in the next two sections.

To address this need for computer Distance Education Accommodation Bundles (DEA-bundles) were developed.

A DEA-Bundle (pictured below) consists of a netbook computer chosen primarily because of cost (i.e., approximately \$500), capability (netbooks can handle the functions needed in an online environment), size (a distinct advantage for shipping and handling) and operating system (Windows XP has advantages in terms of ease of use, and stability). Each computer was installed with a range of adaptive software which included Kurzweil 3000, and Word Q., and a series of labels and a photo sequence chart were designed to aid the learner in setting up the computer.



Tutoring using the DEA-Bundle.

Distance tutoring using DEA-bundles increases the complexity of the tutoring experience. Now, the reliability of the technology becomes essential. Not only were the underemployed workers and the pre-apprentices inexperienced with technology, but they also were intimidated by technology – and like the B-R apprentices – they were skeptical about the power of technology to help their learning. A second important determinant to success is the relationship between the tutor and the learner. While this relationship is important in all tutoring experiences, in distance education, it may be the vital ingredient that predicts the potential success of the model.

Training on the use of the equipment.

As part of their DEA-Bundle package, each learner was given a picture sequence which they could follow to set up the computer. Two of the pictures used in the picture sequence are shown above. At a pre-arranged time, (with the tutor on standby connected by a telephone) the learner assembles the bundle, turns on the computer, and double clicks on the videoconferencing icon. This opens the videoconference where the distance tutor greets the learner and begins instruction on how to use the equipment, how to use the adaptive software, and how to apply it to the curriculum.

Establishing a supportive relationship.

The sense of isolation which results from having to learn on one's own, apart from others, can be a powerful disincentive for those who are using distance education. The lack of the social support of classmates increases the barriers to success when the learner is already insecure about his/her academic abilities, and study skills. A trusting and supportive relationship between the learner and a tutor, who can play a multiple roles for the student – including supporter, problem-solver, technician and teacher, is central to the technology-accommodation model.

The DEA-Bundles in two different formats were used with the Woodstock group. The outcomes of the Woodstock project are described below.

Woodstock group

The Woodstock group consisted of 27 individuals who live in a largely rural area which is heavily dependent on the automotive industry. With the recent downturn in the economy and the collapse of the automobile industry many of this group is unemployed. The 27 learners were divided into two groups: Group A and Group B. While both groups were using the Essential Skills curriculum as a tool for upgrading their skills and for strengthening their job resumes, there were important differences in the way in which we structured the learning environment.

While every learner was loaned a DEA-Bundle and an electronic version of the curriculum, and every learner worked independently through the Essential Skills curriculum, those in Group A were also given a paper copy of the curriculum, and given a choice of whether to work with pencil and paper or electronically. They were provided with a weekly group drop-in session

hosted by a curriculum specialist and a technologist. At other times, they had the option of accessing online support from a curriculum specialist.

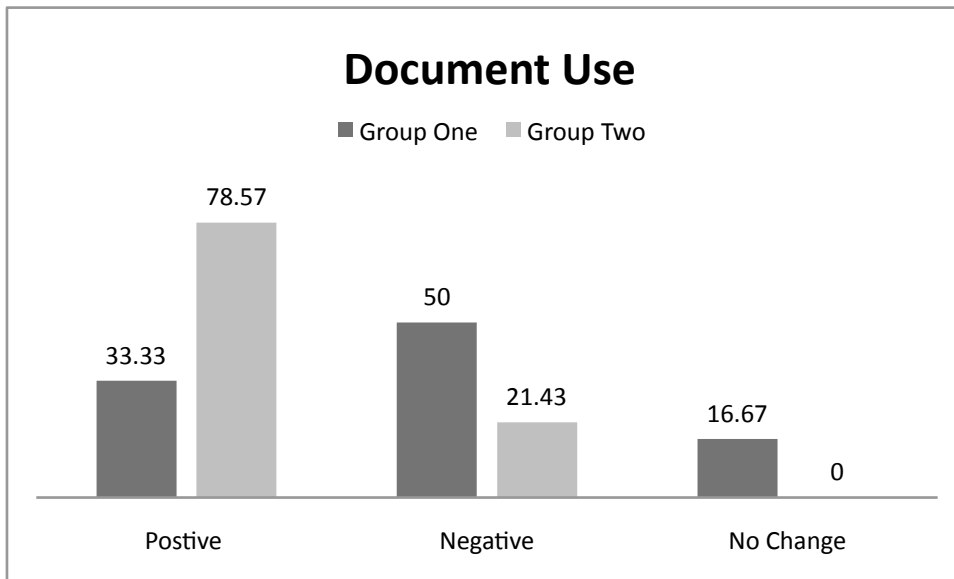
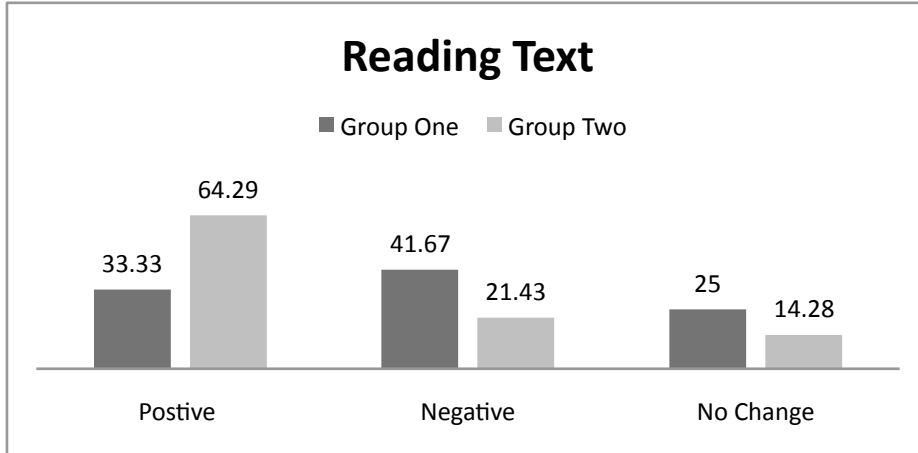
Group B was offered an electronic version of the curriculum, they were given several hours of weekly one-on-one tutoring using web conferencing technology, they also had access to email and telephone support, and they also had access to group drop-in times. At the beginning and the end of the project each participant wrote a TOWES test which served as a measure of academic growth.

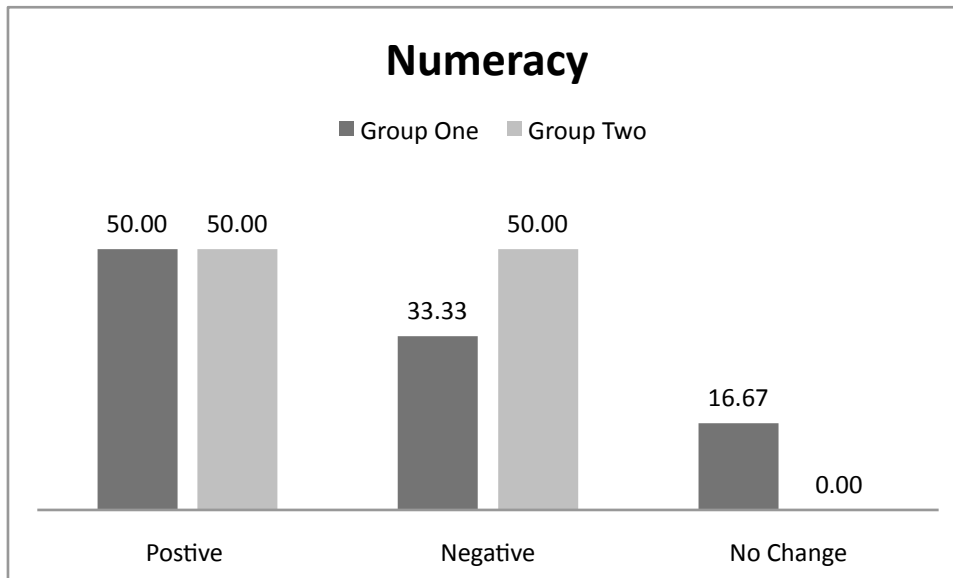
Figure 3 shows the post-test results for Group A and Group B expressed as a percentage of the participants whose scores improved, deteriorated, or remained the same. As can be seen, the percentage of participants who improved their scores in reading (64% for Group B and 33% for Group A) and in document use (79% for Group B and 33% for Group A) was higher in Group B than for Group A. For numeracy there were no differences with each group showing a 50% improvement rate.

While these results are speculative, they do suggest that the human/technology web conferencing model, as a tutoring technique, may have the power to improve the learning for unemployed and underemployed workers using distance education. There are several possible explanations for this finding. As opposed to Group A who were offered tutoring help at a set time each week, the members in Group B were allowed to choose a convenient tutoring time. This greater flexibility may have meant that the participants in Group B were able to spend more time on the learning task.

The second hypothesis focuses on the relationship between tutor and student. The members of Group B were paired with one tutor. Knowing that someone was waiting for them on the other end of the computer, may have encouraged some people to attend their tutoring session when otherwise they may have chosen to do other things. Finally, the novelty of using a computer for web conferencing may have encouraged others to participate in tutoring more frequently than they might have if tutoring was offered in a different format. The reason why Group B did not show an equal superiority in the percentage who improved their numeracy scores is unclear and will require further research.

Figure 3: The percentage of participants in Group A and Group B whose scores on the TOWES test improved, deteriorated, or remained the same on the post-test





Pre-Apprentices: Aspiring Chef

In this case, Steps 1 through 3 were done face-to-face. Steps 4 and 5 were done through distance education using the Elluminate Live software.

Step 1: Background

This young man has a long history of learning difficulties which were so severe that his entire elementary school experience was in special classes and in secondary school he was placed in a program for students who are developmentally challenged. He has a pension from the Ontario Disability Support Program (ODSP). For several hours each week he works in a restaurant kitchen where he does dish washing and food preparation. He aspires to upgrade his skills and to get further training. His goal is to have a full-time job working in a kitchen where he will earn enough money that he no longer qualifies for a government pension.

Step 2: Establish Learning Needs: Strengths and Weaknesses

An informal academic assessment showed that:

1. His reading decoding skills and his comprehension are at a functional level.

“I asked him to read from a standard recipe for Chicken Corn Chowder taken from the internet. Although he did not know the words carcass, shallot or translucent, he could follow the directions for the cooking and appeared to have little difficulty understanding the steps and remembering them.” [note from assessment]

2. Math Skills are very weak.

He could add a simple column of numbers using carrying, and he could check it with a calculator. He had difficulty in borrowing in subtraction although he understands the concept of subtraction. He has some knowledge of metric and imperial measurements.

3. Written communication is very weak

“ hey i left a meg on your phone and i found more of what i have and the book i took my notes in that i found is whmis front of the house training guide and a shit that tell the cook responsibillites and a occuption skill and thask chart and my sanitstion” [Student reporting on course he had taken]

4. Highly motivated to find permanent employment .

“ok thank you and i just want to thank you for takeing the time to help me get in to school like this it means a lot to me” [student note to counsellor]

5. Appears to have fundamental student skills.

“He certainly has the skills of understanding and being able to follow through on appointments. He has appeared exactly on time for all appointments even though they are separated by several weeks.” “Has maintained job for extended period.” [counsellor interview note]

6. Potential Distractors (financial, medical, housing).

“Lives with parents who are supportive, and provide a stable environment.... ODSP support”.... “No evidence of other distractors.” [counsellor interview note]

Step 3: Prescription.

Has high speed internet at home; uses a computer to play games, send messages, and search the internet. Peter (a pseudonym) was loaned a Dea-Bundle and he was introduced to some basic study techniques including how to use pictures and videos from the internet to aid his comprehension of cooking words such as shallot and translucent, and how to use word prediction to improve his spelling. From there, Peter was referred to his distance education tutor.

Step 4: Intervention and maintenance.

The technologist participated in the first tutoring session and then withdrew to become a consultant for technical problems. The tutor, who has never met Peter face-to-face developed a basic skills upgrading program which concentrated on materials taken from a chef's training course. The appropriate technology accommodations were introduced, trained and practiced as needed. What follows is a sample of the tutor notes submitted by the tutor:

Component 1. I sent the following text by email and had him read it to me online. I then gave him questions to answer by looking at the text: "Food Storage Safe storage of food will help prevent the spread and growth of harmful bacteria. Dry Good Storage (For food that does not require refrigeration, e.g.: flour, sugar, cereals, canned goods) Storage rooms must protect the dry goods from freezing, - WORDS HE HAD DIFFICULTY READING constructed, immediately, hazardous, readable, accurate, indicating, circulation, explosive QUESTIONS ON THE READING 1. Why should food be kept off the floor and away from walls in walk-in coolers? - He needed help to find the answer in the text. 2. How should bulk foods be stored?

Component 2. I gave him random sentences to complete. I have written the sentences with his choices underlined. 1) Food should be stored in a refrigerator so the food doesn't go bad. 2) Care should be taken when using knives to prevent cross contamination. 3) All working areas in a kitchen should be kept clean. 4) As part of personal hygiene always wash your hands. 5) Spills on the floor should be cleaned mopped.....

Component 3. Worked on measurement conversions using the measurement conversion chart and the fraction chart. He's hit and miss on the fractional measurements but we will work on some strategies to help . "

Conclusion.

As this example of Peter shows, tutoring through distance education performs best when there is a strong human component built in to the model. The tutor takes on a more multi-dimensional role than is typical in most tutoring environments. In distance education tutoring the tutor adds the role of coach and technician to that of subject expert.

Summary: Stream 2.

1. The technology-accommodation model of assessment and intervention works equally well through distance education as it does through the traditional “face-to-face” approach.
2. By allowing oral communication and “face-to-face” viewing, web conferencing programs such as Elluminate Live, reduce the keyboard barrier faced by vulnerable learners whose poor written language skills are exacerbated when they must communicate through a keyboard.
3. The whiteboard, application sharing and other features of web conferencing programs designed for the educational environment are reasonable alternatives to the traditional paper based approach to tutoring.
4. The role of the tutor is central to the success of this human-technology model of distance education tutoring.
5. The additional costs involved in loaning out equipment to the learners are offset by the saving in travel time and costs, space rentals and other costs inherent in a traditional tutor model.

Conclusion: Essential Skills Online: A Consortium Approach

Based on our research it is possible to make some generalizations about the role of technology in improving the quality of learning for academically-vulnerable individuals who wish to improve their trades related skills.

The evidence is that technology has the power to open up learning for apprentices who are vulnerable learners. This improved access to knowledge is accomplished in a variety of ways:

1. By mitigating the barrier of print language.

In academic environments, such as those encountered by the learners in this project, print language continues to be the major conduit to ideas, and the ability to use print language effectively continues to be the cornerstone of the evaluation of knowledge. With its power to translate the visual symbols of print language into their auditory equivalent, and conversely, by translating

oral language into print language, technology allows vulnerable learners to access and express knowledge in ways that suit their learning style.

2. By allowing ideas to be accessed in a variety of formats and from different sources.

Technology, with its ready access to the internet allows learners to sample videos, diagrams, alternative explanations, and other representations of ideas all of which improve the quality of the learning. Applications which read the print on the screen increase the accessibility of the web material.

3. By creating alternatives for weak cognitive processes.

Hand-held organizers which hold multiple layers of information are easier to use than paper organizers, photos from cameras can substitute for extensive notes, and highlighters, cut-and-paste and search features increase the quality of information storage and retrieval.

4. By increasing the opportunity for independent learning.

Technology allows learners to work more independently than would be otherwise possible. This has the direct benefit of allowing the learner to spend more "time-on-task" because he/she is no longer dependent on the schedule of others.

5. By reducing the barrier of keyboard communicate in distance learning.

By allowing the learner to interact face-to-face with the tutor using oral language, the web conferencing approach to tutoring outlined above, allows vulnerable learners to a natural approach to learning without having to communicate through a keyboard.

At the same time, there are real limitations and boundaries in the extent to which technology can compensate or accommodate the learning difficulties experienced by vulnerable apprentices. These limitations include the extended time needed to master the technology, the inability of the technology to compensate for some individual learning difficulties, and the costs involved in purchasing technology.

