

CONTEXT SITUATED ASSISTIVE TECHNOLOGY TRAINING AND ITS IMPACT ON ENGAGEMENT, LEARNING OUTCOMES, AND ASSISTIVE TECHNOLOGY ADOPTION

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Context Situated Assistive Technology Training and its Impact on Engagement, Learning Outcomes, and Assistive Technology Adoption

Abstract

This qualitative research study investigates a model of delivering assistive technology training to adult students with a variety of disabilities who are enrolled in academic upgrading classes at a Canadian college. The purpose was to examine whether an academic subject context for assistive technology training delivered by Academic Strategists impacted students' engagement in classes, independence, completion of learning outcomes, and adoption of assistive technology. The model of assistive technology training used in this study utilized subject area Academic Strategists to deliver assistive technology training in the context of their regularly scheduled academic strategies sessions.

The findings reflect advantages to this model which include students' perception of the relevance and direct application of training; strategists' ability to individualize training based on students' strengths, preferences, and conceptual abilities; and strategists' knowledge of course content. Disadvantages include strategists' lack of AT knowledge and students' desire to master course content over learning AT during strategies sessions. The findings also indicated that the degree to which AT was instrumental in fostering engagement and independence varied between students, but all felt that AT made it possible for them to complete their courses. Instructors, however, did not note an appreciable difference in student engagement after AT training.

Accuracy of AT assessments, student characteristics, and training contributed to integration or abandonment of the assistive technologies. A number of unanticipated but significant findings emerged in addition to those related to the research questions. Recommendations include accurate and timely AT assessments, knowledgeable and skilled staff, timely application of AT, and prior learning of computer skills. These recommendations reflect more general concerns for modifications to the training model and a review of the AT assessment and equipment procurement process.

Background to the Study

NorQuest College is a post-secondary institution in Edmonton, Alberta, with a mandate to offer educational opportunities in a supportive environment to students who face barriers. The College is a leader in meeting the needs of adult students with disabilities and is actively engaged with various municipal and provincial organizations to support and advocate for the needs of adult students with disabilities. As the number of adult students with disabilities in our College increases, staff and faculty are challenged to meet the needs of this population and ensure accessibility to course content. One aspect of support for students with disabilities is providing assessment and subsequent training in the use of assistive technology (AT). See Appendix A for a glossary of terms relevant to this study.

Students at NorQuest College may participate in the AT model under discussion through several routes. They are often identified at the Office of the Registrar when they apply. They may also self-identify, be referred by an instructor after registration, or be referred by external programs such as the Workers Compensation Board (WCB), Assured Income for the Severely Handicapped (AISH, Government of Alberta), or an employment counsellor at Alberta Employment and Industry (AEI) which includes funding through Disability Related Employment Services (DRES).

Students from all sources are referred to Learning Support Services (LSS) at the college, where each student is assigned to a Student Support Specialist (SSS). If the SSS identifies or suspects disabilities that are less visible, the student may be referred for an Educational Psychology assessment. After all SSS assessments are complete, the student may be referred to an AT Specialist who does an assessment to recommend and facilitate acquisition of equipment and software, and training to overcome technology induced barriers.

The college operates a lending program that allows students to borrow equipment through the library, and the college provides an AT lab with specialized AT equipment and software. In addition, classroom instructors may require orientation to the needs of

students with disabilities. For example, they may be required to use a wireless microphone or to facilitate audio recording while lecturing.

Funding at NorQuest College is most often provided through DRES, which is the funding mechanism for accommodations in Alberta. As DRES is a program through Alberta Employment and Immigration students must have a career goal in order to access funding. Students in career programs (a diploma or certificate program) qualify for a Disability Student Grant (DSG). Presently, the greatest number of students at NorQuest College who are accessing services are adult literacy and academic upgrading students who are funded through DRES. In other post-secondary institutions offering diplomas and degrees, the majority of funding is through DSG. Other potential sources of funding include WCB, and private family resources.

At the Assistive Technology Outcomes Summit in Chicago, Illinois (December 2005), a cadre of experts from general and special education met to clarify the inherent issues related to the effects of assistive technology (AT) on educational outcomes. A recurring theme of the AT Outcomes Summit was the need for a research base that demonstrates the effectiveness of AT for student learning and a need to identify common outcome measures related to achievement (Parette, 2006). The current focus on “accountability in education” requires funders who support students, institution administrators, and classroom instructors to use data-driven decision-making processes when making recommendations to support students. Although professionals who work directly with students who have disabilities agree that assistive technology results in improved performance and a more level playing field for these students, summit delegates acknowledged the existence of a “technology implementation paradox.” Instructors and administrators are hesitant to implement AT in the absence of proof, but the proof of effectiveness cannot be achieved without implementation (Parette, 2006 pg. 20).

A further challenge in measuring outcomes of AT is to “tease out” what really makes the difference for disabled students who succeed. For example, was it the AT, the support of instructional strategists, the supportive classroom instructor and environment, or the motivation of the student that resulted in a positive outcome? In terms of “proving”

effectiveness, researchers advocate a need to identify the ultimate goal we have for students and then to determine how to measure the achievement of that ultimate goal (Parette, 2006). The ultimate goal for students in this research study was engagement, as measured by course completion and class participation. An additional goal was for students to integrate AT across courses and into their personal lives. Measures to determine accomplishment of these goals include course completion records, classroom instructors' observations, Academic Strategists' observations, and students' perceptions of their success.

There is a need to research the use of AT for adult student populations—specifically students with learning disabilities, attention deficit disorders, psychiatric disabilities, and other health impairments (Ofiesh, Rice, Long, Merchant, & Gajar, 2002). In a survey of 163 members of the Association on Higher Education and Disability (AHEAD), researchers found that there is an ever-increasing use of AT across disabilities, yet “No previous research from secondary settings exists on the actual use of AT across differing conditions of disability.” In addition, there is “. . . a limited to non-existent research base on the effectiveness of AT with a variety of disabilities.” (Ibid. p. 99) A goal of our investigation is to add to the existing research on the effective use of AT across disabilities in a post-secondary setting in order to justify the provision of AT to adult learners and to explore effective means to facilitate AT training.

In current research, there is little discussion of who should actually deliver AT training. Several researchers support a “team concept” of AT assessment, training, and adoption to facilitate inclusion and independence (Calloway & Shaffer, 1996; Kintsch & DePaula, 2002; Parette & Hourcade, 2003). Training is seen not as a single event, but rather as an ongoing and collaborative process. In a survey conducted in 1999 by the American Foundation for the Blind (AFB), 50% to 100% of most public agencies indicated that they used outside contractors to provide AT training to their consumers (Wolffe, 2003). Outside contractors were seen to be experts in their field who could travel to consumers' homes, deliver training in a timely manner, and alleviate the demands on in-house staff's time. However, the frequently identified disadvantages included prohibitive costs, lack of quality control, and lack of accountability.

A further challenge identified in the AFB survey was the variability in teaching skills among AT Coordinators who work in public or private agencies. This variability was due to a lack of teaching skills and lack of access to continuing education to update skills and instructional methods. In a descriptive report, the author outlined a pilot course in teaching skills offered to Assistive Technology Coordinators, and underscored the importance of sound instructional strategies in the delivery of AT training (Candela, 2003).

Another challenge identified by the AFB survey was the difficulty of public as well as private agencies to recruit and retain AT Coordinators. The demands of adjusting to new operating systems and applications while maintaining current training platforms leave little time to develop sound teaching strategies and to deliver training (Wolffe, 2003). AT Coordinators may have little formal training in instructional methods. Despite recognition of the challenges of charging AT coordinators with the delivery of AT training, this model of instructional provision is widely accepted.

In our institution, the challenges of recruiting and retaining AT Coordinators, the need to serve an ever increasing number of students requiring AT training, and the recognition that successful AT training should be an ongoing and integrated process led to our model of AT training delivered by Academic Strategists. The efficacy of this model is examined in our study.

An important factor in the adoption of AT is the degree to which technology is changed or modified to meet an individual's unique needs. Several researchers highlighted the importance of customizing an individual's AT (Zola, 1982 in Riemer-Reiss & Wacker, 2000; Scherer et al. 2005; Scherer & Gavin, 1996; Kintsch & DePaula, 2002). An Academic Strategist is best able to identify the student's unique educational needs, learning styles, and strengths, and is thus able to customize training. By working within the context of the student's educational program and by customizing training and application of AT to user preferences in an educational setting, we hypothesized that AT will become part of the student's natural educational routine.

In addition, the Academic Strategist, in consultation with the student, can explore the use of AT in an ever increasing variety of educational as well as personal contexts. The Academic Strategist acts as a liaison between the student and the instructor and can help raise the instructor's awareness, comfort level, and support for AT in the classroom. Finally, successful adoption of AT often occurs after several trials of a variety of assistive technologies (Riemer-Reiss, & Wacker, 2000; Kintsch, & DePaula, 2002). The Academic Strategist is in a position to explore the use of AT in depth and over time with the student, thereby identifying shortcomings and working with the AT Coordinator to identify additional AT needs.

Assistive devices have a high rate of abandonment; approximately one-third of all assistive devices are abandoned within the first three months of use (Scherer & Galvin, 1996). Sardone and Skeele (2003) state that "However helpful an AT device may be, it is of no benefit if it is not used." They point out that an important factor influencing the adoption of AT is teacher receptivity. AT users are more likely to discontinue their use of AT if the classroom teacher is not supportive.

Another factor influencing adoption of AT is the characteristics of the individual with a disability (Parette & Hourcade, 2003; Scherer, Sax, Vanbiervliet, Cushman & Scherer, 2005). Goodman, Tiene and Luft, (2002) found that personal characteristics, including patience, motivation, personal priorities, self-confidence, personal goals, expectations, and acceptance of their disability influence adoption rates. Parette and Hourcade (2003) placed importance on the need to consider the student's goals and expectations. They report that families and individuals from differing cultural and linguistic backgrounds will differ in their expectations for AT and the immediate use of AT, and a perceived change in the individual's level of functioning is critical to the adoption of AT.

The presence or lack of environmental supports, including training, also influenced an individual's choice to adopt or reject technology. In the Goodman, Tiene and Luft (2002) study, students were matched one on one with able partners who provided hands-on application of technological skills. Course content encouraged individuals to use their

technology, and the recommendations of specific equipment that targeted their personal needs resulted in a positive experience with AT.

The current research project examines the factors influencing adoption and abandonment of assistive technology by exploring teacher receptivity, the characteristics of learners who adopt technology, and the effectiveness of providing training in the context of students' academic strategies sessions where the direct application of AT is apparent. The purpose of this qualitative applied research is to investigate the efficacy of our model of delivering assistive technology training through Academic Strategists in the context of academic strategies sessions. The research questions guiding this study are as follows:

1. Does assistive technology training and support have a positive effect on adult student engagement and outcomes, such as the completion of courses?
2. Does an assistive technology training model, which uses course content as the basis for assistive technology training (delivered by an Academic Strategist with the support of an assistive technology team), achieve learner engagement in courses for adult learners?
3. To what extent does this context-based assistive technology training model result in adoption of the technology by adult students?

For this study of adult students with disabilities in NorQuest College, staff who worked with the students believed that engagement was closely related to functional independence and successful completion. Learners who were able to act independently could take responsibility for their own learning and could choose to engage in the learning processes. Those who engaged in courses over an extended time were likely to complete them successfully.

Methodology

This study took place at a college in Edmonton, Alberta. NorQuest College serves over 10,000 students through four city campuses, regional learning sites, and distance learning courses. The Academic Upgrading 7–12 program includes literacy skill building

programs as well as high school academic upgrading courses, and facilitates participation in post-secondary programs. Students in this study attended the main campus site in downtown Edmonton and all students were enrolled in academic upgrading classes for entry into post-secondary studies. The students also received support services from a specialized unit called Learning Support Services (LSS) because they had mobility, sensory, or learning disabilities.

Participants

Several stakeholder groups provided interview participants for the study. The student perspective was correlated with those of Academic Strategists and classroom instructors who worked with the students. The Assistive Technology Coordinator for NorQuest College also provided insight into the emergent findings.

Students

Ten students ($n=10$) participated in this qualitative study. As is often the case, students with disabilities have a primary disability (factor) but also have co-morbid disabilities (DiPasquale, 2001). Of the students interviewed, three students are blind, four have mobility impairments, and three have learning disabilities. All students received one-on-one support from an Academic Strategist three to five times per week with 45 minute to one-hour sessions. The first ten students who received an AT assessment to identify AT equipment and training needs in 2007–2008, and who were to receive their training from an Academic Strategist, agreed to participate in the study. Table 1 (Appendix B) provides demographic information for each student.

Academic Strategists

Five Academic Strategists participated in this study. Two specialized in math/science and three in English/humanities. None were specialists in delivering assistive technology training. AT proficiency is classified as either limited, proficient, or extensive. *Limited* designates Academic Strategists with no previous experience delivering AT training but with some training through vendor workshops, online or product training, conferences, and support from the AT Coordinator. *Proficient* designates experience in training students, participation in vendor workshops, online or product training, conferences, and

support from the AT Coordinator. *Extensive* designates providers of AT training to numerous individuals including students and staff, participation in vendor workshops, online or product training, conferences, provision of AT training workshops for colleagues, and consultation with the AT Coordinator. Table 2 (Appendix C) provides demographic information on the Academic Strategists who participated in this research study.

Classroom Instructors

Seven instructors participated in this study. All were experienced teachers of adult students and all had taught learners with disabilities in classes before this study. Although all were aware of the existence of AT, only two had extensive experience supporting learners to use AT. All were supportive of the use of technology to help learners address learning barriers. Two had only one learner from this study in their classes and the remaining four each had two students who were involved in this study in their respective classes. Table 3 (Appendix D) provides demographic information on the instructors who participated in this research study.

Assistive Technology Coordinator

Although the AT Coordinator was not included in the initial research design, it became apparent during initial and final interviews that an interview with this individual would clarify the researcher's understanding of the issues raised by students and Academic Strategists. As a result, an interview with the AT Coordinator was included during the final data gathering phase of the project.

Data Collection

Data were collected using a one-on-one interview format that required both open-ended and closed-ended responses from the participants. The format was conversational in order to glean the students' thoughts, feelings, and opinions about AT, AT training, and its impact on their lives. Appendix E provides the interview prompts that interviewers referred to. These prompts were used as guides rather than survey scripts and the general tone of the interviews was conversational. Student participants were interviewed at the

start of their AT training to gather data on their previous training and use, the AT assessment process, and their perception of their engagement in class and ability to complete their courses. Student participants were re-interviewed approximately four months later when they were near the end of their academic term, which coincided with the end of their formal AT training. Final face-to-face interviews provided an overall synopsis of their perceptions about the AT training they had received and the impact of AT on their school and personal life.

Students were also asked to comment on emerging trends that were identified following the first interviews, and individualized questions were developed to follow up on significant statements the student had made in the initial interview. Nine of the ten students initially interviewed were re-interviewed; the one student not re-interviewed was not attending classes near the end of the term and we were unable to contact him to arrange a post-interview.

Whenever possible, interviews were digitally recorded and later transcribed for data analysis. Because some students with speech impairments were difficult to understand, interviewers kept careful notes and paraphrased student responses for the sake of accurate data transcription. Initial interviews with students were conducted by the Academic Strategists; however, second interviews with students and all interviews with Academic Strategists, classroom instructors, and the AT Coordinator were conducted by the primary researcher. The student interview data were reviewed with their course completion and class work scores to determine if AT contributed to positive learning outcomes.

Students' classroom instructors were interviewed twice, once near the beginning of the term and again near the end. Initial interview questions were designed to identify whether the students were participating, producing quality assignments, meeting course objectives, and using assistive technology in the classroom. In their final interview, instructors were asked to comment on changes in the students' engagement in class and whether the students met the required course objectives. They were also asked to comment on whether increased AT skills impacted students' ability to be engaged in

classwork. In addition, instructors were asked about the use of AT in class and to comment on trends that were identified from an analysis of the initial interviews.

Academic strategists were also interviewed twice: once near the start of the term when they were beginning AT training in the context of their academic strategies sessions with students, and again near the end of the term. The initial interview included questions about their experience delivering AT training and their interpretation of how AT training would be delivered in the context of strategies sessions. They were asked about the AT training plan they had developed and the anticipated learning outcomes for individual students. Finally, they were asked about their understanding of the AT assessment process to determine the support and communication they were receiving. Final interviews included questions about their students' participation in AT training, students' learning outcomes and engagement during training, and the integration of AT into students' school and personal lives. Strategists were asked for their opinions on a context-based AT training model, and their responses to the trends that had emerged from the initial interviews.

The Assistive Technology Coordinator was also interviewed. During initial interviews with students and Academic Strategists, an emerging theme was the challenge of procuring equipment for students and challenges with the performance of assistive technology in the classroom. It was felt that an interview with the Assistive Technology Coordinator would inform our research and shed light on the issues around assistive technology assessments. In addition to questions that had been raised during interviews with students and Academic Strategists, the coordinator responded to questions about a contextually based AT training model, the role of the Assistive Technology Coordinator, and his responses to emerging themes.

Finally, preliminary results from the initial and final interviews were vetted with stakeholders. Students, instructors, and Academic Strategists who had been interviewed were invited for a luncheon and discussion of the research findings. Two members of the research team recorded the feedback from participants and this feedback was incorporated into the final data analysis. Two additional vettings of preliminary research

results were conducted with an organization of community members and members of the Alberta Post-Secondary Providers of Services for Students with Disabilities (PSPSD). The first was on preliminary findings or emerging themes following initial interviews. These findings were presented at the annual Alberta Student Services Coordinators (ASSC) Conference held in Camrose, Alberta on May 13, 2008.

The purpose was to gather responses to our findings from other post-secondary service providers who also offered AT training. A vetting of the preliminary results of the final interviews was held at the fall meeting of PSPSD, where over 50 student support service providers participated in a discussion of the results. Copies of the presentation and findings were distributed to participants and all were invited to electronically submit individual institutional responses to the findings. Two colleges submitted individualized responses, which were incorporated into our final data analysis.

Data Analysis

Interviews were digitally recorded, transcribed, and analyzed upon completion of all interviews. The transcribed interviews were compared to identify patterns and themes. Student perceptions and Academic Strategists' comments related to the students' engagement and course completion were compared to instructors' comments and students' coursework marks and course completion records. Vetting of preliminary initial and preliminary final interview results was also incorporated into the final findings.

Findings

The focus of the findings in this study centred on our research questions; however, a number of significant but unanticipated findings also emerged.

The Role of Assistive Technology in Student Engagement, Completion, and Independence

Engagement is measured by factors such as active participation, positive relationships with other learners and teachers, and the volume of work. Successful completion is

usually a consequence of sustained engagement, although minimal engagement may result in a passing grade and engaged students don't always pass a course. Independence is needed for engagement and completion in a college. Adult students are expected to take responsibility for their own learning.

In this study, students felt that they were integrating AT into their classwork as well as their daily lives, and that AT was facilitating their engagement in learning and contributing to completion of their courses. Evidence of increased engagement reported by students included increased volume of work. One visually impaired student commented that because of his use of the speech-activated software called Dragon Dictate, he could now produce pages of written work, whereas before learning this AT his written output had been limited. A student with learning disabilities used her laptop to produce classroom notes and was able to keep pace with the class. Students also spoke of less physical exhaustion, less fatigue, less stress, and increased self-confidence. All learners but one completed their courses and all reported greater independence as a result of using AT at school. One student, who did not complete the course, withdrew for medical reasons and is registered to repeat the course in the following term.

Engagement

Engagement is indicated by apparent enthusiasm, active participation, positive interactions with other learners and teachers, and sufficient volume of work. The degree to which AT was instrumental in fostering engagement varied among learners. For the learners who are blind, AT was considered essential to their success. One learner commented, "It's the only way I can learn." For learners with mobility impairments, engagement and independence were enhanced by the use of AT.

A student with cerebral palsy said that having a computer to produce written work was very important to her. "It's faster and the teacher could read it faster and clearer, understanding what you're saying." Having equipment in the classroom or personal equipment to take to class, rather than having to leave the classroom to do assignments or exams in a special area for learners with disabilities, allows students to participate and not miss classroom interaction such as the instructor's additional oral instructions or

directions. Students felt they were better able to participate and engage with instructors and fellow students when technology was available in the classroom.

Learning to use JAWS to navigate websites, use email, and engage in online chat and social networking programs like Facebook gave students who are blind a feeling of reconnecting with a social network. A student with a learning disability established a personal blog and shares her poetry, photography, and short stories with friends and family. Another student with visual impairments was able to maintain part-time employment by using his pocket magnifier and was also able to resume intricate crafts that he had enjoyed before becoming visually impaired.

Successful Completion

Successful completion is measured by completed assignments, passing grades, and other indications of learning over the duration of a course or term. It is accepted here that students who are independent and engaged tend to complete college courses. Even students with learning disabilities felt that AT increased their ability to succeed at school. One learner with learning disabilities talked about using the Franklin language master to understand difficult vocabulary and a digital recorder to record lectures in biology and math classes so that she could replay the lessons while she was reading notes taken by a peer note taker. Another commented that she didn't think she could live without AT and that ". . . having the equipment gives me a reason to be here." Before having access to AT in the classroom, she was falling behind with assignments and note taking, but having a laptop with AT in the classroom allowed her to keep up with her peers.

Although from the students' perspective, AT was instrumental in their engagement and ultimate success in courses, classroom instructors did not note a significant increase in student engagement as measured by participation, completion of assignments, and course completion as a result of students using AT. Classroom instructors observed that at the beginning of term, the students in this study tended to be like other learners in the class and several were above average in terms of oral class participation. Unless students brought their AT to class or had equipment available in the classroom, instructors were unaware that learners used AT. This difference in perception of the impact of AT is

interesting; however, students observed that AT allowed them to “keep up” and “levelled the playing field,” thus allowing them to keep pace with the class and maintain engagement throughout the course.

Independence

Independence is defined here as the ability to engage in and successfully complete courses and programs, with minimal support from others. In this study, students who had their own equipment commented that they were able to do their assignments at home without being restricted to accessing the AT lab during office hours. Those with mobility impairments did not have to struggle with transportation issues in order to access the AT lab at school; instead, they could stay at home to complete assignments. One student emphasized how AT facilitates independence, stating, “I do want to learn some assistive technology because when I get home, my parents always have to be involved in my homework which . . . puts more pressure on me to succeed and do good because I don’t want them sacrificing all this time and I only pull garbage marks.”

AT facilitated independence and engagement with the broader community not only at school, but also in students’ personal lives outside of the educational institution. A blind student said he uses Zoomtext to do bills and email and no longer has to rely on his son. Another student who recently became blind talked about his inability to engage with others in the wider community because of his lack of access to information and communication tools. “So now that I don’t have that access, I want it. I want to learn to email now—that’s something I’ve always wanted.”

Adoption of AT

A key finding of this study related to students’ adoption of AT was that equipment identified in the AT assessment was sometimes not appropriate, or the student did not understand the purpose of the equipment. In these situations, the equipment was abandoned. Students and strategists identified the personality characteristics of learners who successfully integrated AT. The study confirmed that training influenced how broadly and readily AT was applied to the educational and home environment.

Several students felt that the AT assessment was a very important aspect of their adoption of AT; otherwise, they were wasting time learning something that did not help them. One strategist observed that the AT software ordered for the student was inappropriate. Only the read-back feature of the software was being used, while for writing, low-tech solutions and strategies were more appropriate.

Another student was extremely frustrated with the assessment process, because the software recommended was also not appropriate. The student and Academic Strategist both expressed frustration: the strategist's perception was that the student was not applying himself to learning, while the student's perception was that the software was inappropriate. The student was forced to withdraw from classes for medical reasons and has since returned to the College to resume classes. He continues to resist the AT that was recommended and other forms of AT are also proving ineffective.

Other students commented that equipment was ordered for them, but they did not understand how or why they would use it. For one student with a mobility impairment, a piece of equipment with small operating buttons was ordered. The student was unable to use this equipment and it was abandoned. When asked why this student was not picking up additional equipment, including the digital recorder that had been ordered for her, she replied, "Yeah, I think I might be avoiding that . . . because my voice, I don't like it."

Another student found that the process of getting support for his disability before beginning classes was confusing. He said, "The whole process was so jumbling from the beginning because I kind of rushed through everything. . . . she (the funder) was running me around Alberta Works, taking me to people's offices and showing me Dragon and like telling me how cool it is and like this, that, and the other thing, so I just kind of go with the flow after that." A different student commented, "There was a lot more [equipment] offered than I needed, I guess you could say. I mean, all of it was sensible then." (While the equipment made sense to this student initially, in practice some of it proved not to be useful.) Both of these students were passive participants in the AT assessment process and later abandoned some of their AT.

Students and Academic Strategists identified the following as characteristics of students who are successful at learning and integrating AT:

self-advocate	determined
committed	self-confident
positive outlook	positive self-image
goal oriented	realistic about expectations
flexible	self-motivated
self-disciplined	stubborn
patient	willing to dive in and try
dedicated	curious
questioning	diligent
proactive	shows initiative
follows through	able to delay gratification
able to focus	high frustration threshold

Adoption of AT rather than abandonment relates to the consistent use of the technology but can also relate to the use of AT across a variety of environments. Students identified their challenge with adopting technology in this way. One student mentioned that she should be using AT at her part-time job, but was not sure how. She feels that she doesn't know the technology well enough yet to be able to adapt it to new circumstances.

Another recognized that he only learned a small amount of what is possible with his AT and commented that "I'd like to know [more]; I don't know if I need to know it."

A different student said, "It's something [learning AT] I never thought I'd be able to do so as you learn on these things with assistive technology you get more confident, which makes you want to see what else it can do with certain things."

However, one student commented that he was using AT only while at school because he did not have the equipment at home. He expressed frustration with his inability to integrate AT outside of school.

An issue for some learners who have depended on human support (scribes, readers) is to trust their mastery of technology in high stakes environments like exams. Some choose to abandon the technology in favour of human labour- intensive supports which were familiar to them. An Academic Strategist observed that his student is not using technology when under pressure. "...he will resort to his older methods—having a scribe because he's a lot more comfortable with that than the other way." The student supported this observation by stating, "Like at this point in time if the diploma starts tomorrow or even if it does start in June, I'm not confident enough to risk 50% of my mark using that technology."

Challenges and Benefits of AT Training in Context of Strategies Sessions

As outlined in the background to this study, the challenges of recruiting and retaining Assistive Technology Coordinators, the need to serve an ever increasing number of students requiring AT training, and the recognition that successful AT training should be an ongoing and integrated process led to our model of AT training delivered by Academic Strategists. The efficacy of this model was examined through interviews with students and Academic Strategists who delivered AT training. The findings are summarized in the following chart.

Positive aspects of this model	Negative aspects of this model
Strategists reported that students are often more willing to use AT when they are introduced to it as a way of completing a current task related to course content. They see an instant application for AT and if this introduction is successful, students can be introduced to additional features of the AT, or additional AT.	Students commented that doing well in the course and receiving marks takes precedence over learning AT; therefore, time for AT training which was scheduled during their academic strategies sessions was spent on mastering course content and learning low-tech strategies to deal with content. Learning how to use AT required extra time and practice which was often not available when comprehension of course

Positive aspects of this model	Negative aspects of this model
	<p>content was the focus of strategies sessions. One strategist commented, “We end up talking about more of the writing processes as opposed to AT because that’s weighing heavier on his mind—how to do it, not the technology to support him doing it.” Another strategist commented, “AT kind of takes the back burner.”</p>
<p>Vetting of findings with community partners resulted in the observation that AT training during strategies sessions was time effective, as students could spend time on content plus AT training and use, rather than make arrangements which require additional time and organization to meet someone to learn or use AT.</p>	<p>Students without basic computer competence struggled to learn AT during strategies sessions. Some struggled to move beyond basic computer skills mastery and did not learn to use the AT to its capacity. Just as the students’ familiarity and comfort with computers made learning AT easier, Academic Strategists also struggled to master AT when their basic computer skills were underdeveloped.</p>
<p>Most strategists established a comfortable working relationship with their students because they saw them on a regular and long-term basis. This relationship built trust, which was identified by students as vital for training.</p>	<p>Most strategists needed more time to learn AT before teaching it. Their lack of familiarity made it difficult to see applications of AT beyond the obvious manufacturers’ suggested applications.</p>

Positive aspects of this model	Negative aspects of this model
<p>Students and Academic Strategists noted that a benefit of the model was that strategists know individual students' learning strengths and weaknesses and how they learn best. A student said that the strategist "... knows how I think and what would kind of work for me."</p> <p>Another student commented, "A good strategist will know you as a person and know how to explain things in such a way that you are able to grasp . . . there were times . . . I would sit there and bang my head against the wall because I had no clue whatsoever what he [the AT Coordinator] was trying to tell me."</p> <p>Strategists talked of adapting AT training to the individual.</p>	<p>Some strategists were comfortable with this model where they often learned AT along with students. Others, primarily those who were uncomfortable with technology, felt they needed to have greater mastery before teaching. Likewise, some students expressed comfort with collaborative learning alongside the Academic Strategist, but others felt uncomfortable in the role of a "guinea pig."</p>
<p>Students and strategists commented that strategists were able to adapt the pace of learning new information and the complexity of language for instruction to the student. One student commented, "He wasn't really pushing it down my throat. We were kind of going at it at my own pace, which I thought was good."</p> <p>Several students commented on the strategists' understanding of appropriate instructional language for their level of comprehension.</p>	

Positive aspects of this model	Negative aspects of this model
<p>Strategists indicated that they know more about the course content/assignments, so it is easier for them to relate AT training to a specific course than it may be for an AT Coordinator without course content background.</p>	

In summary, participants identified benefits to an AT model that utilizes Academic Strategists. Students and strategists also identified a need for a supportive infrastructure, and the availability of ongoing and relevant training for strategists for this model to be successful. Students and strategists stated that immediate classroom concerns took precedence over the long-term benefits of AT training. Finally, not all Academic Strategists were comfortable with and able to deliver AT training. Just as students without basic computer skills struggled to learn AT, so did strategists who were unfamiliar or uncomfortable with computer technology.

Unanticipated but Significant Findings

The purpose of this research was to examine the efficacy of our model of AT training and the effect of this training on student engagement and adoption of AT. In the process of examining our research questions, a number of unanticipated but significant findings emerged.

Previous AT Training of Student Participants

Contrary to our expectations, our findings indicated that all of our participants had not had significant experience using AT to address their disability in an educational environment before attending our College. Of the ten students interviewed in this study, three are blind or severely visually impaired and all became blind within the last five years. None identified themselves as proficient computer users before they became blind or began losing their sight. All students in this study received a variety of training through the CNIB. One student with some residual vision learned to use a closed circuit television (CCTV) and was given the equipment in Saskatchewan. This student was

taught to type but was not introduced to JAWS, and did not have access to the equipment. Another learner with low vision was taught to use Zoomtext and to master basic computer skills, but was also learning basic life skills. Although he noted that the training was very worthwhile, it was only one month and he commented that there was too much to learn. The third student who was blind was introduced to JAWS but learned only a few basics and found that learning in a group of other persons with visual impairments was not effective for him.

The other participants in this study had mobility impairments or learning disabilities. None had been exposed to assistive technology before attending NorQuest, although all had learning difficulties while in the school system. Two of the learners, who have mobility impairments as a result of cerebral palsy, described having aides or trying to get aides in the classroom while in public school.

One learner said, “In high school, they put me in lower levels so someone would be able to understand and help me write it down and as a result now I have to take this upgrading at NorQuest, whereas if I had proper training beforehand on this technology who knows if I even have to be here. I took all of the lower level courses; all lower level because of the situation I was in ... with my physical capabilities.”

Those with learning disabilities also were not introduced to assistive technology. One student had used a computer for writing assignments, but not software to address her writing disabilities.

Students’ Perceptions of Their Ability to Succeed

We were not surprised that all the participants were positive that they would succeed in school. We were, however, surprised that some felt that their disability had little effect on their ability to succeed. We were also made aware of their determination to succeed in mainstream society.

Some students felt that their disability very much affected their ability to perform at school. One said, “Discouraged? . . . cause I’m slow . . . that’s it. I’m not that fast like

normal students. I'm not that fast because of my health situation." Another acknowledged that her learning disability made it harder for her to learn and another said that she was doing well but her memory was not strong. One learner said, "I know because of my physical disability there's going to be challenges. I know I'm a slower reader because of my disability, but I'm still able to comprehend."

Most of the learners were very aware of how their disability was affecting their performance in class, but none spoke of failing or quitting. Several said that their disability had very little to do with their ability to do well in school. When asked whether they ever felt like they should quit or that they might not make it, one student said, "No, nothing school related—just outside life issues." One said, "If I didn't believe in myself, I wouldn't be here in the first place. I know I'll pass; no problem to pass, but you basically need a 70 to become a journalist. I'm right on the bubble for that."

An interesting comment made by one student was that, "I've only recently laid claim to my disability. I don't think that the disability has anything, like I said for my lack of a better term, 'failures have been my failures.' They've been choices that I've made and none of the choices that I've made have ever been based on my disability, whether they be scholastic or just in life."

One student expressed the view that the general population feels that persons with disabilities should be content with government living supports which provide a very basic standard of living. The student said, "Let's face it, how does the majority of society look at people with disabilities? They look at people with disabilities and say, 'Oh they're having a fun time. They're living a good life—that's good enough for them.'" He added, ". . . people gave me goals that were easy to attain . . . people think I should just be enjoying myself . . . but how is a person supposed to go on trips? How is a person supposed to have a real social life on a thousand dollars a month?"

Challenges With the AT Assessment Process and AT Equipment

Our findings indicated several unanticipated challenges with the AT assessment process. The most common challenge included the time it took for students to be assessed and to

receive their own AT. Other issues included the challenges with borrowing College equipment and receiving technical support outside of the College.

A common frustration expressed by all students in this study is the time it took between being identified for an AT assessment, being assessed, and finally receiving the equipment. One blind student who is learning JAWS at school waited for his assessment for over two months. He is in only one class, but is at school all day because he does not have the equipment he needs at home. He said, “The only thing is, I don’t have JAWS at home right now so I’m limited to how much work I can get done at school. Like that’s happened to me on a couple of assignments. I’ll come in at 8:00 and spend most of my time on the computer here. I like it, but if I had JAWS at home I could obviously be putting in more time.”

One student spoke of having to ask for an extension because he could not access the school’s equipment, has no equipment at home, and no one to help him when his parents were out of town. Another student with cerebral palsy used Read & Write Gold at school but was waiting for it on her home computer. Her home computer was an old model and the request to purchase a newer computer able to support the AT was denied. One student commented that the equipment ordered for him was arriving at the College, but all components had not yet been received, so he had to wait.

One student expressed frustration that she had to borrow equipment from the College, was trained to use it, but had to be retrained because the equipment that was ordered for her differed from that in the College. Another student spoke of the frustration of using the College’s AT lab while waiting for his own equipment. He mentioned that the AT lab was unavailable for general student use during examination times. He also mentioned his software did not respond well on the College’s network.

One student spoke to the importance of having technical support at home once he had his own equipment. He commented, “He [the AT Coordinator] went through it and made sure everything was set up perfectly you know, he eliminated all the junk I didn’t need on it. It’s so important to have someone to give you support . . . without that support there’s

no sense in coming to school.” He went on to say that his AT Coordinator “. . . is great, cause I can run into problems at home and phone him up . . . you know, in other words it would cost me a ton of money and I don’t have that kind of money.”

Training before Beginning Classes

A challenge with offering AT training during academic strategies sessions was that students have to spend time on training while also trying to keep up with the day-to-day demands of classwork. An unanticipated suggestion was to offer an AT training course before beginning regular classes. One student who is blind and who had been a student at the College for two terms said, “Basically, get the training down. You need training, like offer a course on strictly say terms of one on one . . . I’d gladly quit English for a term you know.”

Another student with cerebral palsy said, “I believe that if I was to learn it before the pressure of this course it probably would have been a hell of a lot easier. I’m not gonna lie because to have to learn this while doing a major essay doesn’t help any.” One student was willing to take an AT training course at another post secondary, but the course was cancelled due to lack of enrolment.

Participants’ Roles Regarding AT

We anticipated that students supported by our unit would expect the unit to provide communication about AT and the students’ needs to classroom instructors. We found, however, that all students felt it was their responsibility to inform their instructors about how they use AT. There was no consensus on the roles of instructors, strategists, and students on other matters. Instructors believe it is the student’s responsibility to ensure that their AT equipment is in the classroom and ready to be used. Some students and strategists felt it was the role of the AT Coordinator, while others felt it was the responsibility of the Educational Technology Department or the Information Technology Department. Several students expressed an expectation that their classroom instructors should know how to use AT so that they could assist them in class if they were experiencing problems with the AT. Several classroom instructors commented that demands on their time made it difficult for them to learn about AT to the level they would need to be of assistance to students.

Adjustments Necessary for Students Who Become Visual Impaired or Blind Later in Life

An important consideration that emerged from this research is that adult learners who became visually impaired later in life may face additional challenges and may benefit from adjusting to different assistive technologies. This would include discontinuing reliance on their residual sight and mastering the ability to learn in a new modality. One student with a severe visual impairment came to the College with the expectation that he could use his CCTV to read high school English texts. Another visually impaired student enlarged text on his computer screen in order to compose written assignments. Both were clinging to their use of residual eyesight, but soon came to realize that their efforts were ineffective. The transition to screen reading software to hear text displayed on screen and voice activated software to compose was at first met with some resistance, but became necessary.

All three visually impaired or blind students commented that they had to learn in a new modality. As children, they had struggled with reading, but now could listen to the text as audio files and were much more successful at reading comprehension. One learner who is blind “read” *Lord of the Flies* in audio format for an English class and commented, “I just finished *Lord of the Flies* . . . I’ve always wanted to read that book for a long time . . . yeah it was pretty good . . . like I remember high school, we were supposed to read it but I was never interested into reading and at that time I just wasn’t there, you know.”

Another student who is blind commented that he had always struggled with reading as a child. He was now listening to text in audio format rather than relying on sight. He said, “Cause I concentrated more. You know, I’m not getting . . . my eyes aren’t getting tired because I’m not reading it anymore.” The same student, however, explained that when he was sighted, he was primarily a kinesthetic learner. “Yeah, it’s a lot different than when I used to have eyesight. You give me something when I had eyesight you could throw a motor at me and say, ‘Tear it apart and put it back together.’ All right, I could tear it apart and I could put it back together.” To memorize keystrokes in JAWS, he commented that he was “. . . trying to remember which ones [to] push . . . Just remembering what the Alt

F4 is close to, you know, stuff like that.” He was trying to use the same modality to learn AT as he had used when he was sighted.

Discussion

The use of AT in post-secondary settings expands our understanding of the role of AT in student engagement, the factors affecting abandonment of AT, and optimal models for AT training. This knowledge will help us deliver appropriate support to learners with a variety of disabilities.

By providing AT, we do not give students an advantage; we are giving them what they need in order to keep pace with their peers and continue to develop their academic skills. Students believe that incorporating AT into their academic as well as personal life increases their independence and ability to succeed. Classroom instructors, and perhaps others supporting student learning, often do not notice any appreciable change in a student’s abilities because of AT, but it could be argued that without AT, the student would not have been able to keep pace or continue at a proficient level throughout the course. Although classroom instructors commented that students performed well at the beginning of class before receiving AT training and that they did not notice any change in their participation or engagement throughout the term, students commented that they felt they could not have completed the term without using AT.

Students abandon technology when they do not understand the application of the technology to their lives or if the technology is inappropriate. They are frustrated with the time it takes to receive an AT assessment and the time it takes to receive their own equipment. Those students who require technology in the classroom are frustrated when the technology is not available for several weeks from the beginning of their term and when they experience technical challenges with classroom equipment.

Accurate assessments are difficult to produce if students assume a passive role in the assessment process. It is also difficult to produce accurate assessments without trials of a variety of AT. Trials of a variety of equipment require capital expenditure by the College as well as committed student and staff time. There appear to be bottlenecks in the

assessment and procurement process that need to be identified. From vetting results with other institutions, it also appears that there is inconsistency in the process from one institution to another.

When interviewed about the AT process, the AT Coordinator noted that the College's internal processes related to AT assessments, procurement, and training were being revised and streamlined. A provincial review of the AT assessment and equipment procurement process was also underway and AT Coordinators from around the province were working together to identify best practice and to coordinate professional development. These positive developments improve the efficiency of the system.

Having their own equipment allows students with disabilities to make more efficient use of their free time and efficient use of the time they feel able to focus on schoolwork. Students' existing computer hardware may not be appropriate to run complex AT software; therefore, upgraded equipment at home may be necessary. AT equipment at home allows students to complete homework assignments, practise using the AT, and balance home life and school life.

Specialized AT equipment is often available at school, but priority to use equipment is given to students who are writing exams. The AT lab is also used by some classes and therefore not always available. Many forms of AT software require individual user preferences which are difficult to accommodate in a networked institutional setting. Personal and portable AT equipment also eliminates the frustrations of providing AT in the classroom that is heavy, large, and difficult to move (e.g., TVs, desktop computers).

Timely and accurate communication is critical to ensure that students who require AT in a classroom and do not have their own equipment are accommodated. Students must feel empowered to identify their need for AT in the classroom and communicate their needs. Staff who are responsible for identifying student supports must ensure that adequate lead-time is available for coordination between departments involved in providing equipment for student use in the classroom.

A challenge with the current system in the College appears to be the overlap of responsibilities for technology between three departments: Information Technology, Educational Technologies, and the AT Coordinator position in Learning Support Services. A focussed review of the roles and responsibilities of these three areas may lead to clearer communication and delineation of duties. Another area that requires further study is the issue of compatibility of AT software within the College network. AT that will not function consistently because of networking issues will be abandoned by students who rely on the College computer system.

A benefit of AT training in the context of strategies sessions (rather than as a term-certain training period either from an AT Coordinator or as part of a class), is that students receive ongoing training that evolves as they progress through their studies. They have access to “just in time” training that directly addresses their immediate concerns. Ongoing training and “just in time” training may reduce abandonment.

Strategists are familiar with students’ learning strengths, the pace and language that individual students require, and the course content. Because they meet regularly with students, AT training can be integrated over an extended period of time and applied to a variety of academic tasks. In addition, extending AT expertise to Academic Strategists makes the support services unit better able to meet the growing need for AT training. When adopting this model however, disability service providers must ensure that supports for strategists are in place. It is important for Academic Strategists to understand AT software features before they begin to train students. Ongoing training and support must also be available. We need to recognize that some strategists are better able and more willing to assume the role of AT trainer, and those with little computer experience will struggle to provide adequate support to students.

Adult students with physical disabilities such as visual impairments, brain injuries, or mobility impairments, who are returning to our College for academic upgrading, may recognize the potential of AT to increase their independence. However, individuals will be at various stages not only in acceptance of their disability, but also in their transition from dependence on human interventions and accommodations to self-reliance with the

support of technology. Adults who have limited but impaired vision may choose to use their limited vision by using a CCTV or magnified text as opposed to audio-based technology. Some of these learners may still be dealing with acceptance of their disability and may resist abandoning what little sight they have left for other means of accessing text.

Some students who received the support of classroom aides while in public school may welcome the independence offered through the use of technology, but resist having to rely on their proficiency with the technology in high stakes environments. Some learners with recently acquired disabilities may now be forced to learn in a modality that was not their strength prior to acquiring the disability. Additional time for strategies sessions, AT training, assignment completion, and exam accommodations may be necessary. Scaffolding of supports is also necessary, not only to build independent use of technology, but also to support learners as they adjust to new modes of learning.

In addition to the variability among students in terms of acceptance of their disability and AT, as well as the challenge of teaching and learning in an unfamiliar modality, adult students returning to post secondary may require additional time to master technology as well as complete coursework. Some students have little or no experience using computers. Learning to use computer-based AT software is even more challenging when students have not mastered basic computer functions. Basic computer skills are especially important when teaching AT to students with visual impairments. They are unable to use the same visual cues that sighted learners have access to.

Students requiring basic computer skills may benefit from a number of options. A basic computer course which incorporates applications to skills and content they will encounter in upgrading classes could be offered. Students could be enrolled in an AT course where the focus is on learning AT that can be used across disciplines. Another option is for students to enrol in a course they have already passed, but retake the course using AT. Some students may benefit from a reduced course load so that additional strategies and AT training time can be offered. Flexibility and individualization is necessary to accommodate the variety of learners who need access to AT training.

A team approach to assessment and training is ideal, but often difficult to coordinate when strategists, student support staff, and an AT Coordinator are involved in the day-to-day operations of an active support service centre. Time for team meetings and professional development must be included in daily schedules of all members of the team. In addition to scheduled time for consultation and professional development for strategists, students who require AT training also need to commit dedicated additional time outside their regularly scheduled strategies schedule to learn and practise AT. During strategies sessions, students have the opportunity to learn AT, but they also need sufficient time in strategies sessions to address course content issues. To optimize time dedicated to learning the features and applicability of AT features, students need to have a basic understanding of computer functions before beginning AT training.

Recommendations

The following recommendations will improve the provision of AT support and training to students and improve the efficacy of a contextually based training model. In summary, the key recommendations are:

- Accurate and timely AT assessments
- Knowledgeable and skilled staff
- Timely application of AT
- Prior learning of computer skills

Accurate and timely AT assessments, which are necessary when students require their own AT, are important to curtail abandonment of AT. The adult students served by our College need their own AT equipment while at school and later when they begin their careers. They need to understand their strengths, weaknesses, and preferences in order to enable the assessor to accurately determine student needs, the environment, the training model, and the tools best suited to the individual. Students must be willing to try a variety of tools under different conditions in order to best identify those that are most effective.

This type of effective assessment is possible only if the person who is administering the assessment has a broad knowledge of AT, an understanding of different learning styles and strengths, a wide variety of AT available for trial, and adequate time to properly

administer the assessment. The funding agency also has a role in ensuring accurate and timely AT assessments. To enable institutions to trial AT, funders must be willing to fund training that allows for AT trials. They must expedite the process of identifying and procuring equipment by streamlining their internal processes. A system of checks and balances is necessary to ensure that public funds are well spent. However, a collegial system where institutions charged with providing supports to students are recognized for their expertise, and bureaucracy is minimized, will benefit students who depend on AT for successful learning.

AT must be available in the classroom, from the first day of class, for students who rely on this technology. Each participant in the process has a role to play in ensuring that the necessary equipment is available and functioning.

Students who require complex, computer-based AT must have basic computer skills knowledge before beginning AT training in the context of strategies sessions. Strategists charged with training students must also be comfortable using computer technology and must be trained to use the AT before beginning to train students. A system of ongoing support for strategists and regular professional development related to AT training must be in place. Time for team meetings, which may include an AT Coordinator, classroom instructor, Academic Strategists, and others involved in supporting students who are learning AT must be allocated throughout the term to ensure clear communication and support. Strategies session time for students who are also learning AT must be increased so that both AT training and other course content strategies can be provided.

Conclusion

Students with disabilities who effectively use AT are more independent and better able to keep pace with the demands of college programs. They are also more likely to apply their knowledge of AT across subject areas and into their personal lives. AT can have positive effects on student engagement and on the related issues of independence and completion of courses. Success is influenced by variables such as accurate and timely AT assessments, knowledgeable and skilled staff, timely application of AT, and prior

learning of computer skills. In order to meet the growing demand for AT training, contextually based training delivered by Academic Strategists holds promise. The model requires training and ongoing support of Academic Strategists and increased time for strategies sessions.

In summary, this research provided interesting insights into the perceptions of students, classroom instructors, and Academic Strategists in an adult academic upgrading environment. These insights will help inform our delivery of AT supports to students with disabilities and may highlight considerations for other institutions with similar populations.

References

- Calloway, D. & Shaffer, C. (1996). Interdisciplinary training programs in assistive technology. *College Student Journal*, 30 (3), 349+.
- Candela, A.R. (2003). A pilot course in teaching skills for assistive technology specialists. *Journal of Visual Impairments and Blindness*, 97 (10), 1–13.
- DiPasquale, G. (2001). Learning disabilities: A new definition. Learning Disabilities Association of Ontario. Retrieved December 5, 2008 from www.ldao.ca/about_LDs/Definitions_of_LDs.php.
- Gall, M., Borg, W., & Gall, J., (1996). *Educational research, an introduction* (6th ed.). White Plains N.Y.: Longman's.
- Goodman, G., Tiene, D., & Luft, P. (2002). Adoption of assistive technology for computer access among college students with disabilities. *Disability and Rehabilitation*, 24 (1–3) 80-92.
- Human Resources and Social Development Canada (2004). A way with words and images. Retrieved July 25, 2007 from http://www.hrsdc.gc.ca/en/hip/odi/documents/wayWithWords/03_guidelines.shtml.
- Kintsch, A. & DePaula, R. (2002). A framework for the adoption of assistive technology. *Center for LifeLong Learning and Design, University of Colorado at Boulder*. Retrieved March 16, 2007, from <http://13d.cs.colorado.edu/clever/assets/pdf/ak-SWAAACO2.pdf>
- Ofiesh, N., Rice, C., Long, E., Merchant, D. & Gajar, A. (2002). Service delivery for postsecondary students with disabilities: A survey of assistive technology use across disabilities. *College Student Journal*, 36 (1) 94+.

- Parette, H.P., Peterson-Karlan, G.R., Smith, S., Gray, T. & Silver-Pacuilla, H. (2006). The state of assistive technology: Themes from an outcomes summit. *Assistive Technology Outcomes and Benefits*, 3 (1), 15–33.
- Parette, P. & Hourcade, J. (2003). Cultural dimensions of assistive technology: What we know and what's ahead. Poster presentation to the *Council for Exceptional Children 2003 Annual Convention and Expo*, Seattle, WA, April 11, 2003.
- Patton, M. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage.
- Provus, M. (1971). *Discrepancy evaluation*. Berkeley, CA: McCutchan.
- Purdue University Department of Curriculum and Instruction (1999). *Report of the inclusion committee*. Retrieved July 24, 2007, from http://www.edst.purdue.edu/taber/Inclusion/new_page_1.htm.
- Reimer-Reiss, M. & Wacker, R. (2000). Factors associated with assistive technology discontinuance among individuals with disabilities. *Journal of Rehabilitation*, Retrieved March 21, 2007 from http://www.findarticles.com/p/articles/mi_m0825/is_3_66/ai_66032259
- Sardone, N. & Steele R. (2003). *AT attention: Integrating accessibility awareness and computer-related assistive technologies in teacher preparation programs*. Retrieved March 16, 2007, from <http://education.shu.edu/pt3grant/SITE2003Publication.doc>
- Scherer, M.. & Galvin, J.C. (1996). *Evaluating, selecting and using appropriate assistive technology*. Gaithersburg, MD: Aspen Publishers, Inc.

Scherer, M., Sax C., Vanbiervliet, A., Cushman L. & Scherer J. (2005). Predictors of assistive technology use: The importance of personal and psychosocial factors. *Disability and Rehabilitation*, 27 (21) 1321–1331.

United States of America 150th Congress (1998). Assistive Technology Act of 1998, 105-394, S.2432. Retrieved July 25, 2007 from <http://www.section508.gov/docs/AT1998.html>.

Wolffe, K. (2003). Wired to work: An analysis of access technology training for people with visual impairments. *Journal of Visual Impairment & Blindness*, 97(10), 633–645.

Appendix A

Glossary of Terms

Assistive technology (AT)	<p>In this study, assistive technology is, for the most part narrowly defined as computer-based hardware and/or software. References are also made to other types of AT including a CCTV, electronic dictionaries, and digital records.</p> <p>The broadly accepted US legal definition of assistive technology is, "... any item, piece of equipment, system whether acquired commercially off the shelf, modified, or customized that is used to increase or improve functional capabilities of individuals with disabilities" (USA Public Law 100-407 Technical Assistance to the States Act).</p>
Academic Strategists	<p>Subject area instructors specialized in working with students who have disabilities. Academic Strategists meet one-on-one or with small groups of students and deliver individualized instruction on strategies designed to support traditional classroom delivered instruction.</p>
Assistive Technology Coordinator	<p>The staff member responsible for providing leadership and guidance to the assistive technology team and for supervising the day-to-day operation of the assistive technology lab. In addition, the coordinator participates in the delivery of services and supports to students.</p> <p>These services include the administration or coordination of assistive technology assessments and reports, the procurement and set-up of students' assistive technology,</p>

	coordination of assistive technology training, and support of Learning Support Services staff.
Closed-circuit television (CCTV)	This system, designed for persons with visual impairments, uses a stand-mounted or hand-held video camera to project a magnified image onto a video monitor or a television screen.
JAWS	Designed for persons who are blind or have visual impairments, this screen reading software reads information on a computer screen using synthesized speech or output in Braille. JAWS users navigate the computer screen through keystrokes.
Zoomtext	Designed for persons with visual impairments, Zoomtext magnifies on-screen text. Newer versions also include screen reading capabilities.

Appendix B

Table 1. Demographic information of student research participants

Participant	Age	Primary factor	Subject area	No. of semesters before beginning AT training
0	33	mobility	high school English	0
1	37	mobility	literacy level English	1
2	29	learning disability	high school biology	2
3	25	learning disability	high school English	2
4	42	sensory*	high school English	0
5	27	learning disability	high school biology/math	1
6	20	mobility	high school English	0
7	33	sensory*	high school English	0
8	20	mobility	literacy level English	0
9	44	sensory*	high school English	0

*All students with sensory impairments in this study were visually impaired or blind. All became visually impaired or blind as adults. Students with learning disabilities or mobility impairments had had these disabilities since childhood.

Appendix C

Table 2. Demographic information of Academic Strategist research participants

Participant	Subject area specialization	Experience delivering AT training
S0	English/humanities	extensive
S1	math/science	proficient
S2	English/humanities	limited
S3	English/humanities	limited
S4	math/science	extensive

Appendix D

Table 3. Demographic information of instructor participants

Participant	Subject area specialization	Experience supporting learners using AT
I0	English/humanities	limited
I1	math/science	limited
I2	math/science	limited
I3	English/humanities	limited
I4	English/humanities	extensive
I5	English/humanities	extensive
I6	English/humanities	limited

Appendix E

Interview Prompts

Prompts for the first interview with students:

Did you use assistive technology before you started the program you are in now?

If no, why have you not used AT to help you address your learning challenges?

If yes, please describe your experience.

What kinds of equipment were you trained with?

What was the training like for you? How did you feel about it?

Are you using any kind of assistive technology now?

If yes, how are you using it in school / the classroom?

Does it help you? Please explain.

Do you ever feel like dropping out of your courses?

What makes you feel discouraged?

Prompts for the second interview with students:

Tell me about your experience with assistive technology this term.

What has been done? (assessment, trial of equipment, training, support)

Tell me about how you were trained to use AT. How has that way of learning to use AT been for you?

Did you use assistive technology much in school / the classroom this term?

Please give an / some example(s).

How did you feel about the experience of using AT?

Do you expect to complete your courses?

Do you think using assistive technology has helped you to complete your courses?

In what ways?

Prompts for Academic Strategists, Instructors, and Stakeholders (final vetting)

Personal interviews with academic strategists and instructors, as well as focus groups with stakeholders will be informed by information from student surveys and interviews.

Interview prompts for academic strategists, instructors, and stakeholders will be formulated from the analysis of student information, and cannot be anticipated before students are surveyed and interviewed.