Assistive Technology

Outcomes and Benefits

A joint publication of the Assistive Technology Industry Association (ATIA) and the Special Education Assistive Technology (SEAT) Center

Volume 2, Number 1
Fall 2005

ATIA Innovation Cooperation
Assistive Technology Industry Association

Special Education Assistive Technology
seat center
Illinois State University

Assistive Technology Outcomes and Benefits

Assistive Technology Outcomes and Benefits is a collaborative publication of the Assistive Technology Industry Association (ATIA) and the Special education Assistive Technology (SEAT) Center at Illinois State University. This publication is provided at no-cost to readers. It is a peer-reviewed, cross-disability, transdisciplinary journal that publishes articles related to the *benefits* and *outcomes* of assistive technology (AT) across the lifespan. The journal's purposes are to (a) foster communication among vendors, AT Specialists, AT Consultants and other professionals that work in the field of AT, family members, and consumers with disabilities; (b) facilitate dialogue regarding effective AT practices; and (c) help practitioners, consumers, and family members advocate for effective AT practices.

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Assistive Technology Industry Association

Assistive Technology Outcomes and Benefits

Volume 2 **Number 1** **Fall, 2005**

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ISSN 1938-7261

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Editorial Policy

Assistive Technology Outcomes and Benefits is a peer-reviewed, cross-disability, transdisciplinary journal that publishes articles related to the *benefits* and *outcomes* of assistive technology (AT) across the lifespan. The journal's purposes are to (a) foster communication among vendors, AT Specialists, AT Consultants and other professionals that work in the field of AT, family members, and consumers with disabilities; (b) facilitate dialogue regarding effective AT practices; and (c) help practitioners, consumers, and family members advocate for effective AT practices.

Assistive Technology Outcomes and Benefits invites submission of manuscripts of original work for publication consideration. Only original papers that address *outcomes and benefits* related to AT devices and services will be accepted. These may include (a) findings of original scientific research, including group studies and single subject designs; (b) marketing research conducted relevant to specific devices having broad interest across disciplines and disabilities; (c) technical notes regarding AT product development findings; (d) qualitative studies, such as focus group and structured interview findings with consumers and their families regarding AT service delivery and associated outcomes and benefits; and (e) project/program descriptions in which AT outcomes and benefits have been documented.

ATOB will include a broad spectrum of papers on topics specifically dealing with AT outcomes and benefits issues, in (but NOT limited to) the following areas:

Transitions
Employment
Outcomes Research
Innovative Program Descriptions
Government Policy
Research and Development
Low Incidence Populations

Submission Categories

Articles may be submitted under two categories—*Voices from the Field* and *Voices from the Industry.*

Voices from the Field

Articles submitted under this category should come from professionals who are involved in some aspect of AT service delivery with persons having disabilities, or from family members and/or consumers with disabilities.

Voices from the Industry

Articles submitted under this category should come from professionals involved in developing and marketing specific AT devices and services.

Within each of these two categories, authors have a range of options for the type of manuscript submitted. Regardless of the type of article submitted, primary consideration will be given by the journal to work that has *quantifiable results*.

Types of articles that are appropriate include:

Applied/Clinical Research. This category includes original work presented with careful attention to experimental design, objective data analysis, and reference to the literature.

Case Studies. This category includes studies that involve only one or a few subjects or an informal protocol. Publication is justified if the results are potentially significant and have broad appeal to a cross-disciplinary audience.

Design. This category includes descriptions of conceptual or physical design of new AT models, techniques, or devices.

Marketing Research. This category includes industry-based research related to specific AT devices and/or services.

Project/Program Description. This category includes descriptions of grant projects, private foundation activities, institutes, and centers having specific goals and objectives related to AT outcomes and benefits.

In all categories, authors MUST include a section titled *Outcomes and Benefits* containing a discussion related to outcomes and benefits of the AT devices/services addressed in the article.

For specific manuscript preparation guidelines, contributors should refer to the *Guidelines for Authors* at http://atia.org/

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Outcomes and Benefits in Assistive Technology Service Delivery

Phil Parette, *Editor*
David Dikter, *Associate Editor*

Since publication of the first issue of ATOB in Fall, 2004, and its archival on the Assistive Technology Industry Association (ATIA) Web site (http://www.atia.org/atob/ATOBV1N1/index.htm) more than 7,000 downloads of the journal have been logged. In recognition of the successful partnership between ATIA and the Special Education Assistive Technology (SEAT) Center at Illinois State University in publishing the journal, a case study of the partnership was recently prepared by National Center for Technology Innovation (see http://www.nationaltechcenter.org/partnership/casestudies7.asp). The Editors wish to reiterate their commitment to ensuring the journal's timely dissemination of information regarding the outcomes and benefits of assistive technology (AT) practices across multiple constituencies nationally. We think of these constituencies collectively as a 'community.'

In this issue of ATOB, six articles are presented that provide a cross section of national issues impacting the field of AT, coupled with specific practices having important outcomes and benefits implications for our community.

In the first article, Phil Parette, George Peterson-Karlan, and Brian Wojcik describe an AT visioning activity designed to support the development of a national AT agenda. Conducted in December of 2004, this activity was attended by individuals from across the country representing diverse constituencies (see http://www.seat.ilstu.org/aboutus/Visioning2004/index.shtml). A series of questions were presented to participants including: (a) What do you see as the state of AT services nationally? (b) What do you see as the challenges for the development of AT services nationally?(c) What is your vision for AT services nationally? (d) What do you see as needed 'tomorrow' that is not available now? As needed within 5 years? (e) Who are the existing entities available nationally that could be more effectively integrated to make the power and promise of AT a reality? (f) How could existing entities be integrated into partnerships and/or coalitions to create more effective AT services nationally? (g) What are the critical outcomes that would make this possible? Participant discussions were collapsed into a series of themes that are discussed, providing a clearer perspective of the status of AT service delivery with implications for future planning and systemic change.

In the second article, Dave Edyburn, Sally Fenemma-Jansen, Prabha Hariharan, and Roger Smith acknowledge the paucity of information available regarding the integration of outcome data collection into daily professional practice. The authors use the metaphor of a 'snapshot' as a suggested approach to consider the collection of AT outcome data. Based on work conducted by the Assistive Technology Outcomes Measurement System (ATOMS; see http://www.uwm.edu/CHS/r2d2/atoms/), the authors analyze four strategies designed to collect school AT outcome data, with an emphasis on the 'pattern' of snapshots revealed in each strategy. However, the authors also caution that the development of

snapshot theory may result in initial focii on practical issues (e.g., when, where, and how to take snapshots), though there must also be a "focus on methods of organizing, sharing, and interpreting the data obtained through data snapshots."

In the third article, Bonnie Mintun describes her family quest for augmentative and alternative communication (AAC) technology for their daughter, Anna. Though the process of finding an appropriate AAC system was compounded by Anna's severe cognitive, visual and orthopedic disabilities, low expectations held by others regarding Anna's capability exacerbated the challenges. Reported successes with the Vanguard™ and the Vantage™ supported the family's "conclusion that prerequisite skills should not be used to restrict access to AAC." The author further notes that despite lack of 'fluency' with her AAC device, Anna's observed competencies strongly support use of a more complex device that has given her a sense of Self, increased communicative assertiveness, and a higher social regard by others.

In the fourth article, Karen Erickson, Sally Clendon, Linzy Abraham, and Vicky Roy report an 8-week study involving three classroom teachers and 23 students with significant developmental disabilities in which a new literacy and communication instructional program, *MEville to WEville*, was implemented. Data collection included a variety of pre- and post-implementation literacy measures, teacher interviews, and classroom observations. Though non-statistically significant, 'practical' measured outcomes and benefits of the *MEville to WEville* program were demonstrated through increases in students' attempts to initiate and sustain social interactions, and improvements in literacy skills and understandings.

In the fifth paper, Patricia Murphy describes a combination of strategies and supports (i.e., strategic pooling of AT, human resources and funding options) resulting in 'meaningful' employment for a 25-year-old man with cerebral palsy. Use of an AAC device that interfaces with a bookseller's warehouse computer system and scanner has enabled the consumer to maintain a part-time job processing inventory. The author discusses an additional AT 'mix' necessary to successfully ensure the consumer's employment success, including a new scanner, conveyor belt, an automated book loader, and an attendant to assist with manual job tasks.

In the sixth article, William Morrison, and Tara Jeffs describe a preservice study designed to engage students enrolled in a reading and writing methods course in meaningful and effective uses of the AlphaSmart 3000® and to facilitate 'active' thinking. Employing a split-half design, students were alternately team-taught using both traditional lecture/discussion format and a technology-rich environment that emphasized the infusion of AT techniques. Alternation of quiz formats (traditional vs. technology) coupled with student perception ratings were primary means of data collection. Data analysis revealed that (a) positive experiences using the AlphaSmart 3000® were related to quiz grades; (b) a positive experience with the AlphaSmart 3000® during their pre-service training influenced a student's decision to use the device in his or her future classrooms; and (c) the use of the technology as a test-taking tool did not have a positive or negative effect on the score a student received on a test.

Collectively these articles reflect the interest of and commitment to a diverse range of constituencies that the journal wishes to include in its community of readers. However, we encourage contributions to the ATOB community from even more individuals representing vendors, government,

institutions of higher learning, AT consultants and specialists, not-for-profits, community groups, consumers and families. We also anticipate sharing information about the journal at the ATIA 2006 Annual Conference (see http://www.atia.org/conf_2006.html) and hope to see our readers and those interested in submitting manuscripts for publication consideration at the conference session. A Call for Papers is included in a separate section of this issue. Thanks again to all of you for your support of the ATOB, and more importantly for your dedication to ensuring that AT makes a difference!

The State of Assistive Technology Services Nationally and Implications for Future Development

Phil Parette
George R. Peterson-Karlan
Brian W. Wojcik
Illinois State University

Abstract: On December 10, 2004, selected education and assistive technology (AT) leaders were invited to an AT visioning activity that intended to lead to the development of a national AT agenda. Participants were presented with seven questions to stimulate thinking regarding both the status and future of AT service delivery. Themes resulting from the discussion of each question were identified during the course of the meeting and were presented back to participants for consideration and refinement. Specific issues are described, coupled with recommendations for systematic improvement of AT services nationally.

Acknowledgements: Appreciation is extended to the following participants for their contributions to this event:

- Bob Aaron (Director, University Marketing and Communications, Illinois State University);
- Dianne Ashby (Dean, College of Education, Illinois State University);
- Gil Barner (Former Executive in Residence, University of North Carolina-Chapel Hill);
- Cathy Bodine (Assistive Technology Advisor, Coleman Institute for Cognitive Disabilities);
- Al Bowman (President, Illinois State University);
- Paul Dulle (President and CEO United Cerebral Palsy Association of Greater Chicago);
- Wilhemina Gunther (Executive Director, Illinois Assistive Technology Project);
- Ted Hasselbring (Principal Investigator, National Assistive Technology Research Institute);
- David Richmond (representing J. Dennis Hastert, Representative, 14th District of Illinois);
- Tom Heimsoth (Former CEO/Chairman Resource Information Management Systems, Inc.);
- Donald Kachur (Professor Emeritus of Education Illinois State University);
- Phil Parette [Director, Special Education Assistive Technology (SEAT) Center];
- George Peterson-Karlan (Associate Professor, Illinois State University);
- Marcia Scherer (Director, Institute for Matching Person and Technology);
- Jim Thompson (Chair, Department of Special Education, Illinois State University);
- Caroline Van Howe (Director, Strategic Marketing Operations, Intellitools, Inc.);
- Cheryl Volkman (Co-founder and former CEO AbleNet, Inc.);
- Brian Wojcik (Coordinator, Special Education Assistive Technology (SEAT) Center);
- Ruth Ziolkowski (President, Don Johnston, Inc.)

Keywords: Assistive technology outcomes, Current state of assistive technology, Assistive technology trends, Assistive technology perspectives

Though the field of assistive technology (AT) service delivery is still relatively young, many advances have been made in the knowledge base in the last several decades (Edyburn, 2000, 2001, 2002, 2003). In recent years, greater emphasis has been placed on the outcomes of what have been deemed to be best and emerging practices in the field (Edyburn, 2004). With numerous issues and forces currently impacting the field of assistive technology (AT), a need exists to better understand and integrate the variety of issues, perspectives and practices within the existing AT service delivery system nationally in order to deliver AT services more effectively. Of particular importance are legislative forces, including the (a) No Child Left Behind Act of 2001 (P. L. 107-110) that emphasizes student achievement; (b) Assistive Technology Act of 2004 (PL 108-364) that emphasizes direct delivery of AT services to persons with disabilities; and (c) emphasis on AT consideration for all students with disabilities articulated in the Individuals with Disabilities Education Improvement Act of 2004 (H. R. 750), and accompanying language of highly qualified personnel within the legislation.

To begin to synthesize perspectives regarding how these powerful forces are impacting the AT field, and to better understand the context for identifying AT outcomes and benefits from a national perspective, personnel at the Special Education Assistive Technology Center at Illinois State University extended invitations to a cadre of AT leaders to participate in a national planning activity. This event, Day of Visioning: Increasing Access to Assistive Technology, was hosted in Bloomington, Illinois, on December 9-10, 2004 (see http://www.seat.ilstu.org/ for video and text of these proceedings). At this meeting, representatives from the AT vendors, the private sector, not-for-profit organizations, federal government, and institutions of higher learning were presented with seven questions designed to provide a framework for direction in creating a national AT agenda. These included: (a) What do you see as the state of AT services nationally? (b) What do you see as the challenges for the development of AT services nationally?(c) What is your vision for AT services nationally? (d) What do you see as needed 'tomorrow' that is not available now? As needed within 5 years? (e) Who are the existing entities available nationally that could be more effectively integrated to make the power and promise of AT a reality? (f) How could existing entities be integrated into partnerships and/or coalitions to create more effective AT services nationally? (g) What are the critical outcomes that would make this possible?

Discussions were conducted around each of the seven questions. Discussions were led by a trained facilitator and used a variety of large- and small-group activities designed to maintain an engaged 'community' of participants. These discussions were either video- or audio-taped for later transcription and review. In addition, representatives from the SEAT Center (Wojcik and Peterson-Karlan) served as note-takers and 'summarizers.' Using their notes and observations, summaries of the themes and main supporting points which seemed to have been generated during the discussion of the first two questions were presented to the participants for review and refinement prior to the discussion of the last three questions. Through this process, important issues reflecting multiple perspectives of the leaders present were revealed that illuminated the status of AT service delivery systems nationally. Each of these questions is presented in the following sections with key

Table 1
Themes of Visioning Activity

- Local development is driven by local need
- Uneven distribution of awareness level information and in-depth professional development across potential user constituencies
- Insufficient development and availability of knowledge of and means for determining AT efficacy and outcomes
- A funneling effect operates within service systems due to reliance on experts
- Funding priorities and cost misinformation prohibit informed AT assessment
- Cost concerns are driving upscaling that in turn, may be resulting in AT rejection or abandonment
- Lack of unified vision for AT across all disabilities, both low and high incidence disabilities
- Lack of best practice information for AT leaders and practitioners
- Need for an organizing framework for national AT service delivery
    - Sensitive to the current needs for student achievement and access to the curriculum
    - Demonstrating a linkage of special education strategies to general education content (for all students) and
    - Emphasizing collaboration across non-traditional partners

findings summarized. Themes emerging from the discussions are presented in Table 1.

The State of AT Services

A key theme that emerged from the discussions is that 'local development is driven by local need' with regard to both delivery systems and populations served (see e.g., California Department of Education, 2004; Michigan Disability Rights Coalition, 2002; Reed, Fried, & Rhoades, 1995). Within local communities, where 'local' can mean a school district, a coalition of school districts, or the state as a whole, there is an array of successful 'local solutions' to the full range of service needs, that may include (a) pre-service education and professional development; (b) distribution networks; (c) product development an distribution; and (d) 'individual' research-based strategies (i.e., small scale studies focusing on specific issues/problems). However, these local solutions are either too inefficient to assist large numbers of persons with disabilities nationally (Rose, 2001) or there is little incentive or leadership to integrate local solutions into a national level strategy. At best, solutions develop to the state level and may be known nationally (e.g., Wisconsin Assistive Technology Initiative) but are not systematically integrated or replicated on a national basis.

Discussants noted that both awareness level information and in-depth professional development is not evenly distributed across potential user constituencies around the country. For example, substantive numbers of professional development materials and vendor products have historically focused on individuals with low incidence disabilities (e.g., hearing impairments, visual disabilities, and physical disabilities), with fewer products and training materials addressing the needs of persons with mild disabilities (e.g., learning disabilities, behavior disorders). Ted Hasselbring, Principle Investigator for the

National Assistive Technology Research Institute (NATRI), noted that regular education teachers who are servicing students with disabilities "are really unfamiliar with AT, totally. They don't know what it is, they don't know how it's used, what the possibilities are."

As Cathy Bodine observed,

> if we are going to have systemic differences with change we have to define what success is with use of AT and…what it is that we nationally need to be teaching people and I don't think we've ever sat down…to the table and said so when we are all in agreement on what people need to learn as the baseline knowledge level.

Additionally, knowledge of and means for determining AT efficacy and outcomes are not sufficiently developed nor widely available resulting in education professionals not being prepared to use AT effectively in school settings (Ashton, 2004; Wojcik, Peterson-Karlan, Watts, & Parette, 2004). As noted by Ted Hasselbring,

> I think AT is really underutilized to this point. I think there are a number of reasons for that. I think consumers are not well versed, but I think educators are not well versed and I think that that is the biggest problem; we're finding that in our own data.

More specifically, participants noted that a 'funneling' effect operates within service systems due to reliance on experts (see e.g., Bowser & Reed, 2000; National Council on Disability, 2000). For example, AT experts at the national level funnel information in workshops and conference presentations to state leaders; state leaders funnel information to constituencies in communities; vendor experts funnel information to consumers of their products; and AT experts in schools funnel information to teachers and families. Specifically, funneling occurs when the expertise is based upon a specific subset of AT tools or solutions for which the expert has had more in-depth training and not upon a wider range of tools or solutions for the given area of function (e.g., communication, writing supports, etc.). Expert funneling has the net effect of diminishing the knowledge base of large groups of individuals, such as practitioners, family members, and consumers, and reinforcing the continuing reliance of entities and individuals in the service system on experts. As Hasselbring noted in commenting on the role of vendors as experts, "they're the ones that are primary trainers of our educators right now, much more so than schools or even colleges of higher ed."

In commenting on the approaches that some vendors have taken regarding training, Caroline Van Howe of Intellitools, Inc., observed that,

> …we do a lot of training…directly to schools and also parents at public conferences, but also we have a number of independent trainers, so we haven't tried to train them all. We try to train as many people as possible to take their knowledge back into the community where the community might be able to do that. And what we are just about to change is our focus; we have been doing very much how to use our product within the environment. What we are doing much more now is why you should use it, what scenarios you should use it, what strategies you can have to implement it successfully on a long term sustainable basis.

Training individuals to return to their respective communities and provide AT

expertise on such a long-term and sustainable basis emphasizes the importance of leadership training. As Phil Parette, Director of the Special Education Assistive Technology Center, observed, "…there is a huge need for the training or professional development of leaders in the field of AT…we are not preparing people to go into school districts or whatever the service system is, and assume AT leadership roles."

Another theme that emerged concerned the impact of funding 'priorities' and cost 'misinformation' in prohibiting informed AT assessment which is typically a function of time commitment, and thus associated costs. Marcia Scherer, Director of the Institute for Matching Person and Technology, commented that,

> Nobody feels they have the time to commit to that more comprehensive [assessment] process…the lack of commitment to conducting a good, solid assessment of what supports and blend of supports would be most beneficial for that unique individual.

Lack of commitment to the AT assessment process was seen as being exacerbated by the lack of systematic efficacy and outcome information noted earlier, especially as it impacts justification of the cost relative to the outcomes predicted from the assessment. Caroline Van Howe, reporting on a survey of members of the Assistive Technology Industry Association noted that,

> one of the main concerns…was the lack of information about the outcomes or efficacy of the assistive technology products…It is very difficult to do a cost justification when you can't prove what the outcome is going to be, what the benefit is going to be…There isn't any national information database; it (the information) is isolated, often anecdotal…we have to have the benefits clearly articulated…to put that cost/benefit process together.

It was also suggested that cost/benefit concerns are driving 'upscaling' (e.g., designing and distributing more complex AT through which one product attempts to meet needs of many individuals). The problem of upscaling was succinctly observed by Ruth Ziolkowski, President of Don Johnston, Inc.:

> …from a developer perspective there is a lot of competition, and now we are getting into your feature wars…and we are developing for a lot of the experts--for technology experts--who want more and more features, and I think that's the big problem we have right now is we have been an expert and innovator type of industry and now we need to move to more of the mainstream.

But upscaling may be resulting in AT rejection or abandonment by professionals due to its complexity. As noted by Cheryl Volkman of AbleNet, Inc.:

> I think the funding mentality is costing us as a nation too much because people will do an evaluation of a student and say that this is the product that you need, but knowing that they have to have only have so much money they will go to a more feature rich product so that it will meet the needs of many more students and then it becomes too complicated and the people don't know how to use it and the product is abandoned and never meet the needs of the individual (SEAT Center, 2004).

From a consumer perspective, Marcia Scherer observed that

> …technologies are part of the problems themselves. In order to meet the needs of as large a number of people as possible, maybe in the spirit of universal design or what have you, they are so overloaded with options that you do rapidly reach a point of cognitive overload…it becomes less useful. It's not assistive anymore.

Challenges for Development of AT Services Nationally

Of particular concern to discussants was the recognition that there is no unified vision for AT across all disabilities. It was acknowledged that current educational accountability legislation and requirements, such as the No Child Left Behind Act of 2001 and its emphasis on adequate yearly progress (AYP) may drive systemic change nationally. This potentially poses a threat, according to Dianne Ashby, Dean of the College of Education at Illinois State University, who observed, "The question (in the schools) is how do we get these kids not counted, not how do we see that their academic opportunities and so their achievement improves." This suggested the need for a cohesive business plan with a single goal that addresses development and planning. In addressing the need for such planning, Gil Barner, former Executive-in-Residence at the University of North Carolina-Chapel Hill, noted,

> It's all [the system] fragmented. Everyone is doing very well in some places, but no one is doing very well in all. And so it would seem that some sort of group…needs to sit down and start with some very basic things, which is as where are you, who are you, what do you want to do, where are the strengths, how do we get all of this information…in a cohesive plan that then allows you to in effect advance with PR…and build an image to make this program appear valid to everyone.

Another major issue that emerged from conversations was the lack of best practice information for AT leaders and practitioners. This issue has implications for assisting with the development of regulatory language that addresses highly qualified personnel stated in the IDEA reauthorization. But the issue of highly qualified seems to pale in contrast to the immense challenges of preparing practitioners to have a minimum level of AT proficiency (see e.g., Wojcik, Peterson-Karlan, Watts, & Parette, 2004). Cheryl Volkman, of Ablenet, Inc., commented that,

> there are many, many special education teachers and AT specialists, but because the training is not very efficient in a lot if the colleges and universities, we continue to train all of the new people…and we never get over that baseline, and there is no one place where you can go to get the basics of communication and all of the things that they are doing in access to that curriculum; everybody is working on their own individual thing.

Participants also noted that entrepreneurial skill sets should be an important component of personnel preparation and service delivery approaches. Such skill sets would enhance organizational ability to develop and distribute products more efficiently. For example, Paul Dulle, Executive Director of Infinitec, commented on his organization's success in Illinois in creating school-based coalitions using a business model:

> …When we started the Infinitec program, it's fascinating, because the

> only way, whenever you bring up money, everybody goes, "Not my money!" So we were able to basically identify two cases in which school districts were told they had to buy a piece of technology equipment--pretty expensive piece for a child--and the school district said 'No' and the parents got their lawyers, and we were able to document $180,000 dollar legal fees over a $7,000 device, and it was only when we brought this reality to these people that they said, "Hmm. So the alternative is that we all contribute just a little of money and we create our own loan library", and that's how it [the Infinitec AT Coalition model in Illinois, emphasis added] grew.

Participants also noted a need to 'connect' or share information across various AT knowledge bases, emphasizing a current negative "silo effect" across the various AT disciplines. Infromation "silos" result from the creation of multiple knowledge bases which emerge from varying perspectives (e.g., medical, rehabilitation, education, vendors) and which are frequently not easily accessible across disciplines resulting in a diminished ability to create a comprehensive knowledge base.

Vision for AT Services Nationally

Conversations conducted regarding a national vision for AT services initially focused on six components. The first component was an organizing framework, which would, as Dianne Ashby, Dean of the College of Education at Illinois State University, observed, "bring people together around the notion that we need a national system and what the system looks like." This national system would be sensitive to (a) current needs for student achievement and student access to the curriculum, and (b) a linkage between special education strategies and the general education content, and (c) how those two things would work together to benefit all children.

The need for multiple levels of collaboration across stakeholders was identified as a second component of a national system, including collaborations across (a) State Departments of Education who are driving the state curricula and planning for adequate yearly progress (AYP) in the local schools, (b) vendors; (c) families; (d) children; (e) industries; (f) states; and (d) governmental groups.

A third component identified was the need for developing a more cogent understanding of the nature and effectiveness of existing AT systems and constituencies/organizations. To most effectively accomplish this, participants agreed that there is pressing need to identify both the roles and skill sets of assistive technology specialists nationally. Such an examination might entail convening these specialists to learn from them, with particular emphasis on how collaborations could most efficiently be expedited.

Education was identified as a fourth component of an envisioned national system. Once an understanding was gained from AT specialists regarding what they do well, particularly with respect to education and providing supports to service delivery systems, more efficacious educational approaches nationally could be developed. These approaches would include education (a) for all education practitioners, (b) parents, (c) across disciplines, and (d) of our policy makers and legislators.

A fifth component of a national system would include the creation of national technology standards—both for AT specialists and for teachers. As an example of this approach, Cathy Bodine, Assistive Technology Advisor for the Coleman Institute for Cognitive Disabilities, noted that:

> We went through all the national organizations--ASHA, AOTA--pick one and everybody's got their white paper on AT competencies. So we pulled all those out and created a list of 50 AT competencies. And we've divided into core and advanced competencies and that's what we are developing all of our curriculum around because it's cross-discipline and it's cross approach.

A sixth component of a national system would be increased awareness of assistive technology as a part of life-long system of support for all citizens. Increasing awareness might be facilitated by presenting to the public 'reality shows' in which environments and AT strategies could be showcased where learning was supported.

What is Needed 'Tomorrow' and In the Future

Discussants noted that there is a need to develop a best practices knowledge base that identifies competencies across disciplines and needed assessment tools. Of particular importance was the need to create equal access to knowledge and tools in 5 years.

As Jim Thompson, Chair of the Department of Special Education at Illinois State University, commented, "If we could come to consensus about our basic competencies across disciplines in terms of AT, that will clarify who is an expert and who is a beginner and at this point there isn't that type of consensus." Further, discussants noted the importance of assessment tools, acknowledging that the field has tools that lead people on the right direction, though it would be desirable to have assessment tools that were more prescriptive and provide insightful information in terms of what to do with an individual child. There is also a need to identify measures of meaningful outcomes that go beyond just the numbers of students accessing AT. The field needs to be able to make need statements or to make knowledge claims regarding student success that basically attest that particular students received appropriate student AT services and are using appropriate AT as a result.

Vendors especially would benefit from the dissemination of knowledge, as noted by Caroline Van Howe of Intellitools, Inc.:

> …we spend lot of money on canvassing our customers, getting their business needs, to direct a new form of product level process…we want to have business cases around the AT world, a business case that the vendor will appreciate to a certain extent in a collective way, or coordinated way of getting where do we all want to be five years down the line, sharing that information so that vendors could be similarly informed.

Cheryl Volkman of Ablenet, Inc., echoed the need for sharing information across stakeholders by stating that it was important for vendors to understand (a) how AT specialists are being held accountable in schools, (b) who is measuring that and how they getting a feedback that they are doing a good job ; and (c) how well advertised is the information. As she noted,

> From a vendor perspective if we know how, what they are being held accountable for and how it is being translated into student success , the level of support that they give us can provide that group of people such an incredible job. Then we also understand why 15 states have done it and why aren't other states doing it and how does that actually become a common system and how do more

> people have input into that support of that system.

Participants observed that equal access could be facilitated in a number of ways, including the (a) removal of economic 'disincentives, (b) identification of non-negotiable learner needs, and (c) decreasing the uniqueness of AT experts. As Jim Thompson noted in summarizing participant conversations, there are "…a lot of pockets of very good things happening but it's not equal across districts, across states, across income levels, across a lot of variables, and so to have an infrastructure in place which assures more equal access to equipment, to training, to expertise would be desirable."

The recognition that AT is still a cottage industry, though mentioned numerous times by participants throughout the proceedings, was succinctly highlighted by Tom Heimsoth, former CEO/Chairman of Resource Information Management Systems, Inc., who noted:

> …it is very much a cottage industry and everybody is working very hard to try to make sense of it and you go out and try to, you all are going out and trying to educate the educators and how they use these devices and it's just not enough --not enough traction in terms of the economics and a lot of these savings are not being transferred to the field.

In commenting on the importance of partnerships, Bob Aaron, Director of Marketing and communications at Illinois State University, observed that:

> The simple fact of the matter is that when you are talking about building a coalition--even if you have a common broad interest--there are so many sub-interests and turf issues…all of that has to be mitigated if we are going to look at a larger issue here and it's not just dealing in the governmental spirit, but building partnerships and collaborations with private industry, telling the story to private industry…

It was also suggested that efforts should be made to utilize a process of needs forecast that leads to product forecast.

Existing Entities That Could Be More Effectively Integrated

Numerous professional organizations and constituencies were identified that might be targeted for partnerships in creating a national AT agenda, including, but not limited to the following: (a) National Association of State Directors of Special Education (NASDSE); (b) National Governors Association (NGA); (c) American Association of School Administrators (AASA); (d) Council of Chief State School Officers (CCSSO); (e) National Association of Secondary School Principals (NASSP); (f) National Association of Elementary School Principals (NAESP); (g) Education Commission of the States; (h) Coleman Institute on Cognitive Disabilities; (i) Institute for Matching Person and Technology; (j) National Assistive Technology Research Institute (NATRI); (k) Consortium on Assistive Technology Outcomes Research (CATOR); (l) Assistive Technology Outcomes Measurement System (ATOMS); (m) Infinitec; (n) Assistive Technology Industry Association (ATIA); (o) Assistive Technology Act Projects (ATAP); (p) Quality Indicators for Assistive Technology (QIAT); (q) United Cerebral Palsy; (r) Easter Seals, and other disability organizations; (s) American Association for Retired Persons (AARP); (t) Council for Exceptional Children (CEC); (u) Technology and Media Division (TAM) of CEC; (v) Department of Education; (w) general education teacher groups, including union, grade level groups, and trade

associations; (x) university teacher preparation programs, including both general education and special education; and (y) the general public, including foundations and business sector.

Partnerships and/or Coalitions to Create More Effective AT services Nationally

Discussants observed that there is a need for integration of partnerships nationally to create more effective AT services. Specific strategies for facilitating such partnerships were also articulated. It was noted that determiners of outcomes should be identified, and outcomes incorporated into all partnerships and/or coalitions. A beginning point would be to start with schools who have not yet met adequate yearly progress (AYP, as described in the No Child Left Behind Act of 2001) and determine how technology might promote success. It was also observed that there was a need to quickly develop a national plan, or agenda, using the expertise and commitment of the discussants as a catalyst.

Information, training, access to AT, and outcomes research should be initial focii allowing development of a paradigm that facilitates creation of partnerships. It was also noted that those involved in developing a national plan, or agenda, must include representatives of the entire education curricula (i.e., all students, all levels). The importance of educating parents to empower them to request and make decisions about AT was noted as a change agent. To ensure maximal change, it was noted that crossing systems is important (e.g., linking school and rehabilitative services to ensure that AT travels across multiple systems, such as school to vocational rehabilitation, and vocational rehabilitation to work settings).

Outcomes and Benefits

Discussants noted the importance of identification and national distribution of a clear set of outcomes-based strategies and approaches for teaching people how to use AT. Suggestions included use of AT success stories (e.g., academic outcomes) and case studies reflecting consequences of not using AT. Discussants noted that another outcome desired would be for education and other professional teams to be able to access a point (network) to obtain needed resources for considering and implementing AT. Another outcome might be for the Disney Teacher of the Year to be an education professional who has used AT successfully with students to enhance student achievement. The ongoing involvement of ATIA in planning processes was also recommended.

Given that Illinois State University currently trains approximately 5,000 future education professionals, it was noted that the Special Education Assistive Technology (SEAT) Center was in a unique position to assume a leadership role in collaborating with other national groups to develop innovative training approaches for national dissemination. As observed by Ted Hasselbring,

> You look at the number of students that you educate and the number of teachers that you turn out and the opportunity you have to put lot of this in motion very, very quickly… So a lot the stuff we were talking about today could be put in motion at this university right here, quickly and have an impact and really become a national model.

Discussants observed that opportunities to create a national agenda existed, and that a 'turning point' in the field of AT was potentially existent if a plan was initiated quickly that (a) focuses on both short- and

long-term wins, and (b) emphasized immediate attention being directed toward short-term wins with student achievement as a context for the group effort. The importance of using an entrepreneurial approach as a backdrop for all planning was emphasized in order to synergize multiple partnerships.

Specific 'next steps' toward achieving these outcomes were discussed by participants as both a benefit of the meeting, and expected outcomes. To ensure momentum for the planning effort, it was recommended that financial resources to cover agenda development expenses and needed staffing--both full time and part time—be secured. The importance of convening a meeting in 2005 was also noted as a critical outcome. This meeting would be composed of selected individuals charged with the responsibility to create a working business and strategic plan that reflects (a) some innovation in channel and product development, measurement of need to reflect distribution priorities, and other guidelines and how to best incorporate the other players in a comprehensive AT market place; and (b) immediate innovative objectives that address student achievement initiatives (short-term wins), non-traditional partners, and include input pertaining to the definition of highly qualified personnel in the Individuals with Disabilities Education Act of 2004. Once the initial plan is developed, it was recommended that it be submitted for group review, refinement, and input from broad constituencies. This would then be followed by plan implementation with focus on short-term wins, and emphasis on expansion of partnerships with wide range of constituencies.

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Assistive Technology Outcomes: Implementation Strategies for Collecting Data in the Schools

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Abstract: While the importance of measuring the outcomes of assistive technology (AT) is well documented, less information is available about how outcome data collection can be integrated into daily professional practice. The metaphor of a snapshot provides an intriguing method for thinking about the collection of AT outcome data. The purpose of this article is to summarize recent work by staff of the ATOMS Project to analyze four strategies that have been designed to collect AT outcome data in schools. A brief description of each strategy is provided along with an analysis of the pattern of snapshots revealed through each form of data collection. The implications of this work for future AT outcomes data collection systems in schools will be explored.

Keywords: Assistive technology outcomes in schools; Data collection snapshots; Models of data collection; Implementation issues associated with assistive technology outcomes

While the importance of measuring the outcomes of assistive technology (AT) is well documented (DeRuyter, 1997; Fuhrer, Jutai, Scherer, & DeRuyter, 2003), less information is available about how outcome data collection can be integrated into daily professional practice (Armstrong, 2003; Laskarewski & Susi, 2003; Reed, Bowser, & Korsten, 2002).

Although the word "outcome" has a sense of finality to it, when looking at the effect of AT on a person's life, the reference to a final end-result is somewhat misleading. Often a person with a disability will use a system of AT that will change, be updated, and re-examined, as the person's needs, their tasks, and their environments change.

The analogy of a snapshot is helpful to consider when discussing AT outcomes (Fenemma-Jansen, 2005). A snapshot provides powerful evidence (i.e., data) about what is going on in the life of the child, where they are, who they are with, and what they are doing. Obviously, if you take 10 snapshots in a day, you have a more complete picture of the child's life than can be discerned from a single snapshot.

Likewise, snapshots taken over time allow viewers to gain a perspective on the use and influence of AT. For example, one can take close-up shots to examine finer aspects of technology use (e.g., how many words does the child combine to construct a sentence on her communication device?). Or, a person can use a wider angle and look at the influence that the technology has on a student's roles and relationships. We can also take pictures in different environments to see the effect of the technology at home, school, church, park, or grocery store. On the other hand, the pictures professionals take might look different from those snapshots taken by the child's parent, teacher, or friend. Their snapshots might focus on different things, use different angles than we would, or be taken at times of the day that we might not consider.

The snapshot analogy emphasizes the importance of looking at AT outcomes at many points in time, from many perspectives, in different environments, and considering the perspective of all of the important stakeholders. While the student remains the

primary focus within each picture, determining how, when, and where to take the snapshots are critical questions. In addition, attention must be devoted to developing a method for organizing and sharing the snapshots.

The purpose of this article is to summarize recent work by staff of the ATOMS Project (http://www.atoms.uwm.edu) to analyze four strategies that have been designed to collect AT outcome data in schools. A brief description of each strategy will be presented. Particular emphasis will be placed on understanding the pattern of snapshots revealed through each form of data collection. The implications of this work will be explored for future AT outcomes data collection systems in schools.

Survey of ATO Data Collection Systems

The snapshot metaphor (Fenemma-Jansen, 2005) raises provocative questions about the nature of AT outcome (ATO) data collection efforts. Whereas the literature provides little information about the types of ATO data collection systems currently used in K-12 schools, the ATOMS Project staff assembled a list of four strategies that have been implemented by schools in efforts to address questions of AT outcomes. In the first section we provide a descriptive overview of each ATO data collection system. In the next section, we analyze the patterns of ATO snapshots that are revealed through each strategy.

Assistive Technology Infusion Project

The Assistive Technology Infusion Project (ATIP) is a large-scale project funded by the Ohio Department of Education to disperse $9.2 million dollars of support to purchase AT and measure the outcomes in terms of access and participation in the general curriculum.

Individual schools applied for funding on behalf of an individual child using a web-based application system. Applications were reviewed and ranked by three individuals. Awards were made based on a qualifying score. In four phases of funding during 2001 - 2003, 3,479 awards were made. Award recipients were required to provide follow-up and outcome data on a specified schedule. Outcome measures were specially designed web-based instruments that assessed progress in the general curriculum and IEP goals.

ATIP has produced wealth of K-12 AT outcome data. While preliminary analyses are still being completed (http://www.atoms.uwm.edu), the ATO data has provided insight on the contribution of AT to improve outcomes concerning participation and progress in general education, achievement of IEP goals, performance on state assessments, and graduation rates.

GoalView

GoalView is a commercial Individual Education Plan (IEP) web-based product that is designed to facilitate the development and monitoring of student IEPs. As a leading vendor in electronic IEPs, GoalView has been widely implemented across the U.S..

GoalView does not specifically address the measurement of AT outcomes. However, the company supports district adoption by providing customized features. Kenosha Unified School District (Kenosha, WI) is in the process of adopting and implementing GoalView as the standard IEP development tool. Their strategy is to collaboratively implement customized prompts related to the consideration of AT and subsequent collection of AT use and impact data.

Linking ATO data collection to the IEP is a powerful strategy since it logically aligns instructional planning with outcome

measurement. It also eliminates the need to collect redundant data (e.g., student age, disability, instructional goals) as is required in stand-alone ATO data collection systems. In addition, it provides a single source for locating aggregate information about the number of students using AT or specific information about which students use a particular type of AT device. Finally, storing ATO data in the standard IEP system provides a means for archiving current and historical data.

AT Assessment Trial Data

It is commonly expected, as part of AT best practice, that AT providers will collect trial data as part of an initial AT assessment process. However, little information is available about how often this expectation is actually implemented nor what the trial data reveal.

One example of an easy-to-use end-user AT assessment database is found in the literature (Laskarewski & Susi, 2003; Susi & Laskarewski, 2003). The authors describe the Filemaker Pro-based database as an essential tool for AT decision-making. The database is designed as a case management tool that allows users to track individual students and record the device that was used, and the trial data that was collected. Built-in search tools allow the user to locate information by student, date, device, etc. The product has been used in many school districts in Connecticut and North Carolina in a consultant-support model.

Routine collection of AT performance data, both in trial phases and over time after adoption, has important implications for ATO data collection. The advantages of end-user customization may be offset by the lack of a centralized multi-user database (silo vs. multiuser). The underlying assumption of this model involves designating responsibilities for ATO data collection to a single individual who will then monitor the data and prepare reports as necessary.

Year-End AT Device Loan Survey

AT loan banks often utilize a consumer satisfaction survey to gather data about the use of specific AT. One district, Kenosha Unified School District (Kenosha, WI), distributes a year-end survey to all staff that have utilized AT devices through the district's loan bank.

The most recent survey was a three-item open-ended paper-based survey. The instrument solicits information on how often the device was used by the student, whether or not the device contributed to student progress on IEP goals and objectives, and a description of any unanticipated outcome (positive and/or negative) that resulted.

The survey results are compiled annually and reviewed by the AT staff and district administration. Outcomes can be examined by AT device, disability, or grade level. At this point, the survey illustrates a developmental process in moving an organization along in its efforts to address the questions of AT outcome. Without demographic information (e.g., AT device, disability, grade level), this approach to ATO is perhaps best considered as formative program evaluation. However, it also illustrates a developmental process in moving an organization along in its efforts to address questions of AT outcomes.

Analysis of the Snapshot Data Produced by Each Strategy

The previous section described four recent school-based efforts to collect AT outcome data. The variety of implementation strategies illustrate that each agency has developed a system for collecting ATO data that makes sense to them in an effort to answer

important questions. In this section, we seek to analyze the types of ATO data snapshots that are obtained through each approach.

In early work on measuring AT outcomes in schools, Silverman, Stratman, and Smith (2000) created a framework known as "Continuum of Assessment in Assistive Technology." This theoretical framework was developed in an attempt to define the phases of data collection associated with AT service delivery in schools as a means of profiling the specific or general function of AT outcome measurement instruments. The framework was based on the following sequential phases of AT assessment: screening, referral, comprehensive assessment, matching person and technology, acquisition, implementation, follow-up, and educational impact.

For the purposes of understanding how the four different ATO data collection efforts might yield different patterns of snapshots, we utilized the framework created by Silverman et al. (2000). As illustrated in Figure 1, the phases are represented as columns and the models of school-based ATO data collection are represented as rows. A "yes" response is placed in a cell if the model yields outcome data in that specific phase of the process.

The data in Figure 1 indicate that the four school-based ATO models yield very different patterns of snapshots. Of the four approaches, the Assistive Technology Infusion Project (ATIP) produces the most comprehensive sequence of outcomes snapshots. GoalView is also a solid ATO data collection strategy but has noticeable deficits in the areas of screening for the need for AT and factors associated with matching the person and technology. The Trial Data and Year-end Loan Survey provide contrasting snapshots (beginning vs. end of the process) and seem to suggest only a glimpse of the total picture by capturing snapshots in only three of the eight possible data points.

Discussion

Given the lack of information in the literature about strategies for implementing AT outcomes data collection, ATOMS Project staff identified four different ATO outcome systems currently used by schools as part of their local efforts to collect ATO data. A brief description of each model was provided to illustrate where the model is being implemented and the basic elements of data collection that are utilized. A framework created by Silverman et al. (2000) was then used to analyze the various types of ATO snapshots generated by each outcome system.

The findings indicate that the metaphor of a snapshot has potential value in understanding the nature of ATO data produced by different initiatives. The results suggest that comprehensive models like ATIP and GoalView provide more snapshots than

Figure 1. Pattern of data snapshots produced by each model of AT outcome data collection.

Model	Screening	Referral	Comprehensive	Matching P&T	Acquisition	Implementation	Follow-up	Educational Impact
ATIP		Y	Y	Y	Y	Y	Y	Y
GoalView		Y	Y		Y	Y	Y	Y
Trial Data	Y	Y			Y			
Loan Survey						Y	Y	Y

focused models like Trial Data, and Loan Bank Survey that yield a smaller number of snapshots in a narrower range of phases of the entire process. Therefore, comprehensive models that produce more snapshots over time may be more helpful in answering outcome questions than ATO data collection models that produce only a few snapshots within a short period of time.

It should also be noted that while the pattern of snapshots produced by ATIP are notable, it is important to point out that the entire data collection enterprise is at risk, in the context of being developed through grant funding, if the system cannot be subsequently institutionalized. As a result, in the current pilot study, the potential value of integrating AT outcome measurement into the IEP system appears to be particularly promising method of creating and archiving a comprehensive collection of ATO snapshots.

Future Research and Practice

The results indicate a considerable range in the types of snapshots generated by various AT outcome data collection systems. Additional research is warranted to understand the various patterns that emerge from different ATO data collection systems. For example, when do snapshots need to be taken? How many pictures are needed? From what angle? In what environments? Can snapshot protocols be standardized for all forms of AT or must the data collection timeline and procedures be customized for classes of technology (e.g., mobility, communication, learning)?

While the purpose of this project was not to conduct a comprehensive review of school-based ATO data collection efforts, it represents our initial efforts to explore the notion of ATO data snapshots. Subsequent research should focus on state and national surveys to assess the variety of ATO data collection efforts currently being implemented.

The analysis framework to organize the snapshots produced by the four ATO models should also be subjected to additional research. However, for the time being, this framework may be useful to practitioners as they begin developmental initiatives to assess AT outcomes.

Finally, the snapshot metaphor and subsequent development of snapshot theory appears to hold promise as a key construct in AT outcomes research. While the current project focused on issues of when and how many snapshots might be taken, additional work is needed to focus on issues of storing and utilizing ATO data snapshots. For example, the term, "digital shoebox," is currently used to describe an array of software and web-based products designed to organize and archive digital pictures (An updated extension of the old practice of simply storing family photos in a shoebox.) However, it is important to note that AT outcomes research will not be advanced by efforts that simply produce random collections of pictures. Rather, we need purposeful albums in which snapshots are organized. This line of inquiry may be facilitated by emulating professional practices associated with x-ray and Magnetic Resonance Imaging (MRI) protocols that standardize the time, sequence, and focus of snapshots. Similarly, research and professional development efforts will be required to enhance the ability of practitioners to interpret ATO snapshots.

Outcomes and Benefits

The purpose of this pilot project was to gain insight into four different efforts that school-based leaders have implemented to gather data concerning the outcomes of AT. It is important to view such efforts as essential, but developmental, in terms of advocacy and

leadership in moving the profession along a continuum of evidence-based practice.

The results of this project suggest that the metaphor of snapshots is a practical means of considering when and how to capture ATO data. However, there is much still to be learned. As a result, professionals and practitioners can continue the dialogue and make important contributions to professional practice by exploring the use of snapshots at many points in time as students are completing many different performance tasks with their AT.

While initial research and development efforts are likely to focus on practical issues of when, where, and how to take ATO snapshots, as snapshot theory evolves, considerable attention must also focus on methods of organizing, sharing, and interpreting the data obtained through data snapshots. The ultimate purpose of this work is to improve data-based decision-making about the outcomes of AT (Edyburn & Smith, 2004).

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The Central Role of Expectations in Communication and Literacy Success: A Parent Perspective

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Abstract: The author chronicles the search for augmentative and alternative communication (AAC) technology for her daughter Anna, who is now age 21. Though Anna has severe cognitive, visual and orthopedic disabilities, a more significant obstacle to finding a functional AAC system has been low expectations of her capability. Because Anna could not perform prerequisite skills for using even basic systems, more sophisticated technology was not tried for years. However, because her rich experience of inclusion had led Anna's parents to have "unrealistic" dreams for her, they insisted that Anna try more complex devices. Anna's subsequent success with the Vanguard™ and the Vantage™, by Prentke Romich Company, supports the author's conclusion that prerequisite skills should not be used to restrict access to AAC. In many cases, sophisticated technology may be just what people with the most complicated impairments need. Though Anna is still not fluent with her AAC device, the competencies she has demonstrated with it are way beyond anything she had been able to show with less complex technology. She has also gained a new sense of Self, through communicative assertiveness and a higher social regard by others. Anna's experiences should serve as an example for many underserved people who could benefit from AAC, including individuals with apparently severe and profound cognitive disabilities.

Keywords: Communication, Cortical vision impairment, Inclusion, Severe disabilities

My daughter, Anna, a young woman of 21, is in the process of learning to use augmentative and alternative communication (AAC) technology. Our family's search for AAC tools and strategies for Anna provides the chronology for this article. The ups and downs of our journey through the years provide the basis for my conclusions and lessons learned. Were my husband, Tim, and I to have the opportunity to raise Anna all over again, the main thing we would change would be expectations for her communication ability. Had we more fully acknowledged the communication skills she already used, and had we believed she 'had it in her' to learn the rest, the effect on her life would have been significant. There is no reason to despair. Anna's resiliency, and that of others having severe and profound cognitive disabilities, is remarkable. Once released from the trap of low expectations, and provided with the teaching they deserve, these students are free to grow into the unique individuals they were meant to be.

The beneficial effect of high expectations on children's performance has long been known, but low expectations are still prevalent, particularly for students with severe cognitive disabilities. Why do many educators and therapists continue to base their recommendations on the most cautious predictions for a child with disabilities? Sometimes it is based on the idea of not wanting families and students to "get their hopes up" and be subject to disappointment. However, this misguidance prevents parents from having dreams for their children, and dreams are the foundation for hope and for

action. Encouraging families to accept that their children will not progress beyond a certain level is the main practice which assures that they won't.

Inclusive Education

In order to fully understand our efforts to help Anna find her voice, it is necessary to look at her life in the context of her educational and community experience. Though challenged with multiple disabilities, including cerebral palsy, a seizure disorder, and cortical vision impairment, Anna has grown up attending regular schools and recreation programs in our community of Davis, California. Recently, she has moved into her own apartment in the community, through the benefit of supported living services. In retrospect, it is clear that this context of inclusive school and community has played a major role in our call to high expectations for our daughter.

After considerable advocacy struggles, Anna was allowed to attend her neighborhood school instead of the county's developmental center, using special education support in the kindergarten classroom. Tim and I were both special education teachers before Anna's birth, and we believed in our state's directive for least restrictive environment. Anna's elementary school years were full of wonderment for Tim and me. We were impressed with the astute observations of children, and felt relief in their perspective of life. This is not to say that these weren't also years of great difficulty, due to our "unrealistic" goals and the challenges presented by our only child, but we were always soothed by the other students' fresh "take" on Anna. Who else would speak of her as "lucky" to get a purple wheelchair, when she could no longer walk by herself? Who else would throw a party when she'd made it to one year without a seizure? The children intuitively understood the meaning of inclusion as "supported education". They insisted on teachers seeing the difference between adults doing things "for" Anna and peers helping her "do it herself".

It wasn't only the peers who knew imaginative ways to include Anna meaningfully in school. Once teachers got past their initial fears, they applied their creative curricular skills to Anna. Her second grade teacher, with special education support, used Anna's abnormal EEG at sharing time to talk about the brain. In third grade the classroom teacher, countering the stereotype of helplessness, cast Anna in the role of heroic rescuer of the drowning prince. The band teacher turned the bass drum on its side, so Anna could play it from her standing frame.

During these inclusive elementary school years, we not only learned about the spirit of children and teachers, we also learned about Anna's spirit and personality. Had she been placed within medical model strictures, we might have had to remind ourselves that our child with severe disabilities HAD a personality, that not everything she did was related to her impairments. Thankfully, Anna's personality insisted on being noticed for what it was. She revealed that her interest in music wasn't just because it made her happy. Her attraction to woodworking projects wasn't because they were basic and "hands-on." Her interest in enigmatic poems wasn't just a mystery. Rather, singing and dancing, using technical equipment, and curiosity about language were emerging as interests to be fostered. In a setting other than a regular school, we might have seen these interests primarily as therapy tools or incentives for compliant behavior.

The opportunity to choose electives in junior high and high school made education even more flexible for Anna than in her elementary school years. Just as for the other secondary students, there were many subjects from

which to choose. Among other courses, Anna was able to take World History, Drama, Weight Training, Modern Dance, Auto Shop, Biology and Photography. Within the six or seven class schedule each day, there was always a period or two of resource room work with special education staff and students, providing the best of both worlds, general and special education. This also created regular opportunities for Anna to touch base with her childhood friends with disabilities, important relationships to sustain.

Search for Communication Methods

Parallel to our family's advocacy work for inclusive education, we were constantly striving to figure out how Anna could expand her communication, beyond body language, facial expressions and the sounds that she made. The earliest method that held some promise for her was sign language, but she had a lot of trouble using her hands in certain formations, so she only learned about six signs overall. Communication boards didn't work well at first either, whether photos or drawings were used. Anna wanted to grab the pictures no matter how firm we were in directing her to point to them. Finally we realized that if she were to grab a picture of what she wanted and give it to us, we could use that as her system. Anna responded well, off and on, to this choice board and we used the method over the course of several years, with quite a collection of laminated photos of objects. One day Anna just wouldn't use the board anymore. I took a lot of fresh pictures, of new things in her life, but this did not make any difference and she pushed the board away.

Early alternative computer keyboards looked promising, so we bought equipment for home use and set up a learning station just for Anna. This attracted the neighborhood kids, which was fun, but Anna remained apparently indifferent to the wealth of imaginative software on her computer. Meanwhile, we were also becoming aware of other assistive technology items, and we made a good purchase: some large "jelly bean" switches to activate Anna's cherished tape player and radio. She loved having this technical control of her environment, limited as it was. And for my sake, I was glad Anna could now make something happen on her own. I felt that if one more person asked me if she understood "cause and effect", I would definitely lose my composure.

Anna's friend Nicholas, who could use his speech-generating device very well to speak his mind, was inquisitive about why Anna didn't have a device like his. I never knew what to say. I felt like I ought to explain that she wasn't yet able to use one, and that she couldn't even point to a picture of a cat or a house when asked, and that she really was so far behind in her learning that it would never be possible. But I couldn't say those things. How could I? In spite of my discouragement, I felt like I still didn't really have a clue about Anna's capabilities. Eventually Anna did get a few simple voice output devices, one after another, into which her classmates could record things they hoped she'd like to say. These devices, one of which got mounted on her wheelchair, were good for supporting inclusive participation. A peer could prompt Anna to say the Pledge of Allegiance, or to take her turn in reporting the weather. This didn't seem to have anything to do with real communication, but it didn't matter anyway, because Anna rarely used these devices of her own volition, except as something tactile on which to tap a beat.

Asking Questions, Questioning Assumptions

It was slowly occurring to me that we really should start questioning current assistive technology practices in the same way we had questioned special education practices. I kept

thinking about the rich literacy-filled environment Anna had every day at school, and the wealth of social communication that swirled around her in her community. By now, I believed she was taking it all in, and I was afraid we were running out of tools to try that she could use to express herself. I still didn't realize that attitude and lack of expectations might be the biggest obstacle to overcome. I wanted to learn more about some of the sophisticated devices that children like Nicholas had been using, and began to wonder if Anna could learn to use one. We inquired, but specialists gingerly let us know that we were being unrealistic about our daughter's limitations. According to them, not only had she not shown enough motivation to communicate, she certainly couldn't use a complex device until she had learned basic communication skills and was able to follow directions. Hearing that, I should have known that being called "unrealistic" could once again indicate that we were on the right track. Might it be that assumed truths about communication prerequisites were wrong? Might it be possible that the developmental model, like the medical model, could hinder teaching rather than promote it? Ultimately, even if we weren't on the right track, what harm would it do to try? A standstill like this in communication isn't about being able to order a pizza or not. It is about self-preservation, possibly even about one's soul living or dying. With something this crucial at stake, it is only fair to think in terms of what Anne Donnellan in 1984 called "The Criterion of the Least Dangerous Assumption", a guideline we adopted when deciding school placement: "When we cannot be sure, because we have too little information, we should base our efforts on assumptions which, if wrong, will have the least dangerous effect on outcomes" (Donnellan & Leary, 1995, p. 15).

I decided to take Anna to see her ophthalmologist, a specialist in neurological (cortical) vision impairment (CVI). I took a borrowed dynamic screen display device with me and asked the doctor whether he thought Anna capable of using something like this, given her visual processing disability and severe developmental delay. He looked at me and said, "I think she should have whatever works." His words floored me in their simplicity. Was he suggesting that we actually operate on a basis of common sense? I chuckled at the apparent incongruity of using common sense to guide us in the pursuit of unrealistic goals, but it really resonated with me. This man's matter-of-fact point of view was liberating, and in retrospect I should have expected it from him. He was the one who always asked Tim or me questions like, "Where do YOU think Anna has the best field of vision?" "Do YOU think her delayed response is due to vision processing?" He said we were the ones who knew her best and he needed our observations. CVI, like language impairment, is very complicated and he didn't mind telling us he couldn't determine exactly how Anna processed visual information. I decided to view language processing in a similar way, with respect for how much is unknown, and with trust in our own perspective. I became adamant about finding AAC people who would evaluate Anna in a more open way, listening to her family, assuming her competence, admitting they don't know everything, and looking for "whatever works".

In the process of my search, I was encouraged to learn that a number of researchers and clinicians had been voicing concern about the imposition of prerequisites for access to AAC and communication training (Kangas & Lloyd, 1988; Reichle & Karlan, 1985). Reichle (1991) refers to a lack of data supporting the need for prerequisites: "Despite this lack of evidence, some interventionists persist in demanding cognitive prerequisites. As a result, a learner may be forced to learn inappropriate and non-functional series of tasks aimed at teaching presumed cognitive prerequisites, or

a learner may be prohibited from receiving any communication instruction at all" (p. 41).

This was indeed a sinking feeling of déjà vu for me. In looking for information about AAC, we were in yet another situation in which the field practices were clearly lagging behind research-indicated best practices. Earlier, when Tim and I were seeking school inclusion for Anna, authorities seemed unaware of the concept of education in the least restrictive environment (LRE), even though it had been directed by the Federal Government more than 10 years prior (Education for All Handicapped Children Act of 1975). There was also a more insidious aspect to both of these roadblock situations, and it should be mentioned. Even educators who were well versed in LRE philosophy had assumed the policy did not refer to students with the most severe disabilities - "those kids." Now, I was recognizing similar conclusions being made regarding the use of AAC, for which "those kids" were not considered candidates. Enjoying the company of our intriguing daughter, it often slipped my mind that she belonged to the historically most devalued category of citizens: individuals with cognitive disabilities (Wolfensberger, 1975). But that reality once again hit me in the stomach, and I knew I'd better keep it in mind, even when trying to enlist the support of other AAC users, who had struggled for years to prove they were not cognitively impaired.

Gaining Access to More Versatile Technology

Fortunately for Anna, we met experienced leaders in the field of AAC who were cognizant of best practices and unwilling to let IQ scores, behaviors or appearances prevent students from having a go at high tech devices. I recruited several of these innovators to evaluate Anna's language and communication skills, and to recommend next steps for us. From the start, we knew we had the right people, since they treated Anna with great respect, and were not bound by convention or preconceived expectations. Tim and I watched as they tried different devices and access methods with her, all in the context of enjoyable activities and un-pressured interactions. Sadly, even though the hours they spent were engaging for Anna, we still didn't see her perform or prove herself in any way. Our hopes were once again on hold, until we understood with great relief that these new people weren't concerned about an impressive performance or quick "proof." Instead, they were looking for clues as to what Anna's best modes of learning might be, and for her attraction to various technologies. They were looking for the best way to teach Anna to use a device that would give her access to the most language possibilities. The evaluation process and reports were the first we'd seen with such a positive emphasis on teaching. In the past it felt like assessment conclusions came from mere exposure to technology, implying "either you have it or you don't." These new sensitive and sensible assessments, and the menu of teaching methods they offered, helped to change our view of Anna's potential as an AAC communicator.

Five years ago, based upon several thorough evaluations and a videotaped trial period, Anna received funding for a Vanguard dynamic screen display device by Prentke Romich Company. The Vanguard is a speech-generating device with a language system called Minspeak, or Unity, which enables AAC users to create original sentences "from scratch." It has a selection of voices, which use 'Dectalk' to speak the words. The amount of instruction required to learn Unity completely depends on the student's individual needs and experience. In the past, teachers and therapists had been hesitant to show a device like the Vanguard to Anna, *because of* her severe cognitive disabilities and

unpredictable visual processing. However, my experience now convinces me that this is exactly the kind of technology a student like Anna needs, because of these complicated impairments.

Greater Competence Revealed

In training with the Vanguard, Anna was shown how to direct select, using the dynamic screen feature in which one page is linked to another. The sentence-based utterances were pre-programmed for her, based on what was known about her interests. After weeks of teaching and experimenting, Anna was able to recite by herself, "I want to listen to music. Play a tape. Earth, Wind and Fire." She was so excited that she repeated this sequence over and over, pointing to different musical selections as desired, as if delayed movement had never been a problem. As I described earlier, Anna did not form these sentences herself, but in uttering them independently, she demonstrated more enthusiasm and competence than we had ever seen. Indicating the above musical choice took Anna six separate hits, navigating rapidly through four changing screen displays. She was able to use similar sequencing patterns in a matter of weeks, allowing her to ask for her treasured candles and incense, and asking everyone who came to our house, "Do you want to dance?" There were other surprises as well. We had been told for years that Anna's inability to point her finger indicated the need for a large icon target area; that her CVI required at least two inch x two inch size icons; that her degree of cognitive delay meant using no more than four to eight icons per page; and so on. Anna's new skills with the Vanguard, even though inconsistent, changed all that.

The first important feature of this device for Anna was its back lit screen. Whereas paper overlays on her other devices were of little interest to Anna, the Vanguard's screen captivated her. Not only were the colorful icons - all 45 of them on a page - fascinating to Anna, but her visual attention was summoned each time they "jumped" while pressed. It was as if she was glad to see what she was saying. She saw not only icons, but words, because text is included above or below each icon that represents it. Anna's attending span was easily extended it seemed, by the ever-changing screens of icons as she navigated through her pages. People with CVI often see objects more easily when the objects are moving (Roman, 2004), and this device addressed that fact as no other had, even though the icons were only one inch square.

We could tell that the aspect of predictability was important to Anna from the start, in the placement of her icons on the new device. Again, with the challenges of CVI, familiar activities and things are often more attractive than novel (Roman, 2004), so it is no wonder predictability mattered to her. Anna counted on the icons being in the exact same place on her core page and the other pages she used, so much so that she would become upset if somebody decided there was a "better" place to put them. Stability of icon location proved to be crucial for Anna's motor planning.

The Vanguard's voice, specifically the Dectalk voice "Ursula", seemed to appeal to Anna far more than friends' digitized voices. With the Vanguard, she could predict what she would hear each time, acquire more of a sense of control and have a voice to hear as her own. As for not being able to point, this was solved by a 45-square key guard, a clear plastic grid that allowed Anna to perch her index finger just below an icon square, in order to rock her isolated finger tip in and press the selection. Here she was, learning how to point while learning how to communicate. One prerequisite after another was going out the window!

Versatility: The 'High Tech' Inside the Device

I believe versatility is the best way to think about a dynamic screen display device, rather than assuming the linear definition of high tech, as in "cognitively advanced". Complexity and sophistication are other words applied to such devices, but in my experience these words refer to technical aspects, which don't automatically require a particular cognitive level for the user. Years of cognitive effort are expended by the inventors and researchers who create the language system, and design, build and program the devices, but in the end, the complexity on the inside does not have to be reflected on the outside, in the screen that faces the communicator. Technology like the Vanguard is so versatile in its options, that it can be introduced in many ways and at any age, so that student and teacher have all the tools at their fingertips, allowing them to proceed through a completely individual path of learning. This can include the opportunity to begin with full language, rather than use it as a distant goal.

Through Anna, we have learned to leave our fear of technology behind. I'm convinced another reason "high tech" items are not always in the evaluation tool kit has more to do with teacher, parent or therapist intimidation than with user capability. It isn't fair to project this fear onto a child who might be very comfortable with technology. Cousins Kevin and Logan were nine and eleven when Anna got her Vanguard. They learned in about ten minutes the basics of using it and programmed their own jokes for Anna to tell. The demeanor of all of them was not that of trying to fathom a complicated device. Rather, the effect on these three young people was of looking at something fascinating that could be even more fascinating, once they got their hands on it.

Expanded Interaction and More Meaningful Inclusion

Even though Anna's use of the Vanguard fluctuated unpredictably, we could see that her communication was indeed far more than choice making. Anna liked finding keys for asking questions and making comments, even though still using the questions and comments that others programmed for her. She liked hitting the key that had been freshly programmed to tell me something about her day. Though late in life to begin learning AAC, it was beneficial that she was still in high school when she got the device, because her peer tutors were quick to learn how the device worked and happy to provide appropriate teenage vocabulary. Teen AAC users who are at the mercy of polite parents and teachers for their vocabulary may not be given enough opportunities to complain or to insult friends, as their peers like to do, so it was good that her friends gave Anna a way to say negative things. Negativity can be very motivating to young people with newfound control in communication. "This is pissing me off!" became a favorite, as well as "You don't understand!" and "Whatever!" Unfortunately, she has said "Will you please shut up!" and "Leave me alone!" at completely inappropriate times. Then again, who hasn't?

In academic classes, Anna's new technology helped her participate more meaningfully. Though she didn't do biology curriculum at anywhere near the same level as the other students, her teacher was now able to call on her and she could at least say something. Johnny, her assistant in biology, might help her form a comment pertinent to the subject, or then again, she might reply on her own, "This is pissing me off!" The reaction to Anna saying that statement in class would surely show her the power of her spoken words.

I visited one day in auto shop to take some pictures and was able to surreptitiously photograph Anna balancing a tire on her wheelchair tray, with the help of Libby, her peer tutor. The teacher aide who supervised was showing Anna and Libby how to spell "lug nut" on the Vanguard. Here was my daughter referring to lug nuts, something immediate and personally meaningful, saying, hearing and spelling it on the spot in the auto shop garage. What a sight it was! They were able to do this because every Vanguard page Anna uses has a link to a spelling page; any word at all can be included when forming a sentence. Because of the Vanguard's versatility, instruction can occur in context, almost anywhere, even when changing a tire. Again, as Laura "Dollie" Meyers (Meyers & Horton, 2001) has reminded us, "Teaching is the missing key. During most training for professionals specializing in Assistive Technology, there is no focus on implementation. Courses just address choosing the 'right' device…Extensive, intensive teaching during implementation is the key to success."

As a lover of music and dance, Anna has always enjoyed being in performances. Drama class in high school was the ultimate, because now she had the Vanguard with which to say her lines. In one student-scripted scene, Anna played a young woman, jilted by her boyfriend. In another play, she portrayed the voice of God. In yet another, she got laughs as a mother who yelled things at her daughter, such as, "You ungrateful brat! How could you talk to me like that?" These were pre-programmed lines that Anna needed to deliver at just the right moment, a difficult task for someone who has failed for years at turn taking. Peer tutor Maria sat on stage at her side, helping Anna with cues and tapping her elbow if she seemed "stuck" (Donnellan & Leary, 1995).

There is a difference between AAC goals for participation and those for communication skills. As long as we know the difference, both are worthy goals. It was during the resource room periods that Anna was able to receive more communication training with her device, another convenience of the secondary school schedule. The practice time was not her favorite, as she didn't always respond well to the sequencing repetitions. During these times, it was more stimulating for Anna when peer tutor Marcus helped her write letters or create short reports for her classes by using her Vanguard connected to the computer. With Intellitalk word processing software, Anna heard and saw what she was saying, first on the Vanguard and then again on the computer in enlarged font. Marcus helped her print out the sentences, reading them to her as she looked at the report. Her delight showed that she was tuning in to the power of her printed words. We began to see that Anna would be approaching AAC and literacy in her own unique way, or not at all. We had to live with this, even though it meant instructive activities had to be highly motivating to her in order for her to do well with them.

Expanded Expertise: Internet Friends Who Use AAC

When I was worried about Anna's obsessive repetition of phrases or words, another of her habits with her new device, I emailed several AAC mentors. The internet and email provide an indispensable resource: direct contact with other people who use AAC. Edwin "Speedie" Marrero (personal communication November 10, 2000) replied ironically, "The best advice I can give you is practice, practice, practice! I used to spend hours just playing with the keyboard. I memorized words I used all the time. I didn't use sentences at first." Indeed motor planning - turning voluntary into automatic movements - appears to be a key focus that works for Anna in learning to use her device.

When Anna first started using her Vanguard, we contacted Snoopi Botten (personal communication, October 13, 2000), a Vanguard user who is also an ingenious software developer and musician, with some questions about the changes we saw in our daughter. Here is what he said: "The key is expectations. I see it everywhere. If someone has very low expectations, they not only don't give a person a chance, but they create an environment that only validates their preconceived expectations. The problem is people don't even realize they are setting up the situation so it won't go beyond what they expect. Anna and her Vanguard is a good example. Before she had her Vanguard, there were things that were never tried just because the expectations weren't there. But now her Vanguard is slowly changing people's views and the expectations are slowly growing."

Snoopi's observations about the change in expectations for Anna really made us think, especially when he asked if we thought Anna could be using a Vantage, which is a smaller, more convenient version of the Vanguard. (The Vanguard weighs 6 lbs. and has a 12 inch diagonal screen, while the Vantage only weighs 3.5 lbs. with an 8 1/2 inch diagonal screen.) When the Vantage came out, we hadn't even thought of showing it to Anna, because it seemed impossibly small for her to see. After Snoopi prompted us with his question, we were humbled when Anna tried the smaller device and selected keys with no difficulty at all, pointing to icons that are 3/4' by 3/4 ' in size. Eventually she was able to get a Vantage, and that is what she is learning on today.

Using All Levels of Technology

All the discussion about versatility of high tech does not mean the exclusion of other types of AAC. By keeping ourselves aware of what works for Anna, we have observed that she wants to use all kinds of means to interact. One of the low tech items that is still in her life is the one hit recorded button (talking picture frame or jelly bean switch), attached to various pieces of furniture in her environment. By the back door one says, "I want to go outside." On the game shelf one says, "Will anyone play Twister with me?" By her bed another says, "Hey, I'm awake!" Anna likes to use a multi-level message recorder to sing the lines of a song. She carries a yes/no/alphabet board in her wheelchair pack. Each morning she goes over her schedule with a wipe-off board of icons and topic words that outline her day. Occasionally Anna also uses an eye gaze frame or a clear rectangle of plexiglass to dwell with her eyes on what she wants, as indicated by icons, words or photos.

Since her ability with all of her AAC tools fluctuates, Anna also relies heavily on her vivid facial expressions (e.g. eyes wide open meaning something hurts), body language (e.g. mock-biting of her hand indicating frustration) and mobility (e.g. moving toward something in answer to a question) for communication. She uses different vocal sounds to indicate emotions (e.g. a soft hum means she's pleased, a throaty groan means she's getting angry). I believe we should honor anything Anna uses to indicate her needs and moods, without trying to replace it with something we think might be better. Initially we didn't understand this and tried to "streamline" all of Anna's communication into her device. In so doing, we confused her. For example she stopped using her precarious "yes" and "no" hand signs, which were almost working consistently for her. We won't make that mistake again. A low tech method may work better than a high tech one, depending on the situation.

Language and Literacy Support

The versatility of the Vantage is what allows complete flexibility in teaching approaches,

and also the ability to program easily, if changes are needed. Anna began her Vanguard training with a combination of Unity core vocabulary, and a linking of custom-created pages. Recently, SLP Kristen Newman Carroll has begun skillfully guiding Anna, and those who support her, through the Unity language system, focusing on building sentences completely from the core page, rather than linking to pages and using one-hit sentences. Anna's progress continues to fluctuate all the way from periods of obvious competency to days in which she barely touches her device. It is probable this would have been easier for Anna to learn, had we started from the beginning in this way, but that is water under the bridge, and it is important to remember that the Vantage can eventually be used in any way that works best for Anna, including her previous combination approach (core word-based page, plus linked custom pages) for different types of conversation situations (Higginbotham, Lesher, Todman, File, & Wilkins, 2002). Also, as one of her evaluation team members has put it, "She had 16 years without a consistently effective communication system. She should have at least that long, if she needs it, to learn what she needs to learn." (K. Weber, personal communication, March 18, 2000)

Anna's present life in Davis includes a volunteer job at a local health clinic, weight training at the athletic club, and a beginning choral group, using Snoopi Botten's (2005) new software to program her Vantage to sing. Anna's schedule still also includes supported education; she is taking a world music class at the community college and a night cooking class for students with disabilities at the adult school. Also included in her day are supported literacy activities, guided by linguist Dollie Meyers' approach to computer work with students who use AAC. In Dollie's words, "…the keys to effective computer use by children with language disabilities are to implement the computer both as an access tool and as a personal meaning tool; that is, to use the technology to provide access to speech and text, link it to their personal meaning systems, and thereby allow them to participate in the natural processes of language learning" (Meyers, 1994, p. 260).

Support staff helps Anna create books with topics of special interest to her, like dreaming, flowers in nature, medical equipment and playing the drums. Also, some of her favorite authors' books and verses have been transcribed to her Vantage and her computer. Our next task is to set up controls so that Anna can independently come into her bedroom, wake up her eMac, find her current favorite book in Intellipics® Studio, made with her own iPhoto illustrations, and recite it out loud, turning the pages with the click of her switch-adapted mouse.

In poetry Anna has shown us the most effective tool of all with which to draw her into reading and writing. Rhythmic, rhyming fantastical poetry is still the thing that catches her ear and focuses her attention. Caroline Musselwhite refers to poetry's attraction in this way: "Poetry for Life: At the highest levels, poetry helps students express who they are, a possibility that is especially empowering for students who are non-speaking" (Musselwhite, 1995). Cousins Kevin and Logan have recently used Garage Band software on Anna's eMac, to make a CD of rhythmic/harmonic tracks over which Anna can recite her own rhymes. Anna and her team are writing lines, singing lines, and using core vocabulary words to surround the colorful extended vocabulary that emerges from their community activities (Van Tatenhove, 2000). We are experimenting with a floor stand for the Vantage, so Anna can deliver verses between her beats on a real drum. Much like she formerly used a standing frame for weight bearing, she can now stand at a set of tall conga drums (with someone

standing behind her, just in case). Open mike night at the local coffee house will be a good place to start, with plenty of other opportunities for poetry slams on the horizon, if this "takes off".

Outcomes and Benefits

Inclusive education was the catalyst for the rise in expectations for our daughter, because it allowed us to have dreams, and challenged us not to settle for less than those dreams. Anna living a "regular life" in her community has been our first dream fulfilled, and it is providing the backdrop for the other important dream of AAC communication that is in progress now. Many of the benefits for Anna have been described, in the form of greatly increased opportunities for interaction, participation and literacy, as well as the revealing of increased skills and competence. The versatility of her technology, combined with her new-found skills and the power of good teaching, is leading Anna to a brighter communication future. She is maturing amid unsettling changes in her life and she is developing a clear sense of Self. She is also afforded a much higher regard by others, now that she has become more of a vocal presence. Her device has helped enormously to bring Anna "into the action", which has in turn led her to presenting herself as a contributing individual with a right to be recognized. I firmly believe this assertive self-image is in turn making Anna more receptive to the AAC instruction she will need for a long time to come, by showing her what she has to gain.

The outcomes for Anna and the beneficial effects on her family and support network are intertwined. Tim and I are no longer paralyzed by low expectations, and have allowed ourselves to be more comfortable with the unknown. This includes perplexing periods of stagnation in progress, as well as strings of triumphant moments that erase all of our doubts. Humility, intuition, imagination and unlimited brainstorming are the tools we've come to trust in this process, and we will never run out of these tools as long as Anna is leading the way.

Most important for us is what we are learning from paying attention to our part in communicating with Anna, both in direct interactions and in perceptions. We are trying to take the focus off of her as the problem (i.e. the patient) when things are rocky, and learn a more expansive way of regarding communication, which is affected by what both communication partners do or say, in addition to a host of other environmental factors. 'Joint establishment of meaning' is a way of looking at the whole of a communicative interaction, and it has many aspects, from gestural to relationship and time constraints (Wilkins & Higginbotham, 2005). On a profound level, we are learning how to BE during interactions with someone who may be using her device in a slow or repetitive, circuitous way. The thing that really creates true connection when Anna and I are verbally interacting starts with entering her world by leaving the rest of the world behind. When we do this, the focus is there; I can see it in her face and feel it in her touch. We are familiar with that bond, because we have had it for many years within our non-verbal communication. Carrying it forth, with the effort of using words, is a different challenge. But when Anna knows someone is truly present with her, she trusts that she has time to be herself, laying the groundwork for real communication.

Conclusion

It is my hope that our story will provide an example to readers of the need to stretch the boundaries of expectations for their clients and for their children, and to understand that strong advocacy will likely be required. The need to improve

communication services for people with severe disabilities continues to be an ongoing concern. In 1992, the issue was addressed formally by the American Speech and Hearing Association (ASHA) as a human rights concern: "…the opportunity to have communicative effects on one's environment is a basic human right that should be enforced and enabled by the provision of active treatment for persons with severe disabilities…" (National Joint Committee for the Communicative Needs of Persons with Severe Disabilities, 1992, p. 3). Since that time, AAC users, researchers, educators, clinicians and families have produced a wealth of creative materials, including assessment and teaching methods and philosophies, a number of which have been used in supporting Anna (Beukelman & Mirenda, 1998; Erickson & Koppenhaver, 1995; Fried-Oken & Bersani, 2000; Meyers, 1994; Musselwhite & DeBaun, 1997; Rogers , 1999). In spite of these and many other contributions, ASHA still saw the need in 2003 to alert practitioners, in a detailed Technical Paper: "Eligibility policies and practices often preclude children and adults with severe disabilities from accessing needed communication services and supports" (National Joint Committee for the Communicative Needs of Persons with Severe Disabilities, 2003, p. 19).

The words are clear, the strategies are there, but daily reality is a different story. It is necessary to "walk this talk" into classrooms across the country and into programs right around the corner. One will still find children and adults with communication impairments, whose unscientifically determined "low functioning" label continues to perpetuate their social isolation. The inhumane limbo that these people must endure is still often based on faulty prerequisites, labels and purported lack of funding, rather than on any data about their individual language capabilities. According to ASHA, "Eligibility determinations based on a priori criteria…" …[including] lack of funds or other resources…" "…violate recommended practice principles by precluding consideration of individual needs" (National Joint Committee for the Communicative Needs of Persons with Severe Disabilities, 2003, p. 20.)

Though the challenge of funding AAC tools and services may exist for a long time to come, it is clearly not a legitimate reason to arbitrarily limit assistive technology options. If it requires sophisticated AAC technology to introduce an alert toddler into the world of literacy, then sophisticated technology is what he must have. Likewise, if it takes sophisticated AAC technology to meaningfully bring a marginalized adult into the life-giving world of interactive communication, then sophisticated technology is what she must have.

Ultimately, we may learn all the right strategies to support Anna, and she may grow to be a literate and fluent communicator, at a pace that will hold an ordinary conversation partner's attention. But even if she does not progress to advanced skills with language and literature, Anna and others with her degree of challenges still deserve access to whatever works, for however long it takes, to give them expanded language, truer self expression, and a powerful way to interact with the significant people in their lives. Everyone has a right to communicate. All does mean all.

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Toward Positive Literacy Outcomes for Students with Significant Developmental Disabilities

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Abstract: Three classroom teachers and their 23 students with significant developmental disabilities were studied across 8 weeks as a new literacy and communication instructional program, *MEville to WEville*, was implemented. Before and after the implementation, the students were tested on a variety of literacy measures, their teachers were interviewed, and each classroom was observed. During the implementation, each classroom was observed at least once each week for a total of 35 hours of observation. Measured outcomes and benefits of the *MEville to WEville* program were evident for the students in each classroom. Students demonstrated increases in their attempts to initiate and sustain social interactions, and improvements in their literacy skills and understandings. Although observed differences did not reach statistical significance, the outcomes represent a significant practical difference for the children in the current study.

Keywords: Literacy, Communication, Curriculum, Instruction

Research regarding the predictors of literacy learning success and the instructional approaches that promote success are readily available [see e.g., The National Reading Panel Report (National Reading Panel, 1998); The Rand Reading Comprehension Report (Rand Corporation. (2004); or Preventing Reading Difficulties in Young Children (Snow, Burns, & Griffin, 1998)]. It is now well recognized that literacy learning difficulties can be ameliorated if practices drawn from the extensive scientific research base are implemented to prevent failure before it occurs. Limited evidence, however, is available that specifically addresses the literacy learning needs of students with significant disabilities, particularly those with accompanying complex communication needs (for a complete review see Erickson, Koppenhaver, & Yoder, 1994; Koppenhaver, Spadorcia, & Harrison, 1998).

Research supports the fact that students with significant disabilities can learn to read, at least words in isolation. Students with a wide range of cognitive impairments have learned to read single words in a variety of contexts, under a variety of conditions (for a complete review see e.g., Browder & Xin, 1998; Erickson et al., 1994; Katims, 2000). For example, in a series of studies, students with moderate cognitive impairments demonstrated the ability to: (a) learn words and perform an action associated with each word (Brown & Perlmutter, 1971); (b) read words presented with a picture that was faded over time (Dorry, 1976; Dorry & Zeaman, 1973, 1975); and (c) read words paired with sign language (Sensenig, Mazeika, & Topf,

1989). In addition, research has shown that students with severe cognitive impairments can learn to read words as well in small groups as they can working individually with their teacher (Favell, Favell, & McGamsey, 1978), and that they can learn words incidentally working in small groups (Farmer, Gast, Wolery, & Winterling, 1991) when the small group instruction is systematic (Fabry, Mayhew, & Hanson, 1984).

Furthermore, a few published case studies suggest that students with significant disabilities can learn higher level reading and writing skills when word instruction is a part of a more comprehensive, systematic instructional program provided by a highly skilled educational team with intensive support from consultants with expertise in literacy and severe disabilities (e.g., Erickson, Koppenhaver, Yoder & Nance, 1997; Katims, 1991; Gipe, Duffy, & Richards, 1993). One published study involving a comprehensive, year-long literacy intervention suggests that students with moderate cognitive impairments can develop word identification and reading comprehension strategies, metalinguistic understandings (e.g., phonemic awareness), and confidence in their ability to decode unfamiliar words (Hedrick, Katims, & Carr, 1999).

A New Literacy and Communication Program

In 2004, AbleNet, Inc. published a new literacy and communication instructional program called, *MEville to WEville*. Developed to meet the instructional needs of students in grades K-6 with the most significant multiple disabilities, the program also addresses the needs of the students with moderate cognitive impairments who are often in the same classes. The entire *MEville to WEville* program is intended to teach students about themselves and their place in their family and the larger community. The themes of the two units studied in the investigation described here were: "I have feelings" and "I'm an individual." Within each unit of *MEville to WEville,* activities are divided across categories described in the following sections.

Language development lessons. The lessons in this category include Learning New Songs, Learning New Words, and The Word Wall. The focus of these lessons is teaching new words and developing students' expressive language skills through singing songs, chanting words, saying words, and using words in oral and written phrases and sentences.

Reading and listening comprehension lessons. The lessons in this category include Vocabulary Comprehension and Story Comprehension. The focus of these lessons is providing opportunities to read, experience, listen to, and respond to a variety of books and stories.

Writing development lessons. The Writing Activity lessons in this category provide students with opportunities to express themselves in writing and to develop their writing skills.

Reading development lessons. The Reading Activity lessons in this category provide students with opportunities to read and reread (independently, with help from an adult or peer, and/or with the support of assistive technology) the books they created in the Writing Activities and the books they have heard in the Story Comprehension lessons.

Literacy experience lessons. The lessons in this category include Literacy Activities and Literacy Projects. These lessons are extensions of the literacy learning activities in each of the other categories and encourage students to use the skills they are learning across engaging games and activities (e.g., scavenger hunts, program-specific board games, and creating puppets).

Table 1
Summary of Participants

Class 1 Mrs. B (2 assistants)	Class 2 Mrs. C (2 assistants)	Class 3 Mrs. P (3 assistants)
• 9 students (5 girls, 4 boys) • Ages 5 – 7 • 3 white, 1 Hispanic, 4 African American • Moderate-Severe Intellectual Disabilities • 2 use wheelchairs • 2 with complex communication needs	• 6 students (3 girls, 3 boys) • Ages 5 – 7 • 4 white, 2 African American • Severe-Profound Intellectual Disabilities • 3 use wheelchairs • 6 with complex communication needs	• 9 students (3 girls, 6 boys) • Ages 8-12 • 3 white, 1 Hispanic, 4 African American • Severe-Profound Intellectual Disabilities • 4 use wheelchairs • 8 with complex communication needs

The instructional approach employed in *MEville to WEville* deviates from the repeated trials, mastery-focused instruction that dominates the research literature regarding literacy instruction for students with cognitive impairments (see, Browder & Xin, 1998; Erickson et al., 1994). *MEville to WEville* supports integrated literacy and communication learning through a series of divergent activities that offer the opportunity for students to learn skills through repetition with variety. Rather than repeating the same skill until it is learned to a predetermined level of mastery, students are taught to apply skills across contexts. Skills reappear cyclically with increased expectations for independent use of the skills with each re-introduction. Over the course of the nine parts that comprise the three units, students have repeated exposure to skills in varied contexts, for varied purposes. The intended result is increased comprehension and the ability to apply the new skills when and where appropriate.

Methods

This paper describes the impact that *MEville to WEville* had on the literacy and communication skills of 23 students with significant cognitive impairments.

Research Questions

The purposes of the study were to determine: (a) what factors contributed to the positive outcomes and benefits of *MEville to WEville*, and (b) how *MEville to WEville* influenced the literacy skills and understandings of the students.

Participants

Three teachers and 23 students from three self-contained special education classrooms participated in the study. One of the three teachers had participated in general literacy training offered by the Center for Literacy and Disability Studies and indicated an interest in participating in future research. When approached about participating in this study, she facilitated the process of recruiting the other teachers in her school and securing permission from the district office. All three teachers are assigned to classrooms designated as multi-categorical handicapped (MCH). The children placed in these classrooms all have documented cognitive impairments and meet

the criteria for an educational label of multihandicapped defined by the school system as follows, "pervasive primary disability that is cognitive and/or behavioral in combination with one or more other disabilities the combination of which causes such developmental and educational problems that the child cannot be accommodated in special programs that primarily serve one area of disability."

All of the students assigned to the three teachers were recruited to participate in the study and all parents provided written consent. The students ranged in age from 5 to 12 years and represented a variety of ethnic backgrounds. The students were all identified as having severe to profound cognitive impairments and more than half did not use speech to communicate. More detailed demographic information about the participants is provided in Table 1. In addition to the 3 teachers and 23 students, 8 classroom assistants, 2 speech-language pathologists, one occupational therapist, and 1 guidance counselor participated in the study.

Setting

The classrooms were located in an elementary school in the Piedmont region of North Carolina. The school had approximately 500 students, with 18.4% classified as children with disabilities, and 69.8% of the school population qualifying for free/reduced lunch. In addition, 28% of the students in the school spoke English as their second language. Both the school principal and assistant principal expressed their belief that the MCH classes were an important part of their school, stopped in the classrooms regularly to check in with the teachers and children, committed school funds to support the purchase of technologies and materials for the classes, and were generally viewed as highly supportive of the special education staff in the school.

Procedure

The total project was carried out over a 12-week period. In the two weeks before and after implementation, pre- and post-tests were conducted as were teacher interviews, ecological classroom inventories, and observations of literacy instruction. During the eight weeks of implementation, at least one observation was conducted in each class, each week. Student work samples, communication boards, teacher lessons, and email correspondence with teachers are examples of documents that were collected during the implementation.

There was not a specific implementation protocol for the intervention. Teachers were provided with a prepublication version of the first part of *MEville to WEville* and were instructed to use it as they deemed appropriate for their classes. Teachers agreed to use *MEville to WEville* every day for at least 30 minutes, but no other constraints or controls were put in place for this exploratory investigation.

The procedures for completing the pre- and post-tests were quite informal as the students in the classrooms presented with very significant disabilities and many had never been formally assessed, certainly not by an unfamiliar other. All of the assessments were created to allow for a pointing response. A single researcher assessed the students who could point with a finger or provide an obvious eye-pointing response. Two researchers worked together to assess students who could not provide an obvious pointing response. In some cases, members of the classroom staff were asked to support our efforts to get as much information as possible from each student. Nevertheless, in many cases there were subtests we simply could not complete.

Participant Observation

Five researchers (one faculty member, three doctoral students and one master's student) from a large research university approximately 30 miles from the school conducted weekly observations of the implementation of the *MEville to WEville* program in each of the three classrooms. The primary goal of these observations was to collect data regarding classroom interactions and the teachers' implementation of the program and use of technologies to support student learning, communication, and interaction. One observation was completed in each of the classrooms pre- and post-implementation. In addition, 31 (35 hr and 47 min) observations were completed during implementation. Of these, 8 observations (5 hr and 19 min) were completed in Ms. C's classroom, 9 (13 hr and 1 min) in Ms. B's classroom, and 14 (17 hr and 17 min) in Ms. P's classroom. The differences in the total number of observations in each class were due to two primary factors: the availability of observers and the time spent on *MEville* to *WEville* in each class. When possible, after completing a scheduled observation, observers would check with other teachers to see if they had a *MEville to WEville* lesson coming up. If another teacher indicated that she was going to begin a lesson in the time frame available to the observer, an unscheduled observation was completed.

Documents

During implementation, a variety of documents that were relevant to the literacy instruction in the classroom were collected. These included student work samples and communication boards, as well as teacher lesson plans, activity logs, and email correspondence.

Student Measures

The student measures completed at pretest and posttest are described in the following section.

Writing. The original plan was for the students to produce a writing sample using the writing tool (e.g., pencil, keyboard) that was most physically accessible to them. Unfortunately, the students with physical impairments did not have access to alternative writing tools. Most often these students used a pencil with considerable hand over hand support from their teacher or a teaching assistant. Thus, independent writing samples were obtained using pencil, pens, and markers for all students since this was the most familiar tool.

Letter identification. Each student was presented with an array of alphabet letters and was asked to point to a letter spoken by the researcher. This task was completed for upper case and lower case letters separately. All students who were able to use their finger to point to an array of 6 items were asked to identify the letter from a group of 6. There were 7 children who were unable to use their finger to point. We attempted to have these children eye-point to select from an array of 6, then 3, and finally 2 choices. We acknowledge the dramatic difference in the cognitive challenge presented with a choice of 2 and an array of 6 and support the interpretation that the children's ability to choose was related equally to their limited knowledge of letters and the physical challenge they encountered when trying to communicate a choice.

Concepts about print. Using an approach based on Clay's (1993) concepts about print assessment, each student engaged in an interaction with a modified book with the data collector. During the interaction, the student's knowledge of the orientation of the book, directionality, orientation of pictures and text within the book, and concept of word, letter,

and one-to-one match between spoken and written words was assessed.

Phonological awareness. Sets of phonological awareness tasks that do not require speech production were administered (Howell, Erickson, Stanger, Wheaton, 2000; Erickson & Hanser, 2002). Students indicated their response by pointing to a picture presented in an array of 3. The tasks included: initial consonant similarity (e.g., Which word has the same beginning sound as 'milk'?), rhyme recognition (e.g., Which word rhymes with 'hat'?), and phoneme blending (e.g., Which word do you get when you put these sounds together, /c/ /a/ /t/.).

Analysis

All quantitative data generated from the pre- and post-tests were analyzed using simple descriptive statistics. A constant comparative method was employed to analyze the qualitative data. An inductive process of culling the data to identify categories and themes followed by the careful construction of codes and reanalysis of the data was employed (Bogden & Biklen, 1992; Huberman & Miles, 1994; Merriam, 1998). The specific codes that led to the results reported here include: communication response, communication initiation, assistive technology use, peer-to-peer interaction, social responsiveness, and composition of text (with and without dictation).

Outcomes and Benefits

Influence on Informal Assessment of Literacy Skills and Understandings of the Students

Analysis of the pre- and post-tests administered to the students revealed no statistically significant differences on any of the areas assessed. There were however, very encouraging practical differences between pretest and posttest for a group of students who typically would not be expected to demonstrate progress on the generalized application of skills taught during an 8-week period. Table 2 illustrates that overall scores on the posttest were higher than scores on the pretest, with some students across all ability levels (e.g., ranging from those who could not respond by making a choice from two items at pretest to those who were able to identify a significant number of letters) demonstrating progress. The data is grouped by classroom for ease of presentation and use by the reader, not because the classroom was the unit of analysis in this investigation.

Note that the percentage of students who could attempt the individual assessments increased as much as 12% from pretest to posttest, and only one mean score was lower at posttest than pretest (Initial Consonant Same decreased by 4%). At the time of the pretest, the most difficult task was the phoneme blending task with only 12% of the students able to attempt it. By posttest, 29% of the students were able to attempt the task and the average score was 150% higher. The easiest task at pretest was the writing task with 83% of the students attempting to write. By posttest 87% of the students attempted to write (recall that this was independent writing not hand-over-hand).

Outcomes Noted During Observations

In addition to the outcomes noted through the informal assessment measures, other positive outcomes were noted through the participant observations. For example, students began initiating more communication and interaction with adults and peers. In other words, they directed a communication attempt to a teacher or a peer without prompting or in response to a question or comment. Prior to implementing *MEville to WEville,* the students were frequently passive participants. Our pre-implementation observations suggest that very few students

initiated interactions. Instead, they responded only when asked a direct question or were otherwise prompted to respond. Most students did not appear to be actively engaged and/or eager to communicate. When technology was present during the pre-implementation phase, students waited for the device to appear in front of them or for a direct prompt from an adult before they used the device. By the end of the project, more students were seeking out and using the devices without prompting and all students

Table 2
Pre-test and Post-test Summary Information

Literacy Tasks	% Students Attempting Pre-test	% Students Attempting Post-tests	Pre–Post-test % Change	Pre-test *M* (*SD*)	Post-test *M* (*SD*)	Pre-Post-test *M* Difference
Writing						
All Students	**83**	**87**	**+4**	**1.54 (1.18)**	**1.96 (1.60)**	**+.42**
Class 1	67	83	16	.67 (.52)	.67 (.52)	0
Class 2	89	100	11	2.22 (1.20)	2.78 (1.30)	.56
Class 3	89	78	-11	1.44 (1.13)	2.00 (1.87)	.56
Letter Id: Upper Case All Students	**75**	**83**	**+8**	**6.21 (8.24)**	**7.42 (9.09)**	**+1.21**
Class 1	33	50	17	.33 (.52)	.83 (.98)	.50
Class 2	67	100	33	8.00 (7.60)	10.78 (8.94)	2.78
Class 3	78	89	11	8.33 (10.14)	8.44 (10.51)	.11
Letter Id: Lower Case All Students	**25**	**37**	**+12**	**3.88 (8.16)**	**5.96 (9.48)**	**+2.08**
Class 1	0	0	0	0 (0)	0 (0)	0
Class 2	33	78	45	4.22 (6.80)	10.22 (9.19)	6.00
Class 3	33	22	-11	6.11 (11.32)	5.67 (11.25)	-.44
Print Concepts						
All Students	**50**	**62**	**+12**	**1.79 (3.11)**	**2.88 (3.71)**	**+1.09**
Class 1	0	33	33	0 (0)	.33 (.52)	.33
Class 2	78	89	11	2.33 (2.60)	4.78 (3.23)	2.45
Class 3	56	56	0	2.44 (4.22)	2.67 (4.47)	.23
Initial Consonant						
All Students	**21**	**29**	**+8**	**.96 (2.14)**	**.92 (1.67)**	**-.04**
Class 1	0	0	0	0 (0)	0 (0)	0
Class 2	32	44	12	1.22 (2.73)	1.56 (2.13)	.34
Class 3	33	33	0	1.33 (2.18)	.89 (1.54)	-.44
Rhyme Recognition						
All Students	**21**	**21**	**0**	**1.00 (2.15)**	**1.04 (2.26)**	**+.04**
Class 1	0	0	0	0 (0)	0 (0)	0
Class 2	22	22	0	1.44 (2.88)	1.56 (3.13)	.12
Class 3	33	33	0	1.22 (1.99)	1.22 (1.92)	0
Phoneme Blending						
All Students	**12**	**29**	**+17**	**.33 (1.01)**	**.83 (1.55)**	**+.50**
Class 1	0	0	0	0 (0)	0 (0)	0
Class 2	11	44	33	.44 (1.33)	1.44 (1.88)	1.00
Class 3	22	33	11	.44 (1.01)	.78 (1.56)	.34

demonstrated generally increased levels of engagement.

Activities in *MEville to WEville* also promoted the development of social relationships with their peers in special and general education. One activity that appeared to be particularly successful involved the students using switch-adapted cameras and scripted conversations programmed on a sequential message communication device to take photos of and interact with people around the school. These scripted conversations enabled the students to interact without adult support, and they promoted sustained, successful interactions between the research participants and peers throughout the school. The teachers realized the benefits of these scripted conversations, and created many more scripts for the students to use across a variety of circumstances, for example, when the students went to buddy reading in the general education classrooms or when they responded to questions about their project in the school science fair.

Discussion

The analysis of the classroom observation data suggests several factors that likely contributed to the positive student outcomes that were directly observed and measures. For example, *MEville to WEville* supported interactions and collaboration between home and school for many of the students. The program provides teachers with notes to send home. The notes ("homework sheets" as the teachers called them) encouraged families to share important information about their child with their classrooms and to send in photos and materials related to upcoming lessons. As these notes began coming back in, one teacher noted, "Children are actually bringing back some of their homework for this unit and there is an overall increase in parental interest. Look at the homework sheets for each child on the chalkboard". While the children in the study lacked the ability to direct their parents to read, complete, or return the notes, they certainly benefited from them. Their teachers were able to relate the new information they were learning at school to the information provided by their parents. Furthermore, access to the personally meaningful materials and photos their parents sent to school likely increased interest and understanding during the lessons.

Integrating Assistive Technologies

For the teachers, implementing the program meant that they did not have to spend large amounts of time creating their own lessons and materials. Instead, they were able to focus their energy on addressing the assistive technology needs of their students. One teacher in particular had previous experience using the technologies, but prior to *MEville to WEville* had found it very difficult to find the time to integrate the technology into the classroom routine. About half way through the project she shared, "I have also been able to spend a little more time on the cool stuff - like the Book Worm, switch [activated] digital camera, preparing communication boards, and preparing IntelliTools [IntelliPics® Studio and IntelliTalk® II by IntelliTools, Inc.] and am excited about using this assistive technology more and more over the next few months". The observed integration of assistive technologies into a variety of lessons and interactions is also likely to have contributed to the positive outcomes demonstrated by the students.

Conclusion

During a time when we are all being pushed to provide instruction that is scientifically supported, empirical evidence demonstrating the positive outcomes of a comprehensive instructional program for students with the most significant cognitive impairments should be embraced. Caution must be taken in

interpreting the results of this study as the gains are modest at best, but they are gains that have a practical significance for a group of student participants who have had as many as 9 years of school with little to no literacy learning success. In fact, the majority of the student participants experience cognitive and communication impairments that are so complex that they have had limited success with learning even basic communication and interaction skills. Any program that yields measurable positive outcomes with this group of 23 very hard-to-teach students is a program worthy of further implementation and investigation.

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Assistive Technology as an Evolving Resource for a Successful Employment Experience

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Abstract: Strategic pooling of assistive technology, human resources and funding options has made meaningful employment possible for the 25-year-old man with cerebral palsy who is the subject of this paper. Since graduating from high school four years ago, he has held a part-time job at the warehouse of a bookseller. To perform his job, which involves processing inventory, he has always relied on an augmentative communication device that interfaces with the warehouse computer system and scanner. His assistive technology mix eventually included a new scanner, conveyor belt and an automated book loader. To varying degrees, an attendant has assisted with job tasks requiring manual completion. Though technology is imperative to the young man's success, multiple supports are required to ensure it.

Keywords: Evolving, Resource, Successful employment

The following case study highlights three significant factors in the successful integration of assistive technology into the workplace for an employee with multiple disabilities.

First, the employer, employee (Andy) and those supporting the employee recognized the technology as integral to a spectrum of resources necessary to find and hold a job. Second, the integration of assistive technology (AT) into Andy's current job has worked well largely because it was understood as a process evolving over time as opposed to an isolated occurrence. As Andy's employer noted,

> It was a real pleasure to be continually evolving the technology so that more and more, the work being done was being done by Andy [with] less reliance on his assistant. I know this has made Andy very happy as well. (P. Kreps, personal communication, February 3, 2005)

A third and somewhat broader-based factor in Andy's success was that the process of career development began in high school with school-district funded pre-employment activity that included supported job experiences. Processes followed in helping Andy to achieve permanent employment that may be replicated with variations based on the needs and abilities of the individual seeking employment.

Background: Transitions and Beginnings

Awareness of these factors has proven beneficial to Andy, who at age 17 expressed a desire to enter the workforce despite profound challenges associated with the cerebral palsy he acquired after nearly drowning in a swimming pool as a toddler. The accident left him without the ability to walk, use his hands or speak in his own voice. Andy presents cognitive delays and requires 24-hour assistance with daily activities including all aspects of personal care such as bathing and dressing. He takes meals through a gastronomy tube and wears a urinary catheter.

A good and enthusiastic student, Andy attended classes in the local public school district from kindergarten through 12th grade.

He was in a regular education program in elementary school. In high school, his schedule consisted entirely of elementary-level life skills classes. Andy held a straight-A average and though non-verbal, he acquired good spelling and reading skills. He has always used some form of augmentative and alternative communication (AAC) to express himself.

Andy's participation in social activities is comparable to that of his peers without disabilities. He enjoys spending time with family and friends, traveling and shopping, especially when it involves choosing gifts for others. Throughout his teenage years and young adulthood, Andy has volunteered for disability advocacy programs on a steady basis, a reflection of the prime importance that he and his family place on giving back to the community. Andy is also active in his church.

During high school, Andy relied on a manual wheelchair for mobility and eye gaze techniques for communication. He also used a manual communication board that his occupational therapist created from acrylic and white plastic plumbing pipe. Positioned upright on the tray of Andy's wheelchair, the board allowed Andy to spell out words using his eyes to track one letter at a time. The board also contained numbers and a small selection of words and phrases. It proved useful for classroom and social communication as long as Andy and his communication partners viewed it simultaneously.

Early Employment Experiences

Shortly after Andy entered high school, his mother started to research and visit work sites that employed individuals with physical and mental challenges, with and without supports. Though doubtful that an appropriate job for Andy existed, his mother fulfilled her commitment to help him find one in an effort that, in effect, spanned his high school years. Beginning with the high school transitional services department, she coordinated a continually growing and changing team of specialists and funding sources. Two priorities that remained constant were (a) to ensure that all parties worked together in Andy's best interest, and (b) to be aware of guidelines for spending available funding. Also, two probable reasons for the success that his mother experienced lie in the manner that she engaged the outside parties in this effort. She approached each entity with the understanding that the entity would be one in a network of multiple, interdependent resources required for Andy to achieve permanent employment. This approach helped to taper any concern that a particular entity would be one of few supporting this endeavor, or its sole support. When approaching each of her contacts, she specified the type and amount of assistance needed, and how it would fit into the bigger picture.

A key early step was working with Andy's main transition teacher to arrange a series of volunteer work experiences. These experiences gave Andy a realistic sense of job tasks he could and could not handle. Individuals who use augmentative communication surveyed about their employment in the community said that "a positive work ethic played an even more critical role in maintaining employment than job-specific skills or other factors" and that such a work ethic may "be developed and strengthened further through volunteer and part-time work experiences" (Light, Stoltz, & McNaughton, 1996, p. 223).

Legislative, professional and academic definitions regard transition activity for students with disabilities as an outcomes-oriented process (Will, 1984; Individuals with Disabilities Education Act of 1990).

Professionals similarly consider it a process that requires students to accept the responsibility for preparing for adult life as fully as their capabilities will allow (Halpern, 1994). The literature acknowledges activities outside of the classroom, including community service (Wehman, 2001) and "non-paid work done as a family member, citizen and leisure seeker" (Brolin, 1995, p. 54), as valid components of transition activity and goal-oriented, long-term career development.

Through his own volunteer experiences, Andy cultivated qualities desirable in employees and young adults in general. These qualities include his strong work ethic, excellent interpersonal skills, keen memory, good eye for detail and knack for making quick yet sound decisions based on his observations.

Andy's first job involved supervising other students in the special education program assigned to clean the faculty lunchroom. The experience allowed him to demonstrate that he understood how to set and maintain standards of quality control, and could direct others to complete work that needed to be done in accordance with those standards through eye contact, head movements, facial expressions and vocalizations. While his aide moved him about the room to observe various tasks in progress, Andy alerted workers to errors such as wet spots on tables, litter on the floor and stray chairs. He told them where to retrieve and return tools and cleaning materials. Andy also watched the clock so he could inform his co-workers when it was time to return to class. Job challenges included that his methods of communication were at times subject to interpretation by unfamiliar communication partners. While generally comfortable in his supervisory role, Andy at times found it awkward to monitor the work of his peers—particularly when it meant telling them to redo improperly completed tasks. Another apparent drawback to this volunteer placement was that it was unlikely Andy would find a similar job outside of the school setting.

In another job, Andy delivered mail to faculty and staff at the high school. His primary tool in this job was an accordion-shaped file folder with numerous labeled pockets containing mail for specific people. Andy would look at the name on a file, then immediately shift his gaze to the same name on a shelf of 100 mail slots. Andy's school aide then would transfer the mail from the slot to the pocket in the file folder that matched the name. His aide would ask, "Is this the one?" to verify his instructions. The aide reported that Andy communicated the necessary information with 100 percent accuracy. Using eye movements, Andy then directed his aide to locations throughout the building for delivery of the mail, gazing at a name on the folder to let his aide know whose mail was in a particular pocket. His aide removed the mail from the pocket and handed it to that person. Andy demonstrated a higher level of satisfaction in this job than in the lunchroom job, particularly because of the opportunity to interact with faculty and office staff that it presented. The tasks (giving/following directions and managing large amounts of material and information, for example) and skills (attention to detail, interpersonal skills and clear communication via eye contact, for example) associated with this job more closely matched those that would be associated with a suitable paying job after high school, his team noted.

Those supporting Andy along with his parents felt that it was important for him to pursue work opportunities in the community at this point. An initial step was for his transition teacher to contact the state vocational rehabilitation office to enroll Andy for services. The vocational rehabilitation counselor assigned to Andy arranged for him to meet with the director of an agency that

placed and supported people with multiple disabilities in community-based employment situations. A formal 10-hour work assessment that the agency conducted over a period of two months to evaluate Andy's performance of a range of tasks that could be associated with various jobs provided a framework for future job matching. The tasks included distinguishing between colored and white paper for a possible job where Andy would push piles of recyclable material from his wheelchair tray into the appropriate bin, then putting the material into the correct bin with hand and arm movements.

Other tasks required Andy to move paper from his tray into a simulated shredder, alphabetize files using methods similar to those he used in the mail delivery job and simulate the activation of a switch to run a copier. A final task tested his observation skills for a possible job as a quality assurance agent or "secret shopper" who would evaluate customer service in establishments such as a bank, supermarket or restaurant. In this task, Andy listened to a series of sentences containing the word "bus" and indicated when he heard the word using his communication board. Andy scored a 100% accuracy rate in all of the tasks with the exception of alphabetizing files by the second letter (Jenkins v. Jones, for example), in which he scored a 75% accuracy rate. The assessment also included an observation of Andy on the mail delivery job.

Key recommendations of the assessment were to (a) make printed labels for the folders and mail slots that Andy used to ensure that he, his aide and others viewing the materials could see the names clearly, and (b) consider having Andy perform data entry involved in the preparation of his resume. While noting that Andy's mastery of eye gaze communication techniques would transfer into a highly marketable skill, the report also recommended that Andy find an AAC system with advanced capabilities such as accessibility via scanning and computer access that would better serve him in the workplace. The section of this paper entitled "Implementing Assistive Technologies" includes further discussion of this process.

A recommended short-term objective in the work assessment was to seek a community-based volunteer job placement that would allow Andy to use his clerical skills. His transition teacher and a representative of the employment agency targeted non-profit organizations as possible work sites. This effort yielded an after-school job at the local library that involved identifying and facilitating the tracking of missing books.

Andy quickly learned his way around the library and the Dewey Decimal System so he could direct his aide to the locations of specific books. Working from a computer-generated list of missing books on a standup clipboard attached to his wheelchair, he examined book titles and their numeric sequence on a particular shelf to determine whether a book on the list was missing. If Andy could not find a book, he would look at his list and his aide would make a notation that the book indeed was missing. When Andy found a listed book on a shelf, he would look at his aide, who then would pull the book off the shelf so that Andy could transport it to a librarian for reentry into the system. If he found that a shelved book was out of sequence, he directed his aide through eye contact to return the book to its proper place. Andy performed well in this job, prompting the library to extend it through the summer, during which Andy served as the librarian for fellow students attending summer school, filling and delivering their book orders (E. Coomler, personal communication February 16 and 25, 2005; June 2, 6 and 7, 2005; C. Steury, personal communication, June 1, 2005).

A Turning Point

The next challenge was helping Andy to recognize and utilize his skills and volunteer experience as a segue to meaningful paid employment. To achieve this, his team followed principles of person-centered planning, a process-oriented approach grounded in empowering people with disability labels by putting them in charge of defining the direction for their lives, not on the systems that may or may not be available to serve them (Employment and Disability Institute, 2005).

The roots of person-centered planning took hold between the early 1970s and mid-1980s as approaches to serving people with significant disabilities shifted from rehabilitation or medical models focusing on professional interventions to consumer-driven models emphasizing advocacy and independent living. By 1985, the term person-centered planning was widely used in reference to a variety of practices associated with the latter approach (O'Brien & O'Brien, 2002).

Person-centered planning raised different questions (O'Brien, O'Brien, & Mount, 1998) than those typically asked in traditional approaches to planning. For example, instead of asking "What's wrong with you?" or "How can we fix you?", person-centered planning asked "What are your capacities and gifts, and what supports do you need to express them?" "What works well for you and what does not?" "What are your visions and dreams of a brighter future, and who will help you move toward that future?"

With this contemporary approach, the disability became secondary to the process of planning for the kind of future that the individual with the disability desired.

Person-centered planning did not ignore disability. It simply shifted the emphasis to a search for capacity in the person, among the person's friends and family, in the community and among service workers. A person's difficulties were not relevant to the process until how the person wanted to live was clear. Then it was necessary to imagine and take steps to implement creative answers to this key question, 'What particular assistance do you need because of your specific limitations (not labels) in order to pursue the life that we have envisioned together?' (O'Brien et. al., 1998, pp. 20-21).

The literature (Nisbet & Callahan, 1987) has noted that the more significant a person's disability, the greater the need for an individualized approach to employment. Yet person-centered planning dispels the notion that availability of funding and other resources must drive the person's success in employment or other major life activity. The belief that it is most effective to strategize from the person to the resource rather than from the resource to the person (McLean, 2002) is inherent to the process. Recent literature (Callicott, 2003) also names open-mindedness and attention to successful communication as hallmarks of some of the procedures followed in person-centered planning and suggested that such work also benefits from the objectivity that working with families requires. Callicott further describes the process as one that typically involves using large sheets of paper on the walls and multicolored markers as a skilled facilitator leads a group working together to help the individual with significant disabilities to identify barriers that the person faces in achieving successful community membership. As a tool to help the person accomplish goals and to support those closest to the person, the process can facilitate change and the restructuring of systems that are not responsive to the needs of people with disabilities.

In essence, the process made Andy a stakeholder in his job search, while helping those working on his behalf to identify his talents, interests and natural abilities, as well as the resources and supports that would benefit him. Andy's advocates throughout this process included his school aide and transition teacher, the employment agency director and an independent job development consultant that Andy and his parents hired. A person-centered planning specialist conducted a brainstorming session during which the group considered ways of matching Andy's work experiences and marketable skills with real job opportunities. Andy's friends and relatives participated in a second session held at his home in the spring of his junior year in high school. His mother noted that the mix of people who had just met Andy and therefore had no preconceived notions of his potential (i.e. the person-centered planning specialist) and people close to him (classmates and siblings, for example) added value to the process (Owens, 2003).

Information gathered at both sessions proved valuable in introducing Andy to potential employers. It included: (a) Andy's strengths and capacities (e.g., able to communicate reliably with his eyes, good hearing, attentiveness to detail, ability to stay on task, excellent memory, good people skills, positive attitude); (b) What would work for Andy as an employee (e.g., clear goals, a variety of tasks, morning work hours, a good night's rest, fairly predictable work routine, low to moderate noise levels, AT); (c) What would not work for Andy as an employee (e.g., being rushed to complete a task, working in isolation, excessively repetitive tasks, inadequate rest before starting the workday, working outdoors in cold weather, high noise levels); and (d) and types of jobs that would be possible for Andy (e.g., quality control, tracking inventory or information, doorman or security guard, host or greeter, interoffice mail delivery).

As his mother said, "We were all throwing out ideas about job possibilities. Andy's strengths were listed. Once we saw them on paper, we began to think of ways he could do a job with some limited natural supports" (Owens, 2003, p. 78). These supports, as well as funded supports that Andy utilized, are discussed in the "Key Supports" section.

The school district subsidized the work opportunities and supports (i.e., services provided by the school aide, bus transportation to and from his library job, pre-employment and job development services) available to Andy up to this point. Subsequently, the focus shifted to community resources that potentially would benefit Andy after graduation. One of these resources was the Careers, Community and Families Project (CCF) (Sowers, McLean, & Holsapple, 2001) that originated with the Family Management Grants Project (McLean, Greenwood, & Herrin, 1998) funded by the state Office of Developmental Disabilities that provided a modest amount of funding for job training and placement services to young adults with developmental disabilities. Each project took a consumer-and-family-directed approach to the employment process. Andy received word before his junior year that upon finishing school, he would become one of 25 CCF project beneficiaries.

Search for Employment

In the months following the brainstorming session at Andy's home, the grant project director and the job development consultant joined his mother in contacting employers to discuss job possibilities. Cold calls were few. They focused instead on networking with personal acquaintances in lines of work that appealed to Andy and where his contribution would provide mutual benefit to himself and the employer, reflecting the tenets of person-centered planning. As McLean (2002) wrote,

> Clarity about a person's interests makes it unthinkable to appeal to an employer on the basis of charity or disability. Clarity about a job that will really suit a person writes a script about strengths, common interests and community connections. (p 295)

While resume and interview preparation are "immaterial" to the person-centered planning process (D. McLean, personal communication, May 18, 2005), variations of each were used in demonstrating Andy's readiness for work. His resume was essentially a notebook that listed his experiences as well as his marketable skills along with his personal strengths and capacities as delineated at the person-centered planning meetings. The notebook also contained photographs that showed Andy working at his volunteer jobs and letters of reference from his supervisors. Job interviews consisted largely of questions to which Andy could respond "yes" or "no." His aide interpreted his responses for the employer as needed.

The Right Match

The most promising opportunity evolved from the project director's contact with managers at a bookseller who were receptive to hiring Andy to work in the Price Task Force department of its warehouse. Together, they developed a position for Andy through job carving, a practice in which an employee with disabilities performs work carved out of an existing job (Sowers, McLean, & Owens, 2002). In his job, Andy would receive and process books for inventory. The work appealed to him because of his enjoyment of books and aptitude for detail. It involved tracking inventory or information, one of the job possibilities mentioned in the person-centered planning exercise conducted at his home.

When Andy was offered the job in his last semester of high school, a plan for necessary job accommodations and adaptations took shape. Given Andy's physical limitations, it was understood that he would require a unique combination of human and technological assistance to perform the job, and would do so in a different manner than typical employees, as discussed in the section sub-headed "Towards A Typical Workday" later in this paper.

Key Supports: Finding Personal Assistance

The plan called for the services of an attendant to drive Andy to and from work, and assist him throughout each workday with personal care and job tasks that he could not physically perform himself. For individuals with significant speech and physical disabilities, the need for such assistance in the workplace is not unusual. Sixty-seven percent of augmented communicators surveyed about their community-based employment experiences (16 of 24 respondents) reported that they received some assistance at work, either with job duties or with activities of daily living. Researchers who conducted the survey noted that "if vocational opportunities are to be truly accessible to many people who use AAC, then provision must be made for assistance related to personal care and on-the-job training" (Light et. al., 1996, p. 221).

School district funds covered the cost of this assistance for Andy when his school aide worked with him during an initial on-the-job training period. He and his parents then hired private aides at the same starting rate of $10 per hour using various sources of funding including state developmental disabilities funds matched by Medicaid and money available through the Plan to Achieve Self-Support (PASS) available to Andy as a Social Security beneficiary. The PASS is a work incentive that allows a person to set aside

money or resources for a specified period of time to reach a work goal (Social Security Online, 2005) without jeopardizing the Social Security income he receives. It provided the job coaching (i.e., the work-related support from the attendant) for Andy's first three years on the job. Extended PASS funding later was used to pay for the van Andy uses for transportation to and from work. Andy's father was able to obtain the van at a wholesale price, which helped to minimize this cost.

Andy has earned enough work credits to be eligible to switch from Supplemental Security Income to Social Security Disability Income, modestly raising the cap on his earnings potential while allowing him to keep his Medicaid benefits. The PASS is no longer in effect. Supported employment funding available through a Medicaid Home and Community-Based waiver is currently being used to pay the attendant.

Andy's mother identified finding, hiring and keeping reliable attendants as the most challenging process involved in ensuring that Andy would be able to hold a job, largely due to the associated administrative work (recruiting, background checks, payroll, reports and documentation for funding sources, etc.) that it entails. In the four years that he has worked at the book warehouse, Andy has had six personal attendants, including the school aide. The project director accompanied Andy on the job interview while an attendant did so on the initial on-the-job training. All of the attendants who worked for Andy were required to know and possess the ability to do the job of receiving inventory as both Andy and typical employees did so that they would be prepared to assist him as needed. In addition, they were responsible for the maintenance of Andy's feeding tube and catheter, for assisting him during restroom breaks and otherwise monitoring and helping to ensure his safety and comfort in the workplace.

A nurse delegation, or review, is conducted every 90 days to ensure that the attendant care services that Andy receives meet Medicaid standards. During the delegation, typically conducted at Andy's home, a Medicaid nurse observes the attendant performing tasks such as cleaning the feeding tube and administering medication to Andy through the tube. Medicaid case managers have also conducted observations of the attendant's interaction with Andy in the workplace.

While Andy and those supporting him knew that he would always need an aide for personal care throughout the day, they eventually realized their hope that with time and the implementation of assistive technologies at the work site, he would become less dependent on the aide for work-related assistance. By allowing Andy to be more independent in his job and reducing the need for his paid attendant to assist with job tasks, the technologies fostered the natural supports that have also contributed to his success (D. McLean, personal communication, June 8, 2005). These natural supports have included ongoing job training and orientation that co-workers have offered Andy, as well as his social interaction with co-workers. Andy has developed positive relationships with people at work. His supervisor said that with his attendant serving as an interpreter, Andy is very good at initiating conversations about fun activities in his personal life. He has used the DynaVox to say that he is ready to work at the beginning of his shift. Andy makes it a point to visit the break room on breaks or even after work to talk with his co-workers. Andy has extended his socializing to bringing doughnuts to work for all to enjoy. By all accounts, Andy has achieved the balance in mixing business and pleasure that most employees seek without

losing sight of why he reports to work each day. As his employer said,

> He takes his job seriously, he has a strong work ethic, he works hard, he takes pride in doing a good job. I think people, I know I do, see him and his approach to work as an example of someone who really wants to be a productive member of society and will do everything within his power to make it a reality." (P. Kreps, personal communication, February 1, 2005)

Implementing Assistive Technologies

Also of primary consideration in the plan for Andy's employment was his reliance on an AAC system and a wheelchair, and how to implement these technologies to best serve him on the job.

In his early employment experiences, Andy relied solely on his well-developed eye gaze techniques for communication. The previously described manual communication board served as his means of self-expression in situations that were not job related, as did the Eyegaze Computer System manufactured by L. C. Technologies, Inc., that Andy used from 6th through 12th grade. While school funds were used to purchase the system, Andy's parents provided a monitor and its mounting system for his use of the system at home. A hands-off human-computer interface featuring synthesized speech output, the system required Andy to calibrate his eye movements with the movement of a dot on the screen to select vocabulary pre-programmed into the system. As Andy tracked the dot, his eyes, in effect, became like a mouse used to control the movement of a cursor on a computer screen. While the system allowed Andy to maximize his ability to convey messages through eye contact and provided computer access capabilities, it posed significant limitations in portability. While a spare monitor at home helped to address the issue, the tower component of the system still had to be transported between home and school. Another negative was that it had to be set up in a dark room to work properly. Newer models of the system, including a laptop model considered for Andy, are less light sensitive and work well in a variety of environments. However, the laptop model would have required closing the lid (i.e., the screen) to ensure Andy an unobstructed view while moving about in his wheelchair. His parents preferred to avoid the extra task because it would increase Andy's reliance on his attendant.

The solution pursued for Andy as he prepared to leave school, was, as recommended in the work assessment, a communication system with scanning and computer access capabilities that would allow him to perform a broad range of job tasks. School and private speech-language professionals were consulted in this process. The head mouse system that Andy used for a trial period at school proved inappropriate because the controlled head movements that its operation required were physically taxing for him, particularly in stressful and time-limited situations. As a compromise, Andy's mother suggested a device he could operate by scanning with a head switch. A DynaVox 3100 was recommended.

The DynaVox was a key accommodation in the plan for Andy's employment. He learned to use the device during his occupational therapy sessions at school, practicing the single-switch scanning method of access that he uses. With head movements, he activates a switch on the right headrest of his wheelchair to scan a grid of communication buttons displayed on a page and to select buttons as they are highlighted. In his job, the DynaVox and its separate computer access component, the DynaBeam, would serve as his link to the

warehouse computer system. Employers and co-workers of individuals who use AAC have identified computer access, including interfacing an AAC device with a standard computer, as challenges for such individuals (McNaughton, Light & Gulla, 2003). Finding technology that would give Andy access to and interface with a standard computer system addressed this common and potentially problematic issue early in his employment.

Another goal in the plan was for Andy to learn to use a power wheelchair that would promote his independence in the workplace and for Andy to practice using the chair under the guidance of his father and brother outside of work hours. His mother enlisted the aid of the local Shriners organization in arranging an assessment of his ability to operate such a chair.

Securing funding for the wheelchair and the speech-generating device required much advocacy on her part. The insurance that she carries through her employer paid 80% of the cost of both the wheelchair and the DynaVox, while Medicaid authorized a 20% co-payment for each item.

Money from the extended PASS allowed Andy to compensate his father and brother for time spent training him to use the wheelchair. They conducted the training outdoors in their neighborhood.

Another set of technological adaptations identified as being potentially beneficial to Andy on the job were conveyor belts that could be operated by a head switch and an automated book loader. The project director began to investigate ways that these technologies could be funded, designed and implemented at the work site.

Toward A Typical Workday

With accommodations (personal attendant services, power wheelchair, AAC system with desired capabilities) in place and plans for future accommodations (conveyor belt, book loader) underway, Andy set out to work. From the start, Andy was assigned to work a morning shift. Eager to work, Andy learned quickly while two co-workers trained him in fundamental job tasks. Funds from the CCF project and federal Workforce Investment Act dollars were allocated to reimburse the employer for the cost of the training.

While in training, Andy's primary job was to update information about books already in the warehouse computer system. He compared information for books on a computer-generated book list to similar information on a computer screen, then changed or added information on the screen accordingly. One of his tools was a page on the DynaVox that his father programmed with commands that the DynaBeam sent to the warehouse computer system via infrared signals. Andy executed these commands by pressing his head switch when the DynaVox scanned his desired selection. This page included an ENTER button that he selected if the information for a specific book was complete, buttons labeled HC and SC that he selected to denote whether a book had a hard cover or a soft cover, and an ESCAPE button that he selected if the information was incomplete. Scrolling down a page on the computer screens that Andy worked with required the selection of multiple tabs. To simplify this step, Andy's father created a macro—a keyboard shortcut allowing the completion of a task that would otherwise require the execution of a series of commands and numerous preprogrammed keyboard shortcuts defined by Microsoft for a wide variety of applications. The macro contained seven tabs on a single button, so Andy could scroll down a page by pressing his

head switch once instead of seven times to select the button.

When the training period ended, Andy started his permanent job of receiving new books for inventory. Employees typically performed the same job by placing books, one by one, under a stationary laser scanner or by using a hand-held laser scanner to scan the bar code for each book into the warehouse computer system. This would generate an inventory label that the employee then placed on the book.

For Andy, the cycle of tasks involved in receiving inventory went as follows. Andy's attendant loaded books at one end of a table, then placed them one at a time under the laser on the table in front of him. An ISBN bar code and other identifying information for the book programmed as defaults into the computer system would then appear on the receiving screen at Andy's workstation and a similar screen on a computer in his attendant's adjacent work area. Andy then would decide whether or not to receive the book into the warehouse inventory. To accept the book, he would select the ENTER command on his DynaVox by pressing his head switch. After Andy processed a book for inventory, his attendant stuck the label on it and moved it to a stack at the other end of the table. To reject a book, Andy would select ESCAPE from his command page. A book could be rejected for a number of reasons including inaccurate or inadequate identifying information, or unusual quantity and pricing issues. In such cases, the book would be set aside for later review. Neither Andy nor other employees with receiving duties are required to do anything more with rejected books.

Several weeks into the job, Andy found, as most workers do, that his performance tended to peak at certain times and to dwindle at others. The latter usually occurred while he was experiencing fatigue or stress that made it difficult to control his head movements. At such times, it required multiple attempts to activate his head switch when the DynaVox scanned to a command that he needed to give the warehouse computer. To remedy the situation, Andy asked his father to re-program the page to increase his ability to execute this command accurately on the first try. The new page contained three rows of four ENTER buttons, ensuring that Andy would be able to perform the task with greater speed and ease than by targeting a single button. Its bottom row contained the less-frequently used ESCAPE button, and GO BACK and MASTER SCREEN buttons that Andy would select to get to other locations on the device.

Technical difficulties that arise while Andy is working are addressed by his attendant. For example, the attendant will reposition the DynaBeam on the DynaVox so commands to the warehouse computer can be transmitted readily. The attendant relays questions concerning the operation of the DynaVox and DynaBeam, by telephone as needed, to Andy's father, who in turn walks the attendant through the specific functions of the technology. This technical support may be considered a natural work support. Issues with the technology have rarely prevented Andy from working, the employer reported. In nearly four years, Andy had to sit out just one shift because the battery on the DynaVox needed to be recharged.

As Andy discovered that the new page on his DynaVox facilitated an essential function of his job, new developments occurred facilitating the design and implementation of a combination of technologies that would allow him to further increase his productivity. A team of engineers that the grant director found was hired for this work. Andy's father worked closely with the engineers as additional assistive technologies were integrated into Andy's workstation, a process

that occurred over the course of approximately one year.

The technologies included a conveyor belt wired along with the warehouse scanner into a new head switch attached to the left headrest of Andy's wheelchair and the later addition of a new scanner and automated book loader.

While the engineers completed a design for the loader early in the project, they decided to implement the technology in two phases to keep it cost effective. A support services brokerage created through a state self-determination project for adults with developmental disabilities provided funding for the conveyor belt while state vocational rehabilitation funds covered the cost of the scanner and loader. The incremental nature of the project allowed time to determine whether Andy possessed the stamina he would need to perform his job, with the aid of the conveyor belt alone, for extended periods of time. Another point of consideration was how Andy's use of the belt would affect the role of his attendant.

Design and implementation of the belt was completed in approximately four months. Selected from existing technology, the belt moved each book for a pre-determined distance to the warehouse scanner. Andy activated the belt with a press of the new head switch attached to the left headrest of his wheelchair. His attendant placed the books on the belt using painted lines demarcating zones on the belt as a guide for spacing the books. These marks also act as a signal for the belt to stop after it moves a book to a designated zone (under the scanner) so that its information can be scanned on the warehouse computer screen for Andy to view. Andy then accepted the information into the system by pressing the right head switch. While this setup gave Andy more control over his workflow, it was soon apparent that the arrangement hindered his productivity because of its requirement that the attendant load and unload books to and from the belt. Meanwhile, the engineers began the loader design phase. Vocational rehabilitation approved extended funding to finalize the design, testing, and implementation of the loader. This work took another five months to complete.

The book loader was introduced into the mix of technology as Andy was about to begin his second year on the job, further simplifying and synchronizing his job tasks. While the warehouse scanner could read the bar codes on the books with nearly 100% accuracy when the attendant placed them under it, its limited capabilities and the level of precision with which the loader would place books under the scanner were not compatible. A more sophisticated model with the ability to scan bar codes that are not aligned with primary scan direction and to scan a larger area at once was selected. Somewhat ironically, the supplier of this scanner was one of the businesses that Andy's team had visited while developing potential job contacts for him. When it came time to find and negotiate the purchase of the better scanner, Andy's father revisited the contact at the store.

The loader, which resembles a shelf, sits approximately 14" above the belt and runs parallel to it. Loader, belt and scanner operate as one unit controlled by Andy's left head switch. Andy's attendant places a stack of books, facing upright, onto the loader. When Andy presses his left head switch, the belt senses a zone mark, stops and signals the loader. As a mechanism on the loader releases a book into that zone, the book slides down a ramp at a 45-degree angle onto the belt, which moves the book into position for scanning. Andy then presses his right head switch to execute the ENTER command to accept the book. When Andy hits the switch for the loader to release a new book, the belt moves the first book to Andy's attendant for labeling.

Under normal operation, the release of a book from the loader into an available zone occurs when the belt stops after moving a previously released book past the scanner. In the process of implementing the loader, the engineers encountered a timing problem caused by movement of the belt before the loader released a book onto it. Upon release, the book would land only partially in a zone as marked on the belt. When the belt stopped, a second book would be released into the same zone, resulting in a collision. The amount of time needed to ensure that a book landed entirely in one zone varied considerably depending on its thickness and how it was positioned on the release mechanism, so a solution based on timed releases was not feasible.

Perplexed, the engineers explained the problem to Andy, who proposed what would become a permanent solution. He would wait until the belt came to a complete stop before pressing his head switch to command the loader to release of the next book, which then would put the belt back in motion.

The attendant reported that the loader has significantly reduced the amount of physical effort and time involved in getting the books to Andy for processing. Before, the attendant frequently had to place a new set of books onto the conveyor belt, which could accommodate up to four books at a time. The loader accommodates 50 to 100 books, depending on the their size. Now, the attendant restocks it with a new batch of books only as Andy completes the receiving process for another batch. The attendant reports that Andy receives one or two books per minute on a typical shift. In May 2005, Andy processed 1,806 books, the third highest number of books processed by any of the 16 people in the department that month. He also achieved his highest weekly productivity to date that month when he processed 596 books in one week (D. Owens, personal communication, December 13, 2004 and January 27, 2005; J. Brassfield, personal communication, December 29, 2004; C. Owens, personal communication, January 27 and June 12, 2005; P. Kreps, personal communication, February 1 – 3, 2005; T. Rich, personal communication, February 6 – 23, 2005; S. Noll, personal communication, February 18, 2005; W. Silfies, personal communication, May 24 – June 7, 2005)

Outcomes and Benefits

While Andy has used a number of work supports, his job includes many elements of competitive employment. His wages, job tasks and the productivity expected of him are comparable to those of typical employees. He receives standard performance reviews and is responsible for making job (i.e., inventory) decisions. Measures of his success include steady pay raises (from a starting hourly wage of $7.68 to$10.01 per hour in his fourth year of employment) and an increase from 10 to 15 work hours per week.

The reality that the success Andy has experienced is not common among his peers with significant disabilities may be due in part to the general perception that participation in the Supplemental Security Income (SSI) program is a disincentive to working. Participants fear that gainful employment will jeopardize their eligibility for cash and medical assistance. A 1996 study (Berry, Price-Ellingstad, Halloran, & Finch, 2000) analyzed characteristics of 59,624 SSI recipients of transition age (16-24 years old) in the Rehabilitation Service Administration 911 case service database. All of the teens and young adults had exited a vocational rehabilitation program with employment outcomes. One finding of the study was that those who received SSI worked approximately 11 fewer hours and earned nearly $100 less per week than their counterparts who were not enrolled in the SSI program. The

thoughtful and timely blending of resources that has served Andy well may be a catalyst for changing such patterns. Authors of the Berry et al. study suggest that the coordination of vocational rehabilitation services with Social Security work incentives (e.g., the PASS that Andy used) can improve employment outcomes, and support the introduction of work incentives and related technical assistance early in the transitional planning process.

It is noteworthy that neither Andy's employer nor his parents (with the exception of the private insurance that paid for the AAC device and power wheelchair) spent any of their own money in order for him to reach his work goal or retain his employment.

All along, assistive technology has been a necessary support that has allowed Andy to work competitively and reduced the need for his attendant to help him with job-related tasks. Due to the scope and constancy of his personal care needs, however, the technologies that he uses have not eliminated the need for the attendant to be present for the duration of his workday. There has been some consideration of technological applications that might allow Andy to stick labels on the books instead of relegating the task to his attendant, but it is speculative at this time. Additional benefits to the existing technology have surfaced. For instance, Andy has used statements programmed into his DynaVox to communicate during his performance reviews instead of relying on his attendant to speak for him, as he did when he interviewed for the job.

When Andy's employer planned a move to a bigger warehouse, the mix of technology that he uses was incorporated into the site blueprints and transported to the new location with ease. Andy's new workstation is open, making it easier to interact with co-workers and move about in his wheelchair than in his former workstation, which was enclosed by partitions and a wall. His situation illustrates the desirability of long-range plans for assistive technology in the workplace. A holistic approach that takes the environment as well as personal and social aspects of the proposed accommodation into consideration ensures its effective use (Bailey, 2002).

The role of technology in Andy's employment has evolved smoothly because of the supportive roles of multiple resources. In balancing public resources with personal/private ones, Andy and his team achieved the kind of success often deemed unattainable within the disability community. Sowers et. al. (2002) noted that "the different funding streams are rarely creatively commingled to enable individuals with developmental disabilities to access the resources they need to pursue a quality job or career" (p. 99). Light et. al. (1996) noted that such pursuits require greater interagency cooperation between educational and vocational programs. An important, if less tangible, outcome of Andy's experience, were the collaborative relationships developed through the methodical yet positive approach that Andy's mother took to establish personal contacts and mobilize the pool of resources that ultimately would benefit him.

Andy appreciates the broader implications of his success. He has said,

> Most people didn't think I could work in a real job in the community, but I was determined to prove that I could. I like that I proved a lot of people wrong. My advice to other young people is that you can and should work, and that you have to be determined and get other people to help you reach your goals. (Sowers et al., 2002, p. 102)

He has also noted that "I think because I have shown that I can work, many others now are thinking about the fact that they themselves can work, or that their son or daughter can work" (Oregon Teen Working a Dream Job, 2002, p. 2).

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Outcomes of Preservice Teacher's Technology Use

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Abstract: At a time of scrutiny, when technology integration is being examined in teacher preparation programs, this article provides a closer look at technology use and its adoption by preservice teachers. Current technology integration models provide the framework of the importance of putting technology into the hands of the preservice teachers. Going one step further and taking a "learning with technology" stance, this study engaged preservice teachers in meaningful and effective uses of the AlphaSmart 3000® and enabled them to become active thinkers. Three major research questions were addressed: (a) Are there differences between actual and perceived success by pre-service teachers on traditional and technology delivered assessments? (b) When given the opportunity to learn and use technology, do such experiences impact the decision to use technology in their future classroom? and (c) Are performance scores positively or negatively impacted by the use of technology? The outcomes of this study provide insight to teachers' perceptions and use of technology.

Keywords: Assistive technology, Outcomes, Teacher education, Technology use, Preservice teachers' perceptions.

Technology and Teacher Preparation: A Time of Scrutiny

For almost two decades, teacher education programs have been struggling to prepare teachers to use and integrate technology effectively into k-12 classrooms (Bausch & Hasselbring, 2004; Doering, Hughes, & Huffman, 2003; Smith & Robinson, 2003). National reports (U.S. Congress, Office of Technology Assessment, 1988, 1995; National Center for Education Statistics, 2000) confirm less than desirable outcomes in efforts to integrate technology in university teacher education programs. In fact, lack of teacher training was one of the most frequently cited obstacles directly impacting the use of technology in today's schools (Bausch & Hasselbring; Doering et al.). In an attempt to accelerate universities' training efforts, the National Council for the Accreditation of Teacher Education (NCATE) and the International Society for Technology in Education (ISTE) have designed and adopted technology standards to prepare teachers to utilize technology (ISTE, 2000). Such standards provide a framework for integrating technology into teacher education courses.

Inherent in the standards set forth is the importance of teacher experience with new technology. Infusion must begin in teacher training. The purpose of this study was to add to the empirical support for a practice-based infusion model. Such a model requires that teachers be taught in authentic ways to infuse technology. As such this project provided direct support to pre-service teachers to learn by using the very technology they would later infuse into their own curricula.

Technology Integration Models

Many teacher education programs are making efforts to integrate the ISTE/NCATE

technology standards within their programs. Yet, current research has not led us to a conclusive means on how this can be done effectively nor does it provide us with the ultimate technology integration model. Previous research allows us to examine factors within technology integration such as faculty and preservice teachers' skills levels and comfort in using technology, attitudes towards the use of computers, and confidence. Ertmer, Conklin, Lewandowski, and Osika (2003) believe that in order to translate technology skills into practice, preservice teachers require direction about how to use these skills to achieve meaningful learning outcomes within their curricula.

Although many technology integration models have been established (Doering et al., 2003; Ertmer et al., 2003), one common element of such models involves putting technology into the hands of the preservice teachers. Doering et al. believe that we must go one step further by adopting a learning-with-technology stance. Such a stance engages preservice teachers in meaningful and effective uses of technology and enables them to become active thinkers. Taking this stance requires emphases on four components: (a) technology tools can facilitate learning, (b) technology should be in the hands of the students, (c) students should learn with technology, and (d) preservice teachers should be able to generate future applications/strategies in their classroom (Doering et al., p. 343). Further, Doering et al. state that this perspective, which values discriminate thinking, is a paradigm shift that will not prove to be easy in teacher education. For this reason, there is great need to investigate through a simple research design the use and adoption of technology within this paradigm.

AlphaSmart 3000®

The AlphaSmart 3000®is a rugged portable word processor that provides schools with an affordable alternative to laptops. Its straightforward approach to word processing provides both teachers and students with a handy tool for integrating technology into classroom learning activities. In addition, the AlphaSmart 3000® assessment bundle provides a user friendly Quiz Designer that allows teachers to use and build test items. Teachers can choose a variety of formats and analysis to report their students' performance. Retrieval and scoring of quizzes are quick and automated.

Approximately 800,000 to one million AlphaSmart 3000® units are currently being used in our schools today (Russell, Bebell, Cowan, & Corbelli, 2002). Research conducted by Russell et al. involved observations in 50 classrooms. Findings demonstrated a clear increase in students' use of the AlphaSmart 3000® after each classroom was equipped with one of the devices per student. Thus, the AlphaSmart 3000® became the preferred tool for writing given that the 1:1 ratio led to changes in the way each teacher thought about and used technology with his or her class.

It is because of the aforementioned strength of the AlphaSmart 3000® that the researchers of this project selected its integration into their curricula and chose to investigate its effects on preservice teachers use and attitudes towards the tool.

Purpose

The purpose of this study was to investigate the experiences undergraduate special education teacher majors had while using the AlphaSmart 3000® as part of their methods courses in reading and writing, and to see if current experiences would impact their future use of this piece of technology in their classrooms.

The research questions guiding the data collection and analysis included:

1. Are there differences between actual and perceived success by pre-service teachers on traditional and technology delivered assessments?
2. When given the opportunity to learn and use technology, do such experiences impact the decision to use technology in their future classroom?
3. Are quiz scores positively or negatively impacted by the use of technology?

Method

Sample

A sample of convenience was drawn from 37 pre-service Special Education majors enrolled in a required Reading and Writing Methods (EDIS 441) course at a Midwestern university. The sample (Mean age = 21.4 yrs) was comprised of 34 females and 3 males, of which 36 were white and 1 was African American.

Treatments

The course, EDIS, has as its core component the development of skills in the teaching of reading and writing to k-12 students with disabilities. Skills taught in the course related to reading include, but are not limited to, increased reading fluency, rates, and comprehension. Skills taught in the class related to writing include, but are not limited to, spelling, sentence development and story development. Emphasis within the course focused on teaching techniques and devices to enhance skills related to reading and writing.

The course of study was team-taught using both traditional lecture/discussion format and a technology-rich environment that emphasized the infusion of assistive technology (AT) techniques. During the course this project, there was specific emphasis on the use of the AlphaSmart 3000®.

Design

This project employed a split-half design whereby the participants were divided into 2 sections and each group received both treatment and instructional styles equally throughout the semester. Each class period was 5 hours long and divided into two 2.5-hr segments according to treatment format. Group 1 was provided traditional lecture followed by the technology format, and likewise, Group 2 received technology followed by traditional treatment.

Data Collection

This study employed a mixed-method approach to data collection and analysis. Quantitative data in the form of weekly quiz grades were obtained. Quizzes based on the text readings were designed using the same questions but alternating formats. Each week the groups were administered either a tradition paper/pencil quiz or one using the AlphaSmart 3000® technology. The format switched from week to week for each group. For example, in week one, Group 1 received the traditional quiz format and Group 2 the AlphaSmart 3000® quiz. During week two, Group 1 was given the AlphaSmart 3000® quiz and Group 2 the paper/pencil quiz format. The alternation continued each week throughout the semester.

Participants were also asked to complete a short survey about their perceptions. The survey, as can be seen in Figure 1, asked participants to rate their experience using the AlphaSmart for quizzes on a Likert scale (1 – not at all favorable; 7 – extremely favorable) and the likelihood they will use AlphaSmart

Figure 1. End of semester survey for preservice teachers to share their technology use experience.

Name _____
Date _____

AlphaSmart Survey							
1. Rate on a scale of 1-7 your experience of using the AlphaSmart for quizzes.							
Circle one :	1	2	3	4	5	6	7
	Not all favorable	Strongly unfavorable	Somewhat unfavorable	Same as using Pen/ Paper	Somewhat favorable	Strongly Favorable	Extremely Favorable
2. Briefly describe your experience using the AlphaSmart for quiz taking.							
3. Do you think you performed better on the Alpha Quiz ? Circle One: [Yes or No] State one reason why you feel this way.							
4. Rate on a scale of 1-7 the likelihood of using the AlphaSmart for quizzes in your future classroom.							
Circle one :	1	2	3	4	5	6	7
	Not all likely	Strongly unlikely	Somewhat unlikely	Same as using Pen/ Paper	Somewhat likely	Strongly likely	Extremely likely
5. Briefly state why or why not?							
6. As a teacher what strategies would you use to incorporate the Alpha Quiz successfully?							

3000® in their future classroom (1 – not at all likely; 7 – extremely likely). The survey also included qualitative follow-up questions regarding their experiences and perceptions of performance.

Results

In response to research question #1 "Are there differences between actual and perceived success by pre-service teachers on traditional and technology delivered assessments?" we examined correlation data with regard to actual performance compared to perception of success on quizzes (see Table 1). Pearson correlation coefficients among the variables indicated that participant grade on the AlphaSmart version of the quiz was significantly correlated to their perception of performance. A positive correlation (r=.52) was found between the participants' AlphaSmart 3000® quiz grade and the rating they gave to their experience using AlphaSmart 3000® for quizzes.

To answer question #2, "When given the opportunity to learn and use technology, do such experiences impact the decision to use technology in their future classroom?" comparisons were also made between

Table 1
Correlation Coefficient Between Quiz Type and Perception

Quiz Type	Perception of Performance (r)
Traditional	.11
AlphaSmart	.52*

* Correlation is significant at the .01 level

questions regarding the likelihood the participants would use the AlphaSmart technology later in their careers and their quiz grades and experience. Pearson correlation coefficients for this question can be found in Table 2, a positive correlation (r=.34) was found between a participants' score on his or her AlphaSmart 3000® quiz and the likelihood the student will use that technology later. Participants who did well on the quizzes responded positively that they would use that technology in the future. Similarly, there was a positive correlation (r=.52) between quiz score and perception of experience. Not surprisingly, students who did well on their quizzes rated their experiences more positively.

This finding was also voiced in the written responses provided by the students. One student stated, "I enjoyed it tremendously; I used it in my practicum placement and will hopefully use it in my classroom." Another student stated,

Using the AlphaSmart 3000® for quizzes was definitely a different strategy. It allows for less writing. It only displayed one question at a time, which was less overwhelming. I could see myself using it with a number of students in my classroom.

When asked "As a teacher, what strategies would you use to incorporate the Alpha Quiz successfully?" Those with a positive experience using the AlphaSmart 3000® responded positively. One preservice teacher shared, "I think they are definitely something that some students will perform better with, so if it works for them, I will surely use them. I would model it first and make sure students are comfortable with the procedures." Another stated, "Students need to have a variety of experiences. I would allow students with disabilities to use only if comfortable."

It also became clear through an evaluation of the students' written responses that a negative experience with the AlphaSmart 3000® in their pre-service class greatly increased the likelihood that the device would not be used in their future classroom. One student expressed the experience with the AlphaSmart

Table 2
Correlation Coefficients Likelihood of Use and Quiz Average and Experience

	AlphaSmart Quiz Average	Experience Using AlphaSmart
Likelihood of Use	.34*	.51**

* Correlation is significant at the .05 level
** Correlation is significant at the .01 level

3000® as

> … somewhat unfavorable just because I could not remember the whole question and it was not in front of me. I don't think the majority of students will like them, I didn't like the AlphaSmarts so I probably won't use them,

while a second student who stated they were happy to have received the experience of using the AlphaSmart 3000® stated, "But I wouldn't use it in my class." The reliability of the technology and the fear that it would fail was expressed by another student that shared, "I am used to pen and paper quizzes; I was uncomfortable with the AlphaSmarts. I was constantly afraid something would go wrong with my machine."

When asked, "As a teacher, what strategies would you use to incorporate the Alpha Quiz successfully?" those with a negative experience using the AlphaSmart 3000® responded negatively. One preservice teacher stated, "I think it was very frustrating and took more time than a paper quiz. I would use it for answering questions at different stations in my classroom but it won't be used for a quiz or test." Another participant comment included, "I would allow plenty of time because students with disabilities may really struggle since I did."

In response to research question #3, further investigation took place to see if actual quiz scores were affected using technology. A one-way analysis of variance was calculated comparing AlphaSmart 3000® quiz grade to paper quiz grades; these results can be found in Table 3. There were no significant differences found in preservice teacher's quiz grade averages using either method. The use of the AlphaSmart 3000® as a test-taking tool did not have a positive or negative effect on the score a student received on a test. This conclusion is important for two reasons. First, many of the students in their written responses voiced concerns that the structure of the AlphaSmart 3000® would negatively impact their grades. Because of the limited size of the screen many students found trouble reading the question and scrolling down to find the answer. Two typical comments were, "Not being able to see the entire question and all the answers made it difficult to be able to make the correct decisions," and, "I found if difficult remembering the questions and answer choices because the screen was too small to fit the entire question and answer on it; therefore, I had to keep scrolling." While this was a widely held perception it was found to be not true and must be addressed as an issue. Second, the use of technology did not inflate test scores. An ongoing debate when it comes to the use of technology is to what extent, if any, does its use enhance or inflate test scores. As one student said, "I enjoyed the change. It wasn't any more or less difficult than paper and pencil. Another student summarized her experience with this comment: "One way or another, I either knew the information or didn't—regardless of how I took the quiz."

Table 3
ANOVA Comparisons between methods

	Sum of Squares	*df*	*F*	Sig.
Between Groups	2.89	36	.87	.423

Discussion

The purpose of this investigation was to take a learning-with-technology stance and provide preservice teachers an opportunity to experience technology during authentic learning activities. In addition, this study examined the perceptions of preservice teachers' use of technology and how it impacted their own academic performance. Specificially, the study probed the following questions: (a) Are there differences between actual and perceived success by pre-service teachers on traditional and technology delivered assessments? (b) When given the opportunity to learn and use technology, do such experiences impact the decision to use technology in their future classroom? and (c) Are quiz scores positively or negatively impacted by the use of technology?

The results of this study should be considered in light of limitations. First, a pretest/posttest design would have probed into pre-existing perceptions of technology use before using the AlphaSmart and provided a comparison for any perceptual change. Obviously, additional research and followup is needed concerning the longitudinal use and implementation of technology within the particpants' actual classrooms.

Outcomes and Benefits

The results of this study suggest a number of insights associated with the outcomes and benefits of the use and adoption of technology by preservice teachers: (a) a positive experience using the technology was related to the grade an individual received on a quiz; (b) a positive experience with the technology during their pre-service training influenced the student's decision to use the device in their future classrooms; and (c) the use of the technology as a test-taking tool did not have a positive or negative effect on the score a student received on a test.

The results of this study further support the importance of a positive experience when technology is being introduced to a pre-service teacher cannot be overstated. This study placed technology into the hands of preservice teachers. Participants were required to use technology to demonstrate their knowledge on chapter reading quizzes. Many felt their own academic performance was at stake. Findings of this study proved otherwise. Preservice teachers were given the opportunity to become engaged learners with technology and actively think about when and how they would use technology in their future classroom. Such engagement provided the opportunity to recognizing the advantages and disadvantages when utilizing technology for individuals within the learning environment.

While the use of technology greatly enhances the learning opportunities for all students, assistive technology devices for individuals with disabilities open up learning environments and opportunities that were once beyond the reach of these students. Inexpensive and easy to access devices, such as the AlphaSmart 3000®, allow individuals with disabilities to more equally participate in the learning environments in our schools today

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ATIA Innovation Cooperation
Assistive Technology Industry Association

Special Education Assistive Technology
seat center
Illinois State University

CALL FOR PAPERS

Assistive Technology Outcomes and Benefits

Fall, 2006
Submission deadline: March 31, 2006

Assistive Technology Outcomes and Benefits is a peer-reviewed, cross-disability, transdisciplinary journal that publishes articles related to the outcomes and benefits of assistive technology (AT) across the lifespan. The journal's purposes are to (a) foster communication among vendors, AT Specialists, AT Consultants, and other professionals that work in the field of AT, family members, and consumers with disabilities; (b) facilitate dialogue regarding effective AT practices; and (c) help practitioners, consumers, and family members advocate for effective AT practices.

Call for Papers for Volume 3:

Assistive Technology Outcomes and Benefits invites you to submit manuscripts of original work for publication consideration. Only original papers that address *outcomes* or *benefits* related to assistive technology devices and services will be accepted. These may include (a) findings of original scientific research, including group studies and single subject designs; (b) marketing research conducted relevant to specific devices having broad interest across disciplines and disabilities; (c) technical notes regarding AT product development findings; (d) qualitative studies, such as focus group and structured interview findings with consumers and their families regarding AT service delivery and associated outcomes and benefits; and (e) project/program descriptions in which AT outcomes and benefits have been documented.

The third issue of this peer-reviewed journal will include a broad spectrum of papers on topics specifically dealing with AT outcomes and benefits issues, in (but NOT limited to) the following areas:

- Transitions
- Employment
- Outcomes Research
- Innovative Program Descriptions
- Government Policy
- Research and Development
- Low Incidence Populations

For information on how to submit manuscripts see the *Guidelines for Authors* at http://www.atia.org/

Guidelines for Authors

Assistive Technology Outcomes and Benefits
Submission deadline for Volume 3(1): March 31, 2006

Submission Categories

Articles may be submitted under two categories—*Voices from the Field* and *Voices from the Industry*.

- *Voices from the Field*. Articles submitted under this category should come from professionals who are involved in some aspect of assistive technology service delivery with persons having disabilities, or from family members and/or consumers with disabilities.
- *Voices from the Industry*. Articles submitted under this category should come from professionals involved in developing and marketing specific assistive technology devices and services.

Within each of these two categories, authors have a range of options for the type of manuscript submitted. Regardless of the type of article submitted, primary consideration will be given by the journal to work that has *quantifiable results*.

Types of articles that are appropriate include:

- **Applied/Clinical Research.** Original work presented with careful attention to experimental design, objective data analysis, and reference to the literature.
- **Case Studies.** Studies that involve only one or a few subjects or an informal protocol. Publication is justified if the results are potentially significant and have broad appeal to a cross-disciplinary audience.
- **Design.** Conceptual or physical design of new assistive technology models, techniques, or devices.
- **Marketing Research**. Industry-based research related to specific AT devices and/or services.
- **Project/Program Description.** Grant projects, private foundation activities, institutes, and centers having specific goals and objectives related to AT outcomes and benefits.

In all categories, authors MUST include a section titled 'Outcomes and Benefits' in which a discussion is provided related to outcomes and benefits of the assistive technology devices/services addressed in the article.

Manuscript Preparation Guidelines for Submission to

Assistive Technology Outcomes and Benefits

(Note: These guidelines apply to all *Voices from the Field* and *Voices from the Industry* submissions)

All articles submitted will be refereed by the Editorial Review Board. Recommendations on suitability for publication will be taken as final by the Editor.

All other items would not be reviewed, but the editors reserve the right to refuse or (with the approval of contributors) to edit copy.

- Each manuscript must reflect style guidelines of the *Publication Manual of the American Psychological Association* (5th edition, 2001).
- Manuscripts should be **no more** than 25 pages in length (**double-spaced**), *including* references, tables, and figures. Due to the electronic format of the journal, all submissions should be submitted as email attachments in either Microsoft Word or rich text (RTF) formats. The following information should be provided on the cover page of each manuscript:

    - Author'(s') full name(s) and title(s)
    - Name of corresponding author
    - Job title(s)
    - Organization(s)
    - Full contact information of the corresponding author, including email address, postal address, telephone and fax numbers
    - Each manuscript should have at least the following components:
        - Title (up to 10 words)
        - Abstract (75 to 150 words) presenting the main points of the paper and the contributor's/s' conclusions regarding outcomes and benefits
        - Four keywords
        - Main body of paper
        - **Outcomes and Benefits section**
        - References

- Submissions should be double-spaced.
- Articles should be subdivided into unnumbered sections, using short, meaningful headings according to *Publication Manual of the American Psychological Association* (5th edition, 2001).
- Footnotes and endnotes are **not** accepted; all such information should be included in main text.
- The keywords (just after the abstract) should be separated by **commas**, and each keyword phrase should have initial caps (for example, Communication devices, Families).
- Authors should not use <u>underline</u> to highlight text, but rather use *italics* instead.
- For figures, BMP, GIF, and JPG are the preferred formats. Figures should be included in the text at appropriate places and centered horizontally. Captions (maximum 6 to 8 words each) must be provided for every figure (below the figure) and must be referenced in the text. The figures must **NOT** be larger than 500 pixels in width. **Authors must supply separate**

figures in one of these formats even if they are embedded in text. In the event that the file(s) can't be opened, the Editor will contact the corresponding author by email and request that the appropriate format be provided.

- Tables should be included in the text at appropriate places and centered horizontally. Captions (maximum 6 to 8 words each) must be provided for every table (below the table) and must be referenced in the text.
- The References section should contain appropriate citations noted in the APA Manual (5th ed.)

Sample citations

Journal article

James, P., & Tatem, J. J. (2003). Assistive technology benefits. *American Journal of Occupational Therapy*, *39*, 336-337.

Paper presentation

Stuart, S. K., & Kemp, L. M. (2003, January). *Native Americans and AAC issues.* Paper presented to the Annual Meeting of the Assistive Technology Industry Association, New Orleans, LA.

Book

Kalyanpur, M., & Harry, B. (1999). *Culture in special education. Building reciprocal family-professional relationships*. Baltimore: Brookes.

Book chapter

Soto, G., Huer, M., & Taylor, O. (1997). Multicultural issues in augmentative and alternative communication. In L. Lloyd, D. Fuller, & H. Arvidson (Eds.), *Augmentative and alternative communication* (pp. 406-413). Boston: Allyn and Bacon.

Legislation (please cite any law that is described in the manuscript narrative; see p. 404 of APA Manual)

Individuals with Disabilities Education Act Amendments of 1997, 20 U.S.C. § 1400 *et seq* (West, 1993).

Individuals with Disabilities Education Act of 1990, Pub. L. No. 101-336, § 2, 104 Stat. 328 (1991).

Web site

Institute for Matching Person and Technology. (2003). *Matching person and technology (MPT) assessment process*. Retrieved February 27, 2004, from

http://members.aol.com/impt97/mptdesc.html

- The Editor will acknowledge receipt of a submitted article immediately.
- Authors are encouraged to write in the third person and use "person-first" language, i.e., the individual *precedes* the disability. For example, phrases such as "persons with disabilities," "students with mental retardation," "and "adults with cognitive impairments" are more appropriate than such phrases as "the disabled," "learning disabled students," or "mentally retarded adults." Consumers and family members who submit manuscripts describing specific practices may use the first person.
- A cover statement in the submission should indicate that the manuscript has not been published in whole or substantial part by another publisher and that it is not currently under review by another journal.

All submissions for the third volume of ***Assistive Technology Outcomes and Benefits*** **are due by March 31, 2006.**

After a manuscript has been accepted for publication and subsequent to making all changes recommended by the editorial review board, authors must send a copy of the revised manuscript and a computer file to the Editor via email to: **hpparet@ilstu.edu** or via mail (on CD or 3.5" floppy) to: Dr. Phil Parette, Special Education Assistive Technology (SEAT) Center, Illinois State University, Campus Box 5910, Normal, IL 61790-5910