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Measuring Assistive Technology Outcomes: Key Concepts

Despite the concerns associated with minimal increases in funding for education in recent years, schools have demonstrated a willingness to devote an ever-increasing percentage of their annual budgets to the purchase of assistive and instructional technology. However, little evidence documents the impact of these expenditures.

Several early-warning signals in the field of educational technology suggest a new era of accountability is upon us. Sun (2000) sought to answer questions, "How do we know it is working?" and "How has technology affected student achievement?" by creating rubrics to document and differentiate student performance. Barnett (2000) has suggested the importance of standardizing data collection systems in order to systematically report on the alignment of technology, standards, and outcomes. Jones and Paolucci (1999) highlighted the need for clarifying frameworks for evaluating the effectiveness of educational technology to enhance student learning and achievement.

Within this context of increased accountability and desire for understanding the value of technology investments, three national research centers have been established to advance an agenda that will substantially increase the knowledge base surrounding assistive technology and its effective use by individuals with disabilities. First, the Office of Special Education Programs (OSEP) funded the National Assistive Technology Institute based at the University of Kentucky. This center is charged with conducting AT research, translating research into AT practice, and providing resources to improve the delivery of AT services. To learn more about this center, visit the NATRI home page: <http://natri.uky.edu>. A second federal agency has also been concerned about assistive technology and has funded priorities to advance a research agenda concerning assistive technology outcomes. In October 2001, National Institute on Disability and Rehabilitation Research (NIDRR) funded two, five-year, research centers to address the gap in data collection efforts concerning assistive technology outcomes, as well as the paucity of measurement instruments and strategies. The ATOMS (Assistive Technology Outcomes Measurement System) Project is based at the University of Wisconsin-Milwaukee and CATOR (Consortium for Assistive Technology Outcome Research) is housed at Duke University. Additional information about each of these projects can be found at their respective Web sites: <http://www.atoms.uwm.edu> and <http://www.atoutcomes.org>.

Given the importance of the topic of assistive technology outcomes to both researchers and practitioners, I will devote

the research and practice column in volume 18 of JSET to a series of related articles on measuring assistive technology outcomes in specific academic domains. Here's the tentative outline for this series:

18-1 Measuring assistive technology outcomes: Key concepts

18-2 Measuring assistive technology outcomes in writing

18-3 Measuring assistive technology outcomes in math

18-4 Measuring assistive technology outcomes in reading

To initiate the series, in this column I will describe a number of key concepts that are currently confronting researchers interested in establishing the conceptual foundations of assistive technology outcomes measurement theory.

KEY CONCEPTS

What is assistive technology?

Most readers are familiar with the federal definition of assistive technology:

§300.5 Assistive technology device.

...Assistive technology device means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability. (Authority: 20 U.S.C. 1401(1))

Indeed, the broad definition of the term assistive technology creates some significant measurement problems given that the website maintained by AbleData documents over 26,000 AT products (<http://www.abledata.com>). At the present time there is a significant need for a taxonomy that classifies related devices and facilitates efficient communication about specific AT devices.

What is the relationship between AT services and outcomes associated with AT use?

A second companion definition outlines a critical component associated with assistive technology. That is, success is dependent not only on having access to a device, but also several types of supports. These support factors are outlined in the following federal definition of assistive technology services:

§300.6 Assistive technology service.

...Assistive technology service means any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. The term includes—

1. The evaluation of the needs of a child with a disability, including a functional evaluation of the child in the child's customary environment;



2. Purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by children with disabilities;
3. Selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices;
4. Coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs;
5. Training or technical assistance for a child with a disability or, if appropriate, that child's family; and
6. Training or technical assistance for professionals (including individuals providing education or rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of that child. (Authority: 20 U.S.C. 1401(2))

An assistive technology outcome measurement system will need to collect data not only on the specific type of assistive technology but also on the various kinds of support services, frequency of service, quality of service, etc. Smith (2000, 1996) argues that the concomitant delivery of services must be isolated to adequately understand the unique contribution assistive technology provides. Indeed, the task of isolating the unique contributions of AT to improved function poses formidable research design challenges for AT researchers.

What is meant by outcome?

In focus group research conducted by the ATOMS Project, AT service directors provide the following list of variables that might be measured to understand the outcomes associated with AT use.

1. Change in performance/function (body, structure, activity)
2. Change in participation
3. Usage and why or why not
4. Consumer satisfaction (process, devices)
5. Goal achievement
6. Quality of life
7. Cost
8. Demographics
9. AT interventions (services & devices)
10. Environment context

In the past, single measures have served as the proxy for the outcomes associated with assistive technology use. However, lists like this raise interesting questions about whether or not the construct of assistive technology outcome can be measured in a single dimension or whether it is a complex multi-dimensional construct. This issue relates significantly to the next issue: Whose outcome?

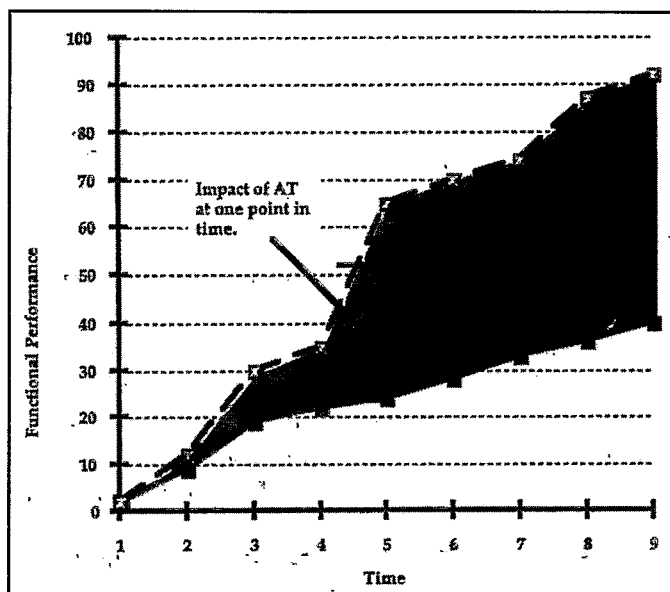
Whose Outcome?

DeRuyter (1997, 1995) raises interesting questions about who's outcome do we measure? If a client reports high satisfaction with a device, is that sufficient outcome data? And, if the client is satisfied with a device, what if discernible differences in performance or participation can not be measured? However, are these outcomes more or less important than the outcomes a funding source is interested in? Indeed, much work remains to be done to understand the values held by stakeholders concerning various AT outcomes and how these values might be transformed into weights within a measurement system to give priority for certain factors within the outcome model. A critical issue in this discussion involves the underlying theoretical application of self-determination.

Repeated Measures of Performance With and Without AT

Central to the definition of assistive technology is the expectation of enhanced performance. Smith (2000) outlines a theoretical view known as Time Series Concurrent and Differential (TSCD) Approach which involves a series of performance measures of an individual when s/he is completing a specific task, with AT, and without AT. Ideally, the results reflect a pattern similar to the one shown in Figure 1. The differences between the two measurements isolates the specific impact of AT and provides evidence of the impact and outcome over time. This approach appears to hold considerable promise for applications of AT in academic content areas.

Figure 1. Environment-free (no AT) and environment-adjusted (with AT) performance over time.





Learn More about AT Outcomes

The purpose of this article was to provide a brief introduction to key concepts associated with research on measuring assistive technology outcomes. Readers interested in learning more about assistive technology outcomes are encouraged to explore the web sites of the three AT research centers (ATOMS, CATOR, NATRI). In addition, the following resources provide a useful, non-technical introduction to this emerging discipline:

A Primer in Assistive Technology Outcomes

<http://www.uwm.edu/CHS/atoms/archive/primer.html>

A brief bibliography of useful resources for getting started in learning about AT outcomes.

Assistive technology outcomes research: Impressions of an interested newcomer

<http://www.utoronto.ca/atrc/reference/atoutcomes/newcomer/index.html>

A thoughtful introduction and overview of the emerging discipline of AT outcomes research by Marcus Fuhrer, Health Scientist Emeritus, National Institutes of Health.

Assistive Technology Outcomes

<http://www.utoronto.ca/atrc/reference/atoutcomes/index.html>

The home page of an international community interested in AT outcomes. A mega-resource.

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