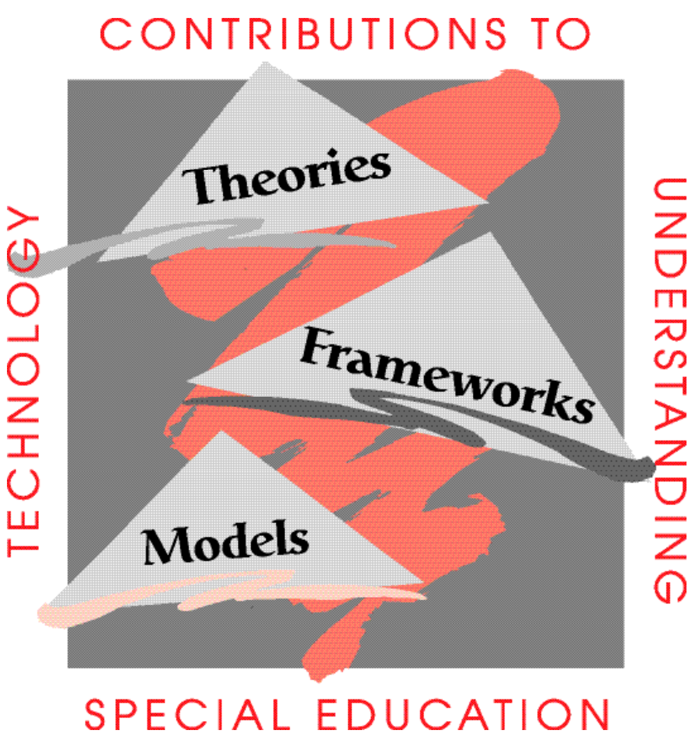
Models, Theories, and Frameworks: Contributions to Understanding Special Education Technology

by Dave L. Edyburn, Ph.D.

By some accounts, the field of special education technology is relatively young. Much of the current interest in technology has its roots in the development and use of Apple II computers in the early 1980s. While the field of special education technology has grown considerably over the past 20 years, compared to disciplines like reading or psychology, one could argue that the knowledge base supporting our discipline is still in its infancy.

One indicator associated with the maturation of a discipline is the emergence of models, theories, and frameworks. Models originate from experience, reflection, and insight and help scholars and practioners understand key variables, relationships, and systems. Theories, models, and frameworks also provide a discipline with an intellectual framework that stimulates advances in theory, research, development, policy, and practice.



The purpose of this article is to highlight 12 models that have impacted the special education technology knowledge base. One particularly encouraging observation about the growth of the discipline is that multiple models are being advanced to describe similar phenomenon. Just as there is no single best theory of learning, multiple models challenge us to consider commonalities, as well as distinct and unique contributions, made by theorists with differing perspectives.

This article seeks to fill a void in the literature by compiling a comprehensive collection of the models, theories, and frameworks that undergird the knowledge base of the special education technology discipline. Analysis of the salient components of twelve models revealed three clusters: (1) assistive technology consideration, (2) technology-enhanced performance, and (3) developmental models which describe specific aspects of technology use in special education. A brief overview of each model is provided in the following sections.

AT Consideration

Four models were identified which describe processes associated with assistive technology consideration. Each of these models has had significant impact on the design and delivery of assistive technology devices and services in schools.

Model Name: The SETT Framework

Author: Joy Zabala

The SETT Framework was designed to aid the process of gathering, organizing, and analyzing data to inform collaborative problem solving and decision-making regarding assistive technology and appropriate educational programming for students with disabilities. Information is gathered concerning the Student's abilities and needs, the Environment(s) in which the student navigates, the Tasks required for the student's active participation in the activities within the environment, and finally, the Tools needed for completing the tasks. As transdisciplinary teams engage in the consideration process, key questions associated with the SETT Framework (see Figure 1) provide a systematic method for discussion and decision-making. The intuitive nature of the SETT model has led to its widespread use by school-based teams.

References

Zabala, J. (2002). Get SETT for successful inclusion and transition. Available at http://www.ldonline.org/ld_indepth/technology/zabalaSETT1.html

Zabala, J. (1995). The SETT Framework: Critical areas to consider when making informed assistive technology decisions. Available at http://www.joyzabala.com.

Figure 1
The SETT Framework

The Student

1. What does the Student need to do?
2. What are the Student's special needs?
3. What are the Student's current abilities?

Environment

1. What materials and equipment are currently available in the environment'?
2. What is the physical arrangement? Are there special concerns?
3. What is the instructional arrangement? Are there likely to be changes?
4. What supports are available to the student?
5. What resources are available to the people supporting the student?

The Tasks

1. What activities take place in the environment?
2. What activities support the student's curriculum?
3. What are the critical elements of the activities?
4. How might the activities be modified to accommodate the student's special needs?
5. How might technology support the student's active participation in those activities?

The Tools

1. What strategies might be used to invite increased student performance? What no-tech, low-tech, and high-tech options should be considered when developing a system for a student with these needs and abilities doing these tasks in these environments?
2. How might these tools be tried out with the student in the customary environments in which they will be used?

Figure 2
Education Tech Points

Tech Point #1 • *Initial Referral Question*

1. Does the student experience any deficits in performance that might be remediated or compensated for by the use of assistive technology?

Tech Point #2 • *Evaluation Questions*

1. Can the student be accurately evaluated with standard assessment procedures?
2. What accommodations should be provided during the evaluation
3. Could the use of assistive technology as an accommodation during testing enhance the student's performance?
4. Are the services of a specialist needed
5. Is an extended evaluation needed?

Tech Point #3 • *Extended Assessment Questions*

1. Does the type of technology we are trying do what we thought it would do for the student?
2. What specific device among the options we have tried is the best one?

Tech Point #4 • *Plan Development Questions*

1. Is the assistive technology that is being considered necessary for the child to meet one or more of the goals on the IEP?
2. Are assistive technology services needed to enable the child to use the device?
3. Was a specific assistive technology device identified in the IEP?
4. Has periodic review been included in the IEP to identify unanticipated problems and review them?

Tech Point #5 • *Implementation Questions*

1. What actions need to be taken to assure that the assistive technology identified by the IEP team is used effectively?
2. Who is responsible for each of these actions?
3. Who is responsible for monitoring each aspect of the implementation of assistive technology goals and objectives?

Tech Point #6 • *Periodic Review Questions*

1. Are the assistive technology devices and/or services that were provided being utilized?
2. Are the assistive technology devices and/or services functioning as expected?
3. Have long range plans (including transition) for the student's assistive technology use been made?

Model Name: Education Tech Points

Authors: Gayl Bowser and Penny Reed

Education Tech Points was created to facilitate decision-making regarding the utilization of assistive technology services and resources when planning educational programs for students with disabilities. Bowser and Reed argue that each Education Tech Point represents a critical juncture in the process of referral, evaluation, and development of the Individualized Education Plan (IEP) or Individual Family Service Plan (IFSP). As illustrated in Figure 2, the six key points are (1) referral, (2) evaluation, (3) extended assessment, (4) plan development, (5) implementation, and (6) periodic review. Because of the compatibility of this model with the traditional special education referral and evaluation process, it has been widely adopted in special education.

References

Bowser, G., Reed, P.R. (1995). Education TECH Points for assistive technology planning. *Journal of Special Education Technology*, 12(4), 325-338.

Education Tech Points. (2002). Available at: http://www.edtechpoints.org/

Model Name: Has technology been considered?

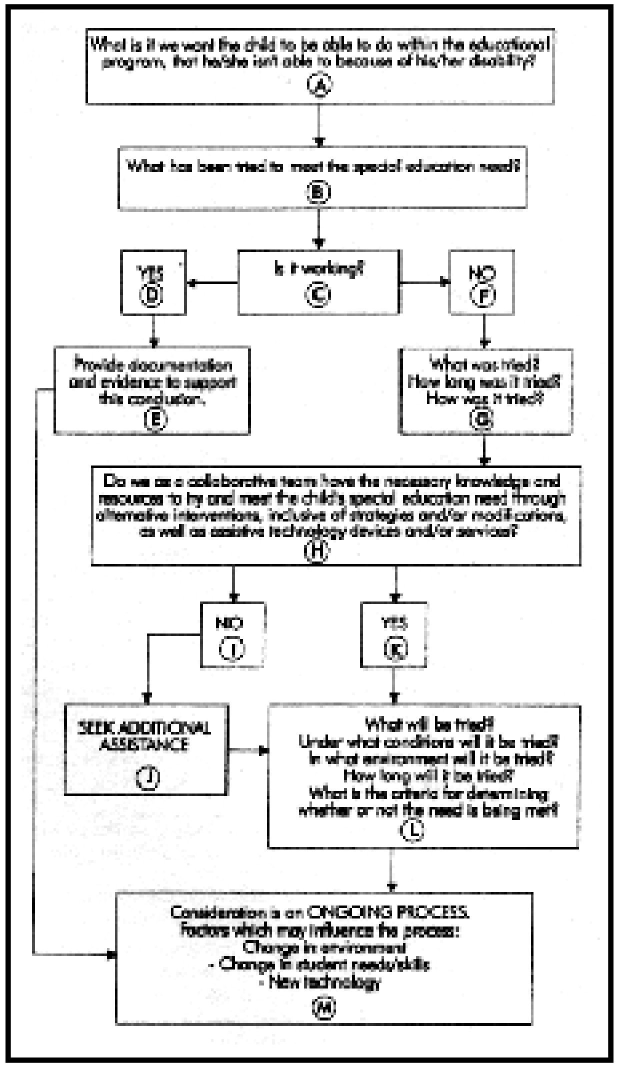
Author: Antonette C. Chambers

Whereas the 1997 reauthorization of the Individuals with Disabilities Education Act (I.D.E.A.) required that assistive technology be considered when planning for the educational program of each student with a disability, no guidelines were initially provided on how to meet this mandate. Chamber's model of the consideration process was developed through research involving a Delphi study of experts and validation with focus groups of practioners. The results of her work is a flowchart of the consideration process (see Figure 3) that illustrates key questions and decisions that must be made when considering assistive technology. Systematic use of the model provides an accountability paper trail concerning the efforts associated with assistive technology consideration. Like the proceeding models, Chamber's model has had considerable impact in school-based assistive technology decision-making.

Reference

Chambers, A.C. (1997). *Has technology been considered? A guide for IEP teams*. Reston, VA: CASE/TAM.

Figure 3
Has technology been considered?

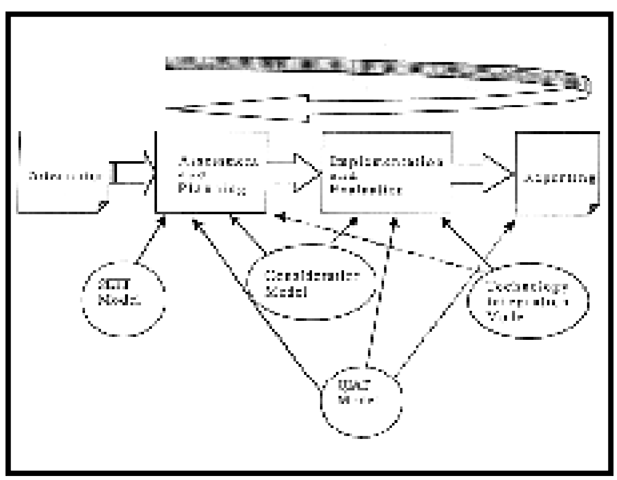


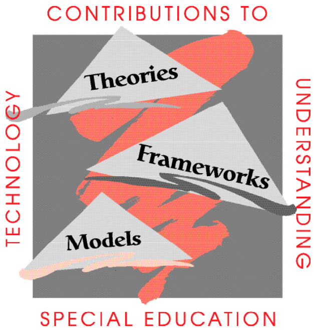
Model Name: The AT CoPlanner Model

Authors: Leonard P. Haines, Gladene Robertson, Robert Sanche, and colleagues

Recognizing the value of technology to foster communication and the time-lock pressures of the school day that infringe on adequate time for collaborative planning, Haines, Robertson, Sanche, and colleagues created *CoPlanner*, a groupware product that supports communication, collaboration, and co-planning. Additional content modules (i.e., *Instruction CoPlanner*, *Transition CoPlanner*, and *Assistive Technology CoPlanner*) provide electronic worksheets and planning systems that support specific applications of collaborative planning. In work describing the theoretical development of the assistive technology module, Haines and Sanche (2000) summarize their review of four common special education technology models and how they used a normalization

Figure 4
The AT CoPlanner Model





process to standardize the terminology and sequence of components advanced by each theorist. The result is a synthesis of the four individual models into a coherent framework which they call, "The AT CoPlanner Model," (see Figure 4) which they have implemented as a content module for *CoPlanner*. Whereas this work has had more impact in Canada to-date than in the United States, the connection between theory, practice, and tool is extremely powerful.

References

CoPlanner [software]. Saskatoon, SK: Slipstream Software Systems, Inc. http://www.quadrant.net/slipstream

Haines, L., & Sanche, B. (2000). Assessment models and software support for assistive technology teams, *Diagnostique*, 25(3), 291-306.

Robertson, G., Haines, L., Sanche, R., & Biffart, W. (1997). Positive change through computer networking. *Teaching Exceptional Children*, 29(6), 22-30.

Technology-Enhanced Performance

Models of human performance contribute to the development of technology-enhanced performance support strategies. Four models were identified which inform our understanding of human abilities; the impact of disabilities; and the role of prostheses, tools, and other devices in augmenting and enhancing performance.

Model Name: The ABC Model

Author: Rena Lewis

While technology can be helpful to everyone, Lewis observed that it is important to recognize the unique contributions technology offers students with disabilities. She suggested that these benefits could be understood by noting that technology can Augment abilities and Bypass or Compensate for disabilities (see Figure 5). This model is intuitively easy to understand and is the essence of rehabilitation and therapy decision-making.

Figure 5
The ABC Model

Technology can

Augment abilities and
Bypass or
Compensate for disabilities

Reference

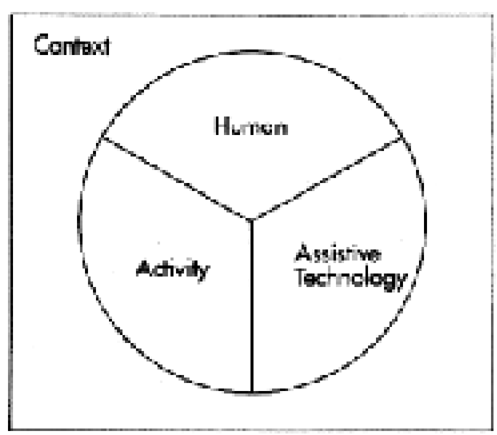
Lewis, R. B. (1993). Special education technology: Classroom applications. Pacific Grove, CA: Brooks/Cole, p. 7.

Model Name: The Human Activity Assistive Technology (HATT) Model

Authors: A. M. Cook & S. M. Hussey

Cook and Hussey have argued that assistive technology services must center on the individual with the primary consideration being improved performance. To understand the contribution of assistive technology for enhancing performance, they have proposed the Human Activity Assistive Technology (HATT) model (see Figure 6). Key components of this model involve the human, a person with a disability who controls a number of intrinsic enablers (sensors, central processing, and effectors or motor) as well as skills and abilities; activity (performance in areas such as self-care, work / school, leisure / play); Assistive technology (extrinsic enablers such as human / technology interface, processor, environmental interface, and activity output); and the Context (such factors as setting, social contexts, cultural context, and physical). Dynamic and sometimes complex

Figure 5
The Human Activity Assistive Technology (HATT) model



interactions between the various components requires assistive technology specialists to pay special attention to the implementation of assistive technology systems. Cook and Hussey also insist that it is necessary to measure the performance of the assistive technology system to determine whether or not it is effective. Because this book has been adopted as the required text for RESNA assistive technology practioner exam, this model has had considerable exposure within the field.

Reference

Cook, A.M., & Hussey, S.M. (2002). *Assistive technology: Principles and practices* (2nd ed.). St. Louis, MO: Mosby, pp. 34-53.

Model Name: Wile's Model of Human Performance Technology

Author: David Wile

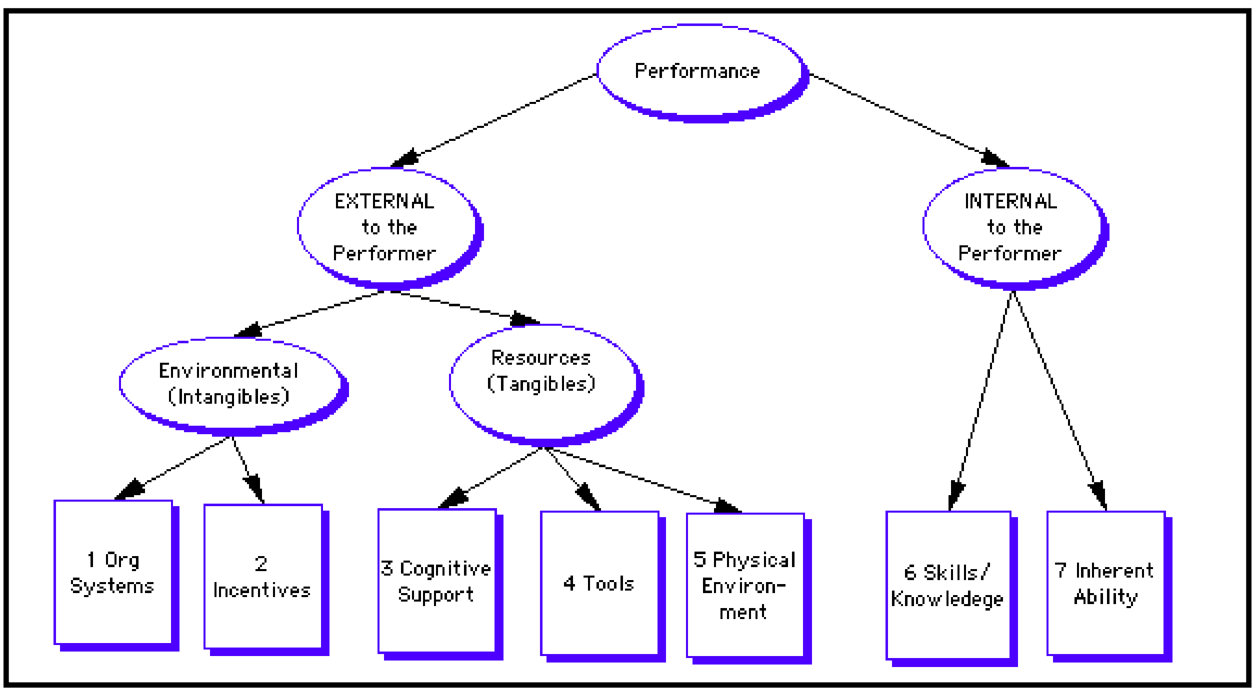
Wile studied five common models of human performance technology and sought to reconcile the differences through a normalization process to produce a synthesis of the many dimensions that have been identified as contributing to performance (see Figure 7). Wile's analysis suggests that performance can be affected by seven variables: (1) organizational systems, (2) incentives, (3) cognitive support, (4) tools, (5) physical environment, (6) skills/ knowledge, and (7) inherent ability. The variables can be viewed as part of two classes: those that are internal to the performer (#6 & #7) and those that are external (#1, #2, #3, #4, #5). Further, the external variables can be understood as part of environmental factors, or intangibles, (#1 & #2) and resources, or tangibles (#3, #4, & #5). Performance problems may be traced to a single variable or a combination. In Wile's estimation, the variables are sequenced in their ease of remediation (i.e., problems related to organizational system variables (#1) are easier to modify than problems associated with intrinsic abilities (#7)). This model helps us understand that technology is not a simple panacea for remediating performance problems. For example, if the issue is really that an individual lacks the incentive to complete an academic task (#2), performance may not improve despite the availability of a technology tool (#4). Likewise, when a tool (#4) is only available in one environment (#5), performance gains will be limited.

References

Edyburn, D.L. (2000). Assistive technology and students with mild disabilities. *Focus on Exceptional Children*, 32(9), 1-24.

Wile, D. (1996). Why doers do. *Performance and Instruction*, 35(2), 30-35.

Figure 7
Wile's Model of Human Performance Technology



Model Name: King's Adaptation of Baker's Basic Ergonomic Equation (BBEE)

Author: Thomas W. King

King builds on work by Baker (1986) to elaborate a framework for understanding the human factors that interact with successful human-machine interactions. As illustrated in Figure 8, key factors associated with the successful use, or not, of assistive technology include: the motivation of the assistive technology user to pursue and complete a given task (M), the physical effort (P), the cognitive effort (C), the linguistic effort (L) and the time load (T). King argues that successful assistive technology use will occur when the numerator, (M) user motivation, exceeds the sum of all the load or effort factors in the denominator. Conversely, assistive technology failure is predictable when the denominator exceeds the numerator. Thus, he concludes, the primary focus of the professions associated with assistive technology must be devoted to maximizing (M) while using our individual and collective expertise to minimize load and effort factors (P + C + L + T).

References

Baker, B. (1986). Using images to generate speech. *IEEE Biomedical Conference Proceedings*, Fort Worth, TX.

King, T.W. (1999). *Assistive technology: Essential human factors*. Boston: Allyn & Bacon, pp. 67-86.

Developmental Models

Four theorists have created models which reflect developmental processes associated with a critical component of special education technology. The following descriptions offer insight into processes surrounding student development; technology integration; the quality of assistive technology services; and the ebb-and-flow of advocacy, accommodations, and accessibility.

Model Name: Stages

Author: Madalaine K. Pugliese

Stages is a theoretical framework which serves to organize resources and assessment materials for documenting student growth and development and its implications for technology use (see Figure 9). Pugliese suggests in stages 1-3, children acquire critical language foundation skills in a sequential pattern. As a child moves into the academic discovery phase, stages 4-7, skills are developed in a complementary pattern. The extensive professional development and well-designed support materials associated with this model facilitate the identification of appropriate technologies for each stage of learning. In addition, Pugliese bridges the theory and practice gap by providing numerous examples on how to document the intervention strategies and tools in IEP goals and objectives.

References

Pugliese, M.K. (2001). Stages: An alternative curriculum and assessment philosophy. *Special Education Technology Practice*, 3(4), 17-26.

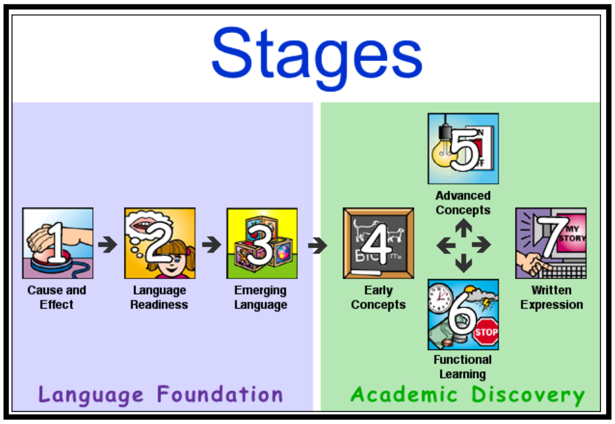
Pugliese, M. (2000). Stages: A framework for alternative assessment. *Closing the Gap*, 18(6), 6-7, 29.

Pugliese, M.K. (2000). Stages [software]. Newton, MA: Assistive Technology, Inc.

Figure 8
King's adaptation of Baker's Basic Ergonomic Equation (BBEE)

$$\frac{\text{Motivation of the AT user to pursue and complete a given task (M)}}{\text{Physical effort (P) + Cognitive effort (C) + Linguistic effort (L) + Time load (T)}} = \text{Successful AT Use ... or not}$$

Figure 9
Stages



Model Name: Edyburn's Model of the Technology Integration Process

Author: Dave L. Edyburn

Despite the clearly stated commitment to technology integration and recognition of the common barriers, the literature generally overlooks an essential component of the integration process. Namely, what does technology integration look like and how is it achieved. Edyburn's model of the integration process was developed to (a) describe the various tasks involved in integrating software into the curriculum, (b) provide a planning guide for individuals interested in technology integration, (c) serve as a tool for discussing the process among the major stakeholders, and (d) assist in the identification of methods and resources for facilitating the process. The process illustrated in Figure 10 illustrates the major tasks involved in selecting, acquiring, implementing, and integrating instructional technologies into the curriculum. The process appears generic in the sense that the process is the same regardless of ability level, subject matter, or type of technology. While the process process involves a significant commitment of time and effort, he suggests that teachers work through the process in order to develop a technology toolbox of 3-10 products that can be utilized to enhance teaching and learning in their classroom.

References

Edyburn, D.L. (1998). A map of the technology integration process. *Closing the Gap*, 16(6), pp. 1, 6, 40.

Gardner, J.E., & Edyburn, D.L. (2000). Integrating technology to support effective instruction. In J. Lindsey (Ed.). *Technology and exceptional individuals*, (pp. 191-240) 3rd. ed. Austin, TX: Pro-Ed.

Model Name: The Quality Indicators for Assistive Technology Services

Authors: The QIAT Consortium

Despite the requirement within IDEA'97 regarding the consideration of assistive technology, the profession lacks a standard definition of high-quality assistive technology services by which schools can measure their compliance. In an attempt to fill that void, the Quality Indicators of Assistive Technology (QIAT) Consortium has created a set of descriptors that can serve as overarching guidelines for evaluating the quality of assistive technology services, regardless of service delivery model. As outlined in Figure 11, quality indicators are available in the following areas: Administrative support, Consideration of assistive technology needs, Assessment of assistive technology needs, Documentation in the IEP, Assistive technology implementation, and Evaluation of

Figure 10
Edyburn's Model of the Technology Integration Process

Phase1	Phase 2	Phase 3	Phase 4
SELECTION	ACQUISITION	IMPLEMENTATION	INTEGRATION
Planning	Previewing	Organizing	Linking
Locating	Evaluating	Teacher Training	Managing
Reviewing	Purchasing	Student Training	Assessing
Deciding			Extending

effectiveness. During a time of intense accountability and scrutiny, the impact and influence of this grass-roots independent organization continues to grow.

References

QIAT Consortium Leadership Team. (2000). Quality indicators for assistive technology services in school settings. *Journal of Special Education Technology*, 15(4), 25-36.

Quality Indicators for Assistive Technology Services. (2002). Available at: http://www.qiat.org

Model Name: The A3 Model

Authors: Smith, Schwanke, & Edyburn

The A3 Model is a theoretical work that seeks to describe a developmental process associated with efforts to provide access for individuals with disabilities to facilities, programs, and information. As shown in Figure 12, the model illustrates a web-and-flow of efforts that are needed to obtain universal accessibility. In the first phase, Advocacy efforts raise awareness of inequity and highlight the need for system change to respond to the needs of individuals with disabilities. Accommodations are the typical response to advocacy. Inaccessible environments and materials are therefore modified and made available in phase 2. Typically, accommodations are provided upon request. While this represents a significant improvement over situations found in the earlier phase, accommodations tend to maintain inequality since there may be a delay (i.e., time needed to convert a handout from print to Braille), it may require special effort to obtain (i.e., call ahead to schedule), or it may require going to a special location (i.e., the only computer with screen reading software is in the library). In phase 3, Accessibility describes an environment where access is equitably provided to everyone at the same time. Historical success stories such as curb cuts and computer accessibility control panels are examples of how disability design has had a subsequently larger impact for the general population. Thus, current work on universal design holds considerable promise. The proportions illustrated in the graphic reveal the efforts associated with each of the three phases at any point in time relative to the impact of the general strategy being applied (advocacy that argues for need, accommodation to remediate inaccessibility, and accessibility where universal access is provided for all).

Figure 11
The Quality Indicators for AT Services

Quality Indicators are available in the following areas:

Administrative Support
Consideration of Assistive Technology Needs
Assessment of Assistive Technology Needs
Documentation in the IEP
Assistive Technology Implementation
Evaluation of Effectiveness

References

Schwanke, T. D., Smith, R. O., & Edyburn, D. L. (2001, June 22-26, 2001). A3 Model Diagram Developed As Accessibility And Universal Design Instructional Tool. *RESNA 2001 Annual Conference Proceedings*, 21, RESNA Press, 205-207.

Smith, R.O., Edyburn, D. & Silverman, M.K. (1999, June). "Using the AAA Model for Performing Accessibility Audits." Presented at RESNA Conference '99, Long Beach, CA, and *Proceedings of the RESNA '99 Annual Conference*, pp. 163-165, Arlington, VA.

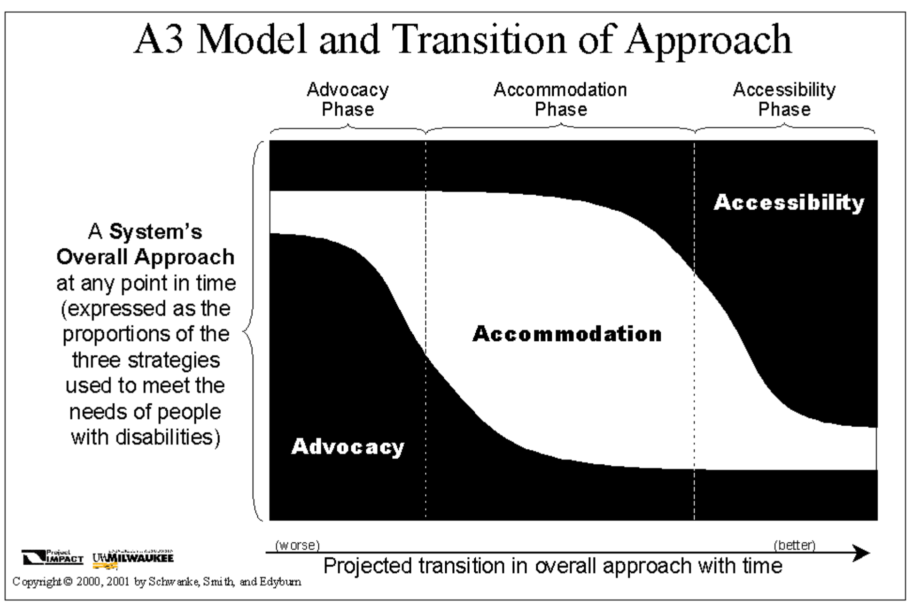


Figure 12
The A3 Model