Comprehensive Individualized Curriculum and Instructional Design

SPED 510

Curriculum and Instruction for Students with Developmental Disabilities/Autism Spectrum Disorders

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Chapter 1

Guiding Principles for Developing Comprehensive and Meaningful Instruction for Individuals with Complex Needs

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Individuals with complex needs require supports from multiple providers across multiple instructional domains. Designing and implementing effective supports for individuals with complex needs requires intentional committed collaboration from all stakeholders. This chapter introduces guiding principles for designing comprehensive instructional supports for individuals with complex needs that should create a conceptual and practical frame for the successive chapters of this text. Each of these guiding principles is a vast topic with multiple associated texts and resources. Therefore, within this chapter, practical resources are provided to help readers develop their repertoire of tools for designing effective and meaningful supports for individuals with complex needs.

Six Guiding Principles for Developing Comprehensive Supports

1. Plan with the individual and family
2. Promote self-determination throughout the assessment, intervention, and monitoring process
3. Examine the current and future inclusive environments
4. Utilize Universal Design for Learning (UDL) principles in developing modifications and supports within inclusive environments
5. Implement evidence-based practices to individualize instruction
6. Use data to make decisions to improve instruction

Guiding Principle 1: Plan with the Individual and Family

An essential first step to designing and implementing instruction for individuals with disabilities (IWD) is to plan with the individual and their family. Person-centered planning is a process used with IWD and others that is key to implementing supports for the individual (e.g., social workers, speech and language therapists, special educators). The purpose of person-centered planning is to establish positive, collaborative, meaningful, and individualized programs for IWD (Claes, Van Hove, Vandevelvelde, Loon, & Schalock, 2010). There are several person-centered planning models such as Planning Alternative Tomorrows with Hope (PATH; Pearpoint, O'Brien, & Forest, 1993), Personal Futures Planning (O'Brien & Lovett, 1992), McGill Action Planning (Vandercook, York, & Forest, 1989), and the Picture Method (Holburn, Gordon, & Vietze, 2007). All of these models are designed to center the supports and services for IWD with the individual and their families.

Choosing Outcomes and Accommodations for Children (COACH, Giangreco et al., 2011) is a comprehensive, yet practical approach to collaborative instructional planning for IWD who require intensive supports. The COACH process is designed to focus on promoting achievement for IWD within inclusive settings. There are two parts of COACH: Part A guides families and educators to determine a student's educational program; and Part B guides the team to translate the family-identified priorities into goals and objectives. Part A involves a family interview that helps IWD and their families identify valued life outcomes and prioritize learning outcomes within selected curriculum areas. Part A concludes with the student team identifying general supports that will improve access and participation in the student's educational program. These general supports outline accommodations, modifications, and individuals essential to implementing a successful inclusive program for a student. Part B of COACH then guides the team to translate these supports into measurable annual goals and short-term objectives. Finally, the team delineates a "Program-at-a-glance" that is shared with everyone who supports the student.

A resource for assisting IWD plan their supports and services is the website www.imdetermined.org. The "One-Pager" from this resource is a practical tool that can be used by students and their teams to share strengths, preferences, interests, and needs with new teachers, employers, case managers, and other people who may support the students. A template is provided that allows students to type or handwrite and embed pictures within this one-page document. Examples are provided on this website for how this tool can be used. Overall, the "One-Pager" is a tool that can be

used with students to ensure that they are the center of their instructional programming.

Person-centered planning outlines life-long dreams for the individual and plans to help them achieve them. The process brings together the individual, their family, and support-service providers (e.g., special and general educators, social workers, community support providers) to collaborate in designing a cohesive instructional program that addresses the individuals' values. This person-centered team (sometimes called an instructional team) will follow a student along in their program, its members consistently updating one another to improve the outcomes for the individual and their family.

Guiding Principle 2: Promote Self-Determination throughout the Assessment, Intervention, and Monitoring Process

When implementing programs for IWD it is important to seek their perspective on the types and levels of supports they need. However, often times IWD struggle to express their preferences and are not provided with opportunities to engage in activities to promote their self-determination. For educators of IWD, promotion of self-determination is foundational throughout the assessment, intervention, and monitoring process.

Promoting self-determination has become best practice in the education of IWD. Self-determination is a broad construct in which no single practice or package of practices applies. Based on work from Wehmeyer et al. (2011) and Walker et al. (2011), self-determination comprises three dimensions in which an individual needs to

develop: (a) causal agency (an individual's control of events), (b) proxy agency (provision of supports and assistance allowing the individual to control events), and (c) opportunities to act upon the environment. These dimensions and specific skills are displayed in Figure 1 below.

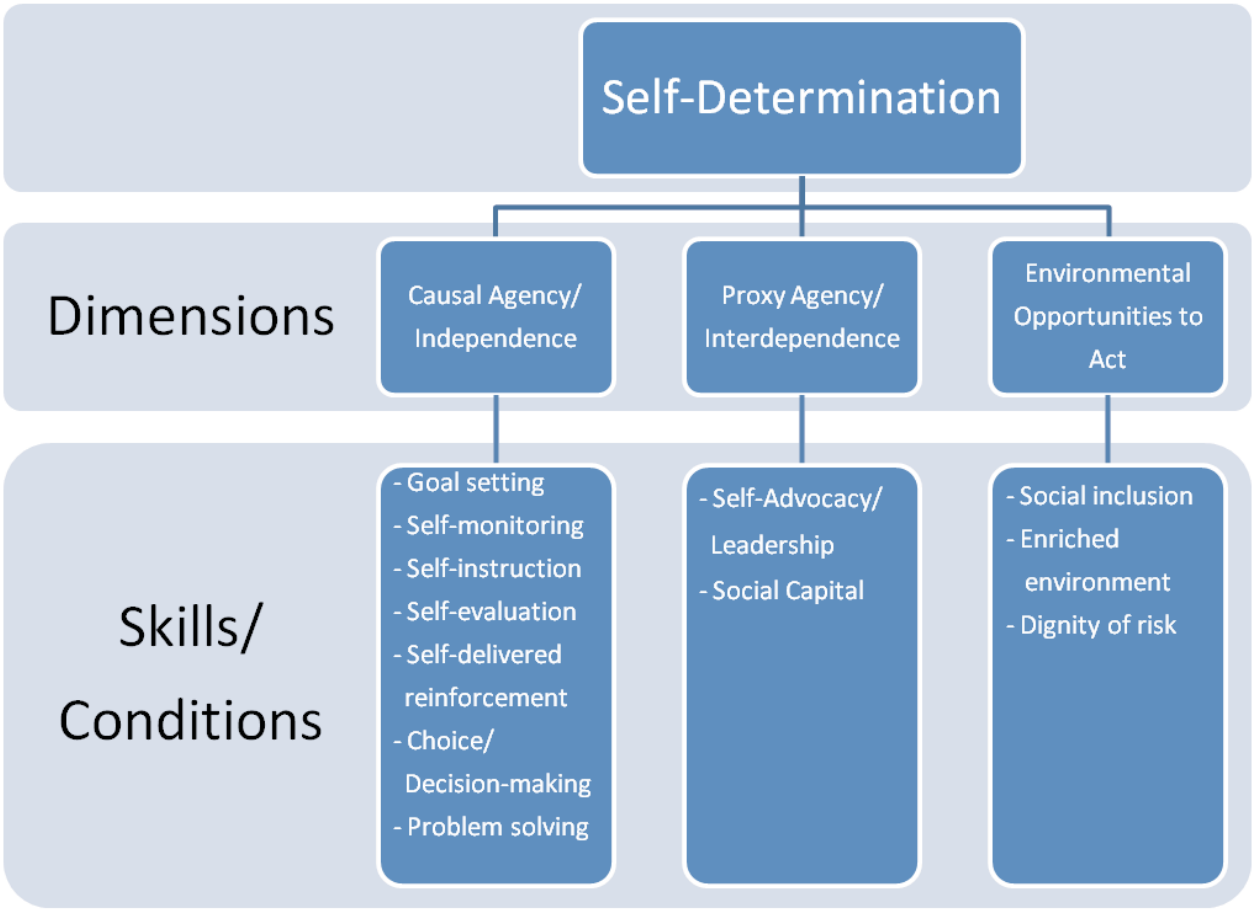

Figure 1. Framework of Self-determination Dimensions and Skills/Conditions (from Loman et al., 2010)

Preference Assessments. During the assessment process, self-determination can be promoted through the use of preference assessments. Preference

assessments include the student in identifying reinforcers as well as identifying meaningful activities and materials. Interviews of significant others regarding a student's preferences are a good starting point. However, it is important to include the individual student in his or her own preference assessment. The use of direct observations of students interacting with different activities and materials is the most reliable way to obtain this information.

Several helpful resources for promoting self-determination are available through the Zarrow Center for Learning Enrichment at the University of Oklahoma (http://www.ou.edu/education/centers-and-partnerships/zarrow.html). The center provides preference-indicator tools for individuals of all ages:

- Child Preference indicators (http://www.ouhsc.edu/thecenter/products/documents/ChildPreferenceIndicators_rev1107.pdf),
- Personal Preference indicators (http://www.ouhsc.edu/thecenter/products/documents/CLL-UCEDD_Personal_Preference_Indicators_June%202006.pdf), and
- Employment Support indicators (http://www.ouhsc.edu/thecenter/products/documents/EmploymentSupportIndicators.pdf).

These tools can assist IWD in identifying preferences and promoting their self-determination.

A systematic preference assessment involves the direct observation of an individual with different stimuli and observing their interactions with the materials or

activities. Common methods for this are free-access preference assessments and forced-choice preference assessments. In a free-access preference assessment (shown below in Figure 2), the assessor makes multiple materials or activities that may be preferred by the student readily available. The student's interactions with the materials or activities are recorded to identify the most preferred items. See a sample template below:

Student:	Date Range of Sessions:					
Complete the table below noting how long the student engages with the materials/activities during the session.						
Date:	Item 1:	Item 2:	Item 3:	Item 4:	Item 5:	Item 6:
Total Time Engaged:						

Figure 2. Free-Access Preference Assessment Template

A forced-choice preference assessment involves selecting a specific number of materials or activities and presenting them in pairs in a random fashion. At the conclusion of a forced-choice preference assessment, a hierarchy of preferred materials or activities is determined. An example of a forced-choice template is available at:

http://r4strategiesasd.wikispaces.com/file/view/Forced+Choice+Reinf+Assessment.pdf

Self-determination practices. Five practices identified as having evidence for promoting self-determination for IWD (Loman, Vatland, Strickland-Cohen, Horner, &

Walker, 2010; Vatland et al., 2011) were: (a) use person-centered planning methods; (b) use teacher-directed instructional strategies; (c) teach students skills needed to self-direct learning; (d) create and maintain a system that involves family supports and family involvement; and (e) organize environments to provide enriched opportunities, supports, models, and resources. In their practice guide, Loman et al. (2010) provide a definition of the practice, level of evidence and social validity, a brief summary of support for the practice, instructions for how to implement the practice, and identified barriers or limitations of the practice.

The promotion of self-determination is critical to the development of an effective and meaningful program for IWD. The practices and procedures presented within this chapter and the remainder of this text should be framed with promoting self-determination in mind.

Guiding Principle 3: Examine the Current and Future Inclusive Environments

Mapping Objectives to Activities in Inclusive Environments. After planning with the individual and understanding their preferences, the next step to designing an effective inclusive instructional program is to examine the instructional environments. When examining the current and future environments, identify their current goals and objectives within the context of an age-appropriate inclusive instructional setting. A common tool used for this is the Infused
Skills Grid (Peak Center Inc., 1999; http://www.cde.state.co.us/cdesped/accommodationsmanual_infusedskillsgrid). The Infused Skills Grid should be completed by inserting the student's current objectives in the horizontal rows. Then, complete the schedule of a typical student's day (it is

important that this schedule be based on a same-age peer without a disability). Using the tool, the student's instructional team will identify when the objectives can be met within the typical instructional settings. Usually all objectives can be addressed within at least 90% of the typical schedule. A facilitator of this process, usually a special educator, can help the team think of ways the objectives can be met within inclusive environments. If an objective cannot be met within the inclusive environments, the facilitator should ask the team if the objectives should be revised to be more appropriate for a student within this setting.

***Identifying Strengths and Barriers within Inclusive Settings*.** A daily schedule analysis (sometimes referred to as an ecological inventory; Figure 3) is used to analyze the schedule and instructional environments within typical settings. Similar to the Infused Skills Grid, the first step in completing this tool is to outline the classes and environments the student would attend if he or she did not have a disability. Following the columns in the daily schedule analysis tool, specify for this class/environment: (a) the activities that all students engage in; (b) natural supports that already exist for all students; (c) target skills that the focus student needs to develop in order to participate in these activities; and (d) recommended accommodations and modifications to promote participation for the focus student. A video example of a completed daily schedule analysis with an explanation is provided in the following link: http://my.brainshark.com/Daily-Schedule-Analysis-Simulation-1-39562592

***Breaking Down Tasks within Inclusive Environments*.** The daily schedule analysis provides a broad picture of instructional targets and modifications needed for an individual student. To break down specific target skills needed to be successful in

inclusive environments, a task analysis should be conducted. A task analysis involves breaking down the steps of a routine or task. These individual steps are then analyzed for variations in cues and prompts to determine how to provide instruction that promotes generalization of the skills.

An example of a completed task-analysis form is provided below (Figure 4). Using this task-analysis form, identify a logical step sequence for completing the routine. Make sure to provide brief, but specific information in the step to prompt the learner. For example, instead of "student will turn the door knob to the right" state "turn the door knob." Using this consistent language will help those implementing the plan identify verbal prompts to use with a student and help the student identify the relevant features to cue their behavior. Next, identification of stimuli that could be varied for each step should be notated in the adjacent column. Finally, data codes from 0 (no opportunity) to 1 (most intrusive level of prompting; e.g., physical prompting) to 2 (less-intrusive level of prompting; e.g., gestural prompting) to 3 (least intrusive level of prompting; e.g., verbal prompting) to 4 (independent) are used to empirically document student progress. A second sheet (Figure 5) is provided to allow for anecdotal and qualitative data collection of student and teacher performance within the task. For more information and examples of task analyses, go to the National Professional Development Center on Autism Spectrum Disorders: http://autismpdc.fpg.unc.edu/content/task-analysis.

Domain **Environments**	**School** **Grade level:**	**Activities (All students experience)**	**Natural Supports (Supports available for all students)**	**Target Skills (For target student during this subject; highlight priority skills)**	**Possible Adaptations/Modifications (Consider Assistive Technology, Augmentative Communication)**
Sub-environments→	Subject 1 (e.g., homeroom, language arts)				
	Subject 2				
	Subject 3				
	Hallway				
	Bathroom				
	Cafeteria				
	Other				

Figure 3. Daily Schedule Analysis Template

Task Analysis Data Tracking System for a Functional Routine

Student: _____ Routine: ___Hair Brushing_____ Setting(s):__Bathroom, Locker room_

Days of Week/Time of Day: _____Data Collection Date Range: _____ to _____

		Baseline			Intervention								
Step	Features to vary (to promote generalization) Note features included for each step	12/5	12/6	12/7	12/9	12/10	12/11	12/12	12/13	12/16	12/17	12/18	% Indep end.
11. Final Step: Put Brush Away	A. Location B. Brush Type C. Time of day	4	4	4	4	4	4	4	4	4	4	4	100%
10. Check Hair for Neatness	A.	2	2	2	4	4	4	4	4	4	4	4	73%
9. Brush Left Back of Head	A., B., C. D. Staff supporting	1	1	1	3	4	4	3	3	4	4	4	64%
8. Brush Left Side of Head	A, B, C, D	1	1	1	3	3	3	3	3	3	3	4	9%
7. Brush Front	A, B, C, D	1	1	1	3	3	3	3	3	3	3	4	9%
6. Brush Right Side of Head	A, B, C, D	1	1	1	3	3	3	3	3	3	4	4	18%
5. Brush Right Back of Head	A, B, C, D	1	1	1	3	3	3	3	4	4	4	4	36%
4. Pick up brush	A, B, C, D	2	2	2	3	3	3	4	4	4	4	4	45%
3. Select Desired Materials	A, B, C, D	2	2	2	3	3	3	4	4	4	4	4	45%
2. Locate Brushing materials	A, B, C, D	2	2	2	3	3	3	3	4	4	4	4	36%
1. **Initial Step:** Initiate Brushing	A, B, C, D	2	2	2	3	4	4	4	4	4	4	4	63%
Staff/Observer Initials		SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	
Total Completion Time (in Minutes):		5	6	5	5	4	4	4	3	3	2	2	
Total Steps Independent - Data Code: 4 (Circle & graph)		1	1	2	2	4	4	5	7	8	9	11	
Total Steps – Verbal & Gesture Data Code: 3		0	0	9	9	7	7	6	4	3	2	0	
Total Steps Partial Physical Data Code: 2		5	5	0	0	0	0	0	0	0	0	0	
Total Steps Fully Physical - Data Code: 1		5	4	0	0	0	0	0	0	0	0	0	
Total Steps w/ No opportunity- Data Code: 0		0	0	0	0	0	0	0	0	0	0	0	

Qualitative Data Collection (On Back)

Figure 4. Task Analysis Tracking Form.

Qualitative Data Collection

	Focus Student Performance	Variables (Planned or unplanned) influencing student performance	Considerations for prompting, supports or adjustments	Instructor practices
Date: Baseline #1				
Date: Baseline #2				
Date: Baseline #3				
Date: Intervention				
Date: Intervention				
Date: Intervention				
Date: Intervention				
Date: Intervention				

Figure 5. Qualitative Data Collection Form to Accompany the Task Analysis Form

Guiding Principle 4: Utilize Universal Design for Learning Principles in Developing Modifications and Supports

Planning instruction for IWD requires collaboration between general and special educators (e.g., special education, speech and language therapist, occupational therapist). This team of educators should be guided by the information compiled from the person-centered planning process, student preference assessments, and assessment of the instructional environments. All of this information will be utilized to

embed a student's individualized instruction within the instruction of the Common Core State Standards and College Career Readiness Standards within the general education settings.

The principles of Universal Design for Learning (UDL; CAST, 2011) create a framework for collaborative creation of curricula that involves both general and special educators. A short You-Tube video presenting UDL from the Center for Applied Special Technology demonstrates this framework (CAST; https://www.youtube.com/watch?v=bDvKnY0g6e4). The primary UDL principles for providing individuals with multiple means of representation, expression, and engagement lay a foundation for designing Common Core units and lessons that promote the participation of all learners.

Developing a unit plan for Common Core content areas that address IWD in general-education classrooms takes a coordinated effort from the instructional team. Falco (2014; modified from Tamarkin, n.d.) created a unit/lesson redesign worksheet (Figure 6) that can be used by instructional teams to ensure they are incorporating UDL into their lessons. Within this worksheet, the team outlines the Common Core state standards and lesson objectives that are being addressed. Then, the team outlines how students will demonstrate their learning and what they currently do to teach these skills. In the adjacent columns of the worksheet, instructional teams can then identify ways they may augment their instruction to ensure that the principles of UDL are incorporated in their lessons. View this video clip to see how a biology teacher has utilized UDL within their instruction:

https://www.youtube.com/watch?v=G18AzLXhEdA&feature=relmfu

Unit/Lesson Re-Design Worksheet (Example)

Course/Lesson __Biology 1_____ Instructor/s ___Dawn_____ Date _Nov. 6, 2014_____

Key Goals/Outcomes (Usually tied to CCSS)	**What I Want Students to Do to Demonstrate Learning**	**What I Do Now**	**Applying UDL: Representation of Content**	**Applying UDL: Student Actions/ Expression**	**Applying UDL: Student Engagement/ Motivation**
Recognize the components of a cell	Show the components of a cell	Give students opportunities to look at cells through a microscope and draw cell and its parts	Provide manipulatives to represent cell parts	Students use manipulatives to show cell parts and use table-top models to assist in drawing	Students enjoy manipulating the models; More success in drawing
Study content following class Use lab equipment accurately & safely	Take notes & review notes to learn parts of cell & their functions Use the microscope	Lecture & draw cell models; Expect students to review their own notes Expect students to use microscope alone or with one partner and to help their partners; spend more time with students with special needs	Use interactive white board to demonstrate drawing & provide good notes	Use teacher's notes from interactive white board & review own & other students' notes posted online All students in groups of three and all students help their partners	Students have accurate notes and drawings to review Students share responsibility for helping partners

Figure 6. Unit/Lesson Re-Design Worksheet. Falco, 2014 (Adapted from Tamarkin, D. (n.d.).)

Guiding Principle 5: Implement Evidence-Based Practices to Individualize Instruction

Implementation of effective instructional practices is the critical step that brings all of the guiding principles together. In 2014, the National Professional Development Center on Autism Spectrum Disorders (NPDC) has updated their autism intervention literature review on evidence-based practices for children, youth, and young adults with Autism Spectrum Disorders (ASD). In their review they identified 27 practices that were considered "evidence-based." The document in its entirety is provided here: http://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/2014-EBP-Report.pdf

The NPDC has also developed evidence-based practice (EBP) briefs for 24 of the identified EBPs available here: http://autismpdc.fpg.unc.edu/content/briefs. These briefs provide a description of each of the practices, the evidence supporting the use of the practices, and step-by-step instructions for implementing those practices. Additionally, the NPDC and the Ohio Center for Autism and Low Incidence (OCALI) have developed online modules for understanding each of these EBPs. Click on the following link and register for a free account to access this resource: http://www.autisminternetmodules.org/

Ensuring that EBPs are embedded in inclusive environments is a challenge for all educators. Scheduling and collaboration with the instructional team using the tools already presented in this chapter will assist with this process. To further assist in the process, Loman (2014) has framed a number of the EBPs within the UDL framework

(Figure 7). This graphic may be helpful for instructional teams to determine how to best support IWD in the Common Core content areas.

Representation	Expression	Engagement
Visual Strategies (Picture Symbols/Schedules)	Augmentative Communication	Social Narratives/ Power Cards
Video Modeling	Functional Communication Training	Reinforcement
Modeling/Prompting	Time Delay	Peer-mediated intervention
Naturalistic Interventions	Discrete Trial Training	Self-management
Task Analysis-Chaining	Pivotal Response Training	Naturalistic Interventions
Structured Work Systems/Activities	Response Interruption	

Figure 7. Evidence-based Practices for Individuals with Autism by Universal Design for Learning Principle

Guiding Principle 6: Use Data to Make Decisions to Improve Instruction

Every step of the process in designing and implementing a comprehensive instructional program for IWD relies on the use of data. A number of tools presented throughout this chapter may be used as sources of data to outline effective supports for IWD. The COACH process (Giangreco, Cloninger, & Iverson, 2011) provides valuable information that brings together information from individuals, their families, and school professionals. These data are used to outline general supports and annual goals and objectives for students. Preference assessments are another good source of data for better understanding the learner and how to engage them throughout the learning process. Additionally, the use of the daily schedule analysis and task analyses are critical to guiding meaningful and effective instruction. Furthermore, data from individualized plans of support such as behavior-support plans or curriculum-based measures within the classroom will provide essential information to monitor the progress of IWD.

Conclusion. The six guiding principles presented in this chapter frame the process of supporting IWD in inclusive settings. Led in partnership with the individual and their family (ideally the student should lead this meeting), instructional teams of individuals with complex support needs should consistently review data at least quarterly to ensure all stakeholders are synergistically heading in a positive direction. Data from Individualized Education Program (IEP) goals should be discussed as well as how the student is engaging in the general-education curriculum. These team meetings should always be guided by an agenda that presents current data and seeks to remove barriers to success for the student. In order for these meetings to be

effective, team members should consistently assume the following roles: Recorder (types and distributes meeting minutes), Data Analyst (compiles and presents data of student progress), Time Keeper (ensures topics are addressed in a timely fashion), and Facilitator (keeps the meeting running; ideally the student). An individual student meeting agenda template is provided below (Figure 8).

Individual Student Meeting Agenda Template
Student: _____ **Recorder:_____**
Data Analyst: _____ **Time Keeper: _____**
Facilitator (if not the student): _____
Date: ____/____/_____
Team Members Present: _____

I. Review agenda, determine whether changes are needed (2 minutes)
II. Review task list from previous meeting, document status of tasks (10 minutes)

Who	What	When	Status
			Not In Done Not started progress Needed
			Not In Done Not started progress Needed
			Not In Done Not started progress Needed
			Not In Done Not started progress Needed

III. Progress summary: Presentation of Current Data (15 minutes)

a. Goals being met. Celebration!
b. Goals not being met or not yet addressed
    1. Determine problem and next steps
        -Possible problems: fidelity, intervention needs to be modified, additional supports or technology are required
        -Possible decisions: Meet with teachers, change intervention, acquire technology or supports, conduct assessment

Problem	Decision	By Whom & byWhen?

IV. Upcoming Activities/ Changes (15 minutes)

Upcoming Activity	*Concerns*	*Decisions*	*By Whom & When?*

Next Meeting Date: _____

Figure 8. Individual Student Meeting Template. Ideally to be led by the student at least quarterly.

References

CAST (2011). Universal design for learning guidelines version 2.0. Wakeeld, MA: Author

Claes, C., Van Hove, G., Vandevelde, S., van Loon, J., & Schalock, R. L. (2010). Person-centered planning: Analysis of research and effectiveness. *Intellectual and Developmental Disabilities, 48* (6), 432–453. doi: 10.1352/1934-9556-48.6.432

Falco, R. (2014). *Unit/Lesson Re-Design Worksheet*. Presented at Seaside School District: Seaside, OR.

Giangreco, M., Cloninger, C. J., & Iverson, V. S. (2011). *Choosing outcomes & accommodations for children: A guide to educational planning for students with disabilities* (3rd ed.). Baltimore, MD.: Paul H. Brookes.

Holburn, S., Gordon, A., & Vietze, P. (2007). *Person-centered planning made easy: The PICTURE method.* Baltimore, MD: Brookes.

Loman, S. L. (2014, February). *Universally Designing Positive Behavior Supports for All Students*. Paper presented at 12th Annual Northwest Positive Behavior Interventions and Supports Conference. Portland, OR.

Loman, S. L., Vatland, C., Strickland-Cohen, K., Horner, R. H., & Walker, H. M. (2010). *Promoting self-determination: A practice guide. National gateway to self-determination.* Funded by the U.S. Department of Health and Human Services, Administration of Developmental Disabilities. Retrieved from http://www.aucd.org/NGSD/template/link.cfm

O'Brien, J., & Lovett, H. (1992). *Finding a way towards every-day lives: The contribution of person-centered planning.* Harrisburg: Pennsylvania Office of Mental Retardation.

Pearpoint, J., O'Brien, J., & Forest, M. (1993). *PATH: A workbook for planning positive possible futures and planning alternative tomorrows with hope for schools, organizations, businesses, and families* (2nd ed.). Toronto: Inclusion Press.

Tamarkin, D. (n.d.). *Universal design for learning: Applications in biology*. Springfield, MA: At Ease Project, Springfield Technical Community College.

Vandercook, T., York, J., & Forest, M. (1989). The McGill Action Planning System (MAPS): A strategy for building the vision. *Journal of the Association for Persons with Severe Handicaps,14*, 205–215.

Vatland, C., Strickland-Cohen, K., Loman, S. L., Doren, B., Horner, R. H., & Walker, H. M. (2011). *Promoting Self-determination for Adults: A Practice Guide. National Gateway to Self-Determination*. Funded by the U.S. Department of Health and Human Services, Administration of Developmental Disabilities. Retrieved from http://www.aucd.org/NGSD/template/link.cfm

Walker, H. M., Calkins, C., Wehmeyer, M. L., Walker, L., Bacon, A., Palmer, S. B., & Johnson, D. R. (2011). A social-ecological approach to promote self-determination. *Exceptionality*, 19, 6–18. doi: 10.1080/09362835.2011.537220

Wehmeyer , M. L ., Abery , B ., Zhang , D ., Ward , K ., Willis , D ., Hossain , W. A ., & … Walker , H. M . (2011). Personal self-determination and moderating variables that impact efforts to promote self-determination. *Exceptionality*, 19, 19–30. doi:10.1080/09362835.2011.537225

Chapter 2
Naturalistic AAC Communication Intervention

Samuel Sennott, Portland State University

"...model, model, model..." —Patty Cassidy, CCC-SLP

It was a crisp autumn day when I departed my graduate class in augmentative and alternative communication alongside my course instructor Patty Cassidy. It was one of those sublime moments after an inspiring class when you find yourself thinking deeply about the subject matter. I remember innocently enough asking her what she thought was most important about language learning for children who could not use their voice to meet their full daily communication needs. At that point we stopped on the steps of the College's building and she shared that she thought modeling the communication systems we were using with the children was the most important principle. She tapped me on the shoulder as we were walking away and said, "model, model, model... remember that, Sam." Walking away inspired from the class session and conversation, I had little idea exactly how important those words and the concept they represent are for the language acquisition process of children who have difficulty speaking. Five years later I found myself defending a Ph.D. dissertation on the subject of teaching adults to model using Augmentative and Alternative Communication (AAC) to help children learn how to use those AAC systems.

I remember finding classic texts on language input and motherese such as Snow and Ferguson (1978) and realizing how long people have been interested in the importance of modeling language interactively to children. The following quote exemplifies the spirit of naturalistic communication interventions.

When asked how a parent might best support a child's learning of language, Roger Brown (in the introduction to the seminal Snow and Ferguson, [1978, p. 26]) provided the following response: "How can a concerned mother facilitate her child's learning of language?" His answer was, "Believe that your child can understand more than he or she can say, and seek, above all to communicate. To understand and be understood. . . . If you concentrate on communicating, everything else will follow." The research on communication interventions for children with disabilities impacting their ability to communicate provides evidence that these same high expectations and the use of AAC modeling based interventions can produce benefits for individuals with CCN. The challenge is how to better provide a rich communication environment full of models of language, engagement, high expectations, and opportunities for participation. When these conditions are provided, there is good reason to think that the learning of language ". . . will follow."

This chapter introduces AAC, shares select intervention resources, and then introduces a naturalistic AAC intervention strategy, MODELER.

What Is AAC?

Child language development is impacted by the interaction of the child's abilities in all domains such as motor, vision, hearing, and language (Siegel & Cress, 2002). For individuals with disabilities that impact their ability to meet their daily communication needs using speech, language acquisition can be empowered through providing access to Augmentative and Alternative Communication (AAC) (Beukelman & Mirenda, 2013).

AAC Definition

"AAC includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas. We all use AAC when we make facial expressions or gestures, use symbols or pictures, or write. People with severe speech or language problems rely on AAC to supplement existing speech or replace speech that is not functional. Special augmentative aids, such as picture and symbol communication boards and electronic devices, are available to help people express themselves. This may increase social interaction, school performance, and feelings of self-worth. AAC users should not stop using speech if they are able to do so. The AAC aids and devices are used to enhance their communication." American Speech-Hearing Association, retrieved from: asha.org/public/speech/disorders/AAC/.

There are many first-hand accounts of individuals who have found alternate ways to communicate (Brown, 1964; Creech, 1992; Koppenhaver, Yoder, & Erickson, 2002). As a whole, their writings, combined with research documenting

efficacy express the message that despite not being able to speak, it is possible to become a competent communicator by utilizing AAC (Beukelman & Mirenda, 2013, Romski & Sevcick, 1996).

The goal of AAC, described by Porter (2007), is to give people the ability to meet socially valued daily language needs efficiently, specifically, intelligibly, and independently. This is accomplished both through using AAC tools and by providing AAC intervention and training to support the individual using AAC.

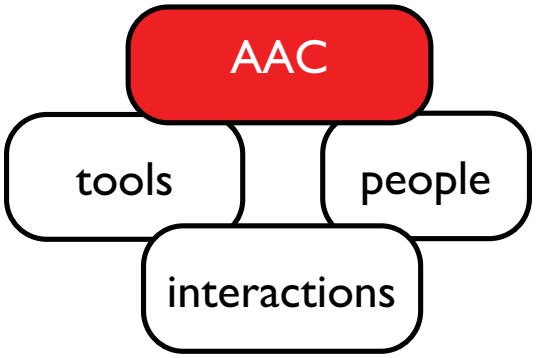

Figure 1. AAC is a set of tools people use for interactions and learn to use through interactions.

One fear many parents and professionals have is that by using AAC system components to assist in communication, the child's speech development will be impeded. Fortunately, this is not the case. Evidence suggests that AAC not only does not impede development, but may even support speech development (Millar, Light, & Schlosser, 2006). Parents, teachers, and therapists also may be concerned about prerequisites for commencing AAC interventions, but as Cress (2002) points out, there are no prerequisites for AAC.

Communication and Language

Communication is sending messages. Language is the coded system of symbols with agreed-upon patterns and rules that enables a community of people to interact and communicate with each other and to efficiently send messages (Beukelman & Mirenda, 2013). There are important social purposes of communication such as (a) expressing needs and wants, (b) feeling social closeness, (c) sharing information, (d) fulfilling established conventions of social etiquette (Light, 1988) and (e) engaging with oneself in an internal dialogue (Beukelman & Mirenda, 2013). Communicative competence is not necessarily an inherent trait, but something that must be learned and scaffolded. Communicative competence can be organized into linguistic, operational, social, and strategic domains (Light, 1989).

AAC Intervention Resources

Table 1 highlights a selection of important Internet resources for AAC.

Resource	Description	Link
AAC Kids	The website provides step by step guidelines for early intervention specifically designed for children with complex communication needs.	aackids.psu.edu
PrAActical AAC	Top blog in AAC provides practical resources for intervention.	praacticalaac.org

Resource	Description	Link
Teaching Learners with Multiple Special Needs	Resources and ideas for teachers of learners with severe, profound, intensive, significant, complex or multiple special needs.	teachinglearnerswithmultipleneeds.blogspot.com

Table 1. AAC intervention web resources

Communication Practices from the Autism Internet Modules

The Autism Internet Modules have some terrific overviews of popular approaches to communication intervention for individuals with complex communication needs.

1. Picture Exchange Communication System (PECS)
2. Pivotal Response Training
3. Naturalistic Intervention
4. Functional Communication Training
5. Speech Generating Devices

These concise modules overview the essentials of a practice or concept along with reviewing key research findings and provide checklists for implementation.

The National Joint Committee, A Communication Bill of Rights (NJC, 1992) is an important document outlining the human and civil rights of people with complex communication needs. This document draws connections to the concepts of inclusion, self-determination, universal design for learning, the least dangerous assumption, and valuing the human dignity of all people. Some of these rights are more straightforward, such as “8. The right to have access at all times to any

needed augmentative and alternative communication devices and other assistive devices, and to have those devices in good working order." Yet others are much more nuanced, "7. The right to have communication acts acknowledged and responded to, even when the intent of these acts cannot be fulfilled by the responder." Taken together, they serve as an important message for pre-service teachers.

National Joint Committee, A Communication Bill of Rights (NJC, 1992)

All persons, regardless of the extent or severity of their disabilities, have a basic right to affect, through communication, the conditions of their own existence. Beyond this general right, a number of specific communication rights should be ensured in all daily interactions and interventions involving persons who have severe disabilities. These basic communication rights are as follows:

1. The right to request desired objects, actions, events, and persons, and to express personal preferences, or feelings.
2. The right to be offered choices end alternatives.
3. The right to reject or refuse undesired objects, events, or actions, including the right to decline or reject all proffered choices.
4. The right to request, and be given, attention from and interaction with another person.
5. The right to request feedback or information about state, an object, a person, or an event of interest.
6. The right to active treatment and intervention efforts to enable people with severe disabilities to communicate messages in whatever modes and as effectively and efficiently as their specific abilities will allow.
7. The right to have communication acts acknowledged and responded to, even when the intent of these acts cannot be fulfilled by the responder.
8. The right to have access at all times to any needed augmentative and alternative communication devices and other assistive devices, and to have those devices in good working order.
9. The right to environmental contexts, interactions, and opportunities that expect and encourage persons with disabilities to participate as full communication partners with other people, including peers.
10. The right to be informed about the people, things, and events in one's immediate environment.
11. The right to be communicated with in a manner that recognizes and acknowledges the inherent dignity of the person being addressed, including the right to be part of communication exchanges about individuals that are conducted in his or her presence.
12. The right to be communicated with in ways that are meaningful, understandable, and culturally and linguistically appropriate.

Table 2. National Joint Committee, A Communication Bill of Rights

AAC modeling Rationale

Language input is an important factor in child language acquisition (Gallway & Richards, 1994; Snow & Ferguson, 1978; Tomasello, 2003). During early childhood, children using speech are exposed to large levels of language input and interaction (Hart & Risley, 1995; Tomasello, 2003). The amount of words speaking children typically hear in their first four years ranges from approximately eight to 50 million words (Hart & Risley, 1995). Similarly to children who learn to communicate using speech, language input is important to children who use other expressive communication modalities as well, such as individuals with complex communication needs (CCN) who require augmentative and alternative communication (AAC). These individuals may communicate expressively using various modalities such as *unaided* AAC modalities such as sign languages, gestures, vocalizations, and speech, or *aided* AAC modalities such as with paper and computer based communication displays (e.g., iPad). The overall AAC language acquisition literature emphasizes the role of language input for individuals with CCN who require AAC (Beukelman & Mirenda, 2013). For example, research in sign language acquisition stresses the importance of language input, demonstrating that given appropriate sign language input, children can develop complex language abilities using sign language (Bavelier, Newport, & Supalla, 2003; Newport & Supalla, 2000).

Individuals with CCN who use aided AAC systems, such as those with picture or word systems that may be paper or computer based, also require

appropriate language input (Beukelman & Mirenda, 2013; Romski & Sevcik, 1996). However, these individuals rarely observe models of AAC use, creating what Smith & Grove (2003) called an asynchrony of language input to output. That is, these individuals experience spoken language as input, but are expected to communicate expressively using AAC. Consequently, a number of AAC interventions have been developed in an attempt to provide this missing language input to individuals with CCN as a way to stimulate language gains (see single-subject meta-analysis; Sennott, Light, & McNaughton, 2014). For clarity and conciseness, Sennott et al. (2014) used the term *AAC modeling* to consolidate and describe the various types of language input provided through AAC modalities. Various AAC modeling intervention packages have positively impacted four different language areas: (a) pragmatics in the form of turn taking (e.g. Kent-Walsh, Binger, & Hasham, 2010); (b) semantics in the form of receptive and expressive vocabulary (e.g. Drager et al., 2006); (c) syntax in the form of increasing multi-symbol utterances (e.g. Binger, Kent-Walsh, Berens, Del Campo, & Rivera, 2008); and (d) morphology in the form of increased use of target structures (Binger, Maguire-Marshall, & Kent-Walsh, 2011). analysis results also indicated that because of the packaged nature of the interventions, parsing out modeling as the sole independent variable impacting student performance was difficult. In addition to the AAC modeling variable, time delay, and responding or recasting, were included in the majority of the reviewed packaged interventions. Those three intervention variables have been included in a

newly designed intervention package called ModelER (Model, Encourage, Respond) for Read and Talk.

MODELER Strategy

The ModelER intervention package is built on theory supporting the importance of language input (Gallway & Richards, 1994; Hart & Risley, 1995, Tomasello, 2003) and effective instructional components as highlighted in AAC modeling research (Sennott et al., 2014).

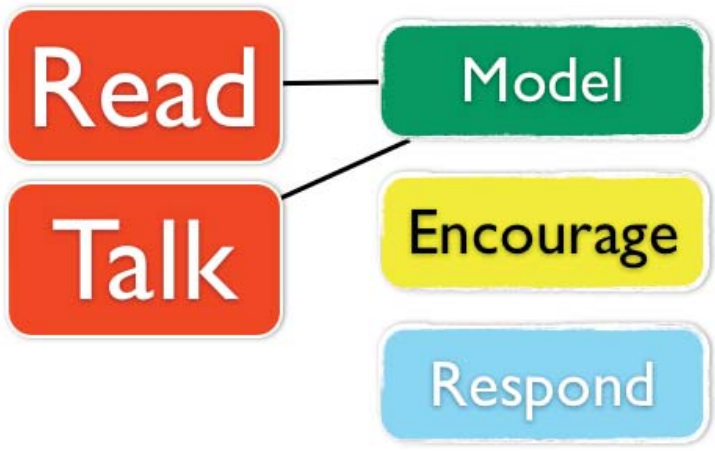

Figure 1. MODELER for Read and Talk

ModelER. The Improving Partner AAC Training (ImpAACt) series of studies (e.g. Binger et al., 2008) effectively used variants of a specific strategy instructional package (Read, Ask, and Answer [RAA] and related variants) to teach partners to better engage in shared storybook reading with beginning communicators who use AAC. These studies demonstrated positive results in the form of increased communication turns (Kent-Walsh et al, 2010; Rosa-Lugo & Kent-Walsh, 2008), increased multi-symbol communication turns (Binger et al., 2008, Binger, Kent-Walsh, Ewing, & Taylor, 2010), and increased use of morphological forms (Binger,

Maguire-Marshall, & Kent-Walsh, 2011). ModelER has been designed to build on the findings of the ImpAACt research, but to optimize for generalization beyond the context of shared storybook reading, because of the importance of promoting interventions that can be used across multiple contexts (e.g. play, academics, snack/ meal times) for children learning to use AAC.

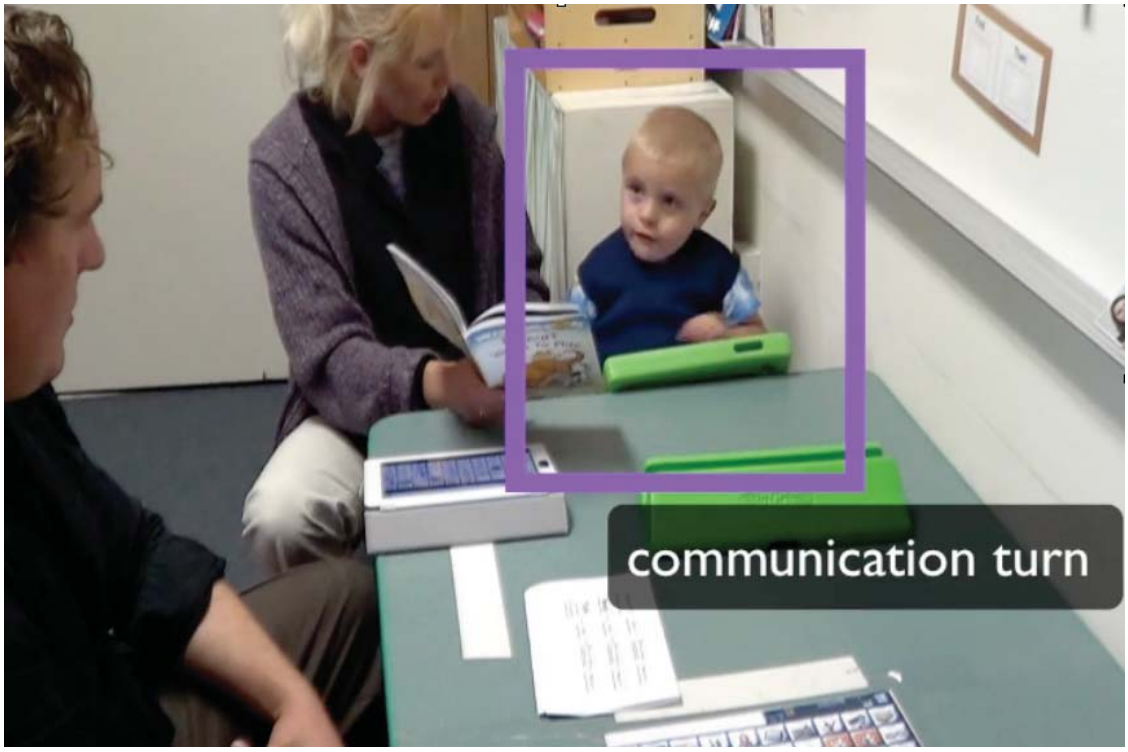

Figure 2. Video example of MODELER found at http://youtu.be/d4tI-xqVoDE

The major components of ModelER are (a) model - modeling AAC use (Sennott et al., 2014); (b) encourage - encouraging communication through time delay/ expectant delay (e.g. Halle, Baer, & Spradlin, 1981); and (c) respond - responding to child communication attempts through AAC recasting (Camarata & Nelson, 2006; Nelson et al., 1996; Harwood, Warren, & Yoder, 2003). AAC modeling is the foundation of the intervention and is designed to provide a model of language

use (pragmatics), content (semantics), and form (syntax and morphology) for the individual with CCN learning to use AAC. Encouragement to communicate, in the form of a time delay, is designed to provide opportunities for the child to initiate a communication turn, showing them that the adult communication partner is waiting and interested. As a support to the child's communication attempts, the respond component focuses on recasting the child's utterance by repeating their utterance, and expanding it in a meaningful way. The respond component is designed as an adaptation of the recasting intervention described in Nelson et al. (1996), which described that the recast maintains the basic meaning of what they child says, focuses on expanding the length of utterance, and keeps the conversation turns flowing. The hope is that the child can better attend to the more advanced structures being modeled because the utterance is based on what they just previously communicated. Put together, the sequence of modeling, encouraging by waiting for the child to take a turn, and then responding through AAC recasting is designed to create individualized, language-rich multi-turn communication sequences.

Figure 3. Video example 2 of MODELER found at

http://youtu.be/htsAWLYfBXQ

Read and Talk. The Read and Talk component of the package refers to reading a book and talking about it through making comments or asking questions. The Read and Talk components create a learning environment that would be typical of an early childhood shared reading context. Variants of shared storybook reading, such as dialogic reading, that includes engaging in conversation with the child, has extensive empirical support in general education (Dale et al., 1996; Whitehurst et al., 1988), special education (Ezell & Justice, 2005), and AAC specific literatures (Bedroisian, 1999; Sennott et al., 2014; Stephenson, 2009).

Dialogic reading interventions (e.g. Dale et al., 1996) are comprised of reading with children and asking targeted questions, which matches the approach the RAA strategy ImpAACt studies took (e.g. Kent-Walsh et al., 2010), which primarily focused on reading and question asking. By including commenting in addition to question asking, the approach taken in the Read and Talk components of the intervention expands on the scope of adapting dialogic reading for children using AAC. The decision to include both commenting and question asking was made because question asking has the potential to place the child into a passive or question prompt–dependent role, which could be detrimental to individuals who require AAC (Light & Kelford Smith, 1993). Instead, this approach is designed to teach the communication partners to model multiple pragmatic functions, comments, and questions, with the objective of promoting the children taking increasingly independent turns such as making comments or asking questions themselves.

Strategy Step	Description
Model	EA models one or more AAC symbols during a communication turn using the iPad based AAC system.
Encourage	EA provides a time delay, or wait time, until child takes a communication turn or five seconds.
Respond	EA responds to a child communication turn with an AAC recast by repeating some portion of the child's utterance and attempts to expand the utterance and models one or more AAC symbols during a communication turn using the iPad-based AAC system
Read	EA reads a page or page spread in the book and uses ModelER
Talk	EA makes a comment or asks a question using ModelER

Table 3. MODELER Implementation checklist

Conclusion

For children who are minimally verbal and use AAC it is important to develop an expressive language system and to have an appropriate language learning environment. The iPad combined with a communication app has become a very popular AAC system, creating more opportunities for these children to have access to expressive language. A number of useful resources have been introduced in this chapter from various web sources. Specifically, the naturalistic communication intervention MODELER has been introduced.

In considering the language learning environment of children, we know about the importance of language input described across general language acquisition (Gallway & Richards, 1994; Gerken, 2008; Hart & Risley, 1995, Tomasello, 2003), sign language (Bavelier et al., 2003; Newport & Supalla, 2000), and AAC (Goosens,

Crain, & Elder, 1992; Romski & Sevcik, 1996; Sennott et al., 2013; Smith & Grove, 2003). AAC researchers have developed interventions that target providing models of AAC use. Sennott and colleagues have developed a package intervention called MODELER (Model, Encourage, Respond) that is designed to help the child's communication partners provide AAC models in an easy, interactive format throughout the day.

References

Bavelier, D., Newport, E. L., & Supalla, T. (2003). Children need natural languages, signed or spoken. *Cerebrum, 6(4),* 19–32.

Beukelman, D., & Mirenda, P. (2013). *Augmentative and alternative communication: Supporting children and adults with complex communication needs* (4th ed.). Baltimore, MD: Brookes Publishing.

Binger, C., Kent-Walsh, J., Berens, J., Del Campo, S., & Rivera, D. (2008). Teaching Latino parents to support the multi-symbol message productions of their children who require AAC. *Augmentative and Alternative Communication. 24(*4), 323–338.

Binger, C., Kent-Walsh, J., Ewing, C., & Taylor, S. (2010). Teaching educational assistants to facilitate the multi-symbol message productions of young students who require augmentative and alternative communication. *American Journal of Speech Language Pathology*, *19*(2), 108–120.

Binger, C., Maguire-Marshall, M., & Kent-Walsh, J. (2011). Using aided AAC models, recasts, and contrastive targets to teach grammatical morphemes to children who use AAC. *Journal of Speech Language Hearing Research*, *54*(1), 160-176.

Brown, C. (1954). *My left foot.* London: Secker & Warburg.

Camarata, S. M., & Nelson, K. E. (2006). Conversational recast intervention with preschool and older children. In R. J. McCauley & M. E. Fey (Eds.), *Treatment of language disorders in children* (pp. 237–264). Baltimore, MD: Brookes.

Creech, R. (1992). *Reflections from a Unicorn*. Greenville, NC: RC Publishing Co.

Dale, P. S., Crain-Thoreson, C., Notari-Syverson, A., & Cole, K. (1996). Parent-child book reading as an intervention technique for young children with language delays. *Topics in Early Childhood Special Education*, *16(*2), 213–235.

Drager, K. D. R., Postal, V. J., Carrolus, L., Castellano, M., Gagliano, C., & Glynn, J. (2006). The effect of aided language modeling on symbol comprehension and production in 2 preschoolers with autism. *American Journal of Speech-Language Pathology, 5*(2), 112–125.

Ezell, H. K. & Justice, L. M. (2005). *Shared storybook reading: Building young children's language and emergent literacy skills*. Baltimore, MD: Brookes Publishing.

Gallway, C., & Richards, B. J. (1994). *Input and interaction in language acquisition*. Cambridge, UK: Cambridge University Press.

Gerken, L. A. (2008). *Language development*. San Diego, CA: Plural Publishing.

Goossens', C., Crain, S., & Elder, P. (1992). *Engineering the classroom environment for interactive symbolic communication: An emphasis on the developmental period 18 months to five years.* Birmingham, AL: Southeast Augmentative Communication Conference Publications.

Halle, J. W., Baer, D. M., & Spradlin, J. E. (1981). Teachers' generalized use of delay as a stimulus control procedure to increase language use in handicapped children. *Journal of Applied Behavior Analysis*, *14*(4), 389–409.

Harris, K. R., Graham, S., & Mason, L. H. (2003). Self-regulated strategy development in the classroom: Part of a balanced approach to writing instruction for students with disabilities. *Focus on Exceptional Children, 35*(7)*,* 1–16.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes Publishing.

Harwood, K., Warren, S., & Yoder, P. (2002). The importance of responsivity in developing contingent exchanges with beginning communicators. In J. Reichle, D. Beukelman & J. Light (Eds.), *Exemplary practices for beginning communicators* (pp. 59-95). Baltimore: Brookes Publishing.

Kent-Walsh, J., & Mcnaughton, D. (2005). Communication partner instruction in AAC: Present practices and future directions. *Augmentative and Alternative Communication*, *21*(3), 195–204.

Kent-Walsh, J., Binger, C., & Hasham, Z. (2010). Effects of parent instruction on the symbolic communication of children using augmentative and alternative communication during storybook reading. *American Journal of Speech Language Pathology*, *19*(2), 97–107.

Koppenhaver, D., Yoder, D. E., Erickson, K. A., (2002) *Waves of words*. ISAAC Press.

Light, J. (1988). Interaction involving individuals using augmentative and alternative communication systems: State of the art and future directions. *Augmentative and Alternative Communication*, *4*(2), 66-82.

Light, J. (1989). Toward a definition of communicative competence for individuals using augmentative and alternative communication systems. *Augmentative and Alternative Communication, 5*(2)*,* 137-144.

Light, J., Binger, C., & Smith, A. K. (1994). Story reading interactions between preschoolers who use AAC and their mothers. *Augmentative and Alternative Communication*, *10*(4), 255–268.

Light, J., & Kelford Smith, A. (1993). Home Literacy Experiences of Preschoolers Who Use AAC Systems and of Their Nondisabled Peers. *Augmentative and Alternative Communication*, *9*(1), 10–25.

Millar, D. C., Light, J. C., & Schlosser, R. W. (2006). The impact of augmentative and alternative communication intervention on the speech production of individuals with developmental disabilities: A research review. *Journal of Speech Language Hearing Research*, *49*(2), 248-264.

Newport, E. L., & Supalla, T. (2000). Sign language research at the millennium. In K. Emmorey and H. Lane (Eds.), *The Signs of Language Revisited: An Anthology in Honor of Ursula Bellugi and Edward Klima.* Mahwah, NJ: Lawrence Erlbaum Associates.

Nelson, K. E., Camarata, S. M., Welsh, J., Butkovsky, L., & Camarata, M. (1996). Effects of imitative and conversational recasting treatment on the acquisition of grammar in children with specific language impairment and younger

language-normal children. *Journal of Speech Hearing Research*, *39*(4), 850-859.

Porter, G. (2007). Pragmatic Organization Dynamic Display (PODD) communication books: Direct access templates (US letter paper version). Melbourne: Cerebral Palsy Education Centre.

Romski, M. A., & Sevcik, R. A. (1996). *Breaking the speech barrier: Language development through augmented means*. Baltimore, MD: Brookes Publishing.

Rosa-Lugo, L. I., & Kent-Walsh, J. (2008). Effects of parent instruction on communicative turns of Latino children using augmentative and alternative communication during storybook reading. *Communication Disorders Quarterly*, *30*(1), 49–61.

Scheeler, M. C., McAfee, J. K., Ruhl, K. L. & Lee, D. L. (2006). Effects of corrective feedback delivered via wireless technology on preservice teacher performance and student behavior. *Teacher Education and Special Education, 29*(1), *12–25.*

Sennott, S., & Niemeijer, D. (2008). Proloquo2Go (computer software). Amsterdam, NL: Assistiveware.

Sennott, S., Light, J., & McNaughton, D. (2014). *A meta-analysis of the effect of aided AAC modeling on the communication and language development of individuals with complex communication needs.* Manuscript in preparation*.*

Siegel, E., & Cress, C. (2002). Overview of the emergence of early AAC behaviors: Progression from communicative to symbolic skills. In J. Reichle, D. Beukelman, & J. Light (Eds.), *Exemplary practices for beginning communicators: Implications for AAC* (pp. 25-57). Baltimore: Brookes Publishing.

Smith, M., & Grove, N. (2003). Asymmetry in input and output for individuals who use augmentative and alternative communication. In J. Light, D. Beukelman, & J. Reichle (Eds.), *Communicative competence of individuals who use augmentative and alternative communication.* Baltimore, MD: Brookes Publishing.

Snow, C. E., & Ferguson, C. A. (1978). *Talking to children: Language input and acquisition*. Cambridge, UK: Cambridge University Press.

Stephenson, J. (2010). Book reading as an intervention context for children beginning to use graphic symbols for communication. *Journal of Developmental and Physical Disabilities, 22*(3) 257–271.

Tomasello, M. (2003). *Constructing a language*. Cambridge, MA: Harvard University Press.

Whitehurst, G. J., Falco, F. L., Lonigan, C. J., Fischel, J. E., DeBaryshe, B. D., Valdez-Menchaca, M. C., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology*, *24*(4), 552–59.

Chapter 3
Principles of Applied Behavior Analysis to Teach

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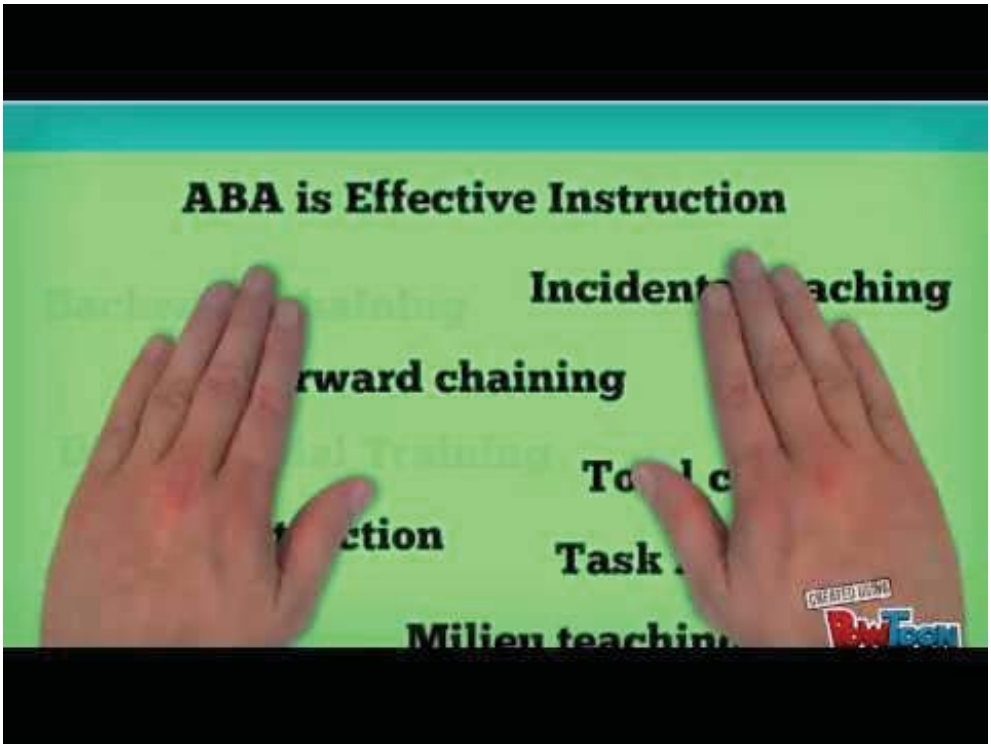
The current chapter will present an overview of Applied Behavior Analysis (ABA) as an effective teaching method. ABA is an approach that, when used properly, can work to teach a wide range of behaviors to a wide range of participants. ABA is a research-based science, derived from the experimental analysis of behavior and the application of those procedures. Multiple studies demonstrate that people's lives can be improved by learning academic skills (Gardner, Heward, & Grossi, 1994), social skills (Garcia-Albea, Reeve, Brothers, & Reeve, 2014) and communication (Luczynski & Hanley, 2013) and by the reduction of problematic behaviors (Roantree & Kennedy, 2012). The foundation of ABA rests on the analysis of environmental influences, such as what happens before and after a problematic behavior (antecedents and consequences) to predict when behaviors will increase, decrease, or remain the same. These principles of reinforcement and punishment will be summarized to highlight the main procedures that teachers may find effective in the classroom. Finally, this chapter will end with a case example that will walk through how a teacher applies the principles and procedures highlighted in this chapter.

Chapter objectives

1. Define Applied Behavior Analysis and explain the characteristics within a 5-step model
2. Describe the principles and procedures that increase or decrease behaviors
3. Provide an example of the application of ABA in the classroom

Defining Characteristics of Applied Behavior Analysis



Principles of ABA for Teachers Video,

https://www.youtube.com/edit?o=U&video_id=UuvQpat4CAk

Based on the principles of learning theory, Applied Behavior Analysis (ABA) is an applied science, meaning that practitioners use systematic procedures to teach, resulting in improvements in areas like self-care, communication, academics, behavior reductions, behavior, and/or recreation and leisure (Allen & Wallace, 2013; Van Camp &

Hayes, 2012; Wolf, 1978). Behavior analysts approach problems of social significance from a scientific perspective. It is not a matter of nature versus nurture but a matter of nature and nurture working together to produce observable changes in behavior (Skinner, 1974). This focus on social relevance, or social validity, to the individual marks a division in the field of behaviorism from a strictly experimental or basic research to an applied research. Baer, Wolfe, and Risley (1968) clarified this distinction in the seminal article "Some Current Dimensions of Applied Behavior Analysis," published in the first issue of the *Journal of Applied Behavior Analysis*, which describes ABA and outlines the future applications of its characteristics. These seven characteristics include: applied, behavioral, analytic, conceptual, technological, effective, and generalizable. When using ABA, one incorporates these components within a process to teach and evaluate effects of the approach. For example, one starts with 1) choosing a socially relevant behavior, 2) measuring the behavior, 3) using data to determine which treatment to use, 4) using data to implement procedures, and 5) using data to evaluate effects of the treatment (Cooper, Heron, & Heward, 2007). The characteristics of ABA will be described within this 5-step model to show how the fundamental characteristics are interwoven with data to make a good ABA program.

Select a Socially Relevant Behavior

ABA is *applied*, meaning that the targeted behavior is of social importance to the individual, rather than its importance to theory (Baer et al., 1968). The proposed behavior change is meaningful to the client and all those who may be affected by the intervention (i.e., parents, siblings, staff). For each targeted problematic behavior, a desired behavior is also identified, optimally a behavior that is incompatible with the

problematic behavior. A common problem is that teachers have too many behaviors identified for change. Cooper et al. (2007) provide guidance on the selection process through guiding questions that help teachers set priorities or criteria for choosing one behavior over another. These include:

1. Does the behavior pose a danger to the student or others?
2. Does changing the behavior improve the person's life and is this behavior change age-appropriate?
3. What is the likelihood of success to change this behavior? For example, are there sufficient opportunities to show the behavior in the natural environment (i.e., classroom) and will teachers and staff reinforce this behavior when demonstrated?
4. Will changing the behavior have long-standing effects or lead to further skill development?
5. Do the benefits of teaching this behavior outweigh the costs (i.e., time, resources) needed?

These guiding questions assess the behavior of interest based on safety concerns, probability of intervention fidelity by the staff who may be involved, and risk-benefit analysis of the proposed behavior. Social relevance or applicability is therefore worked into proposed short- and long-term goals, teaching procedures, and potential results to increase maintenance and generalization of the skill use (Wolf, 1978). Examples can include social skills to increase peer interactions, fluency of academic skills, decrease of maladaptive behaviors that interfere with successful interactions with peers and

staff, self-help skills to build independence, or leisure and recreational skills to improve quality of life.

Measure the Behavior with a Reliable Data Collection System

Behavioral means that the behavior itself is the subject matter, so the dependent variable must be operationalized in observable and measurable terms with the goal of having inter-observer reliability, or a high percentage of agreement between multiple observers that the same behavior occurred or did not occur during observations. In order for direct observations to occur, there must be a precise definition of the behavior and a measurement system to record the behavior. Choosing a measurement system depends on how the behavior is exhibited (Alberto & Troutman, 2003). For example, the behavior may be problematic because of how often it occurs (i.e, too many times or not enough times) or the length of the response (i.e, too short or too long). When the number of occurrences of the behavior is the problem, one would choose an event-recording system if the behavior has a specific start and end in order to teach occurrence, like the number of times a student talks out of turn during instruction time. If the response does not have a distinct beginning and end, use an interval recording system. When the length of time the behavior occurs is the problem, choose duration recording to measure the span of each occurrence. Like duration, latency measures time; however in this measurement, one measures the elapsed time after a signal and the onset of the behavior. For example, one could measure the amount of elapsed time between when the teacher gives the direction and when the student starts the first problem.

The context in which the behavior is exhibited provides a picture of when the behavior occurs or does not occur in relation to other events (Johnston & Pennypacker, 1993). Observing the changes of behavior requires knowledge of an *analytic* approach. To be analytic requires a believable demonstration of the events that caused the change in behavior. These changes of behavior are empirical demonstrations of functional relations between antecedent events, behavior, and consequence events. There are different degrees to this level of analytic behavior change. At the highest level, research methodology using single-subject research designs (i.e., reversal, multiple-baseline line) is used to determine if functional control is established, verified, and replicated (Kennedy, 2005). A less-rigorous level still includes demonstrations of prediction and control (i.e., baseline or phase with no intervention, intervention phase, intervention removal, and reintroduction of the intervention) but may have lower levels of inter-observer reliability of data-collection procedures. The value of the data depends on the accuracy and reliability of the data to make decision about which intervention to choose, continuation of the procedures, or when to stop the intervention.

Select Evidence-Based Treatment Procedures Based on Behavior Contingencies

Conceptually systematic highlights ABA's reference to the principles and basic concepts of behavioral development (Baer et al., 1968). Predicting why the behavior change occurred relies on the established principles in behavior analysis and the past repertoires of the individual.

One observes the patterns or relationships (i.e., contingency) between stimuli before and after behavioral responses. An example of the contingency between the

antecedent and behavior is provided in the following if-then contingency statements: The behavior happens only when the antecedent has happened first, and if the antecedent doesn't happen, the behavior doesn't happen. If the antecedent happens, the behavior happens as well. The behavior doesn't happen unless and until the antecedent has happened first. The repeated and predictable patterns between the antecedent and/or consequent stimuli and the behavior are described as functional relations. The function of behavior refers to the effect the behavior produces on the environment and behavior serves two major functions: to obtain desired events (i.e., objects, attention) or to avoid/escape events (i.e., work, interaction with others). For example, a student may cry as a function to get the desired object but the same behavior for another student may use crying to escape work demands. This is why ABA focuses on the context and contingencies for each student rather than a topography-based intervention, in which all students who engage in the same behavior get the same type of intervention. Interventions focus directly on environmental events that generate and maintain behavior. It's the antecedents that get the behavior moving but the consequences that keep the behavior going (Daniels, 2000); therefore, ABA interventions arrange contingencies of reinforcement to alter the problematic behavior to make the alternate behavior more effective, efficient, and relevant for the student (Sugai & Horner, 2006).

ABA makes interventions specific to the individual, based on the function the behavior may serve for the person. These can be broadly categorized as function-based (negative or positive reinforcement) and include antecedent-based (i.e., prompts, choice, environmental arrangements) and consequence-based procedures

(i.e., positive punishment, token economy, response-cost, differential reinforcement procedures). Antecedent technologies such as modeling, prompting, and prompt-fading are often used to teach new behaviors, or shape new behaviors by reinforcing successive approximations (Alberto & Troutman, 2003). Importantly, larger or more complex skills are broken into component skills (i.e., task analysis) and skills are taught in a specific teaching sequence (i.e., forward chaining, backward, total-task). Instructional procedures like discrete trial training (DTT) or errorless learning have also broken skills into teachable steps then presented in trials, or multiple opportunities, until performance meets a criterion level.

Implement Procedures with Fidelity

Effectiveness is the degree of learning, or the amount of change in student performance, in other words, the change of behavior (either increase or decrease) from baseline to after the intervention is implemented. Effectiveness looks at student performance data to modify what is taught (i.e., programs or curricula) as well as how it is taught. Data, especially data graphed visually, help teachers make decisions to keep going, revise, or stop an intervention. When student performance is not being made, contingencies surrounding the learning environment are examined and these include monitoring and modifying staff behavior.

Reliability measures and inter-observer agreement data collection provides an objective look at the consistency of how staff are recording behavior and also how staff are implementing the programs. A major component of staff performance is *technological*, a term that describes the clarity and precision of written procedures so that others can replicate the teaching. The success of interventions is largely

dependent on the extent to which they are implemented as designed with accuracy and consistency (i.e., treatment integrity; Gresham, 1989). To help with consistency, procedures are operationalized into step-by-step actions with visual prompts that prompt accurate staff behaviors (Noell et al., 2002). Performance feedback is another valuable tool for helping staff improve performance in the implementation of intervention plans (Codding, Livanis, Pace, & Vaca, 2008). In fact, research shows that when staff implement procedures with high fidelity, rates of problematic behavior are low, and the inverse is also shown—when there is low treatment fidelity, there is an increase in problematic behavior (Fryling, Wallace, & Yassine, 2012; St. Peter Pipkin, Vollmer, & Sloman, 2010).

Evaluate Long-term Effects of Treatment

ABA is committed to teaching skills that are practical, relevant, and functional for the student. The last ABA characteristic is *generality*, which describes whether interventions produce lasting change in behavior that occurs in all relevant settings. A student has truly learned the skill when the behavior is shown after a period of time (e.g., 6 months), untaught scenarios, and novel responses to similar antecedents (Baer, 1982). This happens when practitioners incorporate generalization strategies into teaching procedures through multiple teaching examples, practice opportunities outside of the teaching setting, and, importantly, teach the students how to recruit reinforcement (i.e., teacher attention) through socially acceptable behaviors (Reeve, Reeve, Townsend, & Poulson, 2007). Incidental teaching has been used to promote generalization of language skills (Hart & Risley, 1968), social interactions (Strain, 1983), and reciprocal interactions with peer models (McGee, Almeida, & Sulzer-Azaroff, 1992).

This teaching procedure occurs in the naturalistic context and consists of a prescribed chain of student-teacher (or peer-sibling) interactions in which the student initiates a request (e.g., reaching, pointing, vocalizing) and the item requested is given contingent upon appropriate asking in the targeted mode.

In this section, the characteristics of applied behavior analysis were described within a model that all ABA-based approaches have in common which are: 1) select a socially relevant behavior, 2) measure the behavior with a reliable data collection system, 3) select an evidence-based treatment procedure, 4) implement the procedures with fidelity, and 5) evaluate the long-term effects of the treatment.

Procedures

This chapter has discussed how student behavior is regulated by consequences, which are the events that occur after the behavior. The description and analysis of these contingencies surrounding a behavior is operant conditioning, which describes the probability of certain behaviors based on the history of consequences (Skinner, 1974). Reinforcement and punishment are the core tools of operant conditioning, and both affect the desired behavior: reinforcement increases and punishment decreases the probability of the desired behavior. Events can be added in (positive) or removed (negative) from reinforcement and punishment procedures. For example, positive reinforcement is the addition of a stimulus (i.e. praise, token), whereas negative reinforcement is the removal of a stimulus (i.e., loud noise, work demand), and both maintain or increase the frequency of the behavior.

Procedures to Increase Behaviors

In negative reinforcement, a stimulus is present, and the occurrence of the targeted behavior removes the stimulus (Cooper et al., 2007). For example, a difficult task is presented, the student asks the teacher for help, the difficult task is removed, and over time the frequency of the student asking the teacher for help increases. With positive reinforcement, when the targeted behavior occurs, something is added to the environment, and that behavior is more likely to occur in the future. What often gets added is called reinforcers and the types of reinforcers include unconditioned reinforcers (i.e., food, drink) and conditioned reinforcers (i.e., edible, sensory, tangible, activity, social; Cooper et al., 2007). Reinforcers have different values for different individuals; therefore, reinforcer assessments are conducted to identify potential reinforcers. This is done by asking the student, asking others who know the student well, observing the student, or using trial-based methods (i.e., single, paired, multiple; Carr, Nicolson, & Higbee, 2000).

Along with the potential value of reinforcers to the student, other factors related to effectiveness include when it is provided (i.e., immediacy), the level of effort required to perform the behavior and the likelihood of the delivery of the reinforcer (i.e., response effort), availability of the reinforcer elsewhere, and motivational effect (i.e., how much does the student want it based on the state of deprivation or satiation; Michael, 2000). Reinforcers can be provided on a continuous or an intermittent schedule, immediately after the behavior or after a delay, and the decision to use one schedule of reinforcement or another can have predictable effects on the consistency of performance and rate of response. This determines when the reinforcer is

provided—immediately or after a delay (i.e., interval schedule) or after a specific number of responses (i.e., ratio schedule). For example, when a student is learning addition facts, the teacher may provide continuous reinforcement (after every response) to get the quickest learning rate, then fade the schedule to reinforcement after every third response (fixed ratio 3) based on student response.

Decreasing Unwanted Behavior

Like reinforcement, punishment is defined by its effect, by adding (i.e., positive) or removing (i.e., negative) something in the environment, to decrease the future probability of the behavior. The problem with punishment procedures in itself is that they don't teach what to do instead of the punished behavior, but only provide temporary decrease with unintended potential side effects (Rolider, A., Cummings, A., & Van Houten, R. 1991). Extinction decreases behavior by discontinuing the reinforcement after a behavior and is used in conjunction with reinforcement such as differential reinforcement procedures (i.e., alternative, incompatible, other).

Example from the Classroom

In the kindergarten classroom during center time, Ms. Kang ran over to the train set to stop Alex from bothering a classmate again. After being put in time out, Alex returned to the train center and initiated play by shoving a train track into the classmate's hand. Then he grabbed a train from another peer. Alex was a bright student, verbal and compliant to teacher requests; however, his behaviors during peer play restricted interactions. Ms. Kang and Alex's mother agreed that teaching Alex to play would help reduce aggressive behaviors and facilitate social interactions with others. For step 1, select a socially relevant behavior, aggression was operationalized

as unsolicited physical contact with peers (i.e., pushing, pulling, and/or forceful grabbing, excluding tripping or falling onto peers). The long-term desired behavior was to ask, wait, and accept the answer "no"; however, the short-term behavior included appropriate peer social interactions using skills such as getting a peer's attention, asking peers to play, and sharing objects for one minute.

For step 2, measure the behavior, an event-recording data sheet was used during the most problematic routine, center time. Appropriate peer interactions were task analyzed into teachable steps and measured as the number of correct steps completed (see Appendix). Ms. Kang and the instructional assistant, Ms. Sanchez, used the operational definition and data-collection sheet to observe so that they both agreed that the behavior was measured accurately. Next, both observed the social interactions of four boys during the train center time using an antecedent-behavior-consequence data sheet to identify predictable hypotheses such as, when the train track is started by others, Alex will engage in aggression to obtain items (i.e., remove the tracks), to start another track he designed. A reinforcer assessment indicated trains as the highest reinforcer and the absence of a train track at home strengthened the value of this reinforcer.

The next step was to select an evidence-based treatment. A differential reinforcement of alternative (DRA) procedure was used to decrease aggressive behaviors through extinction (i.e., aggressive behavior no longer resulted in access to item) and appropriate social interactions was reinforced with access to trains. The task analysis of peer play with trains was directly taught. The ten steps were printed and cut out so that Alex could sequence the steps. He then watched a teacher and then

peer model each step. A backward chaining instructional model was used so that the teacher prompted the first nine steps and Alex completed the last step independently. This continued until he mastered all ten steps.

In addition, the entire class was taught what respecting property and others looked like during center time and the rules were reviewed before center times. To neutralize the antecedent, each center activity was postponed until all peers were in the group. The absence of aggressive behaviors (i.e., one-minute intervals) resulted in a train sticker and the accumulation of train stickers allowed additional time in the train centers.

To measure implementation with fidelity, Ms. Kang and Ms. Sanchez agreed to both take data for one session during five sessions available using the data sheets located in the same secured location. The staff teaching steps were laminated and both teachers reviewed the steps and the data during Thursday morning planning times. Prior to baseline, the average number of aggressive occurrences was seven, and afterward, when peer skills were directly taught through a DRA procedure, the number of aggressive occurrences was zero. During baseline, the correct number of steps completed was 10%, and after instruction, Alex maintained 80% or higher for five consecutive days.

Last, the ABA program was evaluated for effectiveness and generalization. Based on the data, Ms. Kang continued with the DRA intervention and focused on generalization of peer skills to other center areas. A checklist of the peer-interactions task analysis was sent as homework for Alex's mother to work on with Alex and his other peers.

Summary

This chapter focused on applied behavior analysis (ABA), the definition, the characteristics, and the procedures that make this a program that works to teach desired behaviors. Teachers can design and implement an ABA program using a 5-step model to:

1) Select a socially relevant behavior
2) Measure the behavior using reliable data-collection measures
3) Select an evidence-based treatment based on the contingencies of the behavior
4) Implement procedures with fidelity
5) Evaluate long-term effects

References

Alberto, P. A. & Troutman, A. C. (2003). *Applied behavior analysis for teachers* (6th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.

Allen, K.D. & Wallace, D.P. (2013). Effectiveness of using noncontingent escape for general behavior management in a pediatric dental clinic. *Journal of Applied Behavior Analysis, 46(3),* 723–737.

Baer, D. M. (1982). The imposition of structure on behavior and the demolition of behavioral structures. In D. J. Bernstein (Ed.), Response structure and organization. Nebraska Symposium on Motivation. Lincoln, NE: University of Nebraska Press.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1,* 91–97..

Carr, J. E., Nicolson, A. C., & Higbee, T. S. (2000). Evaluation of a brief multiple-stimulus preference assessment in a naturalistic context. *Journal of Applied Behavior Analysis, 33,* 353–357.

Codding, R.S., Feinberg, A.B., Dunn, E.K., & Pace, G.M. (2005). Effects of immediate performance feedback on implementation of behavior support plans. *Journal of Applied Behavior Analysis, 38(2),* 205–215. Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis*, 2nd ed. Upper Saddle River, N.J.: Pearson Prentice Hall.

Daniels, A. C. (2000). *Bringing out the best in people: How to apply the astonishing power of positive reinforcement*. New York: McGraw-Hill.

Fryling, M.J., Wallace, M.D., & Yassine, J.N. (2012). Impact of treatment integrity on intervention effectiveness. *Journal of Applied Behavior Analysis, 45(2),* 449-453.

Garcia-Albea, E., Reeve, S., Brothers, K., & Reeve, K. (2014). Using audio script fading and multiple exemplar training to increase vocal interactions in children with autism*. Journal of Applied Behavior Analysis, 47(2)*, 325-343.

Gardner, R., Heward, W.L., & Grossi, T.A. (1994). Effects of response cards on student participation and academic achievement: a systematic replication with inner-city students during whole-class science instruction. *Journal of Applied Behavior Analysis, 27,* 63-71.

Gresham, F. M. (1989). Assessment of treatment integrity in school consultation and prereferral intervention. *School Psychology Review*, 18, 37–50.

Hart, B., & Risley, T. R. (1968). Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis, 1(2),* 109–120.

Johnston, J. M., & Pennypacker, H. S. (1993). *Readings for strategies and tactics of behavioral research* (2nd ed.). Hillsdale, HF: Erlbaum.

Kennedy, C. H. (2005). *Single-case designs for educational research*. Boston: Allyn & Bacon.

Luczynski, K. & Hanley, G.P. (2013). Prevention of problem behavior by teaching functional communication and self-control skills to preschoolers*. Journal of Applied Behavior Analysis, 46(2)*, 355-368.

McCGee, G. G., Almeida, M. C., Sulzer-Azaroff, B., and Feldman, R. F. (1992). Promoting reciprocal interactions via peer incidental teaching. *Journal of Applied Behavior Analysis, 25* (1), 117–126.

Michael, J. (2000). Implications and refinements of the establishing operation concept. *Journal of Applied Behavior Analysis, 33,* 401–410.

Noell, G. H., Witt, J. C., LaFleur, L. H., Mortenson, B. P., Ranier, D. D., & LeVelle, J. (2000). Increasing intervention implementation in general education following consultation: A comparison of two follow-up strategies. *Journal of Applied Behavior Analysis, 33*, 271–284.

Reeve, S. A., Reeve, K. F., Townsend, D. B., & Poulson, C. L. (2007). Establishing a generalized repertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis*, *40*, 123–136.

Roantree, C.F. & Kennedy, C.H. (2012). Functional analysis of inappropriate social interactions in students with Asperger's syndrome*. Journal of Applied Behavior Analysis, 45(3),* 585-591.

Rolider, A., Cummings, A., & Van Houten, R. (1991). Side effects of therapeutic punishment on academic performance and eye contact. *Journal of Applied Behavior Analysis, 24(4*),763-773.

Skinner, B. F. (1974). *About Behaviorism*. New York: Knopf.

St. Peter Pipkin, C., Vollmer, T.R., & Sloman, K.N. (2010). Effects of treatment integrity failures during differential reinforcement of alternative behavior: A translational model. *Journal of Applied Behavior Analysis, 43,* 47-70.

Strain, P. S. (1983). Generalization of autistic children's social behavior change: Effects of developmentally integrated and segregated settings. *Analysis and Intervention in Developmental Disabilities*, *3,* 23–34.

Sugai, G., & Horner, R. H. (2006). A promising approach for expanding and sustaining the school-wide positive behavior support. *School Psychology Review*, *35*(2), 245–259.

Sulzer, B., & Mayer, G. R. (1972). *Behavior modification procedures for school personnel*. New York: Holt, Rinehart & Winston-Dryden Press.

Van Camp, C.M. & Hayes, L.B. (2012). Assessing and increasing physical activity. *Journal of Applied Behavior Analysis, 45(4),* 871–875.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis, 11,* 203–214.

Yaw, J. Skinner, C.H., Delisle, J., Skinner, A.L., Maurer, K., Cihak, D., et.al. (2014). Measurement scale influences in the evaluation of sight-word reading interventions. *Journal of Applied Behavior Analysis, 47(2),* 360-379.

Appendix A: Measure Behavior

Event Recording Sheet

Instructions

Tally each occurrence of the behavior. Place completed sheet into the data collection binder in the locked drawer. This data will be graphed on Thursday by Ms. Kang.

Student: _____ Date: _____ Time (Start): _____ Time (End): _____

☐ Baseline ☐ Intervention

Behavior: _____

_____

_____

Context/Activity (e.g. time during the activity, number of students, behaviors of the students)

_____

_____

Tally each occurrence:
Total: Rate: per minute

Student: _____ Target Skill: Play Activity with Trains

Prompt: "Time for trains"

Describe each step, in order, for the behavior. Then, for each date on which the behavior is practiced, record the level of independence for each step of the behavior. Use the following symbols for your records:

I	Independent, Correct	V	Verbally Prompted
M	Modeled, Gesture	P	Physically Prompted

Step	Description of Step	Date:	Date:	Date:	Date:	Date:
1.	Asks peer to play					
2.	Tells peer, "Let's play trains"					
3.	Gives peer at least two tracks					
4.	Tells peer, "Let's make a train"					
5.	Asks peer for train pieces					
6.	Puts train pieces together with peer's pieces					
7.	Asks peer for animals to put on train					
8.	Moves train around track					
9.	Tells peer, "Your turn!"					
10.	Tells peer, "That was fun!"					

Chapter 4
Developing Function-based Interventions

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(based on an article from Loman, Rodriguez, & Borgmeier, 2014)

This chapter presents a practical guide for the use of research-based critical features to design positive behavioral interventions based on the reasons why students engage in problem behaviors (i.e., the function of student behavior). Research-based critical features of function-based supports for school personnel to use data from functional behavioral assessments (FBA) to guide the development of individualized behavior support plans are presented. Two case examples will illustrate the critical features for developing function-based supports.

Function-based supports are individualized interventions developed through the process of conducting an FBA (Carr et al., 2002). The FBA process involves interviews, rating scales, and direct observations conducted by trained school professionals. A mnemonic that has been used to outline the steps in FBA process is DASH (Define, Ask, See, Hypothesize). To start the FBA process, a behavior must be operationally **defined** (it must be observable and measurable). The next step is to **ask** people close to the student and the student (when possible) about what triggers and reinforces the problem behavior. Then, a trained school professional conducts an observation of the student (**See)** in the identified routine. Finally, a summary or **hypothesis** is made regarding variables affecting the student's behavior.

Based on data collected in the FBA, an antecedent-behavior-consequence (A-B-C) sequence is outlined by a summary statement that specifically identifies: (a) when and where problem behavior occurs and the environmental variables that consistently

trigger problem behavior (i.e., context and antecedents); (b) an operational definition of the problem behavior; and (c) the maintaining consequences that follow the problem behavior(s) suggesting why a student engages in the identified problem behavior (i.e., function; for a more comprehensive review of how to conduct FBA see Crone & Horner, 2003; or O'Neill et al., 1997). Function-based supports are designed using the FBA summary statement to guide the development and/or selection of interventions that prevent problem behavior while promoting desired outcomes for students.

Since FBA was mandated in 1997, several books and manuals have been published with the intent to teach function-based interventions (e.g., Chandler & Dahlquist, 2010; Crone & Horner, 2003; O'Neill et al., 1997). Additionally, many states and school districts have developed training models to teach school-based personnel to conduct FBAs (Browning-Wright et al., 2007). These texts often present "critical features" for developing behavioral supports for students with the most significant behavioral concerns. However, this chapter will heed the call from the field to "scale down" (Scott, Alter, & McQuillan, 2010) the focus to the basic features of function-based supports to guide the development of interventions for students with moderate behavioral problems. Therefore, setting events (events occurring outside of the school that may affect student behavior) and corresponding strategies have intentionally been omitted from the critical features presented to emphasize interventions that school staff may implement to immediately improve the environment, curriculum, and instruction affecting student behavior.

Resources for Conducting a Functional Behavioral Assessment (FBA)

A number of resources for conducting interviews and observations are available via the Internet. For example, www.functionbasedthinking.com is a comprehensive website with a training manual, interview and observation tools, and interactive web lessons based on the research-based Basic FBA process (Loman, Strickland-Cohen, & Borgmeier, 2013). At this website, the ***interview tool*** that is taught is the modified Functional Assessment Checklists for Teachers (FACTS; March, Horner, Lewis-Palmer, Brown, Crone, & Todd, 1999) available at: https://sites.google.com/a/pdx.edu/functionbasedthinking/home/fba-bsp-instructions-and-forms. Another useful interview tool for identifying the function of behavior that is available online is the Motivation Assessment Scale (MAS; Durand, 1990: http://www.nsseo.org/wp-content/uploads/MAS.pdf). The ABC Recording Form (Loman, 2009) is taught and used as an observation procedure within the Basic FBA process: https://sites.google.com/a/pdx.edu/functionbasedthinking/home/fba-bsp-instructions-and-forms. Another popular tool is the Scatterplot that helps teachers track student behavior across times and days. This scatterplot tool is available at: http://www.pbisillinois.org/curriculum/Course-Materials/t200fi-individualized-student-support-via-complex-fba-bip-wraparound-for-students-with-tertiary-level-needs/T200fi-ScatterPlot-ILPBIS-9.3.08.doc?attredirects=0. For more information on the FBA process, review the training materials on www.functionbasedthinking.com and http://www.pbisillinois.org/trainings/fba-bip-training-materials. The PBIS Illinois website offers links to past webinars presenting information on conducting an FBA and designing function-based supports.

ABC's of Function-Based Supports

A function-based support plan should include components that (a) address antecedent triggers to prevent problem behavior, (b) teach alternative and desired behaviors, and (c) identify appropriate responses to desired and problem behaviors. Figure 1 illustrates the A-B-C sequence and how function plays a pivotal role in designing prevention strategies, teaching alternative or replacement behaviors, and responding to both desired and problem behaviors. In Figure 1, antecedents are defined as events or stimuli that immediately precede or trigger problem behavior. Behavior is the observable behavior of concern (i.e., problem behavior). Consequence is defined as the consistent response to the problem behavior that reinforces the behavior. This logic is based on applied behavior analytic literature (e.g., Horner, 1994), suggesting function is where problem behavior intersects with the environment to affect learning. Given this logic, an individual exhibiting problem behaviors has learned: "Within a specific situation 'X' (context), when 'A' (antecedent is present) if I do 'B' (problem behavior), then 'C' (the maintaining consequence) is likely to occur." Through experience and repetition, the individual learns that the problem behavior is effective or "functional" for meeting their needs. Therefore, the individual is likely to continue to engage in the problem behavior under similar circumstances. Based on this model, the function of an individual's behavior should guide the selection of each component intervention (prevention, teaching, and consequence strategies) within a positive behavior support plan.

Using Assessment to Guide Function-Based Supports

Function-based supports are developed using a clear, detailed summary statement from the FBA (outlining the antecedents, behaviors, and maintaining consequences within a specific routine/context). This summary statement should be framed within a specific routine or context because similar behaviors often serve different functions for the student in different contexts. For example, a student may predictably hit a peer during round robin reading so he can be sent to the back of the room to avoid reading failure in front of peers, and he may also regularly hit a peer at recess so the peer quits teasing him. Once the team has established a clear understanding of the problem behavior and the environmental features predicting and maintaining problem behavior in a given context, then they can develop function-based interventions.

Above the dotted line in Figure 1, a Competing Behavior Pathway (O'Neill et al., 1997) visually frames the FBA summary statement to guide function-based support planning. The FBA summary statement or hypothesis forms the center of the Competing Behavior Pathway (the antecedent(s), problem behavior(s), and maintaining function of student behavior) for a prioritized routine or context. Within the Competing Behavior Pathway the summary of behavior is used to inform identification of the alternative behavior and desired behavior. Each is defined in Figure 1.

A completed example of the FBA summary statement in Figure 2 should read, "During math (routine/context) when Jackson is asked to work independently on a double-digit multiplication worksheet (antecedent), he fidgets, gets off task, uses foul language, slams his book, and picks on peers (problem behavior), which typically results in the teacher asking Jackson to leave the room and go to the principal's office

(consequence). It is hypothesized that Jackson's behavior is maintained by escaping the independent math worksheet (function; the "why" or "pay-off")."

The completed FBA summary statement for Sophia in Figure 3 should read, "During carpet time (routine/context) when the whole class is receiving instruction and Sophia is asked to sit quietly in her carpet square for more than five minutes (antecedent), Sophia fidgets and disrupts the class by yelling or wandering around the room (problem behavior), which typically results in Sophia's teacher chasing her around the room, asking her to be quiet, and scolding her about how to behave (consequence). Given this information, it is hypothesized that Sophia's disruptive behaviors are maintained by obtaining teacher attention (function; the "why" or "student pay-off")."

Selecting Function-Based Interventions

Using the FBA summary statement, the first step to developing a function-based support plan involves identifying the (1) desired behavior (long-term goal) and (2) the natural reinforcers resulting from this behavior (what typical students receive for performing this behavior; labeled 1 and 2 in Figures 2, 3, & 4). The next step is identifying an alternative behavior (short-term goal; labeled 3 in the figures) to achieve the same function as the problem behavior (Carr, 1997). Once the alternative and desired behaviors have been identified, the focus shifts toward the identification of function-based interventions. Following identification of the alternative and desired behaviors, the next focus is teaching these behaviors. The individual should be provided explicit instruction of how and when to use the alternative behavior appropriately as well as explicit instruction of the skills (or progression of skills)

necessary to engage in the desired behavior (O'Neill et al., 1997). Explicit instruction of the alternative behavior and skills supporting the use of the desired behavior should be paired with antecedent and consequence interventions. Antecedent interventions modify the events or stimuli triggering the problem behavior to prevent problem behavior and concurrently prompt the alternative and/or desired behaviors. Then, procedures for reinforcing alternative behaviors and desired behaviors should be identified in such a way that the student receives valued reinforcement based on reasonable expectations and time frames. Finally, responses to redirect problem behavior and eliminate or reduce the pay-off for problem behavior should be identified. The specific critical features of each of these components of a function-based support plan will be presented in the following sections and are summarized in Figure 2.

Critical Features of Function-Based Alternative Behaviors

Begin the function based support plan by developing a clear definition of what the student should do (versus what not to do). Very often a skill deficit (e.g. academic, social, organizational, communication) prevents the student from being able to regularly perform the desired behavior (long-term goal) right away. In Jackson's example (see Figure 2), the desired behavior is for him to independently complete double-digit multiplication problems, but he currently lacks the skills to perform this task. Until this academic skill deficit is bridged, he is more likely to need a way to avoid or escape a task he cannot complete. Jackson is likely to continue to engage in or escalate problem behavior to avoid the difficult math task, *unless* he is provided another way (alternative behavior) to have this need met.

An alternative behavior is an immediate attempt to reduce disruption and potentially dangerous behavior in the classroom. The alternative behavior should be viewed as a short-term solution to reduce problem behavior that provides a "window" for teaching and reinforcing the skills necessary to achieve the long-term goal of the desired behavior(s). To facilitate decreased problem behavior, it is important the alternative behavior meets three critical criteria: ***the alternative behavior must serve the same function (or purpose) as the problem behavior*** (Sprague & Horner, 1999), ***be as easy as or easier to do than the problem behavior*** (Horner & Day, 1991) and ***be socially acceptable*** (Haring, 1988). In the early stages of behavioral change it is recommended to closely adhere to these criteria as one works to convince the student to stray from the well-established habit and pathway of the problem behavior and commit to a new alternative behavior to access the desired reinforcer. Over time, the alternative behavior will be amended to increasingly approximate the desired behavior (long-term goal). In the initial stages, however, it is important to ensure that the student perceives the alternative behavior as an efficient way to have their needs met or they are not likely to give up the problem behavior.

According to the FBA summary statement for Jackson (Figure 2), he fidgets, gets off task, displays foul language, slams books, and picks on peers to escape difficult math tasks. The alternative behavior for Jackson must allow him to escape the difficult math task (serve the same function as the problem behavior). Asking for a break *addresses this function* and requires less energy than the series of tantrum behaviors described earlier (*easier*). Additionally, requesting a break is more *socially*

acceptable than throwing a tantrum by using foul language and throwing materials in class.

In Figure 3, the FBA summary indicates that Sophia is disrupting the class to access teacher attention. A reasonable long-term behavioral goal for Sophia is to quietly listen during carpet time, participate when it is her turn, and seek attention at appropriate times. The first step to help Sophia toward her long-term goal is to select an alternate behavior that meets the three critical features. First, the alternate behavior should *serve the same function as the problem behavior*. In this case, Sophia is engaging in disruption to access teacher attention. A more appropriate way to request teacher attention is to raise her hand. Raising her hand to request attention should be *as easy as, or easier, to do* than the disruptive behaviors, and it is a *socially acceptable behavior* according to Sophia's teacher.

The main goal of a function-based support plan is overcoming an established habit and pattern of learning in which the individual uses a problem behavior because it is functional (i.e., achieving a pay-off). The initial alternative behavior should be markedly easier to do and more efficient in its pay-off than the problem behavior. Otherwise, the individual may be less likely to abandon the "tried and true" problem behavior for the new alternative behavior.

Teaching the Alternative Behavior, Desired Behavior, and Approximations

Teaching is a critical component of all function-based interventions. Explicit instruction is encouraged to promote fluency and use of the alternative behavior and the desired behavior. Explicit instruction increases the likelihood that the individual understands when, how, and where to use the alternative behavior, as well as the pay-off for using

the alternative behavior (i.e., the same functional outcome as the problem behavior). Ideally, instruction occurs with the person(s) and in the setting in which use of the alternative behavior will occur. While the alternative behavior is a nice starting point, it is a short-term solution, and over time the focus should shift toward increasing use of the desired behavior.

When teaching to promote use of the desired behavior(s), it is important to understand the extent of the discrepancy between a student's current skills and the desired behaviors. If there is a large discrepancy, it may be necessary to identify a progressive instructional plan including instruction of necessary prerequisite skills and a progression of approximations toward the desired behavior. The progression of approximations toward the desired behavior would increasingly challenge the student to take greater responsibility (increasing independence and self-management) to access the reinforcers. Over time, instruction in the skills promoting use of the desired behaviors would provide increasing access and exposure to natural reinforcement for engaging in the desired behavior.

For example, in Jackson's case, we could conduct an assessment to identify Jackson's specific skill deficits and instructional needs in math. Then the behavior specialist would teach Jackson to use a picture card to request to "take a break" appropriately instead of using foul language and slamming books to avoid work. While Jackson begins to break the habit of using the problem behavior, we will provide instruction in multiplication and the prerequisite skills necessary for Jackson to be able to perform the math worksheets independently (desired behavior). As Jackson builds mastery in the necessary math and multiplication skills, the need to rely on the alternative behavior to avoid tasks should decrease. Instruction to address the

underlying math deficits should ultimately eliminate the need for student problem behavior.

As Jackson demonstrates fluency with requesting breaks appropriately and refraining from slamming his hand on the desk and tearing papers, we would increase the expectation for requesting breaks. Instead of giving breaks freely, we might limit Jackson to three break tickets during math, and if he has any leftover tickets he can cross off two problems from his worksheet. As Jackson's math skills increase, the expectation may be that he finishes at least five problems before he can request a break. When first increasing expectations and student responsibility, it is often necessary to increase reinforcement for engaging in the desired behavior to motivate the student to take the next step. As Jackson's math skills increase and he can complete more problems, he is also accessing the natural reinforcement of pride in work completion. At first it is important to make this explicit by praising student progress, effort, and work completion by saying such things as, "You should be really proud of how many problems you completed today."

In Sophia's case, she would need explicit instruction and practice in raising her hand and requesting attention. Requesting attention appropriately and reducing disruption are important, but over time it will be important to increase time between requests for attention to a schedule that is reasonable for the teacher. The next approximation may be to systematically reduce the number of requests for attention (three per carpet time to two, etc.). Additional social skills instruction on appropriate ways (e.g. conversation starters, eye contact, smiling) and times to obtain adult attention should increase Sophia's access to positive social attention during non-instructional times. I ncreasing specific social skills paired with incentives (e.g., earning

a game with an adult) for fewer requests for attention during instructional times will help Sophia increase her endurance during instructional times and reduce her need to solicit attention so frequently. Increased positive interactions and relationships with adults (the natural reinforcers) should increase and maintain social skill use.

Critical Features of Function-Based Prevention Strategies

The next step in developing a function-based support plan is to determine strategies to prevent the problem behavior. These include antecedent strategies that alter the triggers to problem behavior. The literature suggests critical features for prevention strategies that: (a) ***directly address the features of the antecedent (e.g., task, people, environmental conditions) that trigger the problem behavior*** (Kern, Choutka, & Sokol, 2002) and (b) ***directly address the hypothesized function of the problem behavior*** (Kern, Gallagher, Starosta, Hickman, & George, 2006).

Jackson (Figure 2, column A) is engaging in problem behavior when presented with math worksheets (antecedent) to avoid difficult math tasks (function). Prevention strategies could include reducing the difficulty of his assignment by interspersing easier problems with addition and subtraction problems with which he can be more successful. When this is done, his need to engage in problem behavior to escape the task is prevented or reduced. **A number of other prevention strategies have been shown to address escape-motivated behaviors such as:** (a) **to pre-correct desired behavior** (Wilde, Koegel, & Koegel, 1992); (b) **clarify or simplify instructions to a task or activity** (Munk & Repp, 1994); (c) **provide student choices in the activity** (Kern & Dunlap, 1998); (d) **build in frequent breaks from aversive tasks** (Carr et al., 2000); (e) **shorten tasks** (Kern & Dunlap, 1998); (f) **intersperse easy tasks with difficult tasks**

(Horner & Day, 1991); and (g) **embed aversive tasks within reinforcing activities** (Carr et al., 1994). Choosing the most appropriate intervention will depend on the specific antecedent and function of behavior identified in the FBA summary (other possible strategies based on the function of student behavior are presented in Tables 1 and 2).

Sophia (Figure 3, column A) engages in disruptive behavior when asked to sit quietly and listen with limited adult attention for five or more minutes at a time (antecedent) to obtain teacher attention (function). Prevention strategies directly linked to this function would provide Sophia with frequent teacher attention prior to problem behavior, such as a check-in during transition to carpet time, giving Sophia jobs as teacher helper, and seating her near the teacher so it is easier to periodically (every three to four minutes) provide her with attention. These strategies directly address the antecedent by reducing longer spans of time in which Sophia is not receiving adult attention. Prevention strategies that have been effective at addressing attention-maintained behaviors include: (a) use of peer-mediated instruction (Carter, Cushing, Clark, & Kennedy, 2005); (b) self-management strategies where student monitors their behavior to recruit feedback from the teacher (Koegel & Koegel, 1990); (c) provide assistance with tasks (Ebanks & Fisher, 2003); and (d) provide the student with the choice of working with a peer or teacher (Morrison & Rosales-Ruiz, 1997). Once again, choosing the most appropriate prevention strategies will require a match to the specific antecedent and function of behavior identified in the FBA summary statement.

Critical Features of Function-Based Consequence Strategies

Once teaching and prevention strategies have been selected, the next critical step is to determine strategies to reinforce appropriate behavior and minimize or eliminate payoff for problem behavior. Although many people associate the word "consequence" with a punitive response, in behavioral terms consequences can be punitive or pleasant. Within a Positive Behavior Support (PBS; Carr et al., 2002) framework, the goal is to minimize the use of aversive consequences. The function (or purpose) of the student's behavior should guide the selection of strategies to reinforce appropriate behaviors and minimize payoff for problem behaviors.

Reinforcing Appropriate Behavior. There are four critical features for identifying effective reinforcers. The first two are broad strategies to ***reinforce the alternative behavior*** (Petscher, Rey, & Bailey, 2009) and to ***reinforce desired behavior or approximations toward the desired behavior*** (Wilder, Harris, Reagan, & Rasey, 2007). More specific considerations when setting up effective interventions to encourage behavior are to ***identify reinforcers valued by the student*** (Horner & Day, 1991) and to set ***reasonable timeframes and expectations for the student to encourage behavior*** (Cooper, Heron, & Heward, 2007). In our experience there are two common mistakes in using reinforcement. The first mistake is selecting incentives that are not valued by the student. The second common mistake is setting goals, expectations, and time frames that are not reasonable for the student to achieve. If we identify a desired reward but only offer it to the student for engaging in perfect behavior, we are oftentimes setting the student up for failure rather than motivating success. What is reasonable for a student depends on the student's current performance as well as the discrepancy between this skill and the desired behavior.

Often, we must begin by reinforcing approximations of the desired behavior in smaller intervals of time before increasing to closer approximations of the desired behavior over longer spans of time.

For Jackson, when he asks for a break (alternative behavior), it is important to reinforce this behavior by providing a break quickly. If Jackson does not learn that asking for a break is a more effective and efficient way to get his needs met than the fidgeting, slamming his hand on the desk, and tearing his papers, he will quickly resort back to the problem behaviors that have worked so effectively in the past. Additionally, he may earn a "free choice pass" if he completes a reasonable, specified number of problems (desired behavior). If Jackson previously has only started one or two problems on a worksheet, it is probably not a reasonable expectation that tomorrow he will earn a reward for completing the entire worksheet. A more reasonable goal might be that he attempts five problems tomorrow to earn the incentive, a more attainable approximation of the desired behavior. By combining the option for Jackson to take a break (alternative behavior), modifying the task to make it easier (antecedent), and adding the incentive of the homework pass (reinforcement), Jackson's team creates integrated supports that set him up to be successful. The supports incentivize the desired behaviors and reduce Jackson's need to avoid difficult tasks through inappropriate behaviors.

For Sophia, when she raises her hand to request teacher attention (alternative behavior), it is important to provide teacher attention (reinforcement) immediately. Additionally, Sophia should receive more frequent attention for engaging in appropriate, on-task behavior. She can also earn special time with the teacher if she participates appropriately for the duration of carpet time and is appropriate even when

not called on every time she raises her hand (desired behavior). Encouraging Sophia with a highly valued reinforcer like "special teacher time" can be an effective motivator to challenge her to progress through increasing approximations of the desired behavior, as long as the expectations in this progression remain reasonable for Sophia.

Responding to Problem Behavior. Despite our best efforts to set up students and encourage them to engage in appropriate behavior, it is likely the student will revert to problem behavior from time to time. Therefore, a function-based intervention should include specific strategies for responding to problem behavior. These strategies are ***redirecting to the alternative behavior at the earliest signs of problem behavior*** (Kern & Clarke, 2005) and ***actively limiting or eliminating the pay-off for problem behavior*** (extinction; Mace et al., 1988). At the earliest signs that the student is engaging in or is likely to engage in the problem behavior, the first and best option is to briefly remind the student to engage in the alternative behavior and then reinforce the alternative behavior according to the plan. Additionally, it is critical if the student does not respond to the prompt, the team has identified *a response to the problem behavior that does not inadvertently reinforce it*.

In Jackson's case, at the earliest sign of problem behavior (e.g. off-task behaviors, fidgeting), his teacher should remind him he could request a break (redirection). When Jackson asks for a break appropriately, the teacher should quickly provide a break and acknowledge him for making a good choice to request a break appropriately. If Jackson does engage in severe problem behaviors to escape the task, he may temporarily be able to avoid the task to maintain safety and order in the classroom. However, responses to remove him from the room should be minimized,

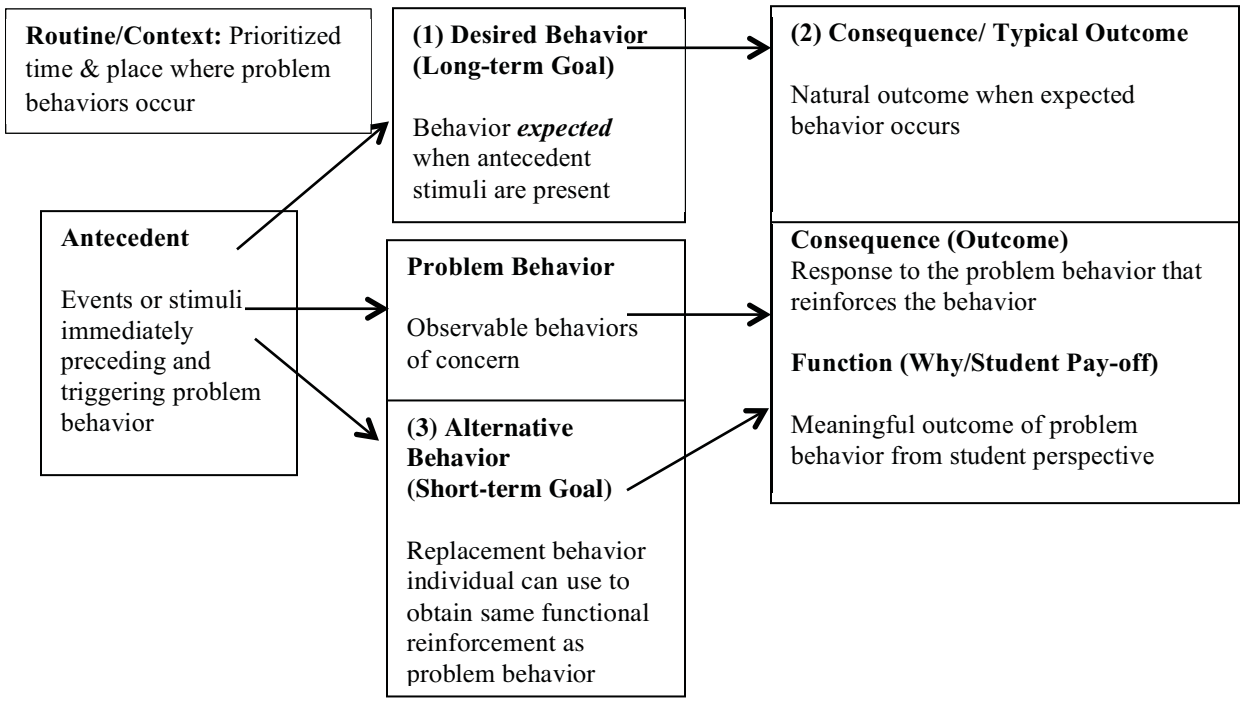
and if he must be removed, the work should be sent with him with the expectation that he completes the work when he calms down. Additionally, Jackson could also be required to come in during recess or after school to complete those tasks to minimize or eliminate his long-term opportunities to escape the task.

In Sophia's case at the earliest signs of off-task behavior (fidgeting, looking around the room), quickly use the visual prompt (limiting the richness of individual verbal attention) to redirect her to quietly raise her hand to request attention. If she does so appropriately, quickly provide teacher attention. If Sophia does not respond, it is important that teacher attention is minimized or eliminated for problem behavior. Instead of chasing Sophia around the room and having a "talk" with her about right and wrong, attention to misbehavior should be limited. In many cases it is not safe for a student to be running around the room, but it is possible to redirect a student in a more impersonal way (no conversation, brief directions, limited eye contact, etc.) that limits attention for problem behavior. In contrast, it is essential that when Sophia is engaging in appropriate behavior she experience rich, high-quality attention so that she clearly learns the difference between the outcomes for desired versus non-desired behavior.

Summary

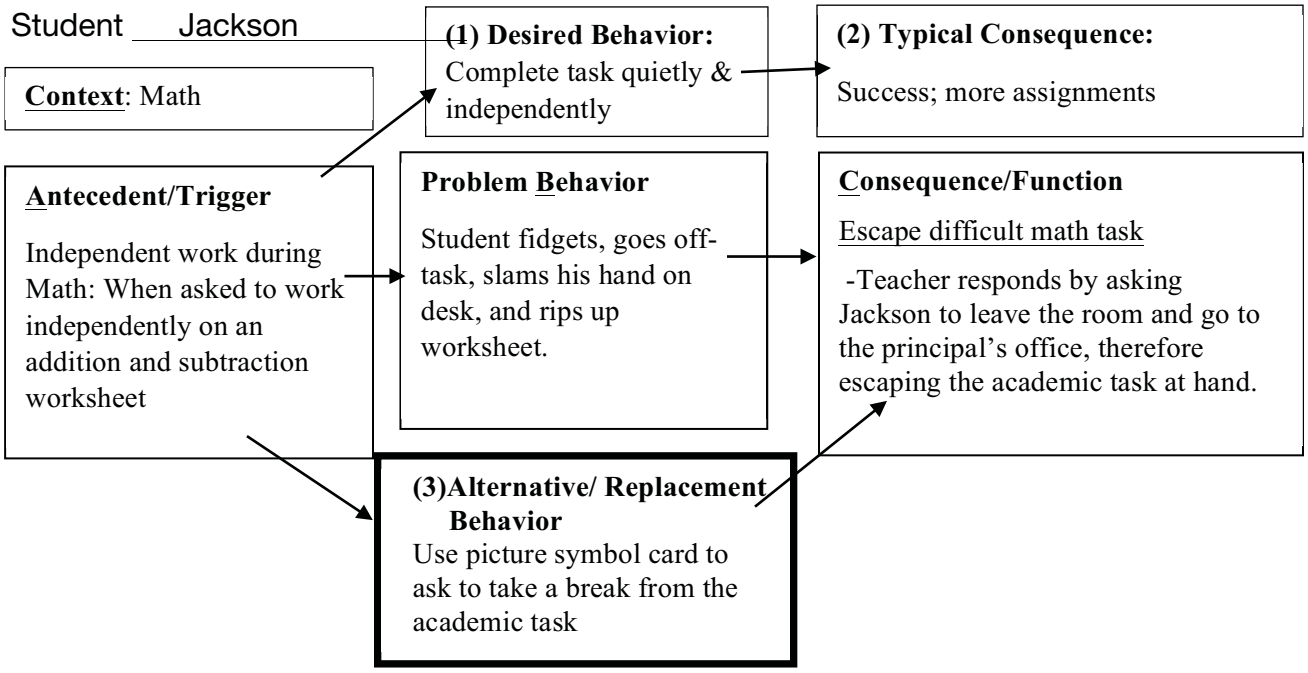
As educators increasingly encounter students with complex academic, social, and emotional needs, it is imperative they have research-based tools that can be appropriately and effectively utilized in unique contexts. The research on the effectiveness of function-based supports is vast, but educators are often missing the "how to" or "practical" strategies drawn from research. This chapter highlights "scaled-down" research-based critical features to consider when developing a

function-based behavior support plan. It illustrates the importance of utilizing the function of a student's behavior to outline prevention, teaching, and consequence strategies synergistically to positively impact student outcomes. As a reference, a list of essential components of behavior interventions presented in the chapter is provided in Figures 1 and 4. Finally, possible antecedent, behavioral teaching, and consequence strategies are presented for the functions of obtaining attention (Table 1) and escaping tasks or stimuli (Table 2).



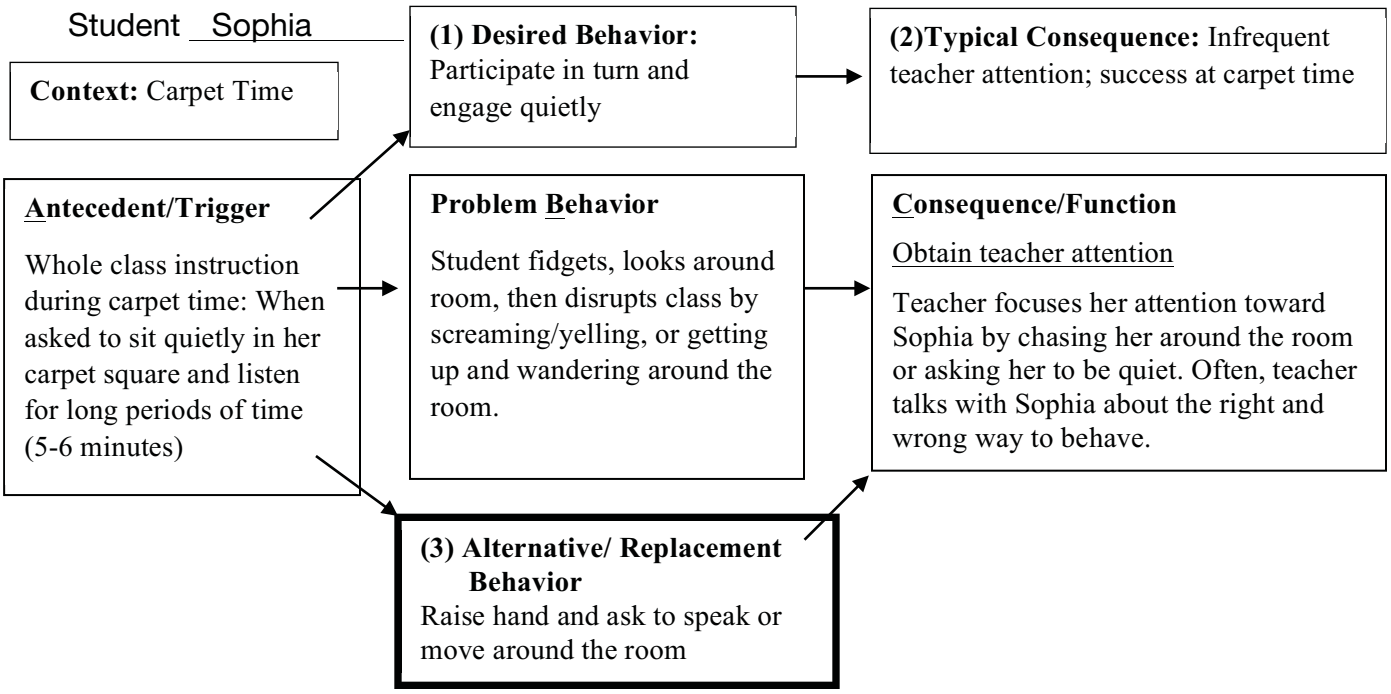
(A) Manipulate Antecedent to prevent problem & prompt alternate/ desired behavior	(B)Teach Behavior Explicitly teach alternate & desired behaviors	Alter Consequences to reinforce alternate & desired behavior & extinguish negative behavior	
		(C) Alt./Expected Behavior	(D) Problem Behavior
Intervention should: □ Directly address the identified antecedent □ Directly address the function of problem behavior	Provide explicit instruction of the alternate behavior(s) that: □ Serves the same function as problem behavior □ Is as easy or easier to do than problem behavior □ Is socially acceptab Explicitly teach skills necessary to engage in desired behaviors or approximations thereof:	Include an intervention to reinforce the: □ Alternative behavior & □ Desired behavior or approximations toward the desired behavior Ensure that reinforcers are valued (use function to guide selection of reinforcers as appropriate) Set up Reinforcement Schedules based on reasonable expectations and timeframes	Prompt the alternative behavior at the earliest sign of problem behavior Eliminate or limit access to reinforcement for engaging in problem behavior

Figure 1. Competing Behavior Pathway with Definitions of Critical Features



(A) Manipulate Antecedent to prevent problem & prompt alternate/desired behavior	(B) Teach Behavior Explicitly Teach Alternate & Desired Behaviors	Alter Consequences to reinforce alternate & desired behavior & extinguish negative behavior	
		(C) Reinforce Alt./Expected Behavior	(D) Problem Behavior
Decrease the difficulty of the math worksheet, intersperse easier addition and subtraction problems with more difficult problems Provide manipulatives and/or stimulus prompts on the numbers as counters (e.g., touchmath) Help Jackson get started with first math problem	Teach student to use picture card or to turn paper over to signal he will take a break from the academic task Teach student to ask for help (using a picture card) on problems he does not understand Teach student to cross out difficult problems he does not want to do and go on to next problem	Student can earn choice time passes after completing so many academic tasks (i.e. 4 completed tasks = 1 choice pass) Reinforce student for asking to take a break with a short 2-minute break from the task	Prompt student to ask to take a break when he begins to display problem behavior Have student spend after-school time on task if he displays problem behavior during class (use visual time timer to show how much time he will owe)

Figure 2. Example of Jackson's Function-Based Support Plan



(A) Manipulate Antecedent to prevent problem & prompt alternate/desired behavior	(B) Teach Behavior Explicitly Teach Alternate & Desired Behaviors	Alter Consequences to reinforce alternate & desired behavior & extinguish negative behavior	
		(C) Reinforce Alt./Expected Behavior	(D) Problem Behavior
Check-in with Sophia during transition to carpet time to provide brief 1:1 attention Make Sophia "teacher's helper" and give her jobs providing teacher interaction Move student's carpet square closer to the teacher so it is easier for the teacher to notice and provide attention for on-task behavior (see Reinforcement strategy)	Teach student to raise her hand and ask to speak with the teacher Provide social skills instruction focused on appropriate adult interactions (e.g. conversation started, eye contact, smiling) and increasing endurance for spans of time with limited attention.	Provide regular frequent attention for on-task behavior Student gets "special teacher time" if she displays appropriate behaviors in class Student gets to talk to teacher when asking appropriately	Prompt student to ask to speak to teacher at earliest signs of disruptive behavior (fidgeting) Have student spend time in the designated "time-out" zone if problem behaviors continue.

Figure 3. Example of Sophia's Function-Based Support Plan

- **Replace problem behavior by teaching a socially acceptable, efficient behavior that allows student to obtain the pay-off/function**
    - An appropriate Replacement Behavior:
        - Serves the same function as the problem behavior
        - Is easier to do & more efficient than the problem behavior
        - Is socially acceptable

- **Prevent problem behaviors by directly addressing triggers & prompting replacement behaviors based on the function of behavior**
    - Prevention Interventions should:
        - Directly address the identified antecedent/trigger
        - Directly address the function of the problem behavior
        - Remind the student to use the replacement behavior

- **Reinforce replacement & desired behaviors based on function/pay off for the student**
    - Immediately reinforce the use of replacement behaviors
    - Reinforce desired behaviors by:
        - Using reasonable goals & expectations
        - Using a reasonable time frame for achieving goals
        - Ensure that the reinforce is valued (matches function)

- **Redirect problem behaviors by quickly & effectively redirecting student to replacement behavior**
    - At the earliest sign of problem behavior:
        - Redirect or prompt student to the replacement behavior

- **Minimize Reinforcement by ensuring that problem behaviors do NOT pay off for the student (i.e. does not result in the function of behavior)**
    - When problem behaviors occur, identify a response that does not result in the desired pay-off for the student.

Figure 4. Essential Components for a Behavior Intervention Plan (from Loman, Strickland-Cohen, & Borgmeier, 2013).

Table 1. Possible ABC Strategies by Behavioral Function: Obtaining Attention
***Strategies should be individualized for each student**

Function of Behavior	***Antecedent Strategies*** ***Prevent problem behavior & support desired behavior*** ***Make problem behaviors irrelevant***	***Behavior Teaching Strategies*** ***Teach replacement & desired behavior that gets results more quickly or easily to make the problem behavior inefficient.***	***Consequence Strategies*** ***Change consequences that have supported rather than eliminated the problem behavior.*** ***Do NOT allow the negative behavior to pay off for the student, put the negative behavior on extinction*** ***Reward appropriate behavior to make the problem behavior ineffective.***
Attention Seeking	***Prevention (give attention early for positive behaviors)*** ***Check-in – provide adult attention immediately upon student arrival*** ***Give student leadership responsibility or a class "job" that requires the student to interact w/ staff*** ***Place student in desk where they are easily accessible for frequent staff attention*** ***Give student frequent intermittent attention for positive or neutral behavior*** ***Pre-correct - Frequently & deliberately remind student to raise their hand and wait patiently if they want your attention***	***Teach student more appropriate ways to ask for adult attention*** ***Identify and teach specific examples of ways to ask for attention*** ***-Raise hand and wait patiently for teacher to call on you*** ***-likely need to differentiate (large group, small group, work time, etc.)***	***Respond quickly if student asks appropriately for adult attention*** ***Give the student frequent adult attention for positive behavior*** ***Student earns 'lunch w/ teacher' when student earns points for paying attention in class & asking appropriately for attention*** ***Eliminate/minimize the amount of attention provided to a student for engaging in problem behavior*** ***--Limit verbal interaction – create a signal to prompt the student to stop the problem behavior*** ***--Avoid power struggles***

Table 2. Possible ABC Strategies by Behavioral Function: Avoiding or Escaping Tasks/Stimuli*Strategies should be individualized for each student

Function of Behavior	*Antecedent Strategies*	*Behavior Teaching Strategies*	*Consequence Strategies*
Avoid Task	***Prevention (modify task or provide support)*** ***Modify assignments to meet student instructional/skill level (adjust timelines, provide graphic organizers, break in to smaller chunks, etc.)*** ***Assign student to work with a peer*** ***Provide additional instruction/support*** ***Provide visual prompt to cue steps for completing tasks student struggles with*** ***Provide additional support focused on instructional skills (Homework Club, Study Hall, etc.)*** ***Pre-Teaching content*** ***Pre-Correct - Frequently & deliberately remind student to ask for help***	***Teach student more appropriate ways to ask for help from teacher or peers*** ***Provide additional instruction on skill deficits*** ***<u>Identify and teach specific examples of ways to ask for help</u>*** ***Raise hand and wait patiently for teacher to call on you*** ***Teach student to use a break card*** ***-likely need to differentiate (large group, small group, work time, etc.)*** ***Provide academic instruction/support to address student skill deficits*** ***-More focused instruction in class*** ***- Additional instructional group*** ***- Special Education support for academic deficit*** ***- additional support and practice at home*** ***-additional assessment to identify specific skill deficits***	***Respond quickly if student asks for help or for a break*** ***Reward students for on task, trying hard, work completion & for asking for a break or help appropriately*** ***Eliminate/minimize the amount of missed instructional time or work provided to a student for engaging in problem behavior*** ***--However, need to make sure student is capable of doing work… or provide support/instruction so student can complete the work***

References

Blood, E., & Neel, R.S. (2007). From FBA to implementation: A look at what is actually being delivered. *Education and Treatment of Children, 30* (4), 67–80.doi: 10.1353/etc.2007.0021

Borgmeier, C., Loman, S. L., Hara, M., & Rodriguez, B. J. (2014). Training school personnel to identify interventions based on functional behavioral assessment. *Journal of Emotional and Behavioral Disorders, 22*(2), 1–12. doi: 10.1177/1063426614528244

Browning-Wright, D., Mayer, G. R., Cook, C. R., Crews, S. D., Kraemer, B. R., & Gale, B. (2007). Effects of training using the Behavior Support Plan Quality Evaluation Guide to improve positive behavior support plans. *Education and Treatment of Children, 30,* 89–106. doi: 10.1353/etc.2007.0017

Carr, E. G. (1997). The evolution of applied behavior analysis into positive behavior support. *The Association for Persons with Severe Handicaps, 22*(4), 208–209. doi: 10.1177/109830070200400102

Carr, E. G., Dunlap, G., Horner, R.H., Koegel, R.L., Turnbull, A.P., Sailor, W., ...Fox, L. (2002). Positive behavior support: Evolution of an applied science. *Journal of Positive Behavior Interventions, 4* (1), 4–16. doi: 10.1177/109830070200400102

Carr, E. G., Levin, L., McConnachie, G., Carlson, J. I., Kemp, D. C., & Smith, C. E. (1994). *Communication-based intervention for problem behavior*. Baltimore: Paul H. Brookes.

Carr, J. E., Coriaty, S., Wilder, D. A., Gaunt, B. T., Dozier, C. L., Britton, L. N., . . . Reed, C. L. (2000). A review of "noncontingent" reinforcement as treatment for the aberrant behavior of individuals with developmental disabilities. *Research in Developmental Disabilities, 21*, 377–391. doi: 10.1016/S0891-4222(00)00050-0

Carter, E. W., Cushing, L. S., Clark, H. M., & Kennedy, C. H. (2005). Effects of peer support interventions on students' access to the general curriculum and social interactions. *Research and Practice for Persons with Severe Disabilities, 30,* 15–25. http://dx.doi.org/10.2511/rpsd.30.1.15

Chandler, L. K., & Dahlquist, C. M. (2010). *Functional assessment: Strategies to prevent and remediate challenging behaviors in school settings.* Upper Saddle River, NJ: Merrill.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Crone, D. A., & Horner, R. H. (2003). *Building positive behavior support systems in schools: Functional behavioral assessment.* New York: Guilford.

Durand, V.M. (1990). *Severe behavior problems: A functional communication approach*. New York: Guilford.

Ebanks, M. E., & Fisher, W. W. (2003). Altering the timing of academic prompts to treat destructive behavior maintained by escape. *Journal of Applied Behavior Analysis, 6*(3), 355–359. doi: 10.1901/jaba.2003.36-355

Ervin, R. A., Radford, P. M., Bertsch, K., Piper, A. L., Ehrhardt, K. E, & Poling A. (2001). A descriptive analysis and critique of the empirical literature on school-based functional assessment. *School Psychology Review, 30*(2), 193–210.

Fox, J. J., & Gable, R. A. (2004). Functional behavioral assessment. In R.B. Rutherford, M. M. Quinn, & S. R. Mathur (Eds.), *Handbook of research in emotional and behavioral disorders* (pp. 143–162). New York: Guilford.

Haring, N. (1988). A technology for generalization. In N. Haring (Ed.), *Generalization for students with severe handicaps: Strategies and solutions* (pp. 5–12). Seattle: University of Washington Press.

Horner, R. H. (1994). Functional assessment: Contributions and future directions. *Journal of Applied Behavior Analysis, 27*(2), 401–404. doi: 10.1901/jaba.1994.27-401

Horner, R. H., & Day, H. M. (1991). The effects of response efficiency on functionally equivalent competing behaviors. *Journal of Applied Behavior Analysis, 24*(4), 719–32. doi: 10.1901/jaba.1991.24-719

Ingram, K., Lewis-Palmer, T., & Sugai, G. (2005). Function-based intervention planning comparing the effectiveness of FBA function-based and non-function-based intervention plans. *Journal of Positive Behavior Interventions*, *7*(4), 224–236.doi: 10.1177/10983007050070040401

Kern, L., Choutka, C. M., & Sokol, N. G. (2002). Assessment-based antecedent interventions used in natural settings to reduce challenging behavior: An analysis of the literature. *Education & Treatment of Children, 25*(1), 113–130.

Kern, L., & Clarke, S. (2005). Antecedent and setting event interventions. In L.M. Bambara & L. Kern (Eds.), *Individualized supports for students with problem behaviors*. New York: Guilford.

Kern, L., & Dunlap, G. (1998). Curriculum modifications to promote desirable classroom behavior. In J. K. Luiselli & M. J. Cameron (Eds.), *Antecedent control: Innovative approaches to behavioral support* (pp. 289–308). Baltimore: Paul H. Brookes Publishing Co.

Kern, L., Gallagher, P., Starosta, K., Hickman, W., & George, M. L. (2006). Longitudinal outcomes of functional behavioral assessment-based intervention. *Journal of Positive Behavior Interventions, 8,* 67–78. doi: 10.1177/10983007060080020501

Koegel, R. L., & Koegel, L. K. (1990). Extended reductions of stereotypic behavior of students with autism through a self-management treatment package. *Journal of Applied Behavior Analysis, 23,* 119–127. doi: 10.1901/jaba.1990.23-119

Loman, S.L. (2009). ABC Recording Form. In Practical FBA: Participants guidebook to the practical functional behavioral assessment training manual for school-based personnel. www.pbis.org.

Loman, S.L., Rodriguez, B.J. & Borgmeier, C. (2014). Critical features of training practitioners to conduct function based interventions: From theory to professional development to practice. *Research and Practice in the Schools*.

Loman, S.L., Strickland-Cohen, M.K., & Borgmeier, C. (2013). *Basic FBA to BSP: Participant's Guide*. *www.pbis.org*.

Mace, F. C., Hock, M. L., Lalli, J. S., West, B. J., Belfiore, P., Pinter, E., & Brown, D. K. (1988). Behavioral momentum in the treatment of noncompliance. *Journal of Applied Behavior Analysis, 21*(2), 123–141. doi: 10.1901/jaba.1988.21-123.

March, R.E. Horner, R.H., Lewis-Palmer, T., Brown, D., Crone, D.A., Todd, A.W., & Carr, E.G. (2000). Functional assessment checklist for teachers and staff (FACTS). Eugene: University of Oregon.

Morrison, K., & Rosales-Ruiz, J. (1997). The effect of object preferences on task performance and stereotypy in a child with autism. *Research in Developmental Disabilities, 18,* 127–137. doi: 10.1016/S0891-4222(96)00046-7

Munk, D. D., & Repp, A. C. (1994). The relationship between instructional variables and problem behavior: A review. *Exceptional Children, 60*(5), 390–401.

O'Neill, R. E., Horner, R. H., Albin, R. W., Sprague, J. R., Storey, K., & Newton, J. S. (1997). *Functional assessment and program development for problem behavior: A practical handbook*. Pacific Grove, CA: Brooks/Cole Publishing.

Petscher, E. S., Rey, C., & Bailey, J. S. (2009). A review of empirical support for differential reinforcement of alternative behavior. *Research in Developmental Disabilities, 30*(3), 409–425. doi: 10.1016/j.ridd.2008.08.008

Scott, T. M., Alter, P. J., & McQuillan, K. (2010). Functional behavior assessment in classroom settings: Scaling down to scale up. *Intervention in School and Clinic*, *46* (2), 87–94. doi: 10.1177/1053451210374986

Sprague, J. R., & Horner, R. H. (1999). Low frequency, high intensity problem behavior: Toward an applied technology of functional analysis and intervention. In A. C. Repp & R. H. Horner (Eds.), *Functional analysis of problem behavior: From effective assessment to effective support* (pp. 98–116). Belmont, CA: Wadsworth Publishing.

Strickland-Cohen, M. K., & Horner, R. H. (in press). Typical school personnel developing and implementing basic behavior support plans. *Journal of Positive Behavioral Interventions*.

Van Acker, R., Boreson, L., Gable, R., & Potterton, T. (2005). Are we on the right course? Lessons learned about current FBA/BIP practices in schools. *Journal of Behavioral Education*, *14*(1), 35–56. doi:10.1007/s10864-005-0960-5

Wilde, L. D., Koegel, L. K., & Koegel, R. L. (1992). *Increasing success in school through priming: A training manual*. Santa Barbara: University of California.

Wilder, D. A., Harris, C., Reagan, R., & Rasey, A. (2007). Functional analysis and treatment of noncompliance by preschool children. *Journal of Applied Behavior Analysis, 40,* 173–177. doi: 10.1901/jaba.2007.44-06

Chapter 5
iOS 8 Accessibility

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Released in the fall of 2014, iOS 8 is the latest version of Apple's operating system for mobile devices such as the iPad, iPhone and iPod Touch. This update was not as significant as iOS 7, with its completely overhauled user interface, but in terms of accessibility it continues to refine the user experience so that it works even better and for more people.

To locate the iOS accessibility features on your device, go to Settings > General > Accessibility. The features are arranged into five categories. Three focus on the needs of specific groups: vision, hearing, and learning. In iOS 8, there is a new category called Media for enabling captions and audio descriptions during video playback, and the category previously named Physical and Motor (which includes a number of features for those with motor challenges) has been renamed Interaction.

A handy option is the Accessibility Shortcut (formerly known as Triple-click Home), which appears at the bottom of the Accessibility pane in Settings. This shortcut allows you to enable and disable accessibility features by triple-clicking the Home button on your device at any time. If you include more than one feature in the Accessibility Shortcut you will see a popover menu when you triple-click the Home button. You can choose which features you wish to enable from this menu while you are reading an e-book, surfing the Web, or checking email, without the need to go back into Settings.

What follows is an overview of the key accessibility features available on iOS devices, with a special focus on the updates and new features in iOS 8.

Zoom

Zoom in iOS 8 Video: https://www.youtube.com/watch?v=eH9VHHueSRE

Apple enhanced the Zoom screen magnification feature in iOS 8 to provide even more flexibility and customization. Whereas in previous versions you could only zoom in on the entire screen (by double-tapping with three fingers with Zoom enabled), iOS 8 users now also have the ability to turn on a window mode where only part of the screen is magnified while the rest of the screen remains at its default magnification.

Furthermore, a number of lens filters are available to customize the appearance of the zoomed-in area of the screen. Lens filter options include:

- Inverted (similar to the Invert Colors feature available in previous versions of iOS, which reverses the colors for added contrast),
- Grayscale (for removing all color and replacing it with shades of gray),
- Grayscale inverted (similar to inverted but with only shades of grayscale), and
- Low light (which dims the screen somewhat for those with light sensitivity).

Many of the options for customizing Zoom, such as the lens filters, are available from a popover menu that can be accessed in a number of ways:

- triple-tapping with three fingers while Zoom is enabled,
- tapping the handle on the edge of the window in window mode, or
- tapping a new floating controller that can be enabled in the Zoom settings. You can move this controller if it gets in your way, and there is even an option to reduce its opacity when it is inactive. A tap and hold of the controller turns it into a virtual joystick for panning around the screen with the Zoom lens in window mode.

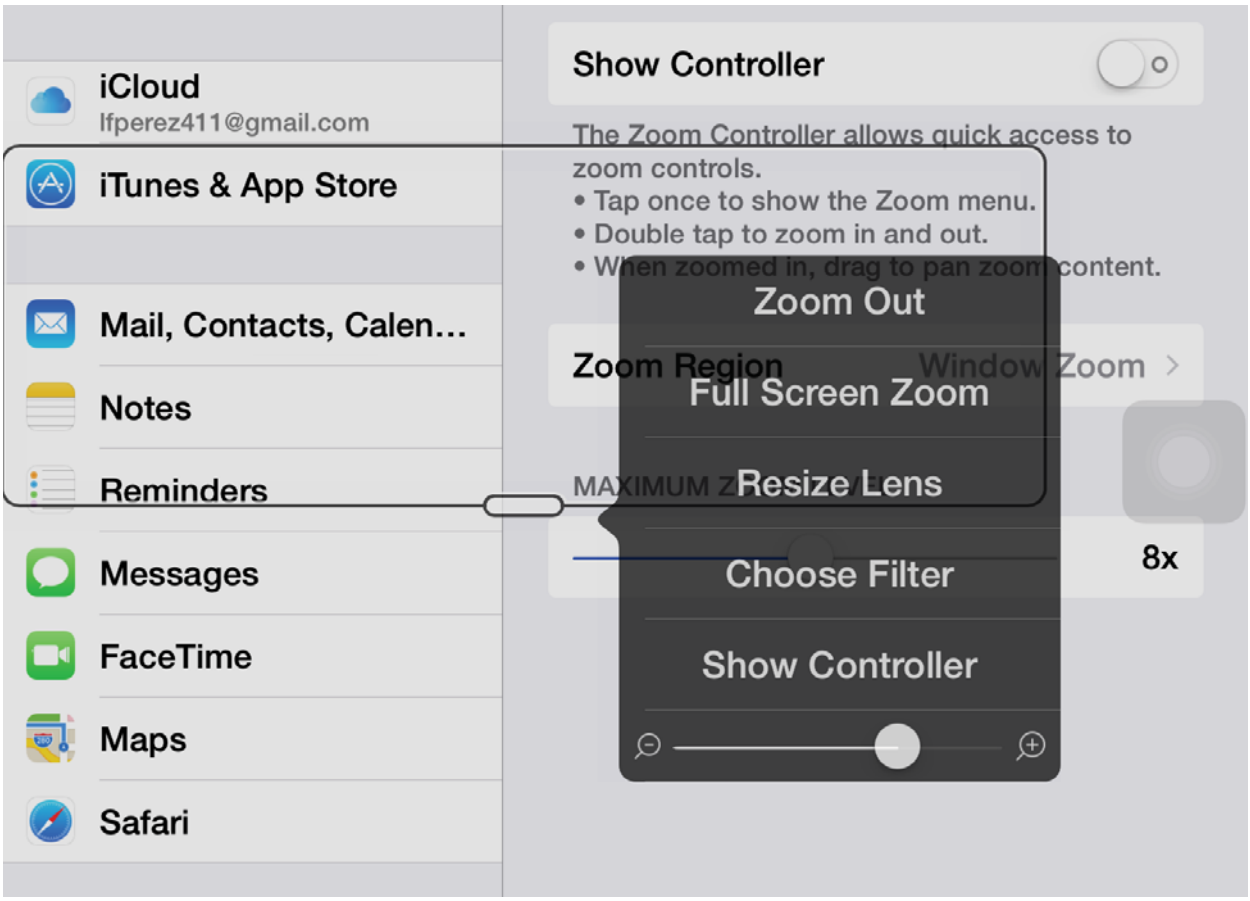

Figure 1. Zoom options menu in window mode.

The popover menu for Zoom also includes options for resizing the lens (the zoomed part of the screen in window mode) as well as for adjusting the zoom level. To resize the lens, choose Resize Lens from the popover menu, use the handles to resize the window according to the user's needs, then tap anywhere outside the lens area to set its size. To adjust the zoom level, move the slider at the bottom of the popover menu until the magnification is at the desired level. A maximum magnification level for the zoom slider can be set in the Zoom settings.

The keyboard is much easier to use with Zoom in iOS 8. A new Follow Focus feature allows Zoom to follow the keyboard focus as you type, and you can also choose to have the keyboard remain at the default 1X magnification while the rest of the screen is magnified.

VoiceOver

VoiceOver is the built-in screen reader for iOS devices. For people who are blind, VoiceOver converts the information on the screen into formats that are more accessible, such as audio and Braille (when the iOS device is connected to a Bluetooth Braille display). VoiceOver navigation can be performed in one of two ways:

- Drag your finger around the screen to hear what is under your finger (including items in the status bar and the Dock). When you want to select an item (i.e. open an app, turn on a setting) double-tap anywhere on the screen (this is the same as a single tap when VoiceOver is turned off).
- Use gestures: flick left or right to move the VoiceOver cursor (the black square that determines what VoiceOver will read back) then double-tap to make a selection (i.e open an app, turn on a setting).

In iOS 8, Apple added Alex, its natural-sounding voice previously only available on the Mac. As on the Mac, Alex is not limited to VoiceOver, but will work with other iOS speech technologies such as Speak Selection and the new Speak Screen (more on those later). However, note that not all devices are supported (check the Apple website to see if yours is on the supported list), and Siri still has its own voice rather than using Alex.

Building on the handwriting-recognition feature introduced in iOS 7, iOS 8 also supports Braille input. Both of these special input modes are accessed through the Rotor, a special gesture for accessing many VoiceOver settings and navigation options, which involves placing two fingers on the screen and turning a virtual dial.

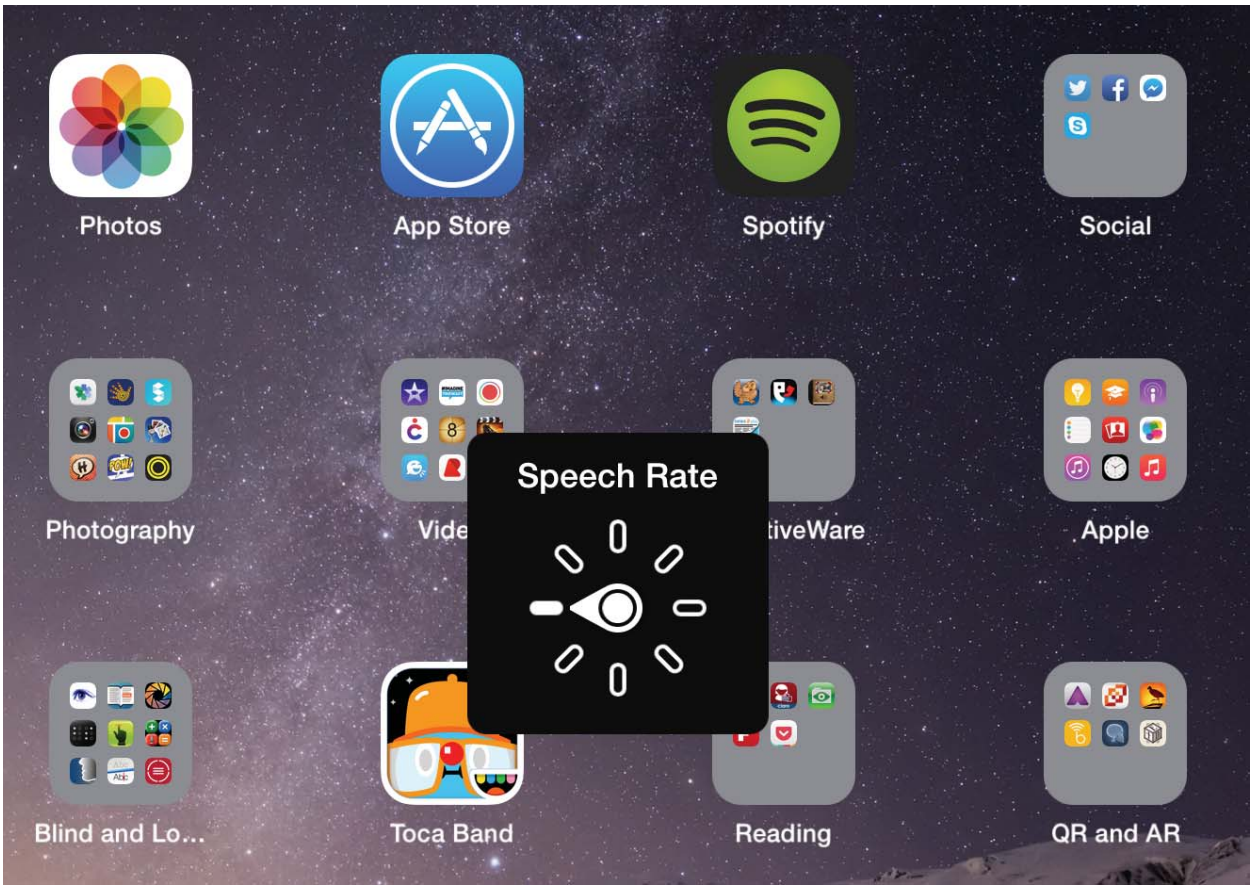

Figure 2. The Rotor with Speech Rate selected.

The Rotor is contextual, and the options that are available will depend on what you are doing. However, you can add and remove options from the Rotor by going to Accessibility > VoiceOver > Rotor and making sure only the options you want to be available in the Rotor have a checkmark next to them.

In my opinion, command of the Rotor gesture and its options is what allows a VoiceOver user to get the most out of this powerful screen reader and take its use to the next level, beyond basic flick and swipe gestures.

With the Rotor, you can:

- adjust VoiceOver settings such as the speech rate and volume at any time, without having to leave a web page or email to go into Settings;
- navigate web pages by using the page's structural elements, such as headings, links, form elements, and more;
- edit text by accessing options such as copy, paste, and replace; and
- access the previously mentioned special input modes, Handwriting and Braille Input.

Handwriting, which was introduced in iOS 7, can be used to search for apps, enter text, or navigate web pages by drawing letters on the screen. For example, to search for the Camera app, you would turn the Rotor to select Handwriting, then draw the first letter of the app's name (in this case "C") on the screen to hear a list of all apps that start with that letter. While navigating a web page with the Safari browser you can draw the letter "H" to navigate a web page by headings, the letter "L" to navigate by links, and so on. The Handwriting feature supports the following gestures:

- Three-finger swipe up or down: switch between upper-case, lower-case, numbers, and punctuation.
- Two-finger swipe left: deletes the last character.
- Two-finger swipe right: adds a space.
- Three-finger swipe right: adds a new line when entering text.

- Two-finger swipe up or down on the Home screen: navigates a list of apps once you have entered a few letters to narrow down your search (apps do not have to be on your Home screen, they can be anywhere on your device).
- Two-finger swipe up or down in Safari: navigates a list of headings, links or any other element you have selected by writing the corresponding letter first (H for heading, L for link and so on).

Alex and Braille Screen Input in iOS 8 Video:

https://www.youtube.com/watch?v=DYUHilllrPk

The Braille Input feature involves the use of an onscreen 6-dot Braille keyboard that will translate 6-dot chords into text (on the iPad's bigger screen you can also enable 8-dot Braille input). Two modes for Braille input are supported: screen away

mode and table top mode. In screen away mode, the device can be held with the screen facing away from the user and the Braille dots will appear on the right and left edges of the screen. In table top mode, the dots are arranged in the shape of the letter V when the device is placed on a tabletop or other flat surface. For the Braille input mode, some of the supported gestures include:

- One-finger swipe left: deletes the most recent character.
- One-finger swipe right: adds a space.
- Two-finger swipe right (while entering text): adds a new line.
- Two-finger swipe right (on a Home screen): opens the selected app.
- One-finger swipe up/down while entering text: accesses typing suggestions.
- One-finger swipe up or down while on a Home screen: navigates a list of apps that start with the letters you started typing.
- One-finger swipe up or down in Safari: moves by the element whose letter you entered (headings, links, etc.).
- Three-finger swipe left or right: toggles between contracted and uncontracted (called “six dot”) braille (on iPads, eight dot braille is also an option)
- Hold with one finger on the screen: enter “explore mode,” where you can move a finger around to find the different dot positions.

You can exit out of either of the two special input modes (Handwriting and Braille) by performing a scrub gesture (moving two fingers from side to side) or by turning the rotor to a different item (speech rate, words, etc.).

In addition to on-screen Braille input, iOS devices support a number of Bluetooth Braille displays for Braille output. A full list of supported displays is available on the Apple website. Some Braille displays not only convert VoiceOver output to Braille but also support control of the device through a number of buttons built into the display. For example, on some displays you can tap a button on the display to scroll up or down a page or screen.

Speech

In addition to VoiceOver, iOS 8 includes support for the following speech technologies: Speak Selection, Speak Screen, and Speak Auto-text. The options for these speech features can be accessed under a new Speech pane found under Vision in Accessibility. There you can tap Voices and choose from the many languages supported in iOS 8, and for some languages you can even choose different dialects (U.S. English, Australian English, etc.). Many of the dialects allow you to download enhanced quality voices for even better results, but note that these voices take up some space on your device. Some devices running the latest A7 and A8 processors (iPad Air, iPad mini with Retina and iPhone 5s and later) also support the same Alex voice that has been available on the Mac, providing even higher quality text-to-speech support.

Speak Selection speaks selected text in email, web pages and any document where there is text that can be selected. Use of this feature requires two steps.

- Turn it on: in Accessibility > Speech tap the On/Off switch for Speak Selection. Use the slider to adjust the speaking rate.

- Select text (this will depend on the app, but in Safari you tap, hold and let go, then use the blue handles to make a selection. From the popover menu, choose Speak and you will hear the selected text spoken aloud

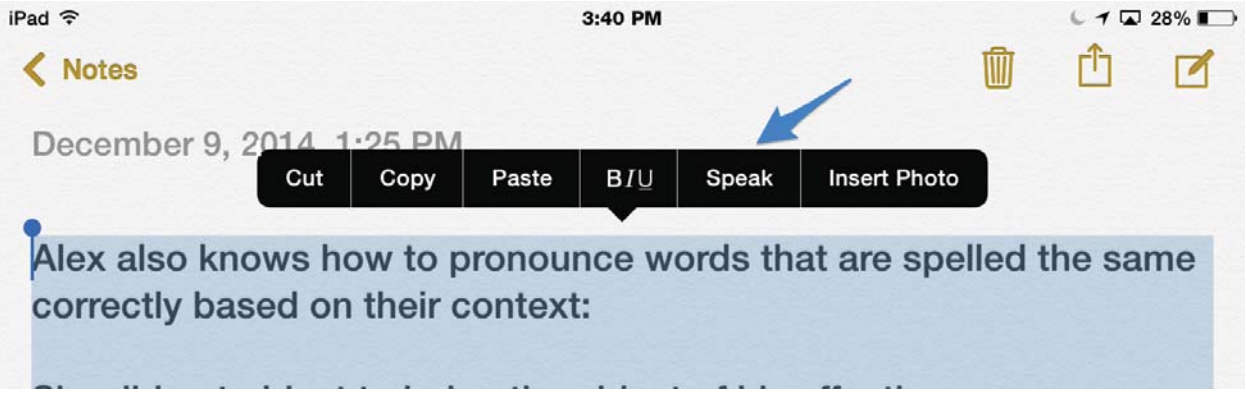

Figure 3. Popover menu for a selection showing the Speak option.

Since iOS 6, Speak Selection can highlight words as the selected text is spoken aloud. To enable word highlighting, go to Accessibility > Speech and make sure Highlight Content is enabled.

Speak Screen in iOS 8 Video: https://www.youtube.com/watch?v=WYpzKPyTyGM

Speak Screen is a new feature in iOS 8 that is similar to Speak Selection but does not require the user to make a selection first. With Speak Screen you perform a gesture (swiping down with two fingers from the top of the screen) and the device will speak everything that is on the display (including buttons and other interface elements). If you prefer, you can use Siri to activate Speak Screen. Just activate Siri and say “Speak Screen” and it should start reading the current screen aloud. Speak Screen has a popover controller with a number of options for pausing and resuming speech, adjusting the speech rate, and navigating the selection on the screen. This popover menu can be moved to the side as needed by tapping the arrow on the left side, or you can exit Speak Screen by tapping the X on the right side.

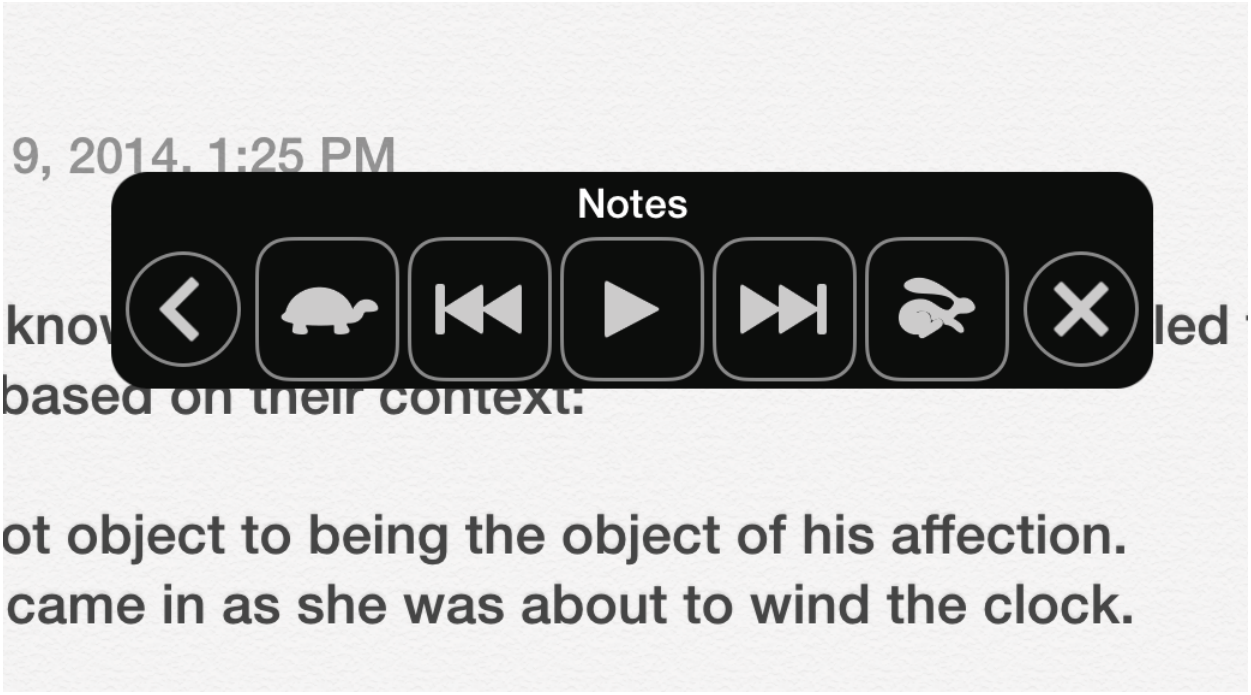

Figure 4. Speak Screen options popover menu.

Speak auto-text: automatically reads the auto-corrections suggested when you start typing some words, as well as the auto-capitalizations. This can save you from typing the wrong thing in email messages, social-media posts and more.

Guided Access

Guided Access in iOS 8 Video: https://www.youtube.com/watch?v=lovgyT06qrw

Guided Access was introduced as a way to set up the iPad or other iOS device in a single app mode. In this mode, users are required to enter a passcode before they can exit an app. Guided Access also can be used to disable certain areas of the interface (for example, the Settings button in an app). To enable Guided Access, go to Settings > Accessibility > Guided Access, then tap on Set Passcode to create the passcode. To use the feature, open the app you want to lock into single app mode, triple-click the Home button, and choose Guided Access. At the bottom of the screen you can disable touch (if you want to use the device for display only) or disable screen rotation. You can also disable the volume buttons, the sleep/wake button, or the keyboard for even more control. Tap Start when you have set your options and you will

be in single app mode (Guided Access). To stop Guided Access, triple-click Home again and enter the passcode, then select End.

While the options screen is visible, you can use your finger to draw a selection around buttons or other parts of the interface you want to disable. Those areas will be grayed out when Guided Access is started.

A new option with iOS 8 is Time Limits. This lets you set up a time limit for how long the user will be able to access the content on the iOS device. You can enable a sound to warn the user the time limit is about to expire or use a spoken warning instead (using text to speech). You set the warning type in Settings, then the length of the time limit in the Guided Access options screen. With iOS 8, devices that included a TouchID sensor allow the use of this sensor as an alternative for entering the passcode to end a Guided Access session.

AssistiveTouch

AssistiveTouch provides access to many hardware functions (volume buttons, screen rotation) through software alternatives. AssistiveTouch also makes it possible to use multi-finger gestures even if you do not have full use of all of your fingers.

When you turn on AssistiveTouch, you will see a floating icon that looks like a dot (you can move this icon if it gets in the way). Tapping the floating icon will bring up the AssistiveTouch Menu with the following options:

Figure 5. AssistiveTouch Menu

- Home: the same as clicking the Home button (for people who do not have the ability to perform a click).
- Siri: will activate the Siri personal assistant on devices that support that feature. When you are done, tap anywhere outside the popover window to dismiss Siri.
- Device: for adjusting and muting the volume, rotating the screen, locking the screen, and other device functions. Tap More for options that allow you to take a snapshot of the screen that will be saved to the device's Camera Roll, and open the task switcher, which can be used to see recently opened apps so that you can switch between apps. The Gestures option is for people who are unable to perform multi-touch gestures with more than one finger. For example, instead of swiping left or right with four fingers to switch apps (if Multitasking gestures are enabled on the iPad), you can do the same thing with one finger using AssistiveTouch.

- Favorites: you can create your own gestures, in the AssistiveTouch section of the Accessibility Settings. A pinch gesture is already included for you.
- Notification Center: for accessing notifications from apps without having to swipe down from the top of the screen.
- Control Center: for accessing the Control Center without having to swipe up from the bottom of the screen.

AssistiveTouch works well in conjunction with a number of special stylus designs, including some that can be mounted on a head harness or held in the mouth with a special mouthguard. These designs, along with others that have special grips, can be used by those who are unable to hold a traditional stylus.

Switch Control

Switch Control was introduced in iOS 7 and provides access to iOS devices for those who have motor or cognitive difficulties that require them to use an adaptive switch to interact with the iOS device. With Switch Control, items on the screen are highlighted with a cursor sequentially, and when the desired item is highlighted it can be activated by tapping the screen or a separate adaptive device connected to the iOS device over Bluetooth.

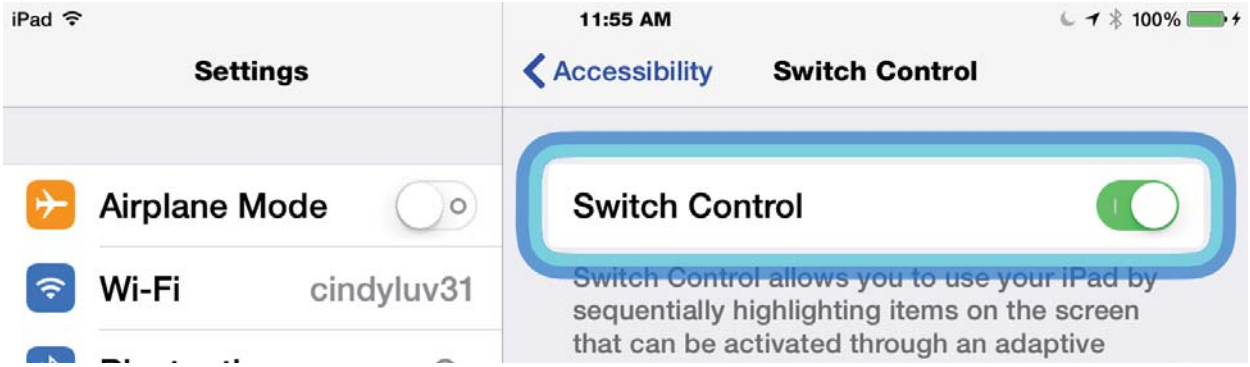

Figure 6. The Switch Control cursor

A scanner menu can also be brought up to access scrolling, saved gestures, and a number of device functions such as clicking the Home button or activating Siri.

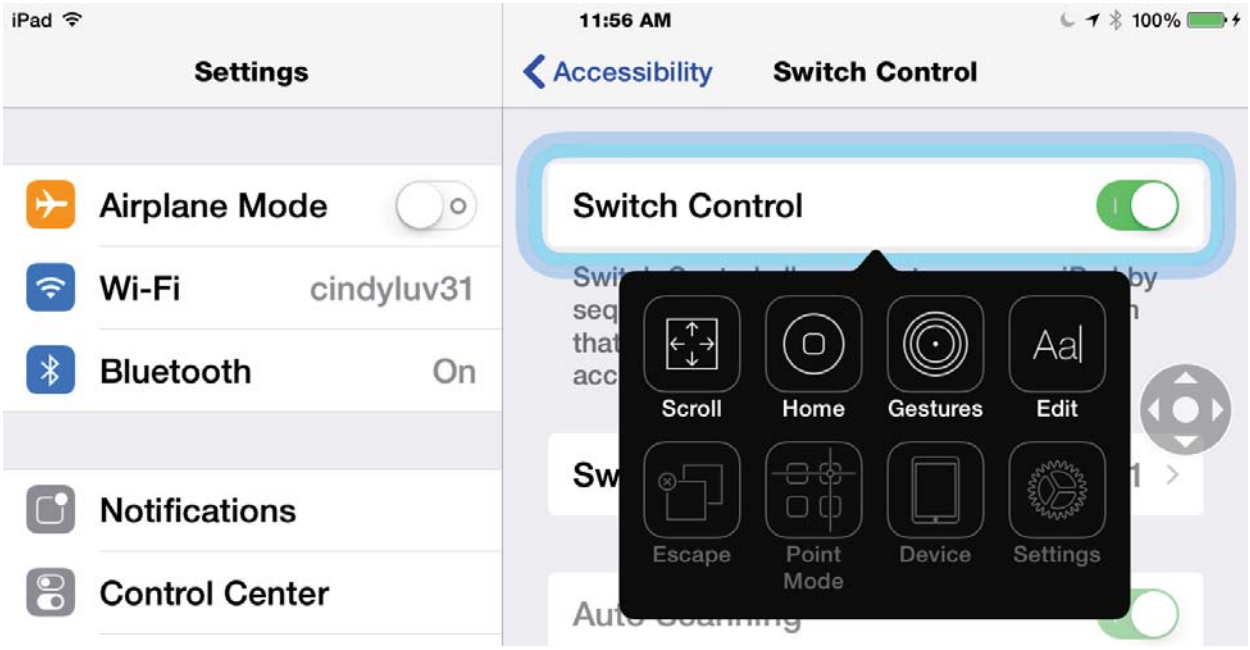

Figure 7. The Switch Control scanner menu

Switch control is highly configurable in iOS:

- You can enable auto scanning and adjust the timing parameters for the auto scanning feature, including the number of times it will loop, how long you have to hold down the switch to activate an item (hold duration), and so on. Auto scanning requires less physical effort on the part of the user, but the timing can be tricky for those who are new to switch use.
- You can adjust the visual appearance and audio effects: for the visual appearance you can choose a large cursor and select from a number of colors for the scanning cursor. For audio, you can choose to hear an audio cue when the cursor advances, as well as enable speech and adjust the speaking rate. This last feature may be

helpful to someone who needs to use a switch device but also has low vision and needs the audio cues for the items on the screen.

- You can add multiple switch sources, and the switch source supports three options: external, screen, and camera. The first two are self-explanatory. You either tap on an external switch device or on the iOS device's screen to activate an item. The camera can also be set to recognize your head movements as an action, and you can assign different actions to either a right or a left head turn. When a head movement is added as a switch source, an option for adjusting the head movement sensitivity will be available. One thing to note is that you should probably have your iOS device on a stand if you plan to make use of the camera as a switch source. Otherwise, moving the device may cause the camera to not recognize your face as desired.

Switch Control received only a minor update in iOS 8 that is intended to make use of the feature more efficient. For example, the scanner menu does not include all of the available options when it first comes up, but rather those that are most needed based on the current context. The user can then scan to a second menu/screen of options. Overall, the number of options available to the user has not changed, just the way they are presented.

QuickType, Dictation, and Third-Party Keyboards

The onscreen keyboard has gained smart word prediction in iOS 8. According to Apple, the QuickType prediction depends not only on your past conversations and writing style, but also on the person you are writing to and the app you are using. For example, in Messages the keyboard will provide suggestions that match a more casual

writing style, while in email it will suggest more formal language. Word prediction can save time and effort for everyone, and it can be especially helpful for students who struggle with spelling or those who find it difficult to enter text due to motor challenges.

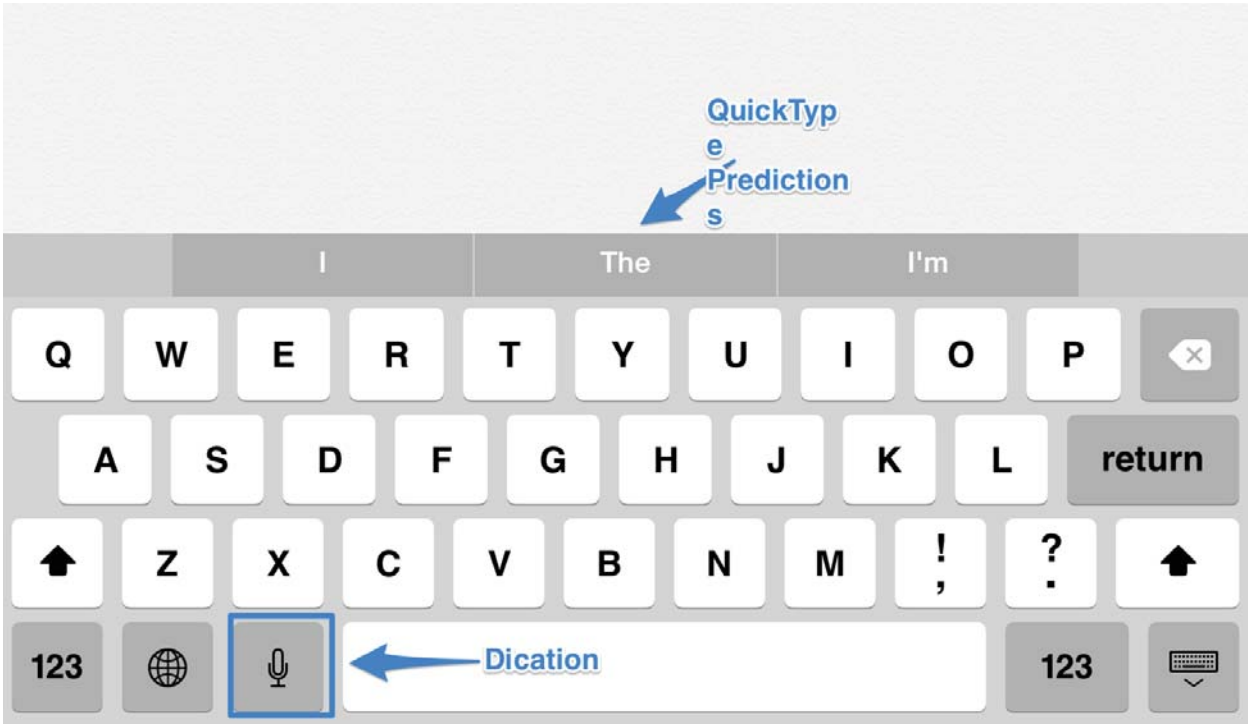

Figure 8. QuickType and Dictation

Dictation has added real-time feedback in iOS 8. This makes the feature easier to use, as you can see exactly what you are dictating on the screen as you go, helping you catch mistakes sooner. Starting Dictation is as simple as tapping a microphone icon that appears to the left of the space bar, speaking the desired text and punctuation, and then tapping done when finished. Dictation does not require any previous training, but it does need an active Internet connection to work.

In addition to QuickType, there is a new API third party developers can use to create customized keyboards that users can choose from instead of the standard one

included with iOS. Already, a number of third-party keyboards are available. Some of my favorites are as follows:

- Keedogo: special keyboard for early writers with a simplified layout and lowercase letters
- Keedogo Plus: similar to Keedogo but with word prediction.
- Lowercase Keyboard: lowercase keyboard incorporating the Open Dyslexic font
- Fleksy: keyboard with support for swipe gestures and color themes
- Swype: keyboard that supports entering text through special gestures that require dragging a finger over the letters that make up each word
- TextExpander: enhanced shortcuts that save time by allowing you to save frequently typed blocks of text for use at any time
- Phraseboard Keyboard: allows you to create keys for frequently used phrases.
- Translator Keyboard: allows you to type in one language and automatically translate it into another language
- ai.type: improves the usability of the Shift key and allows for custom backgrounds

Installing and enabling each keyboard is a three-step process:

1. Download the app for the keyboard from the App Store.
2. Go to Settings > General > Keyboard > Keyboards and choose Add New Keyboard. Your new keyboard will be listed under Third-Party Keyboards.
3. Activate the on-screen keyboard and tap the globe icon to the left of the space bar and choose your new keyboard.

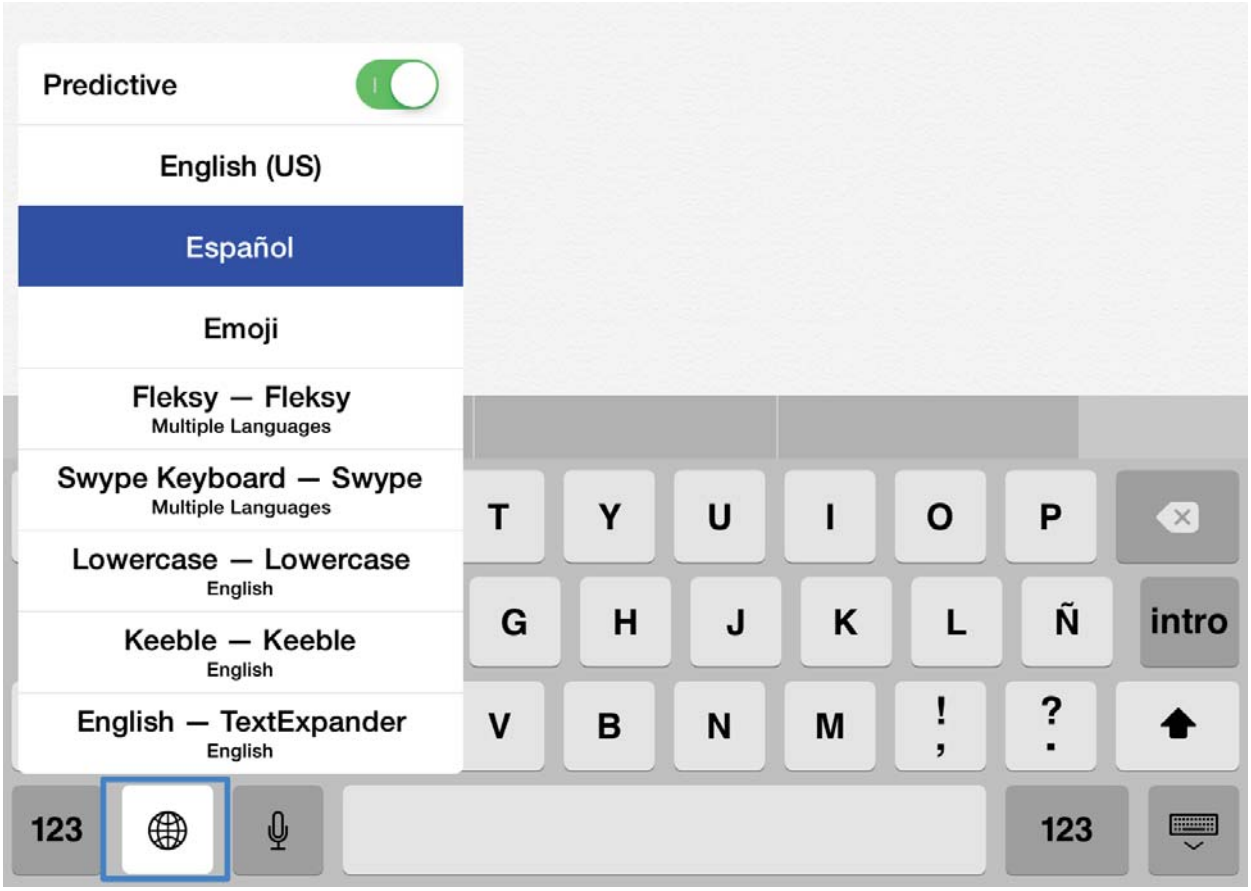

Figure 9. Menu for selecting third-party keyboards

The options for customizing each keyboard's behavior and appearance can be accessed through the keyboard's app.

Display Options

iOS includes a number of options for customizing how information is displayed on the screen. These features can benefit not only those with vision loss, but also older adults whose vision is fading. In iOS 8, the options for customizing the display include:

- Invert Colors: reverses the color on the screen for people who need a higher contrast display
- Grayscale: a new feature in iOS 8 that replaces the color on the screen with shades of gray
- Larger Text: makes the text bigger on apps that support the Dynamic Type feature. Text size can also be adjusted in Settings > Display and Brightness in iOS 8. However, by enabling Larger Accessibility Sizes, you can make the text even bigger.
- Bold Text and Increase Contrast: adjusts the contrast of the text and the background so that the text is easier to read. For Bold Text, you must restart for changes to take effect. You can also adjust this setting in Display and Brightness in iOS 8.
- Button Shapes: adds a shape around buttons to make them easier to perceive
- Reduce Motion: replaces the zoom animation in iOS 8 with a simple fade that may be easier for some people who are sensitive to motion in the interface.
- On/Off Labels: adds an additional visual cue (a 1 or o) to each button to help you identify its state (whether it is on or off).

Audio Options

With iOS 8, the options for those with any kind of hearing loss will vary depending on the device. On the iPad, there are three options:

- Hearing Aids: allows pairing with a number of Made for iPhone Hearing Aids with advanced features such as the ability to adjust the right and left volume separately

or together, environmental presets, and Live Listen for using the iOS device's microphone to pick up audio which can be relayed to the hearing aid

- Mono Audio: converts a stereo signal so that both channels will play out of each earpiece when you have headphones plugged in
- Balance control: allows you to adjust the audio level so that more of it plays out of either the left or right earpiece when headphones are plugged in

On the iPhone, you can also enable the device's flash as a visual alert, as well as turn on Phone Noise Cancellation to improve the audio quality for phone calls when you hold the phone up to your ear. For any of your contacts, you can set a custom vibration pattern. This is done by editing the person's contact information, choosing Vibration > Create New Vibration and tapping the custom vibration pattern on the screen.

Although not considered accessibility features, Messages and FaceTime are two communication technologies built into iOS that can be useful to those who are deaf and need alternative modes of communication such as text messaging and video chat for sign language.

Media

The new Media category in iOS 8 includes two options for customizing video content:

- Subtitles and Captioning: turns on captions on any video or podcast that includes them. Starting with iOS 7, you can customize the appearance of the captions by creating your own styles. These styles allow you to change the text size, font, and other options to make the text easier to see and read.

- Audio descriptions: enables a secondary audio track that describes the action for someone who is blind and cannot see what is on the screen.

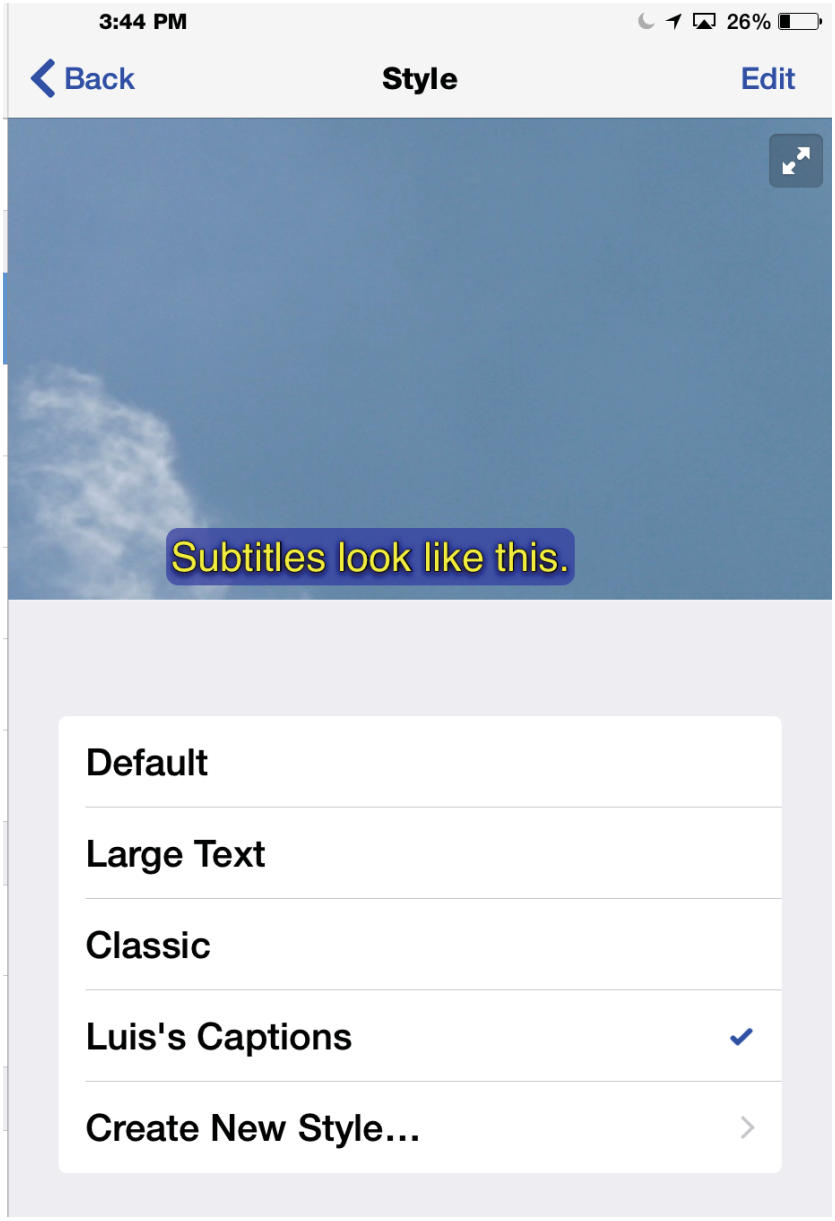

Figure 10. Closed caption styles pane

Other Options

In addition to the options found in the Accessibility pane, iOS includes a number of other features that, while they are not accessibility features per se, could benefit those with special needs. Some of these include:

- Messages: includes an option for sending audio clips from within the app, which will be of benefit to people who can't enter message text as quickly as they can speak. On the receiving end, these messages can be played back by just raising the device to hear them, making the interaction easier for those with motor difficulties. Video clips can also be sent in a similar way. For someone with a cognitive disability, the ability to see something in concrete terms with the help of a quick video clip will be helpful (a picture is worth a thousand words, right?).
- Siri now has an always-on listening mode where the user can just say "Hey Siri" to activate the personal assistant. To avoid draining the battery, this mode will only work when the device is plugged into power. This will be helpful to any individual who has difficulty pressing the Home button to activate Siri.
- The new support for a heath data API for tracking physical activity. For someone who is on the road to recovery (from an illness or an injury), such tools should prove helpful in keeping them on track and motivated about their progress. There is even an option for including a health card (with information about medications, allergies, and the like) in the lock screen. This idea will be taken even further when the new Apple Watch is released with a number of sensors for collecting health information that can be accessed with the Health app on iOS devices.

- A similar home automation API could come in handy for allowing people with motor difficulties to more easily control the appliances, lights, and other aspects of their home environment using iOS devices.
- NFC payments (Apple Pay) could make interactions at gas stations, pharmacies, and other places of public accommodation easier for people with motor difficulties. Rather than fumbling with a wallet to take out a credit card or loyalty card before buying a coffee, all that's required is a simple tap of the phone (or upcoming watch) with the payment station.

The Apple Watch, to be released in early 2015, also points forward to new technologies and means of interaction that will benefit people with disabilities. A great example is the new haptic feedback provided by the Taptic engine in the Apple Watch, which will use subtle vibration patterns to guide someone when using turn-by-turn navigation with the Maps app. Hopefully this technology will appear in future iPhones, as it would be of great benefit for those who are blind.

You can also communicate with the Apple Watch using tap patterns, doodles, and what appear to be animated avatars, and I hope a similar app will eventually be added to iOS. These features could be very useful for young people who are on the autism spectrum or who otherwise have communication difficulties: for example, what would be easier than drawing a big heart to tell your parent you love them?

When you take into account all of the accessibility and other enhancements built into iOS 8, it is clear that Apple is truly focused on creating an ecosystem of hardware, apps, and services that work for everyone. These built-in features are a great example of universal design, an approach where accessibility is built in rather than bolted on

through additional applications that have to be purchased and installed by the user. While iOS provides a great deal of customization through the large number of apps available in the App Store, out of the box a user has much of the accessibility toolkit he or she needs to access information and interact with the device on a level playing field with non-disabled peers. Furthermore, the ability to use the same device as everyone else, regardless of disability status, adds an element of social acceptability to iOS devices that cannot be underestimated when considering their use with marginalized populations.

Chapter 6
Using Content Acquisition Podcasts (CAPs) to Improve Vocabulary Instruction and Learning for Students with Disabilities and Their Teachers

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A big challenge when teaching students with disabilities (SWD) within general education placements is providing evidence-based instruction with fidelity and the dosage needed to "move the needle" on academic performance (Fuchs, Fuchs, & Stecker, 2010). Two key barriers preventing successful student outcomes that reside beyond individual student control are (a) the purpose of content-area classrooms at the upper elementary, middle, and high school levels, and (b) how instruction is delivered within these settings (McKenzie, 2009). General-education teachers in the content areas are often underprepared for the challenges associated with teaching SWD (Brownell, Sindelar, Kiely, & Danielson, 2010; Mastropieri et al., 2005). Reasons include limited coursework on serving SWD during teacher-preparation programs, minimum support from the school district in terms of professional development, and frequently, lack of content knowledge sufficient to adequately support students' learning needs in specific content areas among special educators who may be functioning in co-teaching roles (Kennedy & Ihle, 2012). In addition, teachers are largely required to adhere closely to state- or district-provided pacing guides intended to prepare students for high-stakes assessments that determine school, teacher, and student accountability. Thus, pressures from various sources compel teachers to move quickly through content without regard for the extent to which students are

mastering it (Hallahan, Kauffman, & Pullen, 2015). The resulting mismatch between SWD needs and the delivery of content (and its associated demands) is well documented in terms of their struggles with various assessments and post-school outcomes (see Smith, Manuel, & Stokes, 2012).

A Panacea for Students' Ills?

Many researchers, educators, and other stakeholders consider technology to be a tool that can help SWD and their teachers make critical improvements for learning and other outcomes (Duffey & Fox, 2012; Fletcher, Schaffhauser, & Levi, 2012; U.S. Department of Education, 2010). For some, technology writ large is a panacea for all of the world's problems in education (hyperbole added). However, Perlman and Redding (2011) found that in order to be used most effectively, technology must be implemented in ways that align with curricular and teacher goals and must offer students opportunities to use these tools during learning. While there is documentation of student gains using technology in isolated cases (see Edyburn, 2013 for a recent review) the integration of technology at all levels remains surprisingly low (Lu & Overbaugh, 2009). In sum, relative to how widespread technology's use has become in the field, it is alarming to face up to the paper-thin empirical base for technology's use with SWD in content-area classrooms (Kennedy, Deshler, & Lloyd, 2015).

In addition to the under-implementation and utilization of technology, Kennedy (2013) offered a different critique: Using technology for technology's sake is not consistent with the requirement to provide individualized, evidence-based instruction to SWD as noted in IEPs and required by IDEA. In other words, the presence of

technology as a way to package or deliver content does not automatically inoculate against lousy instruction. This does not mean technology should not be used with SWD, far from it. Instead, stakeholders should resemble what Njenga and Fourie (2010) call technoskeptics: Individuals who insist upon a higher level of theory, empirical evidence, and patience before racing to adopt every new app or technology tool they hear about on Twitter or Facebook. The purpose of this chapter is to introduce a multimedia-based tool that can be created by teachers with technology they already have on their computers, and which meets the standard of providing high quality instruction to SWD. We provide examples of high-quality multimedia and step-by-step instructions for production.

Content Acquisition Podcasts

Content Acquisition Podcasts, or CAPs, are short, multimedia-based instructional vignettes that deliver high-quality instruction for one vocabulary term or concept at a time. There are two domains of concern when creating CAPs: 1) The looks and sounds of instruction independent of content, and 2) The shape of the instruction being delivered using this tool. To address the looks and sounds of instruction, CAPs are built using Mayer's Cognitive Theory of Multimedia Learning (2009) and the accompanying 12 evidence-based instructional design principles (2008). CAPs can be used in a variety of flexible ways. Teachers can show CAPs during traditional lectures; students can watch CAPs at home with or without parents; CAPs can be viewed before exams or quizzes as a review, ahead of lectures as an advance organizer, or really anytime students have a couple of minutes to receive high-quality instruction. We feel CAPs' greatest strength is that they can be repeatedly and flexibly

used among students and teachers in perpetuity once the upfront cost of production (i.e. time) is paid.

Figure 1 contains a list of Mayer's principles, a description of each, and effect sizes based on Mayer's research. A sample CAP (that simultaneously introduces these principles) is available at https://vimeo.com/89716786. A sample CAP that delivers vocabulary instruction for students can be seen at www.qmediaplayer.com/?103. As you watch this CAP, note the pace, the use of visuals, the repetition of the key definition and information, the use of embedded questions, and the short length of the video. None of the decisions regarding the looks and sounds of this CAP were made without explicit reference to leading instructional design theory and evidence-based practices (EBPs) for vocabulary instruction.

Triarchic Model of Cognitive Load (DeLeeuw & Mayer, 2008)	Research-Based Instructional Design Principles (Mayer, 2009)	Brief description of Mayer's instructional design principles (Mayer, 2008; 2009)
Limit Extraneous Processing	Coherence Principle	Instructional materials are enhanced when irrelevant or extraneous information is excluded
	Signaling Principle	Learning is enhanced when explicit cues are provided that signal the beginning of major headings or elements of the material being covered
	Redundancy Principle	Inclusion of extensive text (transcription) on screen along with spoken words and pictures hinders learning. Carefully selected words or short phrases, however, augment retention (Mayer & Johnson, 2008)
	Spatial Contiguity Principle	On-screen text and pictures should be presented in close proximity to one another to limit eye shifting during instructional presentations
	Temporal Contiguity Principle	Pictures and text shown on screen should correspond to the audio presentation
Manage Essential Processing	Modality Principle	People learn better from spoken words and pictures than they do from pictures and text alone
	Segmenting Principle	People learn better when multimedia presentations are divided into short bursts as opposed to longer modules
Foster Generative Processing	Multimedia Principle	People learn better from pictures and spoken words than from words alone
	Personalization Principle	Narration presented in a conversational style result in better engagement and learning than more formal audio presentations.
	Voice Principle	People learn better when narration is clearly spoken with respect to rate and accent.
	Image Principle	People learn better when images are non-abstract, and clearly represent the content being presented

Figure 1. Mayer's Design Principles as Aligned with the Triarchic Model of Cognitive Load.

Shaping the Looks and Sounds of CAPs

The CTML is grounded in cognitive load theory (Chandler & Sweller, 1991), which states that all humans are subject to cognitive overload when capacity in working memory is overwhelmed by environmental stimuli. This theory also builds upon Paivio's (1986) dual processing principle (people learn using visual and auditory inputs), and Baddeley's (1986)

model of working memory (people remember about three seconds worth of auditory and visuospatial information, respectively, without taking explicit cognitive action to remember it). Multimedia instruction is a known perpetrator of overwhelming viewers with fast-paced, visually rich, instructionally redundant features that make no explicit effort to structure content so that viewers have time for processing (Clark, 2009; 1983; Mayer, 2009). The CTML and accompanying instructional design principles help instructors do a better job of creating instruction that is a match for how people learn (Mayer, 2009).

Figure 2 contains a rubric used by Kennedy, Aronin, Newton, O'Neal, and Thomas (2014) to score CAPs' adherence to Mayer's instructional design principles. This rubric is simple, but it can help an instructor carefully study each of Mayer's principles and consider how it influences the looks and sounds of instruction throughout a CAP. Before attempting to create a CAP, we recommend careful study of Mayer's principles and use of the rubric to evaluate multimedia currently being used to teach students.

Mayer's Instructional Design Principles as Rubric for Evaluating Multimedia Instructional Materials

Name:

Research-Based Instructional Design Principles (Mayer, 2009, 2008)	Rubric for Evaluating Multimedia Instructional Materials
Coherence Principle *ES = .97, 14 Studies*	*1 ----------2----------3* Includes Excess Some Irrelevant Content Standard Met Irrelevant
Signaling Principle *ES = .52, 6 Studies*	*1 ----------2----------3* Lacks Explicit Cues Some Cues Provided Standard Met
Redundancy Principle *ES = .72, 5 Studies*	*1 ----------2----------3* Extensive Text Occasional Redundant Text Standard Met
Spatial Contiguity Principle *ES = 1.12, 5 Studies*	*1 ----------2----------3* Words and Pictures Some Content Not Standard Met Not Near Each Other Closely Aligned
Temporal Contiguity Principle *ES = 1.31, 8 Studies*	*1 ----------2----------3* Audio & Text Some Misalignment Standard Met Misalignment
Modality Principle *ES = 1.02, 17 Studies*	Does Not Use Audio/Visuals Uses Audio/Visuals
Segmenting Principle *ES = .98, 3 Studies*	*1 ----------2----------3* Excessive Length Contains Explicit Breaks Standard Met & No Explicit Breaks But is Excessively Long
Pretraining Principle *ES = .85, 5 Studies*	*1 ----------2----------3* No Advance Organizer Limited Use of Standard Met Or Hierarchy of Content Pretraining Strategies
Multimedia Principle *ES = 1.39, 11 Studies*	Not Multimedia Standard Met
Personalization Principle *ES = 1.11, 11 Studies**	Not Personalized Standard Met
Voice Principle *	*1 ----------2----------3* Formal Narration Some Formal Standard Met Some Conversational
Image Principle *	*1 ----------2----------3* Images Are Vague &/or Most Images Clear Standard Met Blurry

Figure 2. Mayer's Instructional Design Principles as Rubric for Evaluating Multimedia Instructional Materials. *Note – Personalization Principle's 11 Studies Includes the Voice and Image Principles. They are separated here for the purpose of guiding instructional design.*

Empirical Evidence for CAPs

There are two emerging research bases for CAPs' use in education. The first is using CAPs to provide vocabulary instruction to SWD. Kennedy, Deshler, and Lloyd (2015) randomly assigned 278 urban high school students, including 30 with learning disabilities, to four experimental conditions: 1) Students assigned to watch CAPs containing a combination of EBPs for teaching vocabulary, including explicit and strategic instruction; 2) Students who learned using multimedia-based instruction that did not adhere to Mayer's evidence-based instructional design principles. The students in Group 1 assigned to watch CAPs containing a combination of evidence-based practices for teaching vocabulary, including explicit and strategic instruction significantly outperformed their classmates in Group 2. In a follow-up study, Kennedy, Thomas, Meyer, Alves, and Lloyd (2014) measured vocabulary learning of high school students with and without disabilities across two units in a social-studies course. Students took turns either using CAPs or not during each unit. Results show significant differences in performance on weekly curriculum-based measures when students had access to the CAPs. Research continuing in this area is examining the effects of CAPs on student vocabulary performance in science courses. Although preliminary, these two empirical studies demonstrate that CAPs can help students improve vocabulary performance.

The second empirical base for CAPs is with teachers and teacher education students. A total of 12 empirical articles support the use of CAPs to improve teacher candidate knowledge of various topics compared to classmates who learn by either reading or hearing a lecture containing the same content. A review highlighting several

of these studies is available from Kennedy, Kellems, Thomas, and Newton (2015). A free resource for teachers wishing to see sample CAPs or use them in teaching or learning is available at www.SPEDIntro.com.

Embedding Evidence-Based Practices within CAPs

While Mayer's model provides the roadmap for considering and designing the looks and sounds of instruction, it offers no guidance in terms of the substance of the content to be delivered. Therefore, CAPs must draw from a menu of EBPs for vocabulary instruction depending on the term or concept being taught. A menu containing EBPs that make particular sense for inclusion within the CAP model for vocabulary instruction is presented in Figure 3. It is important to note that more is not necessarily better when it comes to including EBPs within CAPs. Instead, logical choices supported by the term/concept, the meaning, and how much information students need to know should drive decision-making. To illustrate, it might make sense when teaching the term *biodegradable* to explicitly teach students about the prefix bio-, the root word degrade, the suffix -able, to give an example and non-example of the term, and to define the term using a student-friendly definition attached to an anchor image. In addition, it would make sense to create CAPs for other terms being taught in this unit such as biodiversity, recycling, and conservation.

Review and Select Relevant Evidence-Based Practices (EBPs) *Choose from this menu of vocabulary instruction EBPs that make sense for the term being taught, given its content-specific meaning and students' learning needs. (Note: This list is not exhaustive.)*	
✔	**Evidence-based practices**
	Semantic feature analysis and mapping (Ebbers & Denton, 2008)
	Explicit instruction, using examples/non-examples, student-friendly definitions, explicit language (Archer & Hughes, 2011)
	Keyword mnemonic strategy (Mastropieri, Berkeley, & Graetz, 2010)
	Word ID strategy (Lenz & Hughes, 1990)
	Morphemic awareness & analysis (Reed, 2008)
	Using instructional technology including visuals (Xin & Rieth, 2001)
	Graphic organizers (Dexter, Park, & Hughes, 2011)
	Content enhancements (Deshler & Shumaker, 2006)
	Anchored instruction (Cognition and Technology Group at Vanderbilt, 1990)

Figure 3. Sample evidence-based practices for teaching vocabulary terms/concepts

Figure 4 provides a worksheet teachers and other educators can use to plan the content of CAPs before bringing them to life with Mayer's instructional design principles. Some recommendations to help guide teachers planning to create CAPs include the following:

- Take a bank of vocabulary terms for a unit and practice matching them to EBPs that would be appropriate given student needs and the features of the term.
- Write a script for the CAP in advance and share with a colleague.
- Justify selection of EBPs during a planning meeting with teammates, including other special educators or general-education teachers.

To operationalize these recommendations, Figure 5 is a functional score sheet an

instructor can use to evaluate a CAP's use of EBPs within the video. Kennedy et al. (2014) used this score sheet in a recent study in which teacher candidates were taught how to make CAPs; the products were evaluated using this, and the rubric of Mayer's principles noted in Figure 2.

Term/Concept:
Fancy Definition:
Student-Friendly Definition:

- **What does the student's IEP say about his or her strengths for learning?**
- **What background knowledge is needed to learn this term/concept?**
- **What are related terms and how are they related? Different?**

Term	**Similarity One:**	**Similarity Two:**	**Difference One:**	**Difference Two:**

- **Does the word have any morphological parts that have specific meaning? What do they mean?**
- **What is an example of this term/concept students would probably understand?**
- **Is there a non-example that might confuse them?**
- **In your experience, what is a good way for students to remember this term/concept?**
- **Is this term a candidate for the keyword mnemonic strategy?**
- **Provide a passage from the textbook or other source that uses this term in context.**
- **What is a question about this term/concept you might write for a quiz or test?**
- **What is a sample question from the state assessment that might be asked about this term/concept?**

Figure 4. ***Vocabulary planning worksheet for embedded evidence-based practices within CAPs***

CAP Evidence-Based Practice Worksheet

Name: Term/Concept:

Preteaching/Word choice		Y	N	Notes
Word choice is appropriate for content				
Word choice is appropriate for grade/skill level				
Provides rationale for word selection				
Background knowledge is provided for word				
Puts word in context				
Explains how word connects to class content				
Word is pronounced correctly				
Word is sounded out and pronounced by syllable				
Definition				
Provides formal definition				
Provides student friendly definition				
Definition given at beginning				
Definition given at end				
Definition repeated				
Multiple definitions provided				
Compared to definition of known words				
Teaching Behaviors				
Uses explicit language				
Uses examples				
Uses non-examples				
Provides opportunities to practice				
Breaks instruction into manageable chunks				
Connections to known words				
Evidence-based Practices: Select which practice is used and fill out the chart for that practice				
1. Semantic Feature Analysis				
	Characteristics identified			
	Characteristics defined			
	Other terms given			
	Comparisons made			
	Concluding statement			
2. Keyword Mnemonic				
	Keyword given			
	Keyword appropriate			
	Interaction given			

	Retrieval steps given			
	Retrieval practiced			
	Definition practiced			Number of times?
3. Word ID/morphemic analysis				
	Correct root word identified			
	Correct root word defined			
	Correct prefix identified			
	Correct prefix defined			
	Correct suffix identified			
	Correct suffix defined			
	Root, prefix, suffix stated together with definition			
	Retrieval/definition practiced			Number of times:
4. Graphic organizer/content enhancement				
	Appropriate GO/CE device chosen			
	GO/CE presented			
	Each component of GO/CE taught			
	Each component of GO/CE reviewed			
	Retrieval practice			How many times?
5. Anchored instruction				
	Appropriate anchor chosen			
	Critical components of anchor identified			
	Critical components of anchor explained			
	Critical components of term identified			
	Critical components of term explained			
	Term and anchor explicitly compared			
	Retrieval practice			How many times?
6. Other				
	What practice?			Name the practice:
	Is the practice used correctly?			

Figure 5. ***CAP Evidence-Based Practice Worksheet***

CAP Production Steps

See Table 1 for a set of recommended production steps for CAPs and a two-part CAP on how to create a CAP.

Set of recommended production steps for CAPs	**http://tecplus.org/article/1**
Two-part CAP on how to create a CAP	**Part 1: https://vimeo.com/24179998** **Part 2: https://vimeo.com/24182724**

Table 1. CAP Production Steps

It is important to note that the path to creating CAPs is best left to the discretion and preferences of the person creating the instructional tool. Therefore, the production steps available through the aforementioned website and CAPs should be used as a reference; user creativity and use of other products (e.g., Camtasia, etc.) are welcome. That said, it is critical to ensure that CAPs adhere to Mayer's evidence-based instructional design principles and to embed vocabulary instruction that matches the topography of the term and the learner's needs.

Adding embedded questions. An additional step in the CAP development process is optional, but potentially useful in supporting student learning. Embedding comprehension and other questions throughout the CAP will give a teacher additional data to aid in decision-making. Qmedia allows users to embed questions throughout CAPs and provides data on questions for individual users and groups of users. To add questions, the completed CAP video must be on a video-sharing site such as Vimeo or YouTube. Once the video has been uploaded, go to www.qmediaplayer.com. The remaining steps for embedding questions using Qmedia are presented in Figure 6. CAPs under current research using assessment questions typically have two stop

points: one pretest question at the beginning of the video and a series of questions at the end of the video. Future research could examine at what point the number of questions in a video begins to decrease comprehension due to a lack of coherent viewing of the CAP.

Conclusion

We began this chapter by noting challenges general and special education teachers face with respect to implementing evidence-based instruction for SWD in various instructional settings. It is very easy to offer technology as a path to supporting students' needs, but the empirical evidence does not support applications of technology as a student cure-all. With this in mind, teachers and other education stakeholders should prioritize instructional design theory and evidence-based instructional practices when designing or selecting technology to be used with SWD. This will require educators to become technoskeptics, and to learn about evidence-based design principles such as those from Mayer (2009) in order to properly evaluate various instructional products brought to market.

CAPs are an intentionally flexible instructional tool. Students can watch CAPs during class, at home, before tests or quizzes, on the bus, and at other times when they have an opportunity to spend a couple minutes receiving high-quality vocabulary instruction. There is no right or wrong way to watch CAPs, so long as the learner is engaged during the brief vignettes.

Directions for adding embedded questions to CAPs through Qmedia

Step 1: On the Qmediaplayer home page, click “Qedit.”	
Step 2: On the right side of the page, click “File,” then “New.” When a confirmation window pops up, click “yes.”	
Step 3: Click “Settings” and follow steps below for initial setup. (Other features are available through QMedia. The focus here is on what is most applicable to CAP videos.)	
Title	Enter the CAP title (typically the term being taught)
Require user login?	If you want to collect data on individual students, click “true.” If you do not want individual student data stored, leave as “false.”
Media source (Id or URL)	If using a YouTube or vimeo video, enter the entire identifying information of the video. (Eg. For YouTube: https://www.youtube.com/watch?v=qqbFgasTsDs For Vimeo: https://vimeo.com/111015222 The video should now appear in the player pane when you click the preview button.
Stop time	Enter duration of CAP video in seconds.
Initial width % (0-100)	Enter “100”—this feature will make the video fill the browser window.
Step 4: Click “Preview” to save progress.	
Step 5: To add assessment questions, click “Content,” then “Edit assessments” and follow the steps below.	
Note: In Qmedia terminology, an “assessment” is one stop point in a video that can include one or multiple questions. A “step” is an individual question within an assessment.	
Step 5.1: Pause the video in the location you want to add an assessment.	
Step 5.2: Click “Add assessment.”	
Step 5.3: An untitled assessment will appear. Click “untitled” and rename the assessment. Assessment names are case sensitive and will be used when making data reports.	
Step 5.4: Click “Add Step.” An untitled step will appear.	
Step type	“Radio” is a standard multiple-choice question. These questions are most appropriate for CAP videos. Radio questions can also be used as true and false questions by entering “true” and “false” as the answer options.
Step Id	Enter the name of this specific question. Eg. “SOL Question,” “True or False,” etc.
Text	Enter the directions for the question. Ex. “Choose the best

	answer."
Prompt	Enter the assessment question. Ex. "What is an independent variable?"
If right answer	Enter any message you want the student to see if he or she gets the answer correct. Qmedia has a built-in response if students get the answer correct. What is entered here is in addition to the Qmedia statement.
If wrong answer	Enter any message you want the student to see if he or she gets the answer incorrect. Qmedia has a built-in response if students get the answer incorrect. What is entered here is in addition to the Qmedia statement.
Number of tries	Enter the number of times the student will be allowed to attempt the question.
Allow skipping	Select "true" if students will be able to skip this question. Select "false" if a response is required.
Font size	Select desired font size.
Options	Click "Add new option" and enter each response option for the question.
Designate a correct answer	Put an asterisk (*) in front of the correct answer (e.g., *1776). The asterisk will not appear in the assessment, but it signals to Qmedia which answer is correct.
Step 6: Save Qmedia video by following the steps below.	
Step 6.1: Click "File," then "Save as."	
Step 6.2: In the popup window enter your email address and a password you will use to make future edits and create data reports. The password and email address can be the same for every video you create in Qmedia. Note: Check the "Private?" box if you do not want anyone else to see the video.	
To edit an already existing Qmedia video, follow the steps below.	
Step 7: Go to www.qmediaplayer.com	
Step 7.1: Click "Qedit."	
Step 7.2: Click "File," then "Open."	
Step 7.3: Enter the email and password information used to save the video.	
Step 7.4: Use steps 3-6 to edit. Remember to save the video after editing.	
To view video on Qmedia without editing follow the steps below.	
Note: Every Qmedia video is assigned a number when it is saved (eg. 103).	
Step 8: In an Internet browser, enter www.qmediaplayer.com/show.htm?XXX where the XXX represents the number assigned to the video. (Eg. www.qmediaplayer.com/show.htm?103	
Note: This link can then be added to a teacher's website or sent to students to allow them to easily view the completed video.	
Note: The original video uploaded to Vimeo or YouTube will still exist in its original location without embedded questions. To watch videos with embedded questions, viewers must go through Qmedia.	

Figure 6. ***Directions for adding embedded questions to CAPs through Qmedia***

References

Archer, A. L., & Hughes, C. A. (2011). *Explicit instruction—Effective and efficient teaching*. New York, NY: Guilford.

Baddeley, A. D. (1986). Working Memory. New York: Oxford University Press.

Brownell, M. T., Sindelar, P. T., Kiely, M. T., & Danielson, L. C. (2010). Special education teacher quality and preparation: Exposing foundations, constructing a new model. *Exceptional Children, 76,* 357–377.

Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction, 8,* 293–332.

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53,* 445–459.

Clark, R. E. (2009). Translating research into new instructional technologies for higher education: The active ingredient process. *Journal of Computing in Higher Education, 21*(1), 4–18. doi:10.1007/s12528-009-9013-8

Cognition and Technology Group at Vanderbilt. (1990). Anchored instruction and its relationship to situated cognition. *Educational Researcher, 19,* 1–10.

DeLeeuw, K. E., & Mayer, R. E. (2008). A comparison of three measures of cognitive load: Evidence for separable measures of intrinsic, extraneous, and germane load. *Journal of Educational Psychology, 100,* 223–234. doi: 10.1037/0022-0663.100.1.223

Deshler, D. D. & Schumaker, J. B. (2006). *High school students with disabilities: Strategies for accessing the curriculum*. New York, NY: Corwin Press.

Dexter, D. D., Park, Y. J., & Hughes, C. A. (2011). A meta-analytic review of graphic organizers and science instruction for adolescents with learning disabilities: Implications for the intermediate and secondary science classroom. *Learning Disabilities Research and Practice, 26,* 204–213. http://dx.doi.org/10.1111/j.1540-5826.2011.00341.x

Duffey, D., & Fox, C. (2012). *National Educational Technology Trends 2012: State Leadership Empower Educators, Transforming Teaching and Learning*. Washington, DC: State Educational Technology Directors Association (SEDTA).

Ebbers, S. M., & Denton, C. A. (2008). A root awakening: Vocabulary instruction for older students with reading difficulties. *Learning Disabilities Research & Practice, 23,* 90–102. http://dx.doi.org/10.1111/j.1540-5826.2008.00267.x

Edyburn, D. L. (2013). Critical issues in advancing the special education technology evidence-base. *Exceptional Children, 80,* 7–24.

Fletcher, G., Schaffhauser, D. & Levi, D. (2012). Out of print: Reimaging the K-12 textbook in a digital age. Washington, DC: State Educational Technology Directors Association (SEDTA). Retrieved from: http://www.setda.org/wp-content/uploads/2013/11/SETDA_Out_of_Print_FNL.pdf.

Fuchs, D., Fuchs, L. S., & Stecker, P. M. (2010). The “blurring” of special education in a new continuum of general education placements and services. *Exceptional Children, 76,* 301–323.

Hallahan, D. P., Kauffman, J. M., & Pullen, P. C. (2015). *Exceptional learners: An introduction to special education* (13th ed.). Pearson: Boston, MA.

Kennedy, M. J. (2013). Multimedia instruction: The runaway train that spontaneously changes direction and speed. *DLD New Times, 31*(3), 1–3.

Kennedy, M. J., Aronin, S., Newton, J. R., O'Neal, M., & Thomas, C. N. (2014). Creating multimedia-based vignettes with embedded evidence-based practices: A tool for supporting struggling learners. *Journal of Special Education Technology, 29*(4), 15–30.

Kennedy, M. J., Deshler, D. D., & Lloyd, J. W. (2015). Effects of multimedia vocabulary instruction on adolescents with learning disabilities. *Journal of Learning Disabilities, 48,* 22–38. doi: 10.1177/0022219413487406

Kennedy, M. J., & Ihle, F. M. (2012). The old man and the sea: Navigating the gulf between special educators and the content area classroom. *Learning Disabilities Research & Practice, 27,* 44–54.

Kennedy, M. J., Kellems, R. O., Thomas, C. N., & Newton, J. R. (2015). Using content acquisition podcasts to deliver core content to preservice teacher candidates. *Intervention in School and Clinic, 50,* 163–168. doi: 10.1177/1053451214542046

Kennedy, M. J., Thomas, C. N., Meyer, J. P., Alves, K. D., & Lloyd, J. W. (2014). Using evidence-based multimedia to improve vocabulary performance of adolescents with LD. *Learning Disability Quarterly, 37,* 71–86. doi: 10.1177/0731948713507262

Lenz, B. K., & Hughes, C. A. (1990). A word identification strategy for adolescents with learning disabilities. *Journal of Learning Disabilities, 23,* 149–163. http://dx.doi.org/10.1177/002221949002300304

Lu, R., & Overbaugh, R. C. (2009). School environment and technology implementation in K–12 classrooms. *Computers in the Schools, 26,* 89–106.

Mastropieri, M. A., Scruggs, T. E., Graetz, J., Norland, J., Gardizi, W., & McDuffie, K. (2005). Case studies in co-teaching in the content areas: Successes, failures, and challenges. *Intervention in School and Clinic, 40,* 260–270.

Mayer, R. E. (2008). Applying the science of learning: Evidence-based principles for the design of multimedia instruction. *American Psychologist, 63,* 760–769. doi:10.1037/0003-066X.63.8.760

Mayer, R. E. & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology, 100,* 380–386.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). New York: Cambridge University Press.

McKenzie, R. G. (2009). Elevating instruction for secondary-school students with learning disabilities by demystifying the highly qualified subject matter requirement. *Learning Disabilities Research & Practice, 24,* 143–150.

Njenga, J. K., & Fourie, L. C. H. (2010). The myths about e-learning in higher education. *British Journal of Educational Technology, 41,* 199–212. doi: 10.1111/j.1467-8535.2008.00910.x

Paivio, A. (1986). *Mental representations: A dual coding approach*. New York: Oxford University Press.

Perlman, C. L., & Redding, S. (Eds.). (2011). Choosing and implementing technology wisely. In *Handbook on effective implementation of school improvement grants*. Lincoln, IL: Academic Development Institute.

Reed, D. K. (2008). A synthesis of morphology interventions and effects on reading outcomes for students in grades K-12. *Learning Disabilities Research & Practice, 23,* 36–49. doi:10.1111/j.1540-5826.2007.00261.x

Scruggs, T. E., Mastropieri, M. A., Berkeley, S., & Graetz, J. E. (2010). Do special education interventions improve learning of secondary content? A meta-analysis. *Remedial and Special Education, 31,* 437-449.

Smith, T. S., Manuel, N., & Stokes, B. R. (2012). Comparisons of high school graduation rates of students with disabilities and their peers in twelve southern states. *Learning Disabilities: A Multidisciplinary Journal, 18*(2), 47–59.

U.S. Department of Education, Office of Educational Technology. (2010). *Transforming American education: Learning powered by technology*. Washington, DC: Author.

Xin, J. F. & Rieth, H. (2001). Video-assisted vocabulary instruction for elementary school students with learning disabilities. *Information Technology in Childhood Education Annual, 1,* 87–103.