TEACHING STUDENTS WITH AUTISM SPECTRUM DISORDERS: TECHNOLOGY, CURRICULUM, AND COMMON SENSE

By

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ABSTRACT

Autism is a spectrum of disorders which comprises Asperger's Syndrome, Pervasive Developmental Delay – Not Otherwise Specified (PDD-NOS), Rett's Syndrome, Childhood Disintegrative Disorder, and Autistic Disorder. It affects 1 in 110 children (Center for Disease Control and Prevention, [CDC], 2011), and it is a complex neurological disorder that is characterized by impairments in communication/language, behavior, and social interaction. The individual with ASD may have mild to severe impairments in one or more of the areas listed above. This makes it difficult to meet their needs, and it provides educational challenges. This manuscript explores the role of technology, curriculum development, and common sense in educational planning for individuals in the spectrum.

Keywords: Autism Spectrum Disorders, Technology, Curriculum, Education.

INTRODUCTION

According to the Center for Disease Control and Prevention (CDC, 2011), the number of children diagnosed with Autism Spectrum Disorders (ASDs) is 1 in 110. This may be attributable to criteria broadly specified in the DSM-IV-TR (APA, 2000), increased awareness because of public service announcements and information disseminated through the World Wide Web, and more or better reporting capabilities. The cause of ASD is unknown; researchers continue to explore biomedical, environmental, and genetic factors that may be responsible (Ratajczak, 2011).

Is Autism Spectrum Disorder (ASD) a Recent Category of Disorders?

No, ASD is not a recent category of disorders. In 1911 the term autism was coined by a Swiss psychiatrist named Eugen Bleuler who pioneered treatments for adults with schizophrenia. Bleuler's term, autism, comes from the Greek words autos (self) and ismos (condition), which means highly self-absorbed or drawn inward (Autism Epicenter, 2008-2011). Thirty-three years later, the work of two other researchers rose to prominence. In 1943, Austrian physician Leo Kanner used the term "early infantile autism" to describe children who displayed self-absorbed characteristics. He classified the characteristics of the children he studied as a syndrome (Chesney, 2011). In 1944, Kanner's contemporary, a pediatrician in Vienna named Hans Asperger, wrote Autistic Psychopathy in Childhood. Asperger used the term autism and expanded it by documenting the exceptional abilities he witnessed in children he observed. Asperger's work was not translated into English until 1991 by Dr. Uta Firth; it appears that both he and Kanner were describing the same phenomenon even though they were separated by thousands of miles (Harris, Durodoye, & Ceballos, 2010; Long, 2007).

The person with ASD may have co-morbid conditions that make the traditional educational setting challenging. A diagnosis of ASD may be accompanied by a learning disability, an anxiety or sleep disorder, visual processing problems, seizure disorders/epilepsy, problems processing sensory information, gastrointestinal issues, and motor skill difficulties. In addition, short-term memory deficits, difficulty managing time, problems transitioning between activities, Attention Deficit Disorder (ADD), or Attention Deficit Hyperactivity Disorder (ADHD), deficits in executive functioning, aggression, and inconsistent academic, social, and emotional development may also accompany the diagnosis (Bregman, 2005; National Autism Center, 2009).

Individuals with autism are a heterogeneous group and they vary greatly in the amount of impairment they have in communication, social skills, and behavior (stereotypical, restrictive and/or repetitive). A "One size fits all" classification is definitely a misnomer, and it is common for an individual in the autism spectrum to have normal or average intelligence. Some individuals possess skills that make them a genius in a narrowly defined area which relies on memorization, pattern recognition, computation, musical, or artistic talent. Others are borderline in their intellectual capability and some are intellectually disabled. This variation makes Autism an extremely complex spectrum of disorders with no easy answers or fixed solutions (Lord, Cook, Leventhal, & Amaral, 2000). Even though there are no fixed solutions, the application of technology, curriculum planning which considers the needs and issues of individuals with autism, and common sense approaches which acknowledge and leverage the user's strengths are critical tools for successful educational outcomes.

Technology and ASD

There are many different types of technology that can be used to help autistic learners observe appropriate behavior and social interaction, gain academic skills, and communicate. Some applications of technology gaining momentum include video modeling, virtual reality, and augmentative communication devices. Video-modeling (VM) is technology-based strategy supported by a body of evidence (National Autism Center, 2009). It allows an individual with autism to observe visual sequences, procedures, and social interactions and learn those procedures and appropriate forms of behavior and communication. It is a visual form of training that has been used to teach autistics a variety of social, procedural, and functional skills. Video sequences can be captured on a flip video camera or more expensive device and displayed on an iPod Touch, iPad, laptop computer or DVD Player. Video Modeling stems from Bandura's Social Learning Theory; learning takes place when behaviors, attitudes, and actions of respected models are observed. Individuals with ASD may have poor eye gaze, limited social interaction, few verbal initiations, poor joint attention, and limited imaginative and pretend play skills. Video modeling has been used successfully to increase skills in these and other areas: emotional perception, play skills, conversation, social communication, spontaneous requesting, social initiation, and perspective taking (D'Ateno, Mangiapanello & Taylor, 2003; MacDonald, Clark, Garrigan & Vangala, 2005; Nikopoulos & Keenan, 2007; Owen-DeSchryver, Carr, Cale & Blakeley-Smith, 2008).

A virtual environment (also known as virtual reality) is an emerging technology in the field of pediatric rehabilitation; its ability to present realistic settings and training scenarios makes it ideal for autistic learners. According to Parsons, Rizzo, Rogers, and York (2009), virtual environments have many advantages: strong visual presentations, systematic control over real-world scenarios, the ability to capture detailed performance data, user control, and the fact that children with ASD find visual technology and the control over it highly appealing. The findings in the literature on children with ASD and VEs are as follows: VR supports individualized learning; desktop VEs can be used for longer periods of time than immersive VEs; and visual representations and stimulus control are beneficial to learners with ASD. A growing number of researchers are building and investigating this type of technology because it provides vestibular stimulation, generalization, and repetition (Hetzroni & Tannous, 2004). Several researchers have indicated that VR is a promising application of technology because of its incomparable control over the environment, its ability to promote learning and generalization, the ability to gradually introduce and remove distracting stimuli, and its high degree of realism for teaching skills that may contain an element of danger (i.e., safety training, pedestrian crossings, etc.) (Goldsmith & LeBlanc, 2004; Schmidt & Schmidt 2008). As technology advances and costs decrease, lower-cost virtual environments may become widely available.

Augmentative and alternative communication (AAC) devices have been used to help individuals with communication impairments due to autism, cerebral palsy, strokes, and other disabilities. AAC devices

supplement or replace speech and writing when these skills are temporarily or permanently impaired. AAC can include gestures, sign language, facial expressions and even complicated computer systems with synthesized speech. Simple non-electric devices that allow users to select letters or pictures that represent their needs, desires or activities are known as low-technology AAC devices. The user's options are selected from boards or books, and individuals can use eye gaze, head or mouth pointers if they have physical limitations. Other more complex high-technology AAC devices store and retrieve electronic messages, synthesize and provide voice output (Glennen & DeCoste, 1997). They include display devices with changeable symbols. "High-Tech" AAC devices can be expensive: DynaVox, LightWRITERs, SpringBoard, and Pathfinder. As technology evolves, the communication applications have become programmable on the iPod Touch, iPhone, and iPad, offering users a more affordable solution. Several AAC applications like Proloquo2Go, iCommunicate, iConverse, Look2Lean, TapSpeak Button, and others are available.

AAC devices use a variety of symbols; professionals working with families must understand the meaning of the symbols within the cultural context of the family. Symbols vary in meaning across cultures. Cultural and linguistic background impact the use of AAC devices (Trembath, Balandin, & Rossi, 2005). Programming a "thumbs up" symbol on an AAC device in American and European cultures means OK, but the same symbol is rude and offensive in Islamic and Asian Cultures. Using the hand in a upward position in American and British cultures means stop or halt, but in Singapore or Malaysia, the same symbol can mean that you are trying to get the attention of someone (a waiter or other service provider), or you are asking for permission to speak. Hence the importance of family input and cultural sensitivity is needed when symbols are programmed on AAC devices.

Other Useful Technologies

Technology is a powerful force; it can liberate, connect, provide access, increase productivity, and support learning. Several applications of technology in Autism Research facilitate data collection, analysis, and intervention planning: systems for data collection, video for monitoring behavior and social skills development, electronic data transmission to professionals, and more. Goodwin (2008) discusses a variety of technology applications that can assist individuals with Autism, practitioners, and researchers:

Communicating Behavior to Health Professionals

- http://www.caringtechnologies.com/bicapture

Learning About Emotions

- http://autismresearchcenter.com/books/dvdvideo.asp

Skill Generalization and Instructional Aids

- http://dotolearn.com/

Research and Implementation

- http://www.IANproject.org

Speech Recognition, Synthesis and Voice Transformation

- http://www.cslu.ogi.edu/projects/researchprojects.html

Autism Speaks – Innovative Technology for Autism (ITA)

- http://www.autismspeaks.org/science/research/initiatives/ita_initiative.php

Some additional applications of technology include the following: listening centers, reading software, e-books, online comic strip conversations, writing and typing software, CAI for mathematics and vocabulary acquisition, talking calculators, talking photo albums (steps in a process, recognition of facts, places, people, emotions), software for emotional recognition, instructional software for academic enrichment, distance learning courses, card readers and recorders, personal digital assistants (PDAs), mobile phones, customizable overlays for computerized input, Nintendo DS (math and reading games), virtual reality (Reaction Grid and Second Life for older learners), and others. When technology tools match desired learning outcomes, they provide the opportunity to teach content in more engaging, more interesting, and more visually appealing formats.

Technology and Learners with ASD

Methodology

Students ages 4-12 were recruited to attend a special technology lab (http://tara.unt.edu) to use software and hardware and interact with other children. The students attended the lab during spring of 2010, and they used a variety of software packages and tools. Their reaction to software packages, preferred features of software, and use of technology at home was gleaned from interviews with their parent. Each student attended the lab for 2.0 to 3.5 hours each week during the semester.

Findings from the TARA Lab

Five students (3 female & 2 male) between the ages of 8 and 12 with similar characteristics participated in this study. The students had a primary diagnosis of Autism, and each had academic and social skill deficits. The most common academic problems reported were reading comprehension (80%) and mathematics – division problems (80%). The students' most commonly reported social skill deficits were developing relationships with their peers (80%) and understanding the concept of friendship (80%). A mixed-method design with a purposive sample was used in this study. Parents were interviewed, and they filled out a survey designed to collect data on their child's academic and social skills problems. The survey contained demographics, family history, the child's educational history, medical information, information on private services the child received, and information on the child's technology use at home.

All five children used technology at home (including e-Books, Nintendo DS, Wii, and Laptop Computers with Internet access & home schooling curriculum); the most frequently used software packages reported by parents were Math Whizz (Whizz Education), Mavis Beacon Keyboarding Kidz (Broderbund), Type to Learn 4 (Sunburst Digital), JumpStart World & Jumpstart Games (Knowledge Adventure), Destination Math (River Deep), Click n Spell (ClickN KIDS), Where in the World is Carman Sandiego (The Learning Company), Disney's Aladdin Chess Adventures, and Super Mario Bros (Nintendo). The most frequently used online resources and games reported by parents included BrainPOP (FWD Media), streaming videos from Nova (PBS Series) and the Discovery Channel, Magic School Bus Games (Scholastic), and Digi Games (Dress Up 121.com). The parents also provided information on why these resources and games were appealing to their children. Interestingly, all parents reported that their children do not like repetitive or boring activities and games, and they lose interest quickly when they become frustrated or cannot grasp the rules of the games or control features of the software. According to the parents, their children absorb material completely if videos are used to explain content; they gain the most from the combination of visual and auditory information. The parents also reported that their children lose interest in games that become hard quickly and those that perform inconsistently.

As the children visited the lab each week, it was noted that they developed preferences for some of the software packages. Sixty percent of the children preferred Nickel Takes on Disrespect (Thinking Publications) and Nickel Takes on Stealing (Thinking Publications). Other favorites were Mini Mystery Readers (Remedia Publications), Read, Write & Type! (Talking Fingers, Inc.,) Words & Music (Topologika Software - Marion Broadie), and The Deciders Take on Concepts (Super Duper Publications). These packages had full screen presentations, vivid colors, realistic content, animation that could be invoked by the child, exaggerated characters, a combined audio and visual presentation, and a positive message. When the students visited the TARA Lab, several were hypersensitive (60%) and found some sounds in the software bothersome. The volume had to be adjusted or turned off to accommodate these students. When the students were asked what they liked about software, they responded with the following comments:

- "I just like them, and I want to do them in order." (This student went through each item in the programs, clicked animations to see what would happen, and remembered all the actions.)
- "Everything"
- "It's a fun game, and you can learn about not being disrespectful." (A student's comment on Nickel Takes on Disrespect (Thinking Publications).)
- "Shows problems [with the] right number at the right

time. This could be perfect for kids who struggle."

During some lab visits one student (20%) appeared impatient and frustrated when the software did not load quickly or perform as expected. This student was observed hitting her computer screen when the program was too slow and did not adjust to her settings. One student responded that the singing in one program was "kinda lame isn't it?" Fifty percent of the students had delayed reactions to questions asked of them while they were engaged with the software. Their answers came after at least 2-3 minutes after being asked, or they were asked the question a second or third time.

As students used software packages, common characteristics emerged. The features of software the students found appealing were:

- intuitive learning opportunities,
- short games without repetition,
- an adventure element,
- instructions delivered in both auditory and visual formats,
- animation initiated by the student,
- clear examples,
- variety, so activities do not become boring,
- easy to follow rules and program directions,
- gradual increases in difficulty of software, and
- entertaining video segments.

Curriculum Planning and Instructional Delivery for Students with ASD

Teachers and others working with individuals in the spectrum should plan curriculum with an instructional support tool kit. This kit should include technology and strategies to improve educational outcomes: hands-on activities and materials, frequent breaks, opportunities to assess skill level, choice, visual support, and repetition. Instructional delivery will be more successful if it includes an awareness of sensory issues, direct language, positive reinforcement, learner attention, and TOM (Theory of Mind).

Strategies for an Instructional Support Tool Kit.

Curriculum design should begin with instructional objectives and an analysis of the needs and capabilities of the learner. This information is usually found in the IEP (Individualized Education Plan) of learners with ASD. The IEP is a legal agreement between the family and school system for students who have qualified for special education services. IEPs should contain measurable goals that should be accomplished within one year; the progress a student makes toward accomplishing his or her educational goals should be monitored and reported to the parent or caregiver. A team of professionals including parents, the school counselor, the school psychologist, the student's teacher, and others construct the IEP (Friend, 2006; Lytle & Bordin, 2001). Clearly defined evaluation criteria, descriptions of services provided, benchmark measures, and specific dates for services should be included in a student's IEP (Lytle & Bordin, 2001; Yell, Katsiyannis, Drasgrow & Herbst, 2003). The IEP can be a valuable resource for teachers and others planning curriculum. Once the instructional goals and student capabilities are known, a task analysis can be performed to break the instructional objectives into component parts. Once the parts are well understood, the student can be taught specific tasks using an instructional support tool kit. This is a series of strategies to support the learner with ASD as he or she approaches novel problems and attempts to master IEP goals. During instruction, students should engage in hands-on activities as much as possible. Their learning should involve active engagement and multi-modal (kinesthetic, auditory, and visual) activities that help them build a foundation for future learning. All of these elements can be found in instructional software. Computer games can also be used to support learning, teach new content, or provide students with a much needed break. Students with ASD need frequent breaks as they matriculate through learning activities. Breaks give them time to process and understand content, decompress, and relax from any stress caused by learning a new task. As they process new information, their skill level needs to be reevaluated. If they are successful, they should move to a more complex task.

If, however, they are unable to master the task, it should be simplified and they should receive assistance to complete the task rather than escape.

Choice, where possible is a good thing. If learning outcomes can be accomplished independently, students will perform better if they can select the order of activities or choose the activities in which they engage. During visits to the TARA Lab, students had the choice of several activities and software programs, and they chose the order of activities. That type of shared control engendered cooperation, provided comfort, and made students want to return to the Lab. Visual support is critical for sustaining interest and providing opportunities for improving learning. Pictures and computerized demonstrations of procedures, routines, schedules, problem-solving activities, and instructional objectives help learners understand both the content and context for learning. Lastly, the instructional tool kit for learners with ASD should contain many opportunities to practice activities and rehearse. Using these strategies to plan curriculum is the first step toward creating a positive learning environment for individuals with ASD. The next step is skilled instructional delivery that considers the special needs of learners in the spectrum: sensory issues, direct language, positive reinforcement, learner attention, TOM (Theory of Mind).

Instructional Delivery and ASD - Sensory Issues

Learning situations can be difficult for students with ASD, because many have sensory integration dysfunction. They may have a hypersensitive (over-active) or hyposensitive (under-active) sensory system. The hypersensitive student may avoid touch and hear lights humming, coughing, other children talking, the A/C, the pencil sharpener, and the teacher talking simultaneously and have difficulty filtering these sounds. The smell of glue, playdoh, markers, and lunch being prepared in the cafeteria might be enough to make the student with ASD uncomfortable, ill, or even unresponsive to instruction. The hyposensitive student may seek out stimulation by touching objects or seeking deep pressure. Sensory issues can hinder participation and prompt inappropriate behavior. The author visited a classroom and saw a child in the spectrum cringe and refuse to write information displayed by an overhead projector. His facilitator told me, "he can see that, his eyes are not as old as mine." How does she know what that child can see? She cannot view the world through his eyes. She thought he was being obstinate. As it turns out, the child had visual issues that made it difficult for him to view and write projected information. We must make an effort to be aware of the educational environment and the items that may cause over-stimulation in learners with ASD. Consultation with an Occupational Therapist and other professionals can identify special sensory challenges and provide activities which lessen the student's discomfort.

Instructional Delivery and ASD - Use Direct Language.

In addition to an awareness of sensory issues, we must communicate with the student in simple and direct terms. Slang, sarcasm, colloquialisms, and jokes are not well understood by the individual with an ASD. Clear, direct language is more effective. Telling a student to turn in homework is vague and unclear. Telling a student with ASD to put his finished papers in the green box on your desk is less vague. Saying I have had it, we will call it a day is also unclear. A better statement might be we will stop now. Short, simple statements are better than detailed instructions. This advice is relevant for software as well. Instructions presented to orient the user should be short, simple, and visually presented. After providing clearly stated auditory instruction, a brief review is in order to make sure the learner understands what is required. Many students with an ASD have auditory processing delays, and it may take them more time to comply with requests.

Instructional Delivery and ASD - Use Positive Reinforcement

Individuals with ASD need to be rewarded for their efforts to behave appropriately, integrate, engage, and overcome their many challenges. Praise, checkmarks, stickers, the use of technology, and opportunities to engage in preferred activities are all examples of positive reinforcement. Pleasant and affirming rewards selected by the learner reinforce desired behaviors and motivate students to repeat the behaviors. Reinforcers should not

be overused, and they should be changed as the student changes; this way they will remain effective.

Instructional Delivery and ASD - Gain and Maintain Attention.

Always get the student's attention before asking him/her to complete a task. Face the student and tell him/her what you want in simple and direct language. Follow that with a check for understanding to make sure the student knows your expectations (Zager & Shamow, 2005). It is critical to gain the student's attention, and give the student time to process your request. They typically have no problem executing, but they do need extra time to process and respond to language.

Instructional Delivery and ASD - Understand Theory of Mind (ToM)

"He just won't leave her alone, and she told him to stop!" An angry guidance counselor aware that the male student had ASD did not understand Theory of Mind in the quote above. The 3rd grade male with ASD kept "bothering" a little girl in his class. Bothering was the term the guidance counselor used; she did not understand that the male student was not purposefully trying to agitate or harm his classmate. He had no idea that his classmate had different desires, opinions, feelings, and interests from his own. He wanted to engage in a task, and he simply did not understand that his classmate wanted to do something different. Individuals with ASDs have deficits in their ability to understand another's intentions, reciprocate socially, and understand the effects of their behavior on another. Simon Baron-Cohen co-authored the first research study documenting deficits in ToM in children with Autism. He first used the term mind-blindness to help us understand that individuals in the spectrum may not gather enough information (from social and environmental queues, emotions, gestures, facial features) to help them develop an awareness of what another person might think, want or feel. The young man in the example could not put himself in his classmate's shoes or view the world from her eyes. His own lenses were the only vantage point he could use to assess the situation. Software packages can help – facial recognition programs like MindReading and iPad/iPod Touch applications like Emotion X can be very useful tools to support the recognition of emotions and the development of ToM.

Using Common Sense in Learning Environments with Learners with ASD

Learners with ASD are unique, and they require patient, guided instruction that minimizes their skill deficits and promotes their independence. Practical, everyday wisdom (common sense) should be used effectively to select support staff and deal with meltdowns.

Qualified Support

When selecting support staff for individuals with ASD, education and experience should be prerequisites. Untrained paraprofessionals can impede social skill development and acceptance, create confusion, and promote overdependence (Zager & Shamow, 2005). The experienced professional or paraprofessional should spend time with the child and his/her family and learn as much about the child as possible. An understanding of the child's current reinforcers, non-preferred activities, language and academic skills is critical. The individual supporting the child should know how to collect data on the child's performance and modify the environment to help the child succeed. Para professionals in this role must be well trained; they should be an advocate for the child, a coach when necessary, a mentor, and a facilitator. They should work with families and members of the school staff develop the child's language skills and social relationships with peers. At stressful points in the child's school day (recess, lunch, transitions to and from special activities like music, art, and school sponsored events), the facilitator should provide a safety net of assistance, encouragement, and reassurance. The individual supporting the child should build his/her confidence, promote as much independence as possible, provide structure and routine, help the child develop cognitive flexibility, assist the child with difficult tasks, and reduce the child's anxiety and sensory overload. Strong systems of support neutralize the isolation, anxiety, and depression of those with ASDs (Brewin & Renwick, 2008; Marshall, 2002;

Muskat, 2005; Rayner, 2005).

Meltdowns and their Meaning

The behavior of an individual with ASD can be absolutely explosive at times. It is tantrums times ten. Depending on the child, these explosive outbursts can include kicking, hitting, and even fighting. Sometimes these can be averted, if their signs are noticed. The only way to discover the signs is to talk with parents/caregivers, and observe the child closely. If the child is verbal and able to tell you the things that make him/her angry or upset that is a start, but that may not be the case. Sometimes physical or psychological factors trigger a meltdown. Some of the more common signs can be rubbing eyes, loud repetitive language, a demonstration of confusion, tearing, picking hands or nose, crying, kicking, or disengagement. When the signs are observed, simplify the task, reduce the demand, and help the student complete the task. Do not allow the student to escape the task, because the student may learn that he/she is allowed to escape a non-preferred task by exhibiting the signs of a meltdown. Children in the spectrum can learn the wrong things from our reactions to them; do not reinforce behavior that is undesirable.

Meltdowns can have many sources. Some of these include: hunger, fear, isolation, remembering an unpleasant event, over-stimulation, frustration, exhaustion, chemical imbalance, mistreatment, inability to communicate, and others. Some meltdowns can be triggered by demands that push the individual beyond their level of competence and capability. Making sure prerequisite skills are in place, providing support, and scaffolding new information to what is currently known can make sure students are not pushed beyond their capability.

If you cannot divert a meltdown, work through it with the student. Remain calm and patient and keep a low to moderate tone of voice. Realize that the child is having a difficult time, and he is not trying to hurt or threaten you. It is not about you at the moment, and your reaction can extend, heighten, and escalate a bad situation, or it can help diffuse the situation. Try to redirect the student to activities that take his mind off the meltdown, and prepare for it to "run its course." Meltdowns are not teachable moments; they are just times to endure with patience and resolve. Do not try to teach content or reason with the student. This is not the time! The student's primitive instincts take over, and flight or fight may occur.

Conclusion

The most successful instructional environment for individuals with ASD will be those that recognize and celebrate diversity, preserve the student's dignity, make appropriate accommodations after a careful review of the IEP, set reasonable and progressive standards, and foster a positive attitude (Kluth, 2003). The student with ASD will need technology tools that are engaging, intuitive, offer visual and auditory instructions, and present content that gradually increases in complexity. An instructional tool kit of strategies and technology tools can help improve the quality of the learning environment, and common sense approaches for selecting qualified support for the student and dealing with meltdowns can assist the student with ASD. Use technology tools as often as possible to help learners with ASD accomplish the desired learning outcomes, because according to one TARA Lab Attendant "technology helps kids with things they're not good at, so they can keep practicing."

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