Assistive Technology Resources for Children and Adults with Disabilities

Closing The Gap

Solutions

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Instructional Method:

Teaching Scanning to Beginning Communicators with Complex Access Needs- Expand Vocabulary and Grow from Low Tech to High Tech

This article is written to be one instructional method to consider when working with emergent communicators who require scanning. It does not need to be used exclusively, and thus can be combined with other instructional methods simultaneously. The inspiration for this as a discussion point is due to the frequency with which I have seen well-intended professionals implement emergent scanning instruction utilizing methods that do not take a growth mindset.

Therefore their users are not truly learning how to scan through vocabulary sets to access robust vocabulary, but more so are only presented with word choices, limited to the switch(es) they can access. Thus their access to vocabulary is significantly limited, which ultimately affects participation and language growth. (Example: One switch says "go" whereas another says "stop" to allow the user to direct action during an activity. However those are the only accessible words as they are housed on the two switches the student can access.) Whereas teaching scanning can allow for access to limitless vocabulary by teaching how to scan through vocabulary arrays, and thus is a skill that can grow to a functional communication endgame.

Let's talk more about this!

BUT FIRST- A LITTLE BACKGROUND ON SCANNING TO GROUND US…

Please note: This article picks up after access points have been established, and after considering and rejecting exhaustive direct selection access methods. Thus it was determined that scanning is the best access method for the individual. I strongly recommend coordination with an Occupational and/or Physical Therapist or other specialist to support determining where the client has volitional movement for cause/effect access as the overall first step.

Scanning is defined as *items in the selection set are presented sequentially over time and the user makes a selection indirectly, typically via one or multiple switches*.

Often scanning utilizes either *auto scanning* or *step scanning*.

- Auto Scanning is when the vocabulary items are automatically presented to the communicator, at a predetermined rate, for the user to then interrupt the scan to communicate their message.
    - This typically requires a single switch selection, and you can almost think of that user response as being *"yes, that's it"* OR *the picker*.
- Step Scanning is when the user is able to step through or control the movement of the scan, and the system does not automatically move through the choices.
    - This typically requires access to multiple switches (or ability to vary your switch access holds or recipes), and you can think of this as requiring the user to have a response of "*no, not that*" OR *the mover* as well as the "*yes, that's it*" OR the *picker.*

TESSA HECKEL MS CCC-SLP. Cooperative Educational Service Agency (CESA) 8 AT/AAC Consultant and Lead SLP. I am a Speech and Language Pathologist with over 12 years of experience working as an Augmentative and Alternative Communication (AAC) Specialist working with children and adults with a wide range of abilities and complex communication needs. I have provided AAC-related services in a variety of settings, and now directly with school districts throughout Northeastern Wisconsin and throughout the state. I believe in approaching services with a growth mindset, keeping it authentic and fun, and all while remembering that communication at its core is about human connection.

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I'd also like to note here, that it is my opinion that one scanning method should not be viewed as more advanced or superior to the other. Appropriate scanning selection method should be determined based on which supports the most ACCURATE and EFFICIENT means to retrieve target vocabulary as the main criterion.

There are various motor and sensory considerations to consider when selecting an appropriate access method. *We won't get too in-depth into this, but will give a very abbreviated overview of some of the main descriptive generalities of each scan type. Please know that these types of scanning and characteristics are not exhaustive.*)

- Auto Scanning requires timing/initiation skills (i.e. user needs to be able to hit the switch consistently within a designated 'wait time' period to select a choice.) Potential barriers to being successful with auto scanning include: apraxia of movement (i.e. difficulty initiating) or may be difficult if the user needs increased visual or auditory processing time.
- Step Scanning does not require timing or an interruptive response. (i.e. user is in control of timing and moving on to the next choice within the scan.) A potential barrier to successful step scanning is that this will require overall more selections and/or refinement of motor movements, so may be more fatiguing and/or require varying motor initiations and/or access points.

NOW LET'S TALK ABOUT TEACHING SCANNING…

Please note: I often choose to start with some level of instruction of scanning being conducted via a partner assisted method, outside of tech-based scanning systems.

WHY?

This is because the human element is not only natural and connection-focused, but more so because we can make inferences of attempts, provide constructive feedback, help teach/shape responses, and are overall "more forgiving" than technology for new learners.

I will indeed typically choose to pair this instructional method with allowing the user to have access to explore a tech-based scanning system for the wealth of knowledge that can come with experiential learning concomitantly to this method that I will describe below. In addition, please recognize that although partner assisted scanning is a part of the instructional method being described, independent access to a robust communication system is indeed the end goal. This approach seeks to highlight how starting with this method does indeed start with a skill instruction that can grow towards that independent access to a robust communication system.

PARTNER ASSISTED SCANNING INSTRUCTIONAL METHOD:

Set-Up:

I will often start with voice output switches that are programmed with a "yes, that's it" (or something similar) and a "no, not that" (if two switch step scanning was deemed the appropriate scanning method to utilize with my user.

- The YES is then your PICKER
- The NO (or an absence of a yes within a designated time period if auto scanning) is then your MOVER

Set-Up Tips to consider:

- Tone of voice often is impactful and should match output.
- Symbols and color coding on switches to support identification is often recommended, especially initially.

Implementation:

1. Present Vocabulary Choices (may be concrete referents)

-Label vocabulary choices (so student isn't waiting for something not available in present vocabulary set- as we understand with presuming competence, the student may be thinking or wish to communicate something different).

-Remember, this is a bridge towards the end goal of a robust communication system.

-Often the communication function of requesting can be highly impactful for cause/effect correlative learning to start, and an easy jump from cause/effect switch activation that may have been previously targeted.

-However requesting should not be the only function taught or elicited ongoing.

-Presenting actual objects, demonstration of use, and allowing exploration of items/interactions can aid in teaching vocabulary and for immediate reinforcement as individually required.

-Presenting symbols with objects can support symbolization skills for the future as well.

-Highly motivating items/actions/interactions to start (win-wins) are typically encouraged at this introductory stage.

2. Let the user move towards or indicate either: "yes" or "no" switch/response.

-Sometimes prompting hierarchy cues and models may be needed to support access or learning switch locations/activation means.

-Extensive facilitator modeling without expectation is another strategy to aid in learning.

-Every move counts! Interpret meaning, respond, reinforce effort and all forms of communication, yet assist when appropriate to support access to switch.

Why?

-The switch messaging is concrete (no partner interpretation needed or subtle cue reading) and will help global comprehension of communication intent across familiar and unfamiliar partners.

-Utilizing a switch (even when we know the communication

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intent) is a skill that supports growth towards independent equipment utilization in the future. (…as a piece of high tech equipment, no matter how sophisticated, likely won't be able to pick up on those subtle twinkles or telling smirks like we can!)

3. Respond appropriately.

-If "no/mover" is selected- offer the next item from the choices initially presented. (You are the "scan".)

-When "yes/picker" is selected, respond to that communication your user provided. (And maybe even happy-dance!)

Implementation Tips to Consider:

- You may need to work with seating and positioning specialists to ensure optimization of motor control for access.
- Be consistent with the time that you wait between scans (especially with auto-scanning with only "yes" response.)
    - Consistency helps the child to learn what is expected and within what time frame. This then can directly translate to an SGD scan timing.
    - Sometimes I even tap or audibly mark the time for more explicit feedback.
- Give meaningful and specific feedback, especially with auto scanning.
    - Example: "You stayed quiet and did not hit the switch. You might be thinking, 'no, not that'".
- Once the child is consistent with "win-win" vocabulary requesting with a level of consistency for responding (attesting that they understand the expectations and the cause/effect correlation of their communicative responses), you can move towards "win-lose" scenarios to increase complexity and to almost give authentic "targets". (Although we never truly know the "target" of someone's communication until robust communication is available.)
    - This could be requests for a highly desired item/action ("the win") with an undesirable or less desirable item/action ("the lose").
    - This helps to increase attention to selections to support communicative intent.
- Always reinforce whatever is communicated- even if you think it is "off". This is how we all learn!
- What if "no" is continuously selected?
    - I first usually try to set expectations of picking a choice from those presented, and begin scanning through choices again until "yes" is selected.
    - Sometimes I also add a "something different" to the end of the scan.
    - If nothing is selected, I model selecting yes and reinforcement for such.
      Note: With introductory partner assisted scanning methods such as this, it is not possible to provide all possible vocabulary options- as we aren't using a robust system YET. Presenting the options/choices first hopefully helps with reducing this up front. However, I always just try to validate any discernible gestural or other communication and do my best to respond respectfully.

<u>Variations in Implementation to Further Support Growth:</u>

- Similarly structured partner assisted scanning methods can be used with low or mid tech arrays to expand to varying vocabulary (i.e. verbs, core, attributes, etc) and icon/symbol exposure.
- You can scan pages within an existing Speech Generating Device (SGD) software so the student gets exposure to all the aspects of that high tech system, but still receives the benefits of partner support that partner assisted scanning can provide. Note: This could also be a system we ensure they are getting independent exploration or use time as well for consistency and experience with independent tech operation. Or in some cases, multiple systems could be explored and trialed to support feature matching.
- Increased symbol recognition (with adequate vision/visual attention) can result in decreased auditory labeling or cues while scanning. Could start to group scan as well with or without auditory cues (dependent on sensory needs, of course).
- This system can also be used for expanding language and we could introduce groupings such as CATEGORIES or ASSOCIATIONS (which is necessary for SGD navigation, which is an operational feature of AAC competency). Example: "Do you want a TOY or do you want to EAT?" -Then present choices that would fall within that category.
- Can work on various scan patterns (ie. row column, block, etc).

<u>Frequently Asked Questions:</u>

- Why don't I just label each switch as one of the actual choices instead of the "yes/want/that's it" and "no/not that"?
    - We are trying to teach a skill (scanning) that can grow to access robust communication systems. Even if we only have two choices today, this is laying a foundation for listening/viewing scanning and selecting from future endless choices which essentially requires this "yes/picker" and "no/mover" skill.
- Will I always label the switches with voice output?
    - Likely not, but it can be great feedback to cue selections and label their function to aid in that initial learning.
- When can I introduce robust (often technology-based) vocabulary systems?
    - There are no prerequisites and you do not need

to wait for any level of mastery to start this introduction. Access to robust systems and explorative learning with natural responses is also a powerful teaching/learning tool.

- The method presented explains one simple model for teaching introductory scanning as an access method for communication, often with kids or adults with the most difficult bodies who are emerging communicators.
- Partner assisted scanning can also be used to scan through any (robust) vocabulary systems/vocabulary arrays as well, and even concurrently with these access method teaching opportunities. It depends on the language and skills of the individual.
- In addition, much of what you are learning about the user's access needs using partner assisted scanning (ie. such as positioning, scan type, scan timing, switch location, debounce features, etc) can directly translate to access method interaction features of high tech dynamic display speech generating devices (SGDs). This gets you ahead of the game when you "plug those switches in"!
- *Remember- The goal of this instructional method is to teach the foundational skills of scanning to ultimately allow the user to obtain independent access to a robust AAC system. With what system a user will ultimately land on (or a combination of)- is always completely personalized to their own skills, needs, and preferences. This is simply an implementation tool in your toolbox to help work your user towards that end goal.*

Overall, utilizing this method, we created a scaffolded context for an emergent communicator to allow for informative feedback, user learning, and skill refinement which can directly translate to functional, communicative use with a variety of AAC equipment independently using scanning. We started our instruction with the end in mind… and in utilizing this growth mindset, we were able to lay a foundational scanning skill set which can be consistently utilized across no/low to high tech AAC methods. …And ultimately the power of scanning and the tools it can help access now and into the future are endless! ■

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What about Bin?

The Cognitively Demanding Task Matrix and Instruction for our Most Complex Communicators

When Bin came to the William E. Carter School in the fall of 2014, he was 13 years old. He was one of 25 students with severe and profound disabilities, entering one of our 5 substantially separate classrooms. Reports from previous teachers and schools, said "he could not do anything." He was described as unable to make any volitional movements.

Flash forward nine years to 2023. Bin is graduating from the Carter School. He is now functionally using a speech generating device via eye gaze interaction technology. For the first time, Bin is independently and accurately telling his mother that "Something is wrong" + "I need the bathroom." At home, Bin is directing his younger sister, "I want" + "to read a book". In the classroom, he is initiating communicative turns during topics of conversations. Bin is spontaneously repeating utterances to be clearly understood that he does "not like" slime and "no no no" does not want to touch it. He would rather have "something different." As a peer laughs uncontrollably, Bin navigates the side bar and reads the room. He comments and describes his friend's mood, "funny."

So how did we get here? From reflexive responses to advocating for himself and initiating conversations? We began by providing Bin with a variety of stimulating activities in order to look for one physical response, any response, to communicate. This is where we began using the Carter School Cognitively Demanding Task Matrix.

The Cognitively Demanding Task Matrix (CDTMatrix) is a tool we created to analyze teacher instruction. It is not an assessment of student performance. It does not analyze the cognitive levels of what the student can or cannot do. Rather, it addresses the context, conditions, and complexity with which we create our lessons, so that if a student gets "stuck" in their learning, we can change our instruction.

SARAH WAKABAYASHI M.S., CCC-SLP, is a speech language pathologist and an assistive technology consultant for the Boston Public Schools. She has over 27 years of experience working with students with complex communication needs. Ms. Wakabayashi is part of the team that developed the Carter School Cognitively Demanding Task Matrix, a tool to create explicit instructional programs for students with multiple challenges. This leadership team has presented at conferences including Closing the Gap, ATIA, and ASHA, as well as webinars for NHAT Connect and Don Johnston, Inc. Ms. Wakabayashi has also been a short-term faculty member at Emerson College. Email: swakabayashi@bostonpublicschools.org

KIMBERLY KULASEKARAN M. Ed., TVI, Kimberly Kulasekaran was recently awarded the 2021 Educator of The Year Award for the City of Boston. Kim is a teacher of students with complex needs at the Carter School in Boston, MA, where she has taught since 2009. She shares her passion with a team of dedicated colleagues who have a common vision, to provide a first class education to their students.

Kim helped lead her school's first literacy program and helped create the Carter School Cognitively Demanding Task Matrix – a tool for educators to use to develop cognitively demanding instruction for students who have complex needs, with a focus to increase their ability to communicate.

Kim also serves on the BPS/BTU Teacher Leadership Fund committee. Since 2017, Kim has helped educators across the district bring their creative and innovative ideas to life in order to create real change for the most marginalized students within the district. Kim is a Lynch Leadership Academy Fellow for the 2023-2024 school year. Email: kphillips@bostonpublicschools.org

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The original concept of the CDTMatrix was created in 2017 in response to a district-wide push to increase the cognitive demand of all instruction. Charged with finding a way to bring this initiative to the Carter School, lead teacher, Kimberly Kulasekaran and her colleagues analyzed and organized their current instruction by increasing levels of cognitive demand. Behavioral consultant, Debra McManus and Carter School principal, Mark O'Connor, joined in and finalized the CDTMatrix using principles from cognitive theory and behavioral science. We further developed our understanding of this tool with the support of our SLP, Sarah Wakabayashi. Today, we continue to find new and insightful ways to use the CDTMatrix to improve instruction.

WHAT IS THE COGNITIVELY DEMANDING TASK MATRIX?

The CDTMatrix (Figure 1) is made up of five levels of instruction. Each level takes concepts from behavioral and cognitive theory utilizing the notions of simple discrimination, stimulus control, response generalization, stimulus generalization and conditional discrimination (Cooper, et. al 2007; Saunders, et. Al 1989). Although this behavioral jargon initially intimidated some of our staff, we were committed to learning these concepts. Equipped with this terminology, we better understood how to systematically increase the cognitive demand of our instruction for our most complex students.

CDTMatrix	Level 1	Level 2	Level 3	Level 4	Level 5
Demand of the Student	The student is expected to make an intentional response.	The student is expected to make a *simple discrimination* under *stimulus control.*	The student performs a simple discrimination utilizing *response generalization* and/or *stimulus generalization.*	The student performs a *conditional discrimination* under stimulus control.	The student performs a conditional discrimination utilizing response generalization and/or stimulus generalization.

Figure 1: Cognitively Demanding Task Matrix, 2017.

Many of our Carter students are similar to Bin. They come to us at 13, 16, or even 20 years of age, with minimal communication skills, and a host of other medical, behavioral, cognitive, and physical needs. They often have had years of instruction, but are "stuck" in their ability to access, and learn new skills. For these students, we begin in much the same way we did with Bin. We use the CDTMatrix to identify and strengthen the student's intentional, indicating response. We then provide them with ample opportunities to use that response in increasingly complex ways. Our instruction never stays at just one level. Instead, our instruction moves across increasingly challenging levels of cognitive demand, so our students stay engaged and keep learning. Using the CDTMatrix, we aim to analyze where the breakdown is for our students who may not be progressing in their skills. It enables staff to find holes in their instruction – and how we can all better support our students' ability to progress in their learning.

Level 1
The student is expected to make an intentional response.

LEVEL ONE - INSTRUCTION AIMED AT DEVELOPING AND INCREASING AN INTENTIONAL RESPONSE

At Level One of the CDTMatrix "The student is expected to make an intentional response." The teacher provides external stimuli to elicit a student's volitional behavior. If no clear intentional response is observed, the entire team's job is to provide reinforcing experiences to stimulate a response.

For Bin, many sessions were spent, presenting him with various auditory, tactile, visual, or kinesthetic stimuli, using guidance from the sensory based approach of *Every Move Counts* (Korsten, 1993). We sat and observed Bin closely - watching for any responses, to anything. Does he intentionally move his hand, leg, foot, finger? Is there a way to work with or around his reflexive responses to increase his intentional responses? What stimuli or environmental factors affect either his reflexive or potentially purposeful responses? What about facial expressions? Vocalizations? Can he turn his head towards or away from something? Does he open, close, or move his eyes or mouth with intent when presented with specific stimuli? Does his body tense or relax?

All team members participate in finding the answers to these questions. We work as a transdisciplinary team – the teacher, speech language pathologist, all paraprofessionals, physical and occupational therapists, and teachers of the visually impaired – to support his positioning, motor, visual and hearing needs. We collaborate to find, strengthen and increase any of Bin's potential access points. The goal of our instruction during Level One of the CDTMatrix, is to increase the frequency of his intentional behaviors.

What was Bin's intentional response? After multiple observations, collaboration, and brainstorming, we settled on his eye movement. (Image 1, next page). Everytime we worked with him, we held up motivating objects and moved them across his field of vision towards the left side of his head. This was the intentional response the team agreed would be best to shape and increase. If Bin looked at the object when it got to his left side, we would tell him, "You looked at the ball. Great job, looking." Data was taken and Bin intentionally began to move both eyes to the extreme left with greater frequency.

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Image 1: Bin's Intentional Response: Bin volitionally moves both eyes to the extreme left. The team targets this intentional behavior and aims at increasing the frequency of this response.

Level 2
The student is expected to make a *simple discrimination* under *stimulus control.*

LEVEL TWO - INSTRUCTION AIMED AT TEACHING SIMPLE DISCRIMINATION:

We then moved quickly to Level Two of the CDTMatrix, combining the goals of increasing the frequency of his volitional response in Level One, to using that response in order to make a simple discrimination. A simple discrimination is when there is a stimulus control that elicits a target behavior. The stimulus control? This is where we engineer the environment or context and provide consistent stimuli to motivate Bin to use this response. The following is an example of a Level One instructional task: The educator presents Bin with a massaging frog (the stimuli), turns it on so he can hear it, and moves it across his field of vision to his left visual field. This elicits his eye movement to the extreme left. She immediately reinforces this movement by turning on the frog, and praising his response. This is the beginning of mapping meaning onto his physical response. "Bin, you moved your eyes to the left! You said 'Yes! You want more massage!" The goal in Level Two is to increase the frequency of his intentional response for communication.

Essentially, Bin learns that if he uses his intentional response when presented with specific stimuli, something positive will happen . This is crucial for students who are strengthening the use of one extension response. In Level Two of the CDTMatrix, it reminds educators to map meaning onto Bin's intentional behaviors. His eyes moving to the extreme left is a way for him to communicate specifically with us. Given our experience, we decided to start with mapping "Yes" so that Bin would learn to use his eye movement to the extreme left as a way to communicate "Yes" for his most preferred stimuli.

Level 3
The student performs a simple discrimination utilizing *response generalization* and/or *stimulus generalization*.

LEVEL THREE - INSTRUCTION AIMED AT GENERALIZING SIMPLE DISCRIMINATION

In Level Three of the CDTMatrix, Bin is generalizing the use of his intentional response to make simple discriminations. By providing stimulus generalization, teachers give the individual multiple opportunities to use their new skills in a variety of contexts, with a variety of people, during a variety of activities. Simply put, Bin is set up to use his "best yes" to request for more things - to hear more music, to watch a video, to see a ball light up, to request lotion on his hands. Bin is asked to use his "yes" eye movement in different therapies, and during group or classroom activities. The goal of any generalization task is to increase the cognitive demand of our instruction.

Response generalization is when we provide the individual with opportunities to make something happen using a different intentional response. For an individual who uses switch activation to communicate "yes" with a device, response generalization may include moving the switch to a different location, having the individual use their head while lying on a wedge, instead of their hand. Another type of response generalization is having them use a facial expression or vocalization as potential "yes" responses, for those situations when a switch is not available. As Bin has such limited volitional movements and minimal facial expressions, we continued to target and encourage the movement of both eyes to the extreme left. That being said, we also continued to observe other potential intentional responses - a head turn, or maybe body movement that may serve as an alternative "yes" response.

During Level Three instruction, we also began to give Bin access to eye gaze technology and cause and effect software applications. Our principal, Mr. O'Connor, used school funds to purchase classroom computers with eye gaze technology and software. This technology gave our students access to instruction that focused primarily on increasing our students' intentional responses - using eye gaze technology in order to play games, play the drum, turn on a Youtube video, turn the page of a digital book. At the time, it was unclear what Bin was actually seeing. However, with increased practice, he began to learn that moving his eyes made something happen on the computer screen (Image 2). His intentional eye movements could communicate a "yes" response, and also made something happen. His eye movements could give him access and control over his environment.

Response generalization also involved providing Bin with access to communication via eye gaze technology. We began by using a simple "yes" button on the left side of the screen, so that he could move his eyes to activate a digitized "yes". His eye movements suddenly had a voice! Bin had a few months accessing eye gaze technology instruction at school until March 2020.

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Image 2: Bin uses eye gaze technology for cause and effect. Using a donated Tobii I12+ and Communicator 5 software, Bin learns to play the drums by moving his eyes.

When the pandemic hit us, like all schools, we went fully remote. For students like ours, this was quite a shift, and a huge lift for families. Bin attended our online classes everyday, with his mother at his side, supporting the technology of a chrome book, providing Bin with therapies as we guided her, and helping us observe his intentional responses. Our Level Three instruction for Bin continued on another level entirely. Due to circumstance, we had to provide even greater stimulus generalization.

As part of remote learning, we often had multiple staff members observing students and shouting out everyone's "best yes" responses. Many students did not have family members who could set up switches or provide symbols for communication, so we leaned into calling out no-tech "yes" responses. All staff members had to intently watch each student for their "best yes" responses - and call them out to map meaning on Zoom. If Bin moved his eyes to the extreme left while music therapist Tim sang, staff would exclaim, "Bin you moved your eyes to the left, you said "Yes! Do you like Tim's singing?" Data was taken online and visually to encourage staff and students to increase their positive intentional responses, and keep communicating. (Image 3).

Generalizing his skills further, a school desktop computer with eye gaze technology was set up at Bin's home. This enabled him to use various cause and effect software and increase his intentional eye movements in his home environment. Bin's mother, dedicated and determined to help Bin communicate, introduced Bin's teacher Kim to special education advocate Elizabeth Bostic. Elizabeth's son James had recently passed away, and she wanted to donate his Tobii I12+ speech generating de-

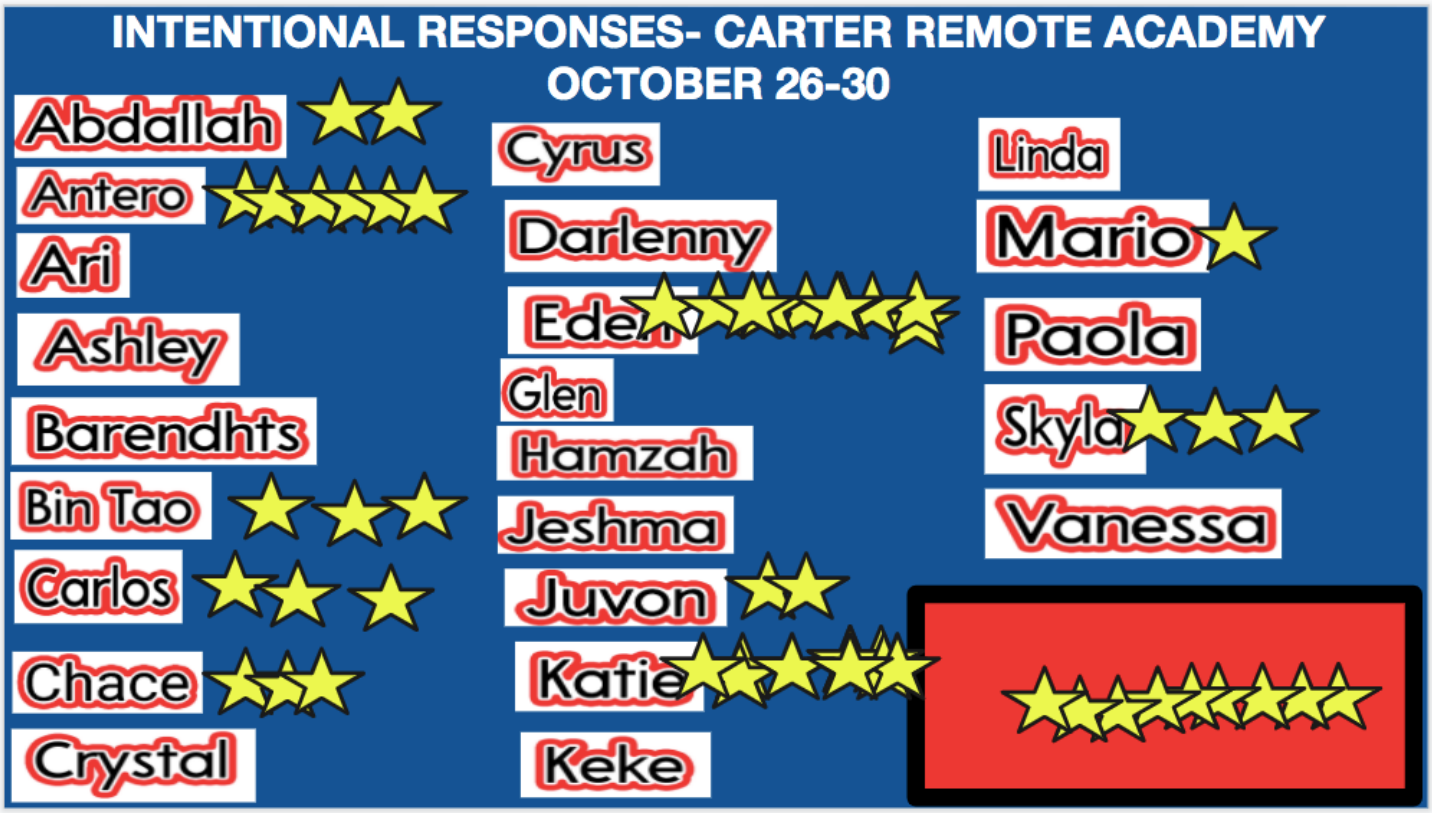

Image 3: During remote learning, all staff were charged to visually attend and verbally call out every students' intentional responses. This is a digital data sheet created on Jamboard, which encouraged and explicitly called out each students hard work. By explicitly stating and visually showing this work during literacy lessons, Carter staff reinforced and increased all of our students' "Best Yes" responses AND modeled the importance of this work for caregivers and each other.

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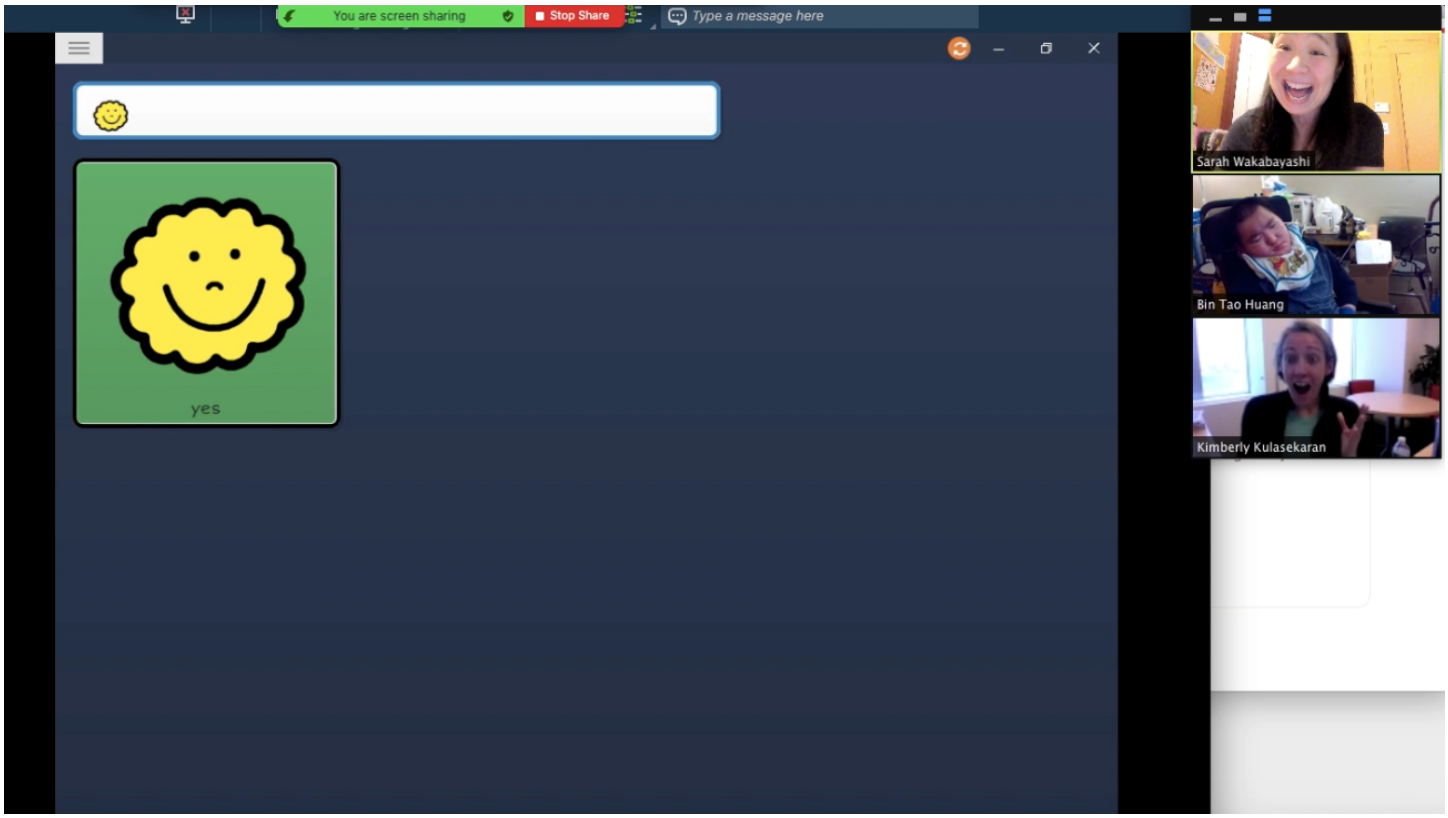

Image 4: With James' Tobii I12+ and a simple "yes" communication board, Bin was able to use his eye movement to the extreme left to say "yes" outloud and remotely. Teacher Kim and SLP Sarah were overjoyed when they heard Bin initiate his "yes" over Zoom.

vice with eye gaze technology to Bin. Suddenty, Bin had access to 24/7 communication. Bin was now able to generalize his eye movements and his "Best Yes" at home. He was also able to use eye gaze to communicate that "Best Yes" online remotely to us. (Image 4).

Generalization also included providing Bin with a greater variety of language and vocabulary, giving Bin the opportunity to communicate for different reasons. That is, when Bin looked tired or sleepy, we asked "Bin, Your eyes are starting to close. Are you tired?" We observed to see if he moved his eyes to the extreme left. In this way, Level Three gave Bin the opportunity to expand upon his use of that "yes" eye movement to the extreme left. He was no longer just requesting more. Generalization involved giving Bin opportunities to use his "yes" response to communicate for a greater variety of communicative functions, increasing the cognitive demand. By moving forward with our instruction, Bin could learn to use that one intentional response in order to comment, agree, take a turn in a conversation and participate during shared reading. And from there, we were ready to go even further on the CDTMatrix.

Level 4
The student performs a *conditional discrimination* under stimulus control.

LEVEL FOUR: INSTRUCTION AIMED AT TEACHING CONDITIONAL DISCRIMINATIONS

Level Four of the CDTMatrix involves conditional discrimination, where Bin is challenged to stop and think about whether or not to use his intentional response and communicate "yes". It is at this point that the cognitive demand of the task increases. At Level Four, we give Bin choices where the answer may not always be a simple "yes". Bin may not want to say "yes" to everything. At Level Four, a "no" response can be just as motivating. For many students, we create explicit lessons to teach "no." We do this by offering non-preferred options. The individual now must stop and think more critically about the question and their answer.

Another way to teach conditional discrimination is by delaying the more motivating choices when using partner assisted scanning. Less preferred choices can be offered first. For example, if I know a student would rather hear a Cardi B song than listen to Barry Manilow, I may offer them a choice of Barry Manilow first. If my student uses their "yes" response to choose Barry, and then show their dislike of that choice, they may use more thought when expressing "yes" the next time. They will learn to stop and think before responding. They will learn that maybe

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"yes" is not always the answer they want to express. They will learn to wait and hear all their choices first, and only respond "yes" when they hear their favorite choice, Cardi B.

Many students with complex communication needs have trouble transitioning into Level Four of the CDTMatrix, and making theseconditional discrimination. Educators often come across that one student who gets "stuck" exchanging pictures to request without ever really looking at the picture they are exchanging. This student may know that if I exchange this piece of paper, I will get something great. Yet, they have not learned to stop and think about which picture they are exchanging. No one has taught them that the picture matters. They may be able to discriminate between pictures or even match to sample. But they need that added explicit instruction – what they choose to exchange matters. They need to learn to make conditional discriminations. Sometimes the correct response depends upon the context or the circumstance or the condition.

Abstract language forms, such as core vocabulary, are another type of conditional discrimination. For some, the core vocabulary word "all done" can be very motivating. Think of the individual that expresses "Yes," they are all done with therapy before they walk through the door. But this same individual may want to say "No" when asked if they are "all done" listening to Cardi B. They may want to say "No," I am not all done with Cardi B. When presented with a more robust vocabulary system, an individual begins to make conditional discriminations with greater fluidity and speed.

Level 5
The student performs a conditional discrimination utilizing response generalization and/or stimulus generalization.

LEVEL FIVE: INSTRUCTION AIMED AT GENERALIZING CONDITIONAL DISCRIMINATIONS

Level Five on the CDTMatrix is generalizing these conditional discriminations. Generalizing these conditional discriminations involves instruction that provides both response generalizations and stimulus generalizations. It is at this point that Bin was given access to a communication book with more robust language, in the style of Gayle Porter's Pragmatically Organized Dynamic Display (PODD) book. Bin's PODD book gave communication partners an organized script for partner assisted auditory scanning. It gave Bin access to words for a variety of communicative functions that included opinions, feelings and ways to self-advocate when something was wrong. Staff modeled each word, using the PODD, to teach each concept. When Bin communicated with his "Best Yes" intentional response or used his "no" response, he could now communicate so many messages.

Level Five also provided Bin with opportunities to make these conditional discriminations through response generalization. It was here, we gave Bin access to more vocabulary via eye gaze technology, in particular an 8 symbol core vocabulary page (ie. "yes, no, more, different, all done, like, funny, not like"). Our instruction at Level Five of the CDTMatrix was to model these varied core words across a variety of contexts. We modeled the core word "like" or "funny" when he appeared to enjoy a particular story or activity. We modeled "not like" or "different" when he becomes agitated during a task. Bin began to initiate the use of these core vocabulary words to communicate. As Bin's communication advanced, we continued to increase the cognitive demand of his communication tasks. With James' device, Bin had access to this core vocabulary board during a variety of therapies, lessons, and activities with a variety of teachers, therapists and peers - making conditional discriminations through both response and stimulus generalization.

Level Five conditional discrimination does not stop here. The CDTMatrix demands that we keep going - keep providing students a full range of cognitively demanding tasks and instruction. And Bin deserves access to more - in particular a more robust and dynamic communication system, with more vocabulary, in more contexts, with more communication partners. He deserves a new device, tailor made for him. With a brand new speech generating device, and a multi-level individualized vocabulary set, Bin can have that access. He can have access to multiple categories of words, photos of his family, teachers and friends, social phrases, greetings, opinions, feelings and topic specific vocabulary. This access can give him control and independence. Access that will let him nitiate his words, clarify himself by clearing mistakes, and repeat himself so he is heard.

So what about Bin? What did we learn? We learned that it's all about Bin! The students who need us the most also need the most explicit, intentional instruction. To teach them that one intentional response can say it all. Just as the student who raises their hand the most in class gets called on the most, it is our job as educators to find ways to teach and engage the students who cannot raise their hands. With a shared belief in the least dangerous assumption that all students can learn, we must always figure out how to teach our most complex students, even if we do not yet know how. The CDTMatrix tasks us to always teach better and never stop asking ourselves and each other, "What about Bin?"

Acknowledgements: We want to use this space to thank a host of colleagues and friends who have worked tirelessly with us in order to provide cognitively demanding tasks and instruction for our students at the Carter School. They include: our principal, Mark O'Connor and consultant Debra McManus who were both instrumental in developing and implementing the CDTMatrix. Our work is impossible without our entire Carter school staff - teachers, paraprofessionals and transdisciplinary team, which include teachers Kevin Crowley, Abby Marsa, Jillian Allen, Michelle Ambrogio, and Elizabeth McDonnell, and therapists Meghan Aycock, Maryanne Johnson, Barbara Doucet, Joann Doherty, and Charlay Yates. We would also like to thank our mentors, Caroline Musselwhite, Susan Norwell, and Susan Bruce, for your support and teachings. We are forever indepbted to Bin's mother, Jianing Luo, for her tireless and passionate advocacy, her incredible love and generosity, and for

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her amazing son, Bin Tao Huang. We want to thank Bin for his hard work and resilience. He is the hero here, and his story is a legacy that will impact many more students like him to come. What we learned from you, Bin, has made such a difference in how we look at our work and how we teach. Thank you for your voice, and having so much to say!

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An Interprofessional Practice Approach to Using AAC with Students from Culturally - Linguistically Diverse Backgrounds in the School Setting

In the United States (U.S.), there are approximately 4 million individuals with complex communication needs (CCN) who require unconventional means to communicate (Beukelman & Light, 2020). With the rapid growth of preservice trainings and technologies, professionals can offer individuals with CCN alternative communication methods or a practice that augments speech, referred to as augmentative and alternative communication (AAC) (Beukelman & Light, 2020). Approximately 12% of this population are young children in special education programs (Binger & Light, 2006). These students with CCN rely on AAC to participate in familial interactions, social events, and academic activities. Many of these students come from culturally-linguistically diverse backgrounds (CLD) and face communication challenges due to a language barrier (Linn & Hemmer, 2011; Tipton, 2021). However, these challenges are heightened when these students also have CCN (Muñoz, 2023a). Thus, there is a rising need for SLPs and educators to collaborate with other stakeholders in using evidence-based practices that support the academic needs of students with limited or no verbal output from CLD backgrounds (Biggs & Hacker, 2022; Larson et al., 2020).

CULTURALLY-LINGUISTICALLY DIVERSE BACKGROUNDS

For students to be identified as having a CLD background, they must (a) speak or listen to a language other than English, (b) belong to an ethnical minority group, (c) have cultural practices differing from Western civilization, and/ or (d) practice a faith identified as a distinct religion or lack a religious entity (Larson et al., 2020). The United States Census Bureau (n.d.) and Annie E. Case Foundation's Kids Count Data Center (2021) reported that over 72,000,000 children from birth thru 17 come from culturally and linguistically diverse backgrounds. This number represents over 50% of the children in the United States. These statistics indicate that students from CLD backgrounds are on the rise. With this shift in the student demographics in the schools, the need for culturally-linguistically responsive practice in AAC use in the classroom setting has become more prevalent. Therefore, it is necessary for speech-language pathologists, regular and special education educators, family members, and other relevant stakeholders to develop a culturally-linguistically responsive AAC practice for a student from a CLD background to succeed academically (ASHA, n.d.; Biggs & Hacker, 2021; Kulkarni & Parmar, 2017).

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THE STUDENTS' RIGHT TO ACCESS ACADEMIC AIMS

Students with communication challenges have the right to access educational curricula. However, these students will need adaptations to achieve academic outcomes, such as using AAC to participate in the classroom setting. These adaptations are required by law as a response to the *Technology-Related Assistance for Individuals with Disabilities Act* of 1988 (Pub. L. No. 100-407) and its reauthorizations, *Assistive Technology Act* of 1994 (Pub. L. No. 103-218), 1998 (Pub. L. No. 105-394), and 2004 (Pub. L. No. 108-364), respectively (Muñoz, 2023b). The first legislation (1988) highlighted the rights of individuals with disabilities to participate in their community, which extends to students' academic access within the classroom setting. This legislation was the first to grant funds necessary for implementing assistive technology, including AAC. In 1994 this Act was reauthorized to support the continued funding and availability for young children with disabilities. A subsequent reauthorization of this Act in 1998 ensured that those students enrolled in an academic program also had access to funds for purchasing AAC devices (Muñoz, 2023b). These efforts were expanded and legalized in a subsequent reauthorization in 2004, which required state programs to support additional funding and accessibility to AAC devices.

INTERPROFESSIONAL PRACTICE APPROACH WITHIN THE SCHOOL SETTING

The *Individuals with Disability Education Improvement Act* of 2004 (Pub. L. No. 108-446) defines *Assistive Technology Device* as any electronic equipment customized to improve, increase, or maintain the capabilities of a student with a disability. For students to use AAC in the classroom setting, an interprofessional practice team must indicate this need for assistive technology devices and/or services on the student's intervention plan. Collaborating with various stakeholders is essential for students who rely on AAC to succeed academically. The stakeholders in this *Interprofessional Practice (IPP)* include all individuals that directly or indirectly impact the effectiveness of the student's educational journey. IPP is a framework comprised of two or more individuals/ professionals collaborating to support an individual's needs by learning about, with, and from each other (American Speech-Language-Hearing Association, n.d.). Along with educational and health professionals, the IPP team members include any family and community members that can influence the successful implementation of the student's educational plan (Muñoz, 2022a; 2023a).

DEVELOPING THE IPP TEAM

The first step in developing an intervention plan for a student with CCN from a CLD background is identifying the stakeholders and their respective roles (Muñoz, 2022a). Within the school setting, the stakeholders involved in the IPP team include family members, caregivers, or legal guardians; regular and special educators; therapists (speech-language pathologists, and occupational and physical therapists); or school personnel (program and staffing specialists, local education agency representatives, or administrators); and even the student. Other members may include assistive technology specialists, school counselors, nurses (for medically fragile patients), therapists from private practice, and/ or interpreters. Members of the IPP team can change depending on the student's specific needs or professional availability.

Once the team is identified, meetings are arranged to gather information about the student. The planning meeting(s) may occur prior to, during, or after the Individual Education Plan (IEP) staffing with some or all of the IPP team members. Within an IPP approach, the team members describe their role as it relates to the student, whether professionally or personally. Subsequently, the IPP team will describe the student's strengths and weaknesses within their scope of discipline. The family members are also given the opportunity to describe their concerns, anticipated goals, and cultural-linguistical background, which may include faith-based concepts (ASHA, n.d.; Kulkarni & Parmar, 2017). Some of these meetings are conducted informally with only two IPP members, such as a family member and one other stakeholder. However, they are responsible for informing other team members or critical personnel that were not present at the meeting to ensure that all concerns, goals, and objectives are still aligned with the educational needs of the student relying on AAC.

CULTURAL HUMILITY

Information gathering during formal or informal meetings is necessary for the decision-making process in AAC customization. Oftentimes, the IPP team members may differ regarding their upbringing, educational background, culture, linguistic profile, faith, and/ or beliefs. These differences may impact their ability to assess, recommend, implement, or participate in a collaborative approach in an AAC school-based intervention. Therefore, for their recommendations to be effective, it is instrumental for professionals working with students from CLD backgrounds to use a culturally humble approach to gather the information necessary to customize an AAC device (Gormley, 2017). A culturally humble perspective emphasizes self-awareness of personal views and differences (Mosher et al., 2017). This self-awareness guides IPP members to respond to the student's different cultural-linguistical upbringing without being influenced by their background and beliefs (Gormley, 2017). Since IPP team members' efforts must always be centered on the student's distinctive characteristics, strengths, and weaknesses, they must be receptive to validating and incorporating these cultural-linguistical differences during the AAC customization process (Hass & Abdou, 2019; Mosher et al., 2017).

THEORETICAL FRAMEWORK

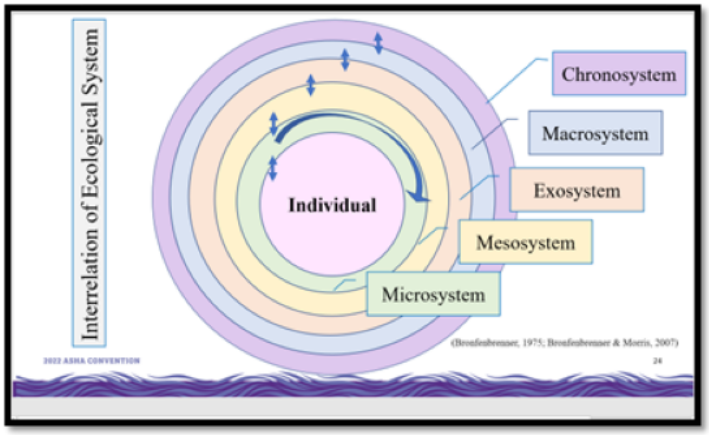
Gloria Anzaldúa's theory, *Borderland/La Frontera: The New Mestiza*, highlighted the disparity often seen between professionals and their students from CLD backgrounds (Muñoz & Valdés,

2023). These professionals' perception, readiness, and willingness to work with students with CCN from CLD backgrounds may present challenges in the implementation and effectiveness of AAC within the classroom environment. In the borderline theory, Anzaldúa explains that family members from CLD backgrounds ponder on whether to belong or not belong within a group (Anzaldúa, 1987; Muñoz & Valdés, 2023; Murphy, 2016). Cultural differences include social economic status, educational level/ background, ethnicity, and generational category (age) (Muñoz & Valdés, 2023; Tinto, 1975). These variances can influence a person or group of individuals' experiences, impacting their intent and commitment level in using a culturally and linguistically responsive approach (Muñoz & Valdés, 2023). Thus, each IPP team member must evaluate their perceptions of cultural and linguistic diversity, AAC strategies and devices, and the integration of culturally-linguistically responsive AAC intervention within the classroom setting. This self-evaluation can support the collection of information without bias. The information collected on the student's background is then reviewed and analyzed through the lens of each team member. Lastly, the team determines how to use this information to customize the AAC device or method to attain a common goal supporting educational achievement.

ECOLOGICAL SYSTEMS

Gathering background student information stems from a theoretical model proposed by Bronfenbrenner (1975), *Ecological Systems Theory*. In this theory, the child's development is viewed as the interaction of multiple systems surrounding the student's environment. These systems are comprised of five ecological levels. The first level, the microsystem, recognizes the significance of the student's home environment. This level acknowledges each family member's attitudes toward the child's disabilities and communication limitations. In some instances, the family member(s) may speak different languages, come from different cultural backgrounds, or have religious beliefs, or differ from the stakeholders who comprise the AAC IPP team. Each family member's educational background is also considered at the microsystem level. Therefore, this insight into the family dynamics relating to the student's cultural and linguistic characteristics is essential in the decision-making process for culturally responsive instruction. Additionally, the microsystem level reviews the student's interaction with the school environment. This involvement includes stakeholders, such as the educational team members involved in the planning and execution of an intervention plan, the actual IEP document, peers, educational placement, and curriculum. The interaction among and between these stakeholders occurs within the mesosystem level, the second system. At the exosystem level, the IPP team evaluates the student's AAC access, funding opportunities, community resources, and disability-related associations to determine appropriate AAC educational support systems (Muñoz, 2022a). In the fourth system, the macrosystem level, policies are reviewed to ensure that the student's rights to communicate and equal education opportunities are met by using appropriate AAC funding and equipment. The policies may include programs, laws, and/ or ideals associated with the student's educational process, disabilities, communication limitations, or AAC access. Moreover, any assistive technology and relative advances supporting this access are evaluated at this level (Biggs & Hacker, 2021; Bronfenbrenner, 1975; Bronfenbrenner & Morris, 2007). Additionally, the student's societal and cultural influences are considered (Biggs & Hacker, 2021; Bronfenbrenner, 1975; Bronfenbrenner & Morris, 2007; Muñoz, 2022a). Lastly, at the chronosystem level, environmental changes in the student's home and/ or school environment are evaluated by the IPP team members. These changes can include transitions in life, school programs, regular and special educators, and/ or historical events (Muñoz, 2022a). See Figures (s) 1 and 2 for a diagram of the *Interrelation between a Student's Ecological System* and a *Sample of Ecological System Levels and IPP members*, respectively.

Figure 1: *Interrelation of a Student's Ecological System*
Note. The chart was printed with permission from Muñoz (2022a).



CONCLUSION

The school demographics are frequently changing, and diversity is on the rise. Therefore, to meet the needs of students from CLD backgrounds who rely on AAC, educators and speech-language pathologists need to ensure that culturally relevant instruction is available for all students (Kulkarni & Parmar, 2017). Research has provided evidence of the effectiveness of AAC use in the classroom setting on student achievement. However, findings have also indicated that disparity between research and AAC implementation within the schools still exists (Walker & Chung, 2022). Since students with complex communication needs have challenges in attaining academic achievement and developing communicative competencies, members of an IPP team need to evaluate how AAC is used to access learning (Walker & Chung, 2022). These stakeholders, such as family members, educational and healthcare professionals, and even the student, need to work collaboratively to identify the purpose and function of the AAC system and develop a culturally-linguistically responsive

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Figure 2: *Sample of Ecological System Levels and IPP Members*. *Note.* The chart was printed with permission from Muñoz (2022a).

Ecological Level	***Examples of Ecological Level***	***Examples of IPP Member***
Microsystem	Homes Health Services Schools Religious Organizations School Rehabilitaions Centers Hospitals	Family / caregivers School Staff (Teachers, Paraprofessionals) Rehab / SNF staff Priest / Rabbi Clergy Therapist (SLP, OT, PT) Health Profe3ssionals (PCP, Nurse) Social Workers AAC Specialists
Mesosystem	Interaction between within Microsystem	Same as above
Exosystem	Economics Social Services / Health Care Providers Govertment Agencies School Board Media / Social Media Insurance benefits	Extended Family and Neighbors Governmentall Personnel District Personnel Administrators Journalist Social Workers / Insurance Companies AAC Device Representatives
Macrosystem	Cultural Attitudes and ideologies Ethnicity Socia; Economic Status Geographic Location	Social Workers Family Embassies Community Resources Travel Agencies

intervention plan. This identification process can promote the effective assessment of the student's strengths and weaknesses and the development of goals and objectives to be implemented within the classroom (Da Fonte & Boesch, 2016). For the students to be responsive, the AAC device, communication board, or picture icons must be sensitive to their cultural and linguistic background. This customization of the AAC method/ device can only be possible through a culturally humble stance taken by the IPP team (Muñoz, 2022b; 2023a). This paper provides insight into the significance of IPP team members in individualizing instruction by promoting culturally-responsive AAC practices to ensure that students with communication limitations can access their academic learning. Although student classroom engagement can increase with customized AAC methods/ devices, there is still a need for a greater understanding of the impact of cultural and linguistic factors on education. Therefore, future studies should evaluate the effectiveness of the IPP team using a culturally humble approach and culturally-linguistically responsive AAC method/ device on academic performance.

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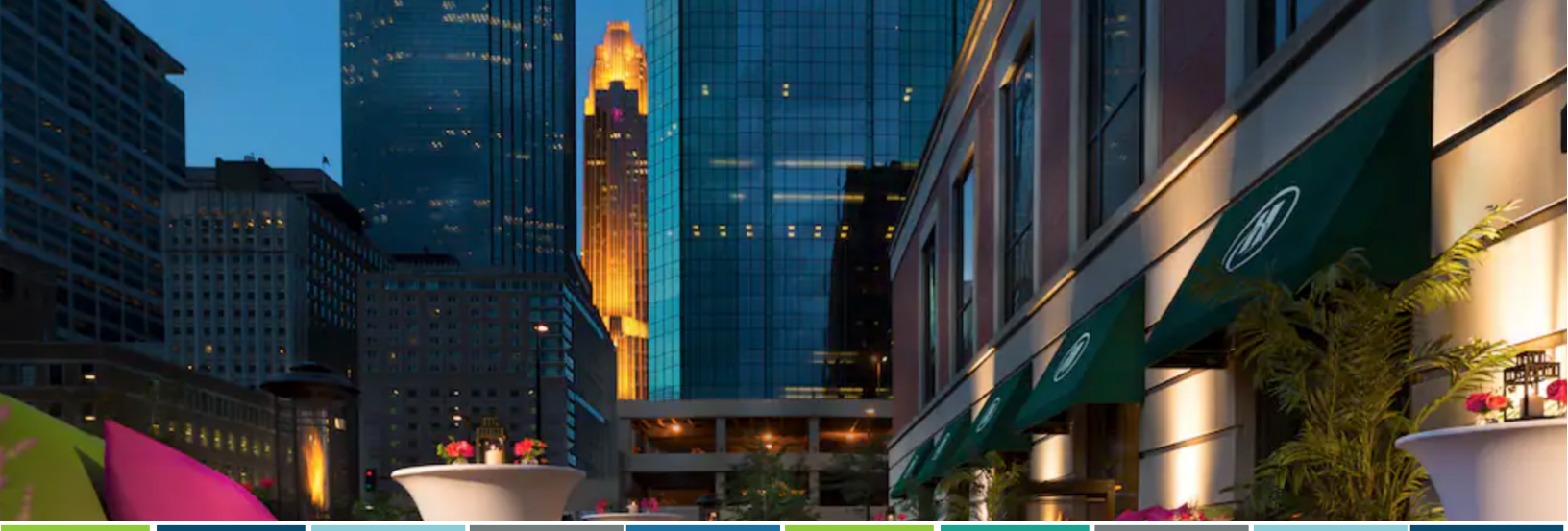

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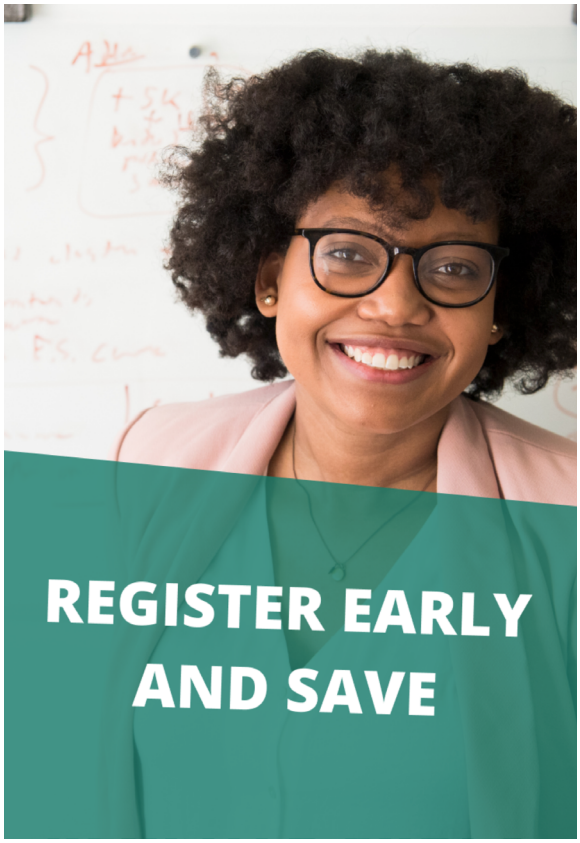

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Playing with Switches: Opening a World of Possibilities

Summary:

Providing children with significant motor deficits with the ability to play, access their curriculum and control the environment around them is a collaborative and important process. After reviewing key assessment and training methods, we will further explore this process starting with simple cause-and-effect adapted toy activation and moving into developing independence through access to computers and mobile devices.

INTRODUCTION

Imagine it is your birthday, you're turning five years old, everyone just sang, and it is time to open gifts. You open up boxes and boxes of gifts that include toys like a dancing cactus, a disco light, and a remote control car. What happens to that smile when those toys you just opened are not accessible because you have Cerebral Palsy and your hands do not have the required dexterity to activate the small little push button or toggle switch on the side of the toy?

I did not realize what an adaptive switch can do beyond playing video games or battery-operated toys until I started working with a student with cerebral palsy at the Henry Viscardi School who had been an "access" challenge over the years. Each therapist explored and tried many different devices and access points trying to find ways for him to access the curriculum, communication devices, and leisure base activities. Once that point of access was determined, there was no stopping him from doing so much more than anyone ever imagined. Starting off with playing space invaders on the computer, listening to audiobooks and downloading movies on iTunes, and now ordering DoorDash. It all happens by pressing a simple adaptive switch.

As disability professionals, we facilitate the use of assistive technology as a method to make play accessible. By removing barriers and providing necessary support, assistive technology allows individuals to engage in play activities that may have otherwise been inaccessible to them. The simplest method to

CHRISTOPHER MAROTTA is an occupational therapist who provides services to students with physical disabilities at the Henry Viscardi School in Albertson, NY. He has worked as an OT for over 20 years in a variety of settings, but his passion is assistive technology and enabling his students to be successful in and out of the classroom. Chris is an avid tinkerer and enjoys designing and fabricating adaptive devices. He shares his knowledge with others by lecturing occupational therapy students as an adjunct faculty member at Stony Brook University and Touro University. Christopher also presents and hosts workshops at national conferences and guest lectures at other schools and organizations. He is currently pursuing a doctorate in occupational therapy focusing on the impact of adapted sports on quality of life. Christopher is also volunteer co-leader of the NY Metro chapter of the Makers Making Change organization, where his goal is to teach others the skills of adaptation along with increasing awareness of disabilities. chrismarottaot@gmail.com

LORETO DUMITRESCU is an occupational therapist who has worked for the New York City Department of Education for over 20 years, providing both direct service as well as AT evaluations and previously provided early intervention services. Loreto received her MA in Educational Technology from Adelphi University where she is currently an Adjunct Professor teaching courses on assistive technology and Universal Design for Learning to pre-service educators. She co-founded Zero Day Camp, a non-profit on a mission to bring computer science and media literacy to youth and educators throughout New York City. Currently, she is a volunteer co- leader for the NY Metro chapter of Makers Making Change. loreto@zeroday.camp

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accomplish this is by switch adapting. It begins with a basic inexpensive 3.5 mm mono jack or using something called a battery interrupter. Battery-operated toys like the ones you find in mall kiosks can be converted with this jack to allow the connection of any adaptive switch. Switch-adapted toys are specially modified toys that allow children with disabilities to operate them using an adaptive switch. These toys offer a range of benefits for children with disabilities, including increased independence, improved motor skills, and enhanced social interaction.

These toys can be adapted to suit a wide range of disabilities, including those with limited mobility, vision or hearing impairments, and cognitive disabilities. The use of adapted toys can promote inclusion and help children with disabilities feel like they belong. Through adaptation, they can play with the same toys as their peers.

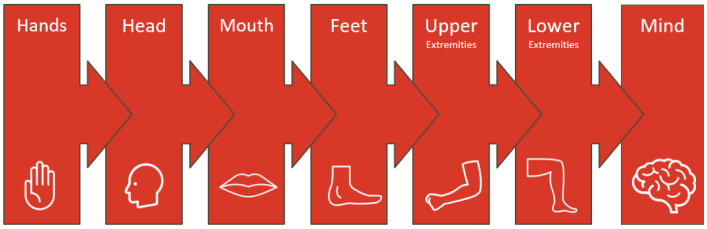
Switch-adapted toys also provide a sense of control and independence, as they allow children to participate in play activities on their own terms and at their own pace, which can improve confidence and self-esteem. Adapted toys can also help to improve children's motor skills. By pressing a switch, children can develop their fine motor skills and hand-eye coordination. Finally, switch-adapted toys can promote social interaction among children with and without disabilities. By playing with the same toys, children can learn to communicate and play together, which can help to break down barriers and promote acceptance and understanding of differences. Overall, assistive technology plays a crucial role in leveling the playing field, promoting engagement, and unlocking the potential for meaningful and enjoyable play for individuals with disabilities.

It is beneficial to introduce the use of assistive technology at a very young age. Encouraging adaptive play for children with physical disabilities and/or are medically fragile is important in supporting learning cause-and-effect, and early use of technology can lead to so much more later in life. The ability to physically touch a toy and turn it on is one of the first steps in looking at methods of access. There are two types of access methods, direct and indirect selection. Direct selection methods are more intuitive, fast, and efficient. Options may include means such as adapted styluses, adapted joysticks, adapted mice, head-tracking cameras, and eye gaze systems. Indirect methods are more time-consuming and require more control, accuracy, and attention. Examples of ways to indirectly make selections can be through the use of a single switch, multiple switches, using voice commands, macros, and even Morse code.

When working with students who have complex physical needs, there are times when using adaptive switches can be the only viable option as a method of access for that individual. An assistive switch in its most simple form is a single device that uses an audio cable connection that sends an activation signal to the connected toy/interface. This audio cable connection is the male counterpart to the 3.5 mm mono jack discussed earlier. There is a large variety of commercial options found on the market, from companies like Ablenet, Enabling Devices, Inclusive Technology, and open source versions that can be created at home from the Makers Making Change (MMC) organization using off-the-shelf components. Every adaptive switch has the same function but they come in all shapes, sizes, and textures. Some require significant force to activate and others none at all. It is through a detailed evaluation process that the most beneficial type of switch is identified.

FINDING YOUR SWITCH: THE EVALUATION PROCESS

One of the main focuses of occupational therapists and other disability professionals is to aid the user in determining the most efficient method of access. This evaluation process takes into consideration the student and all those involved in the student's care, including parents, guardians, paraprofessionals, caregivers, nurses, therapists, and teachers. The evaluation process for assessing a student for switch access is not something that happens in a short time frame, it requires trial and error, data collection, and collaborative effort. The switch access relies on many factors, including the reliability of movement, examining time and accuracy, intention and isolated control, endurance, and proper placement. Positioning is a key factor in having an appropriate switch site with ideal mounting being a key component. Identification of a reliable access site generally has a hierarchy of body parts to explore. It begins with more flexible parts of the body such as the hands, head, and mouth to more restricted parts such as the feet, and upper and lower extremities, and ends with using muscle and brain signals. Each part has its own unique qualities and features that allow for greater versatility with access.



Switch location hierarchy chart

Below you will find a chart that provides examples of what each body part may look like for a switch user.

Hands	Head	Mouth	Feet	Upper	Lower	Mind
Tap a microlite switch with an index finger.	Tap a small specs switch with the right side temple of the head.	Activate a sip-and-puff switch with breath support.	Tap on a large pedal switch.	Activate a jelly bean switch by elevating the shoulder.	Tap a pal pad switch with the inside of the knee.	Activate a brain-computer interface (BCI) via EEG to select a desired letter.

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Another important aspect of learning to utilize a switch includes using proper verbal, visual, and physical cues to foster a student's understanding. Saying to a student "Hit the switch" or "Tap the button" may inhibit the student from learning the causal relationship of activating the switch. It is vital to connect the switch action with a functional outcome and to encourage the function (turn on a toy, type a letter on a computer, tap on a tablet, or select a "Hi, how was your weekend?" on a communication device). The evaluation process must include intrinsic motivation and take into account who the user is.

Data collection is a principal aspect of determining the correct switch choice and proper placement. There are multiple tools and strategies that are available to aid in this process. A team may begin with a simple document or spreadsheet table that collects response times based on various conditions.

	Able to wait	Able to activate	Able to hold	Able to release	Able to activite again
Right hand					
Left hand					
Head					
Right knee					

Sample table used to collect data on the access point and its responses

Moving from there, there are a variety of software systems available that automatically collect speed and accuracy data. These include software such as Koester Performance Research's Compass or the free web-based application, Scanning Wizard. Scanning Wizard provides switch users, practitioners, and caregivers recommendations to optimize switch and scanning setups.

GETTING STARTED

Once the optimal switch, access method, and location are identified, it is time to get to work! Switch progression is a graded method of introducing switch access and developing scaffolded proficiency. Most often, users begin with simple cause-and-effect activities; pressing the switch to engage with a toy, learning to press it again, or holding the switch for prolonged periods. The next development would include introducing two or more switches that provide differing effects followed by the introduction of timing. This would involve waiting for a particular event to occur before pressing the switch. All these skills build a user's ability to then complete formal scanning where items are scanned through with switch activation on the desired item. Mastering the ability to scan can open the user to a wide range of mobile and computer access, which is the ultimate goal.

When first developing cause and effect skills, one of the most widely used motivators is switch-adapted toys. There are various commercially available options of toys that may be purchased online from companies like Enabling Devices, Ablenet, Inclusive Technology, or from sellers on Amazon and Etsy. The high cost of commercially obtained toys can be a considerable barrier for most individuals with disabilities and their families. Like all children, a variety of toys and ongoing novelty are important to maintain, making purchasing more burdensome.

As discussed earlier, simple battery-operated toys can be modified or switch-adapted using an inexpensive basic 3.5 mm mono jack cable and a bit of soldering skills. Various organizations support access to these toys or provide instructions on how to modify them. Makers Making Change, FairPlay, and Switched are examples of some organizations found nationally that support the mission to create accessible play opportunities. They host workshops, hold hackathons, and create free instructional manuals and videos to teach others to adapt.

Continuing to develop play skills, users may move beyond smaller toys, and explore other switch-adapted devices. Devices such as adapted Uno Attack, Nerf guns, card shufflers, dice rollers, and even switch-operated bowling ramps are some examples. Single switch presses may even be used to support adapted mobility projects such as Go Baby Go. This same cause-and-effect skill can transfer to the control of an environment to turn a fan, appliance, light, or music source on or off. Switch presses may also be used for single message communication buttons as a form of Alternative Augmentative Communication (AAC) systems.

Example of an adapted Uno Attack for switch use.

DEVELOPING SKILLS FOR LIFE

Once establishing many of these foundational cause-and-effect skills and developing the understanding and independence of being able to affect their environment, users can begin experimenting with mobile and computer access. A key intermediary between switches and computers is a switch interface.

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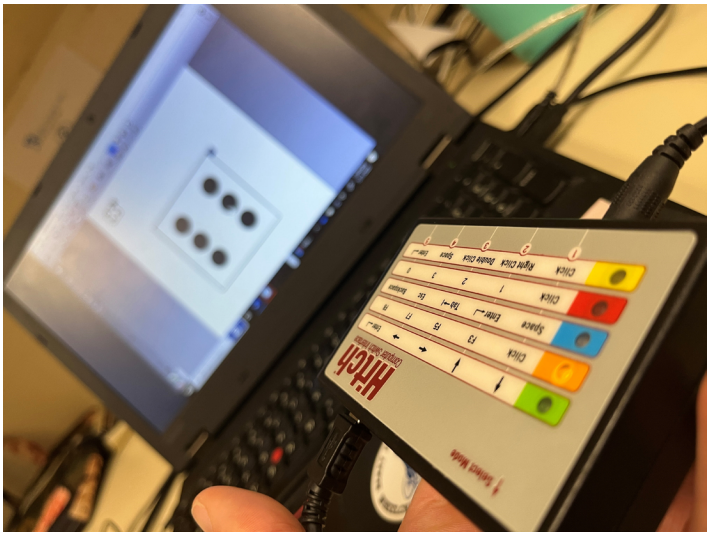
This device does the important work of converting the switch activation signal into information the computer can understand. Most commonly, these devices convert the signal to a keyboard keystroke but may also send a mouse button press, or media control. There are a wide variety of commercial devices and open-source versions available. The choice depends on the needs of the individual, the type of device being used, and the cost. Features of the switch interface boxes include the ability to customize the keystrokes being sent, connection methods (wired/USB or wireless/Bluetooth), and the number of ports and connections. A more recent and exciting innovation has developed in providing access to highly customized interactions through the use of microcontroller boards such as Makey Makey and Microbit. These boards can send keystrokes to the computer by connecting two conductive surfaces to close a circuit and use alligator clips to create these connections, lowering the entry barrier. This solution type is lower in cost and may serve as an effective prototyping mechanism.

An example of the Makey Makey board connected to a computer with the ground wire clipped to a metal bracelet and the input wire clipped to a metal measuring cup. The circuit is activated once the user lightly touches the cup.

An additional and important aspect to consider is the built-in accessibility settings within the operating system. The Apple Mac and iOS operating systems have robust and complex settings to support computer-wide access using even a single adaptive switch without additional software. Google Chromebooks and Android devices have also added built-in switch accessibility. Windows operating systems, however, do not have switch accessibility settings and require the purchase and installation of additional software that may provide this functionality. The only switch accessibility found in Windows is in the built-in onscreen keyboard. RJ Cooper developed a mouse alternative called CrossScanner, which enables a switch user to use one or two switches to navigate a mouse cursor.

FROM WRITING TO RIDING.

Now having selected the optimal setup, the user is ready to explore the world and the possibilities that having access to computers and mobile devices offer. For younger users, supporting their role as a student and providing literacy solutions is key. Switch access may be used to engage in learning activities created using familiar software such as PowerPoint and Google Forms when using an iPad tablet. Engaging games such as Breakout Rooms and MadLibs may be interacted with. Switch control may also allow the student to read and navigate through digital books available from a wide range of web apps and mobile apps which include: Voice Dream Reader, iBooks, Libby, Tarheel Reader, and Tumble Books. Literacy software such as Clicker, support a switch-friendly method of writing and navigating through books. Cricksoft's Clicker writing application interface allows for both automatic and step scanning incorporating auditory feedback and word bank options. Additional software such as Grid3, HelpKidzLearn, and Inclusive TLC software provides a more scaffolded learning environment and access to literacy through customizable learning activities.



The Hitch switch interface box connected to the computer using Smart Notebook as a classroom dice roller when playing a math board game in the classroom.

Written responses are most often completed through the use of the onscreen keyboard available on all operating systems. Alternatively, if a user can memorize Morse code, typed print may be produced using switch control for dots and dashes leading to a faster rate of keyboarding when compared with onscreen keyboard scanning. Customized 3rd party onscreen keyboards are also available providing a chunked scanning method (Cricksoft's Superkeys), word prediction support, and customized visual presentations (Keeble).

Being able to tell someone "I'm hungry" or "I'm in pain", is crucial for individuals who do not communicate using traditional speech. In many cases, that person who is unable to speak clearly also has complex access issues where using switches may be the most appropriate option. Switch scanning capabilities are built into all AAC devices and programs found on the market, and offer the ability to customize timing and feedback. For iP-

ad-based AAC apps, users may choose to use the switch settings available on either the operating system level or within the app.

Controlling one's environment and engaging in leisure is a way to further develop independence. With the rise of connected and smart home technologies, the ability to control so much of the home environment is now possible using these same switches at a much lower cost than previously available. Devices such as the PowerLink, provide the user the ability to activate appliances throughout the home. Most smart home devices also come with companion apps that can be switch-activated providing an additional method of controlling the environment. Switching TV channels and viewing options as well as selecting and playing music is now readily possible using the accessibility settings within AppleTV or connecting devices such as the Puck to navigate a TV that does not have "smart" capabilities. These same systems also allow the user to scan through apps to order groceries and takeout.

Switch navigating through apps allows individuals to not only use this technology as a consumer but become a creator. Switch control may be used for visual creativity such as photography, video recording/editing, and digital arts such as graphic design using more complex switch gestures on iOS. Music creation using commercially available apps and exploring keyboard-accessible websites such as Experiments with Google provides new opportunities for expressing creativity.

Creating social connections outside of the caregiver network is now possible through the growing world of adaptive gaming. One of the most popular accessibility devices for gaming, the Adaptive Controller, was developed by Xbox to support switch access. This device also features Copilot which allows a companion to navigate the joystick while the user activates the switch as a button presses. The success of this device is leading other console developers to follow suit and create their own hardware. Playstation recently announced Project Leonardo, an accessible controller with four 3.5mm AUX ports to support a variety of external switches and third-party accessibility accessories. A diverse number of organizations such as AbleGamers are working towards breaking down barriers in this world of adaptive gaming both on the hardware and software side.

Although most console games may be fast-paced and complex for emerging gamers, some entry-level options are available via games from HelpKidzLearn, web-based games, and through purchases from vendors like Marblesoft. Additionally, there are a few web-based platforms like Scratch and Makecode Arcade that are available to allow for the custom creation of games using block-based code to adjust for many gaming variables like timing, visual complexity, and activation methods. These platforms allow games to be played on any computer or mobile device and are keyboard and switch accessible if programmed correctly.

Requesting an Uber or other rideshare using switch scanning can certainly be done, but the logistics of finding an accessible van may be a barrier. However, it is possible to drive a power wheelchair using single, two, or even an array of adaptive switches. Two examples of switch use for power mobility are using a head array which is made of three proximity switches and using a sip and puff switch.

CLOSING

It is not every day or even every year that you have that moment when someone you are working with can do something independently using assistive technology. Sometimes the simplest click of a switch, tap of a button, or blink of an eye can open the door to pathways of possibilities. It is important as clinicians to encourage early learning accessible play and consider the use of adaptive switch technology as it can provide that hope that someone is looking for to give them access to the world of independence they truly deserve. We would like to leave you with a poem written by Kiley McDonnell, a student at the Henry Viscardi School, describing her journey through this process:

BUTTERFLY BY KILEY

I felt sad
I was stuck
I could think
But couldn't move
People talked around me
About me
As if I weren't there
But I was there
Listening and learning
Unable to say a word.

I could move my eyes
Raise my brow
And hope the answer
Was a Yes or No

Then someone came
And broke me free
To flick a finger
Move a knee

I learnt to scan
Click a switch
Change TV channels
Music stations
Facetime grandma
Use You Tube
I now have ways to talk
By tweet and text
Use my device
To Explore
To Connect
And Express

My thoughts are unique
Experiences too
I soar in JOY
As my world expands

I feel special
I feel free
Glad to be free
Glad to be me
I could see the world
Now the world sees me ■

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UPCOMING WEBINARS

Google's Hidden Gems for Diverse Learners and Beyond

By Anne Truger
Thursdaty, September 14, 2023
3:30 pm – 5:00 pm (Central Daylight Time)

Anne Truger, M.S., Digital Learning Specialist at TrueNorth Educational Cooperative 804. She has over 20 years of classroom experience in Special Ed, Instructional Tech and Administration. She is a Google for Education Certified Trainer, Google Certified Innovator, DEN STAR, Tech4Learning Innovative Educator, past President of ICE (Illinois) and former co-chair for the ICE Conference. She is a graduate of Johns Hopkins University in partnership with ISTE: Supervision and Leadership program.

Includes 0.2 IACET CEUs, and/or Closing The Gap Issued Certificates of Contact Hours.

This fast paced session will focus on "hidden" accessibility and productivity features that are built into all of the main Google tools: Drive, Docs, Sheets, Slides, Gmail, Gcal, Chrome, Extensions, Search, and Keep. These features and "gems" will be tools that an individual with diverse learning needs may use themselves or tools that will be helpful to a teacher/therapist that is using inclusive practices to share materials with a class that includes both neurotypical and diverse learners.

As a general rule, Google makes several hundred changes a year to their tool suite, and they are tough to keep up with. This session will introduce all known new features and hidden features that can support individuals with diverse learning needs, including those with Executive Functioning and access issues. The 8 defined areas of functioning that this session will focus on primarily are impulse control, emotional control, flexible thinking, working memory, self-monitoring, planning and prioritizing, task initiation, and organization. This session will also give you tools to help with alternate access and productivity. You will learn how to work smarter not harder. These "buried" gems will become your discovered treasures!

Adapt, Play, Connect

By Teresa Glardina and Courtney Grimes
Wednesday, October 25, 2023
3:30 pm – 5:00 pm (Central Daylight Time)

Teresa Glardina, is the Co-Director of HMS Connect and a special education teacher at HMS School for Children with Cerebral Palsy where she has been employed for over a decade. Her professional journey started with volunteer opportunities, then paraprofessional work, onto a classroom teacher, and now education administration. Teresa is a proponent of DIY assistive technology, playful exploration, and interpersonal play.

Courtney Grimes, has been a special education teacher at HMS School for Children with Cerebral Palsy for 17 years. Her early experiences as a camp counselor at Easter Seals inspired her to infuse play and playful exploration in all that she does. Courtney aims to create accessible play activities for all her students using assistive technology and creativity.

Includes 0.2 IACET CEUs 1.5 ACVREP CEs and/or Closing The Gap Issued Certificates of Contact Hours.

Students with Complex Needs are often unable to participate or access games/activities during school events. Students with Complex Needs are often placed to observe play. A few key purchases and an imagination can change the role from observer to participant!

This interactive workshop will both outline the importance of accessing assistive technology in play for all individuals and discuss techniques for how to put this into practice. Presenters will demonstrate the effectiveness of including assistive technology that can be utilized for play, along with specific examples. Examples will include students/clients with complex needs evidenced by physical/motor impairments, intellectual disabilities, and extraneous factors such as cortical visual impairment.

Presenters will identify key strategies used within a holistic setting to implement these strategies within school, home, and community settings. Discussion will include specific information related to training new team members, family members, etc. for populations outlined. The presenters will open the topic for participants to discuss their own experiences with various populations in AT-based intervention. will be shared with participants.