AUTISM SPECTRUM DISORDER SERIES

Assistive Technology for Students with Autism Spectrum Disorders

Introduction

For years, different modes of technology have been used to improve the quality of life of people who have various developmental disabilities . However, the varied use of technology for children with autism continues to receive limited attention, despite the fact that technology tends to be a high interest area for many of these children.

This issue of the Autism Spectrum Disorder Series will discuss how various modes of technology (including technology designed as augmentative communication systems), can be used for children with autism to increase or improve their:

- Overall understanding of their environment
- Expressive communication skills
- Social interaction skills
- Attention skills
- Motivation skills
- Organization skills
- Academic skills
- Self help skills
- Overall independent daily functioning skills

What is Assistive Technology?

According to the Technology-Related Assistance for Individuals with Disabilities Act of 1988 (Public Law 100-407), an assistive technology means any item, piece of equipment, or product system, whether acquired commercially, off-the-shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities. Assistive technology service is any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device.

Typically, children with autism process visual information easier than auditory information. Any time we use assistive technology devices with these children, we're giving them information through their strongest processing area (visual). Therefore various types of technology from "low" tech to "high" tech, should be incorporated into every aspect of daily living in order to improve the functional capabilities of children with autism.

Visual Representation Systems

It is important to determine which visual representation system is best understood by the child, and in what contexts. Various visual systems, such as objects, photographs, realistic drawings, line drawings, and written words, can be used with assorted modes of technology, as long as the child can readily comprehend the visual representation.

Some children may need different visual representation systems in different situations. This may be dependent upon numerous factors, such as the skill being taught, as well as the unique characteristics of autism: attending, organization, distractibility, etc.

- **Example:** A child may use real objects for his visual schedule, as the objects appear to give him more information as to where he's going and what's coming up next, as well as to help him remain more focused during the transition. However, this same child may use photographs or line drawings in a picture exchange in order to communicate expressively. Some researchers suggest that, for most children, it is best to start with a visual representation system of line drawings, and move to a more concrete representation system of photographs or objects needed (18). See the line drawings in Mayer-Johnson "Picture Communication Symbols".

The Mayer-Johnson software program, Boardmaker, is a user-friendly program for both adults and children (18). The program offers a 3,000 Picture Communication Symbol (PCS) library in either black/white or color, and can be accompanied by any written word/message. The symbols can be made in any size, and tend to be universally understood. They present a relatively clear, 'uncluttered' representation and remove any ambiguity, which can sometimes arise when using photographs, especially personally-made photographs, as in the following example.

- **Example:** A teacher took photographs of the various teachers that a child with autism encountered at school, in order to help him learn the names of his teachers. When reviewing the names of the teachers in the photographs, the child referred to the photograph of a particular teacher as "Mexico". Upon further review of this photo, the teacher realized that in the background, barely visible, was the corner of a map of Mexico. Although the teacher's face was the prominent feature in the photo, the child processed the minimally visible map as the most prominent feature and thus labeled the photograph according to this feature.

When using line drawings such as Boardmaker, caution should also be taken in determining whether to use black/white or color picture communication symbols, as some children with autism may prefer or dislike specific colors. They may focus only on the color instead of processing the entire picture. This will render the Picture Communication Symbol (PCS) virtually meaningless to the children as they are not processing the entire picture. Black and white picture communication symbols tend to remove any ambiguity which might arise.

- **Example:** If a child prefers the color red, and the Picture Communication Symbol (PCS) for "lunch" has a red apple as well as a brown sandwich and orange juice, the child may only process the apple, as it contains his preferred color. The child may not even process the image, but attend only to the color red. Therefore, the PCS becomes non-meaningful to the child.

If the child has difficulty understanding the Picture Communication Symbol (PCS) line drawings and needs a more concrete representation, a good software program to use is Picture This (20). This program allows for the presentation of real photos, without risking ambiguous background clutter, which can be a part of personal photographs. Picture This contains over 2,700 photos from numerous categories which are ideal for:

- Creating schedules
- Augmentative communication systems
- Games
- Reading activities
- Sequence activities for following directions
- Various academic activities.

- **Strategy:** To teach a child, who is using photographs or objects as his visual representation system, to understand black/white line drawings, place a small black/white picture communication symbol in the corner of the various objects/photographs currently used by the child. Gradually increase the size of the picture communication symbol until it eventually covers up the entire photograph/object.

For children who have difficulty understanding two dimensional visual representation systems (e.g., photo, drawings, line drawings), and require objects as their visual representation systems, the use of True Object Based Icons (TOBIs) is suggested (3). These TOBIs can be any line drawing, picture, etc., which are cut out in the actual shape or outline of the item they represents. The child can both see and feel the symbol and shape, thus assisting him to more readily understand the two-dimensional representation system. TOBIs tend to be somewhat larger than the typical two-dimensional visual representation system. When first introduced, they may be 3 inches in size or larger (3). The printed word label should always accompany the picture, and should be placed strategically so as not to alter the symbol shape.

- **Strategy:** When any visual representation system is used, it is important to combine it with a written word, as many children with autism exhibit a high interest in letters and words, and some even become early readers. Therefore we should continually enhance the child's literacy skills by also providing the written word with any type of visual representation system.

The rest of this article will outline the various skill areas commonly associated with children with autism, with supporting technology strategies defined as follows:

"Low" Technology

Visual support strategies which do not involve any type of electronic or battery operated device - typically low cost, and easy to use equipment. Example: dry erase boards, clipboards, 3-ring binders, manila file folders, photo albums, laminated PCS/photographs, highlight tape, etc.

"Mid" Technology

Battery operated devices or "simple" electronic devices requiring limited advancements in technology. Example: tape recorder, Language Master, overhead projector, timers, calculators, and simple voice output devices.

"High" Technology

Complex technological support strategies - typically "high" cost equipment. Example: video cameras, computers and adaptive hardware, complex voice output devices.

"LOW" TECH STRATEGIES

- **Comprehension Skills**

- **Expressive Communication Skills**

- **Social Skills**

- **Attending Skills**

- **Academics**

COMPREHENSION SKILLS

Increasing comprehension of tasks/activities/situations is essential in addressing skill areas such as organization, attending, self help, following directions, following rules and modifying behavior. As a result, the child becomes more independent. The following "low" tech visual support strategies can be created and used to assist the child in increasing his comprehension skills and thus decreasing the occurrence of challenging behaviors:
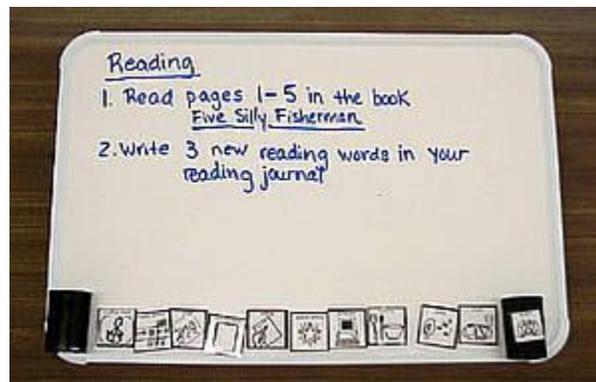
"Visual Schedule"

Schedules: Consistent daily use of an individualized visual schedule will increase a child's organization skills and independent functioning throughout all aspects of his life and will ease transition through adulthood. There are numerous ways to present visual schedules.

Example: object schedule, 3-ring binder schedule, clipboard schedule, manila file folder schedules, dry erase board schedules, etc.

"Object Schedule"

Each child's individual needs should be considered in designing his personal visual schedule. It should be noted that visual schedules are as important for the child to use at school as at home. The information given to the child through a visual mode is extremely critical in helping him to understand the day's events and their sequence.

"Object Schedule": A visual schedule will give the child the following information:

- What is currently happening
- What is coming up next (the sequence of events)
- When they are "all done" with something
- Any changes that might occur

A visual schedule is a "first-then" strategy, that is, "first you do ___, then you do ___", rather than an "if-then" approach (i.e., "if you do ___, then you can do___"). The "first" activity can be modified as needed to accommodate the child's changing ability to process in-coming information. Once this is done, then he can move on to his next visually scheduled task/activity. It is important for the child to indicate that he is "all done" with a scheduled activity. For example he can cross out/check off the scheduled item, or place the scheduled activity object/photo/Picture Communication Symbol (PCS) in an "all done" envelope.

Various social interactions can be included in the child's daily schedule as well as building in a balance of "high stress" (non-preferred) and "low stress"(preferred) activities. Each child's "break time" or "quiet time" can also be visually scheduled at various times throughout the day as needed.

- **Example:** Showing completed work to a teacher for social interaction and reinforcement, or saying "hello" to the teacher and students when entering the classroom.
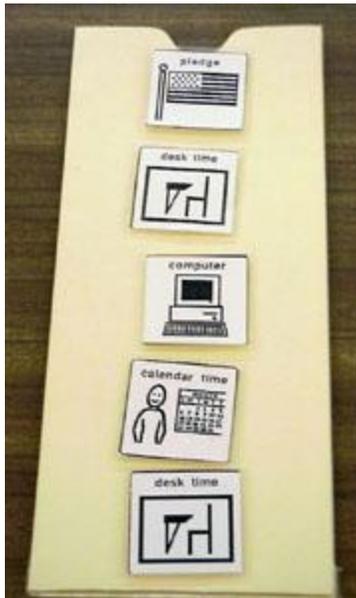
"Visual Schedule"

Mini schedules/routines can also be incorporated as needed into the child's day.

Example: A visual routine checklist titled "Before Kindergarten" was developed for a child who was having difficulty establishing a routine while waiting to go to kindergarten following lunch. As he did not readily comprehend what was expected of him during this time period, challenging behaviors typically occurred. The "routine" was laminated and posted on the refrigerator with magnets glued to the back. The child would then check off each completed routine activity (e.g., eat lunch; wash face and hands; brush teeth; read 2 books; put on shoes and socks; put on coat and back pack; wait by the door for the bus). o a teacher for social interaction and reinforcement, or saying "hello" to the teacher and students when entering the classroom.

ACTIVITY SCHEDULES

"Activity Schedules"

"Activity Schedule" Independently engaging in appropriate tasks/activities for a certain period of time is an important life skill for children with autism. An activity schedule teaches this skill through a set of pictures (photo or PCS) or written words, which are used to visually cue the child to engage in a sequence of activities for independent recreation/leisure time (19). The number of activities and sequence of steps per activity need to be individualized for each child. For some children, activities will need to be broken down and depicted step-by-step in order for the child to complete the activity independently. For other children a more general, single photo/PCS/written word can be used to cue the child to perform an entire task or activity. Any type of binder, photo album, etc., can be used as the child's activity schedule book, or simple written lists may suffice for the child who is able to read and comprehend. The activity schedule book should contain the various tasks/activities (and steps if needed) depicted in whatever visual representation system the child best comprehends (e.g., photos, line drawings, etc.). Upon completion, a social reinforcer can be "built in" as the last page in the activity schedule book.

- **Example 1:** On the first page of a photo album a photograph of a puzzle is depicted. On the next page, a photo of a shape sorter is depicted. On the third page, there is a photo of the child being thrown up in the air by Daddy.

- **Example 2:** A written list with the following items listed, to be checked/crossed off by the child: Unload dishwasher; Vacuum living room; Fold towels; Computer for 30 minutes.

"Visual Calendar"

CALENDAR (home/school)

Use of a weekly/monthly calendar at both home and school can provide the child with important information regarding up-coming events/activities, rather than relying on auditory information. When the child asks when a particular event will occur, he can easily be referred to the visual calendar. For example, class field trips, "bath night", McDonald's, etc.

Use of a visual calendar can also be helpful in assisting the child to understand when regularly scheduled events may not occur.

- **Example:** If the child has swim lessons every Friday after school, but this Friday the pool is closed, draw an international "no" - circle with a slashed line through it on the scheduled swim lesson.

In this example, acknowledgement is made that the child has a scheduled activity that is not occurring on a particular day.

Calendars can also be used to give the child important information regarding school attendance, which is particularly helpful for "days off" from school during the typical school week. A visually depicted monthly calendar is used with each day that the child will be at home or at school . Many parents put these monthly calendars on the refrigerator and reference them daily with their child by crossing off a completed day, and noting where the child will be going (or staying) tomorrow.

In addition to schedules, comprehension skills can be increased by the following strategies:

International No

INTERNATIONAL "NO"

Use of the international "no" symbol (red circle with a line drawn through it) has proven very effective in visually communicating the very abstract concept of "no" for children with autism.

Use of the international "no" symbol can assist the child in visually comprehending the following:

"Stop - don't do what you are doing"

- **Example:** For behavior management cards such as the Picture Communication Symbol (PCS) of "no hitting" with an international "no" over it.

"That is not a choice right now"

- **Example:** If the child hands you a Picture Communication Symbol (PCS) of something that he wants, that is not an option at this time, use a red dry erase marker to place an international "no" on the PCS and say "no_____, not now".

"You are not permitted"

- **Example:** Placement of a tag board-size international "no" on doors has stopped children from running out of the door.

"Nonexistence"

- **Example:** Placement of the international "no" on a scheduled activity to acknowledge that, although the activity typically occurs at this time/day, it will not be occurring today - for whatever reason.

DIRECTIONS

Low tech strategies can be used in numerous ways to give the child visual information for following directions. Visual information greatly increases the child's comprehension of what is expected of him and is far more effective than auditory directions only. Visual directions help gain, maintain and refocus a child's attention as well as ensuring that he gets complete instructions, thereby reducing the amount of support needed and increasing independent skills.

The following "low-tech" strategies can be used to give the child visually presented directions.

Use of a dry erase board or contact paper white board covering part of a notebook or schedule system to write/draw various visual directions which are given auditorilly.

- **Example:** Take out your journals; Write 3 sentences about your weekend; Raise your hand when you are finished.

Sequential step directions for specific tasks/activities.

"Visual Directions"

- **Example:** Brushing teeth, making lunch, vacuuming, folding towels, setting the table, checking out books from the library, cooking, "homework directions", "school morning directions" etc.

"School morning directions"

- **Example:** Upon arrival at school a child is given a "morning directions" card to assist him in completing a visual list of instructions before sitting at his desk and beginning the day. The card is laminated with a dry erase marker attached by a string and is located near the child's coat hook. After hanging up his coat and backpack, he can take the card and begin the "morning directions", checking off each item upon completion (e.g., Put reading book in tub; Put attendance stick in box; Put lunch ticket in hot/cold box; Put "Morning Directions" card away; Sit at desk).

"Brushing teeth"

- **Example:** Picture Communication Symbols (PCS) representing each sequential step in this task, are placed on a Velcro strip positioned directly above the sink (in front of the child). As the child completes each step of the task, he pulls off the PCS representing the step which he has completed, and puts it in an "all done" envelope.
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"Library"

- **Example:** A small set of Picture Communication Symbols (PCS) representing the steps necessary to complete the library routine of choosing a book, "checking" the book out, sitting at a table and reading the book, and then walking back to class is created. This set of PCS is attached via a metal ring which can easily be kept in the child's pocket or attached to a belt loop or binder for easy step-by-step reference when going to the library.

"Setting Table"

- **Example:** Photographs of each sequential step for setting the table are placed in a small photo album accompanied by the written direction. The last page should indicate something desirable for the child to do upon completion of this task, such as "computer for 30 minutes". The child is taught to turn each page as he has completed a step.

FOREWARNING

For children who need very explicit forewarning regarding when something is going to "stop/end" or be "all done", use of "go", "almost done" and "stop" cards have proven very effective in giving children this important information to assist them in making this sometimes difficult transition (to stop).

Strategy: These cards are particularly useful for activities which do not have clear cut endings, such as some computer games, video games, drawing, etc.

"Stop" Card

Each card is a large colored circle with "go" as green, "almost done" as yellow, and "stop" as red, with the word written in large letters in the center of the colored circle. When the child starts an activity, the "go" card is placed on his desk, computer table etc., accompanied by a verbal message to "go" or "start" the task. When there are approximately 1-2 minutes left for the child to continue the activity, the "almost done" yellow circle is placed in front of the child again, accompanied by a verbal message. When it is time to stop the activity, the "stop" circle is placed in front of the child with the verbal message that it is time to stop.

RULES/ALTERNATE BEHAVIORS

Putting rules in a visual form allows the child to understand the expectations, as well as what actions or alternatives are acceptable. This strategy results in more consistent behavior (12). In addition, visual representation of rules and alternative behaviors allows the child to improve his self-regulation and self-management skills without needing the support of an adult.

"Individual Rules"

Class rules or individualized personal rules taped to desk: These rules should be provided through a visual representation system which the child can understand (written words, line drawings, etc.). If the child is engaging in an inappropriate behavior, he can be directed to look at a specific rule, e.g., "Read rule number 3".

"Good Choices That I Can Make" list: This visual support strategy assists the child in understanding and making appropriate choices when he has "broken" rules or engaged in inappropriate behaviors. This list should be posted so that the child has easy visual access to it, and should initially be referenced by an adult in the environment to teach the child the importance of this visual support strategy.

Example: The child is making silly noises at the beginning of a math assignment, with math typically being a difficult subject for the child. An adult can direct the child to the appropriate rule that is visually represented on his desk, by either pointing to the rule or stating "look at rule number___", which states "sit quietly and do my work" . The adult should then reference the child's "Good Choices That I Can Make" list. The adult may initially need to point out which specific choice the child should make in this circumstance. This strategy will greatly assist the child in developing behavioral self-management skills. The following "Good Choices That I Can Make" list is an example:

- I can raise my hand to ask questions or get help.
- I can ask more questions if I still don't understand.
- If I don't understand what someone is saying or doing, I can ask them.
- I know that my own words and actions can make people feel differently than I do.
- I can use "I" messages to tell people how I feel. ("I feel bad when you tell me it's inside recess")
- I can write down the problem and then think of appropriate things that I could do.
- I could use relaxation strategies. "Take a deep breath, count to 10, breathe out slowly"
- I could ask for time-out (break) all by myself.
- I can make good choices.

Individual rule/behavior cards: These visual representation cards can be kept on a metal ring and used when needed either singly or in succession. Use of the international "no" should be drawn in red on top of the Picture Communication Symbol (PCS) or photo when appropriate to clearly indicate that a specific behavior should not occur. Behavior management cards can also be "color coded". This gives the child additional visual information to better understand desired and undesired behaviors. The following colors are used:

Red: behaviors you don't want the child to do (e.g., "no throwing").
Yellow: behaviors you request the child to demonstrate (e.g., "shhh, quiet", "quiet hands").

Green: appropriate alternative choices (e.g., "give a hug", "take a walk").

"Individual Rule/Behavior" Cards

Example: Picture Communication Symbol (PCS) laminated on large index cards to communicate the following:

- "Look at Mrs. Jones" - PCS of eyes
- "Sit on chair" - PCS of a child sitting in a chair
- "Shhh, be quiet" - PCS of a face with its finger to lips indicating "Shh"
- "Don't hit" - international "no" drawn on top of PCS of a child hitting another child; etc.

Transition rule cards: These cards can be used to help the child understand (visually) where he is going and what is expected of him in this environment.

Example: Going to McDonald's: A photograph of McDonald's is laminated to an index card. On the back of the card, specific "rules" for McDonald's are visually represented. If something is bothering me I can...: This strategy visually helps the child choose appropriate alternative behaviors when he is anxious or stressed. This card can be taped to his desk with the above heading and the following examples, or placed in a small photo, album which may also contain other visual support strategies:

- raise my hand for help
- close my eyes and count to 10
- take 5 big breaths
- ask for a break

EXPRESSIVE COMMUNICATIONS SKILLS

"Low-tech" strategies designed to focus on a child's expressive communication skills include the following:

Picture point communication board system: In order to communicate the child points to various visual representations (e.g., photos, PCS, objects, etc.) located on a "communication board" . Numerous communication boards can be created that are child, task, or environmentally specific.

- **Example:** Placemat communication board to be used during snacks and meals with PCS around the edge of the placemat; communication board created for the "play" area.
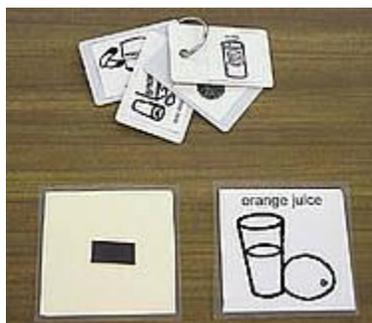
"PECS"

Picture Exchange Communication System (PECS): The child approaches and gives a picture of a desired item (photo, PCS, object, etc.) to a communicative partner in exchange for that item (7). The use of this type of communication system provides the child with a way to communicate and most importantly, teaches the child to spontaneously initiate a functional communicative exchange (7).

Numerous adaptations can be made when using a PECS program to meet the individual needs of a child. For example, placing the visual representation system on frozen juice can lids or other hard discs or squares (counter top samples) allows the visual representation system to become more prominent to the child by giving him more tactile input (weight and hardness). He may tend to "crumple" up lightweight paper type items (pictures on plain paper) as a possible sensory need.

Break cards: This is to help the child communicate that he needs some "down time" or a "break". Break cards should be easily accessible to the child and could be located in a consistent spot in the classroom, such as on the child's communication board or book, on the child's desk, etc. The purpose of the break card is for the child to communicate the message that he needs a break by using an appropriate communicative mode (visual representation system) rather than having to become increasingly anxious and frustrated, which may result in the occurrence of challenging behaviors.

Choice cards: Choice cards (again using any type of visual representation system) allow the child a degree of independence by indicating a choice from a pre-determined set of possibilities. (e.g. a "work time" choice card could be presented to the child with several choices of activities for the child to choose from). When presented in this manner, the child is less likely to act out because he is allowed to make a "choice" of what he wants to do.

"All Done" Cards

"All done" cards: Many non-verbal children exhibit challenging behaviors to indicate that they are "all done" with something, as they typically have no other way to communicate this concept. Therefore, teaching a more appropriate way to indicate "all done" through a visual representation system will lessen both the child's and adult's stress and frustration. "All done" cards can be taped to the child's work area and taught to the child by stopping an activity prior to reaching the child's attention/frustration level, then pointing to the "all done" card. The child's hand can be physically prompted to point to the "all done" card if needed. "All done" cards can also be placed on the child's communication board, or book, for him to use.

Topic ring/topic wallet: These are designed for children who are verbal, yet have difficulty initiating a topic with others or, have difficulty initiating various topics with others, particularly when these topics are not related to their high interest areas. The "topic wallet/ring" can have various topics visually illustrated (e.g., written words, PCS) to prompt the child to initiate a topic.

- **Example:** The following topics are illustrated individually on small 3" by 3" laminated cards using both PCS and written words. They are either attached by a metal ring in the corner (for the child to hook on a belt loop) or placed in a small "communication wallet" to be kept in his pocket. The topics include "What did you do over the weekend"? "What is your favorite movie?" "Do you have any pets?" "What books do you like to read?"

Relating past events: Many children with autism, both verbal and non-verbal, have significant difficulty relating past events. Using a visual representation system, which the child readily understands, can help to bridge this gap, at least between home and school. General templates are developed, which can be easily circled or filled out each day and sent to the respective location (home or school), to aid the child in relating past information through this visual representation system.

SOCIAL SKILLS

Children with autism need to be directly taught various social skills in one-to-one and/or small group settings. Numerous low-tech strategies can be used for this purpose. Social skills training will also be needed to consider the child's possible difficulties in generalizing this information different social situations, which may be supported through the following visual strategies:

Social Stories: The use of Social Stories, developed by Carol Gray, provides the child with the use of visual information/strategies that will improve his understanding of various social situations and teach him specific behaviors to use when interacting with others. Social Stories are written in first person and are individually written for each child for various difficult social situations (for example, staying in assigned seat on the bus). The Social Story should be visually represented in a mode which the child can most readily understand (such as written words, line drawings and written words, photos and written words).

The repetitious "reading" of the Social Story, when the child is calm, is what leads to the success of this strategy. Two 3-ring binders of identical Social Stories, kept in page protectors, could be made, one for home and one for school, so the child can read them at his leisure. This strategy has proven to be very successful for many students in learning to recognize, interpret and interact appropriately in different social situations.

A software program from Slater Software Company which converts text to a graphic symbol, is called "Picture It",. This software program is ideal for adding line drawing graphics above written words to increase the child's understanding of Social Stories.

Social Scripts: Social scripts are similar to Social Stories; however, an actual script is developed for a specific social situation (it is specific to the child and the social situation).

- **Example:** A child has difficulty asking peers if he can join in their "ball-tag" game at recess. He typically runs in the midst of the game, takes the ball and then runs away. The script would read: Joey - "Hi guys. Can I play 'ball-tag' with you?" Guys - "Sure you can, Joey, but you will have to wait over there until it's your turn to throw the ball." Joey - "O.K. I'll wait until you tell me it's my turn." Use of social scripts also readily helps in role playing these various social situations with peers, puppets, etc. Social scripts can also be used to visually, and thus clearly indicate what went "wrong" in a social situation.

Comic Strip Conversations: The use of simple drawings to visually clarify the elements of social interactions and emotional relations. Comic Strip Conversations are used to visually "work through" a problem situation and identify solutions.

Turn-taking cards: Turn taking cards are used to visually represent and mark whose turn it is. This use of turn-taking cards through a visual representation mode (PCS, object, written word, etc) is very effective in teaching this social skills concept.

"Wait" Card

"Wait" cards: Wait cards visually represent the abstract concept of "waiting" through the use of a large orange colored oval card printed with the word "wait". These cards can be used at any time to teach the abstract concept of "waiting".

- **Example:** Place the "wait" card on the computer monitor while waiting for the computer or a program to boot up; have the child hold the "wait" card while waiting in line.

"Help" cards: "Help" cards are used to teach the child the abstract concept of raising his hand in order to indicate that he needs help. Initially it is necessary to provide a concrete reason for the child to raise his hand by using the "help" card. An "I need help" visual representation (PCS, photograph, written word - taped to a Popsicle stick, or object) is used for the child to raise up in the air to indicate that he needs help. The item that he raises in the air can gradually be eliminated until the child is readily raising only his hand to seek assistance.

"Waiting hands" card: An outline of a person's open hands on colored paper is used as a guideline as to where the child should place his hands while waiting (either for his turn, or for a chance to perform an action, etc.).

Social "rule" cards: These cards are taped to the child's desk in the classroom (e.g., "I will raise my hand and wait for the teacher to call on me"). Social "rule" cards can be made for other environments than just the classroom. A "rule" card per environment can be written on an index card, laminated, and then given to the child to carry along as a visual reminder of the social "rules" for that particular situation.

- **Example:** Library social rules cards: "I will sit at a table with at least one other student". "I will discuss my book with one other student". "I will discuss another student's book". card while waiting in line.

ATTENTING SKILLS

The visual symbols "go", "almost done" and "stop" can also be used to increase a child's attending skills. Data will need to be initially obtained to get a general idea of how long a child attends to a particular task.

- **Example:** The child attends to a particular task for approximately 45 seconds and then throws all of his materials to indicate that he is "all done". To teach the significance of the "go" , "almost done" and "stop" cards, the "go" card is given at the start of the activity, the "almost done" card is given after approximately 30 seconds (as we already know the child will throw the materials after 45 seconds) and the "stop" card is given at approximately 40 seconds, with the activity immediately ceasing. It is critical to initially use the cards to "stop" the activity prior to the child throwing the materials, so that the child realizes the significance of the cards in relaying the messages of being "almost done" and "stopping". Gradually, the length of time for giving the child the "almost done" card and the "stop" card is increased, thus increasing the child's attending skills. It is important to note that the "almost done" card is always given to the child within a short time frame of giving him the "stop" card. Consistency is important in using these cards to increase the child's attention.

ACADEMICS

File Folder Activities: The use of file folder activities can assist the child to independently focus on numerous academic tasks. Long strips of Velcro are placed on the inside pages of a laminated file folder. Matching tasks focusing on colors, shapes, alphabet letters, common nouns, familiar people, categories, relations (e.g., shoes and socks) etc. can be developed for the child, as well as focusing on reading comprehension skills, math skills, generalization skills, etc.
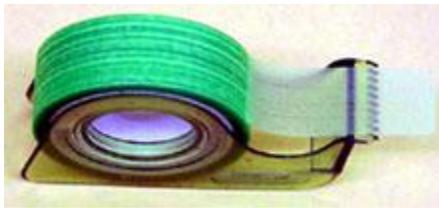
"Highlighter Tape"

Highlighter Tape: Many children with autism possess relative strengths in their reading recognition skills (decoding), but experience significant difficulty understanding what they have read (comprehension). Highlighter tape is an economical, non-destructive way to highlight text wherever needed via a removable transparent tape (25). The tape can be used in such ways as highlighting key words pertaining to a reading comprehension question. Different colors of highlight tape can be used to encode different significant concepts (e.g., blue highlighter to mark dates, yellow highlight tape to mark people, etc.).

"MID" TECH STRATEGIES

- **Language Comprehension Skills**
- **Espressive Communication Skills**
- **Social Skills**
- **Attending Skills** (motivation):
- **Organization Skills** (story sequencing and time management)
- **Academics**

Listed below are descriptions of several "mid" tech devices that can be used by children with autism to enhance specific skill areas. Most of these devices are very appealing to these children and provide them with motivation to participate and focus on various skills and classroom activities successfully.

These devices are called Voice Output Communication Aids (VOCAs). Any type of visual representation system can be placed on simple voice output devices for children to access by a simple push of a "button". Most of these devices are battery operated and are easy to operate for recording messages. It is important to note that these devices were created for use as an augmentative means to expressively communicate. However, for many children with autism, as noted above, these devices are very appealing and motivating, and can be used in numerous ways to focus attention on various skill areas, as well as increase classroom participation, focus and communication. The following list identifies a number of such VOCAs mid tech devices.

"Big Mack": A single switch/button device available from AbleNet which allows for 20 seconds of record time. Approximate cost is $89.00.

Talk Pad: A 4-message/button battery operated device available, which allows for 15 seconds of record time per button. Available from Frame Technologies for approximately $99.00.

Voice in a Box

"Voice in the Box": Multi-message battery operated communication devices available in 16, 24 or 40 messages/buttons from FrameTechnologies or approximately $195.00.

"Cheap Talk 4": A 4 message/button device which allows for 5 seconds of record time per button available from Enabling Devices for approximately $69.00.

"Step-by-Step Communicator": A battery operated device which allows for prerecording a series of unlimited sequenced messages up to a total of 75 seconds of record time. Available from AbleNet for $129.00.

Language Master

Language Master: The Language Master is a "mid" tech piece of equipment that has been used for more than 20 years (25). The Language Master is an electronic device about the size of an old tape recorder. The cards, which are approximately 3" by 8" with a "recordable strip" across the bottom, are played "through" the Language Master. A short verbal message can be recorded on each card. The cards are also big enough to include corresponding visual cues (e.g., words, PCS, photos) of the recorded message.

Tape recorder: Any easily operated tape recorder can be effective in addressing various skill areas in children with autism spectrum disorder.

Voice Output Communication Aids (VOCAs): Can be used to develop the following groups of skills for children with autism: Language Comprehension Skills, Expressive Communication Skills, Social Skills, Attending Skills, Organization Skills and Academic Skills. The following is a discussion of these skill areas and the possible use of specific VOCAs to help children with autism function more independently.

LANGUAGE COMPREHENSION SKILLS

Talk Pad: This device can be programmed with simple 1-4 step directions. The child is motivated to hit the buttons and thus complete the sequence of steps.
Example: A child with autism experiences great difficulty following the 3 step sequence to complete his "job", which is to prepare for snack time. The child requires continual verbal and physical prompting from an adult to attend to the task - as the child typically runs around the room - and then to complete each step of the task. The 3 steps of the task are recorded on the Talk Pad, with the 4th message telling the child to "Sit in chair". Visual cues, corresponding with each verbal message, are placed on top of each "button" on the Talk Pad with Velcro. The child is extremely motivated to "push the buttons" on this device and, following the initial teaching, is now able to independently do his "job" for snack time.

Language Master: The teacher may record multi-step directions on the cards, one step per card. If a student cannot remember the auditory directions that were given, he can run the cards through the Language Master to hear some or all of the directions).

ESPRESSIVE COMMUNICATION SKILLS

"Big Mac"

Voice Output Communication Aid (VOCA): Children can express themselves with the assistance of any visual representation mode, or visual cues placed on a "simple" voice output communication aid/device. Many children with autism are motivated to communicate by use of these devices, particularly by the auditory feedback immediately given as they use the device. Use of VOCAs have proven effective in teaching a child the cause/effect of language through activities which are stimulating to him.

- **Example:** Use of the Big Mack for a child to request highly desired sensory activities, such as "chase me"; "tickle me"; "hug me"; "listen to music". The use of VOCAs as communication devices are not always effective for all children with autism. Some children find the VOCAs so overly motivating and stimulating that they do not become effective communication devices. The child may repeatedly push down the button(s) on the device for the self-motivation that he receives from the auditory feedback, rather than for the cause/effect of the communicative message. In this case, the VOCAs can still be used with the child, since they are clearly motivating, but in a different manner. For example, they may be used to focus attention on various skill areas, as well as increase classroom participation. In this case, the child's communication needs may be more effectively addressed through the use of "low" tech expressive communication strategies.

A research study evaluating the use of VOCAs by children with autism revealed the following:

- Young children with autism can learn to use VOCAs to effectively communicate various language functions (i.e., request, answer yes/no questions, make social comments)
- VOCA use generalized across settings
- Use of VOCAs increased the child's use of gestures, words and vocalizations
- Communication partner interactions increased when VOCAs were used.

Audio taping: Audio taping can be used to focus on communication skills to draw the child's attention to an inappropriate communicative behavior. (e.g., interrupting, perseverative speech, incessant question asking, topic maintenance, etc.) as well as to develop self-awareness and self-regulation of appropriate communicative interactions.

Language Master: For a child, who is able to imitate, the Language Master could be used as a model for imitation, as well as an opportunity to engage in social interactions.

- **Example:** At the end of a child's activity-schedule-book is a Language Master card with a picture of bubbles glued on and the written words, "I want bubbles". The child places the card in the Language Master and then takes the card and gives it to someone while repeating the utterance.

SOCIAL SKILLS

Big Mac: This piece of equipment is a great motivational device to focus on turn-taking activities. Countless turn-taking activities can be created and incorporated into every aspect of the school day.

- **Example:** During circle time: taking turns pushing the Big Mack button to respond to prerecorded calendar routines, songs and books. (What day is it? what month is it?; Using repetitive lines work great (Old McDonald had a farm); "Turn the page" -during large group reading; and "my turn" as a visual/physical marker during focusing on specific turn-taking tasks, etc.

Audio taping: Any type of social interaction, both appropriate and inappropriate, can be taped and then replayed as a teaching method to assist the child in identifying what is an appropriate, and what is inappropriate social communicative behavior. (e.g., interrupting, asking for assistance, drawing attention, initiating varied topics, maintaining topics initiated by others, etc.). Audio taping may also be used to focus on various non verbal social communication skills such as vocal volume or emotional tone of voice.

ATTENDING SKILLS (motivation)

Voice In the Box: This device can help the child to focus his attention during large group-listening activities. These activities tend to be very difficult for children with autism. Again, countless activities can be created and incorporated into any large group listening time.

Example: When the teacher is reading a book aloud to the class, numerous lines from a book can be visually represented with a corresponding recorded message on the buttons. The child can "assist" in "reading" the story by pushing the appropriate buttons for the story. Repetitive line books such as "Brown Bear" work great. The child can push the button for "Brown Bear, Brown Bear what do you see?" Another example would be the line "...but he was still hungry" from "The Very Hungry Caterpillar". Circle time activities can be programmed in a similar manner.

Big Mack: To increase attention to large group listening/reading activities, record a repetitive line from a story, along with a corresponding visual representation system placed on top of the Big Mack.

- **Example:** A picture of the Big Bad Wolf placed on the Big Mack switch with the repetitive line "I'll huff and I'll puff and I'll blow your house down" recorded.

VOCAs as Reinforcement: Many students with autism find the VOCAs to be very reinforcing and thus provide the necessary motivation to attend to and complete other less desirable tasks/activities, if allowed to interact with the VOCA upon completion of those tasks.

"Talk Pad - Sequencing"

ORGANIZATION SKILLS (story sequencing and time management)

"Talk Pad - Sequencing" Talk Pad: The physical layout of the "buttons" on this device works well for focusing on sequence stories, because the four buttons are positioned from left-to-right, rather than the Cheap Talk 4, where the buttons are located 2 above and 2 below.

Each step of a sequence story can be prerecorded on each of the four buttons in sequential order. The four corresponding sequence story pictures are placed in front of the child not in order. As the child presses the first button in the left-to-right sequence of buttons, he hears the auditory message for the first sequence picture. He can then select the corresponding picture to that message as the first picture in the sequence story, and place it on top of the first button using Velcro. This continues with each of the subsequent buttons and pictures. Printed sentences can also be used in place of pictures for the sequence story.

Language Master: The Language Master provides a motivating and novel approach to focus on sequence stories, a typically difficult activity for a child with autism. The child listens to the sentence on the card describing a picture, which is part of a sequence story. The child can then put the appropriate picture in sequential order for the story, according to the message given on the Language Master.

Timers: Use of a timer (either egg, kitchen, or Time Timer, Inc.) can assist many students with autism in providing much needed time constraints and structure for completing tasks. When given an unlimited amount of time, these students typically take an unlimited amount of time for completion. The use of timers tends to improve task completion. However, caution should be taken in the use of a timer, since some children may become too highly focused and distracted by the timer, and thus become less attentive to completing the task.

ACADEMICS

"Talk Pad--Phonics" Talk Pad: This device can be used as a motivating way to focus the child's attention on phonics. Each button can be prerecorded with a sound from a 3 - 4 "sound" word (e.g., "dog"). The child then chooses the corresponding letter card to match with the recorded sound.

Example: The first button of the Talk Pad is recorded with the sound /d/. The child chooses from a selection of the 3 letters that comprise "dog", as well as the entire written word, and places the matching letter on the first button (using Velcro). The child progresses through each button in the

same manner. The final button says "dog", and the child matches the whole written word, "dog", to this final button.

Voice In The Box: This motivating device can be used in numerous ways to focus on various academic skills.

Example: Varied levels of reading comprehension skills can be addressed from matching simple single pictures to corresponding written words, to questions regarding various written information (e.g., Animal pictures are velcroed to a top-to bottom button column on the Voice In the Box, with corresponding words recorded under each button. When the child presses one of the pictures, such as "dog", the recorded button message says "dog, find the word dog". The child must then choose which written word matches the picture and its auditory message, and place that written word (using Velcro) on the blank button next to the picture of the "dog". When the child places the written word, "dog", on the blank button, the button responds with a prerecorded message of "d-o-g, dog".

Overhead projector: Billy, a child with autism, expressed extreme interest and motivation to the use of this teaching device, calling it "the most beautiful T.V. screen I have ever seen". Most academic areas lend themselves to the use of an overhead projector:

- Allowing the child to do math work on overhead transparencies
- Teaching the child spelling words via the overhead projector
- Focusing on reading comprehension by having the child fill-in-the blank for various questions regarding understanding of previously read materials
- Focusing on mechanics of writing using the overhead projector.

"HIGH" TECH STRATEGIES

- **Video Taping**
- **Computers**

VIDEO TAPING

Children with autism are often highly interested, motivated and thus attentive to videos. Many children enjoy repetitive viewing of videos due to the "predictability" of the information given; that is, knowing what's coming up next. Thus video taping can serve as an excellent tool with which to teach numerous skills to children with autism. These skills may include:

Language comprehension skills: Receptive vocabulary skills can be taught through video taping (names of common everyday objects, toys, names of familiar people, animals, etc.). Directions to complete various routines can also be taught by the same video taping strategy (e.g., making the bed, setting the table, getting dressed, going to the library, etc.).

Social skills: Numerous social situations can be video taped and replayed to teach identification of appropriate/inappropriate social behaviors. Video taped segments can be made of any social area in which the child might be experiencing difficulties (e.g., asking for assistance, initiating varied topics, maintaining topics initiated by others, repetitive / perseverative speech or question asking, interupting others, etc.).

Non-verbal features of social communication can also be effectively taught through video taping (e.g., tone of voice, facial expressions, body postures/language, gestures, personal space, vocal volume, etc.).

In addition, video taping can be used to demonstrate how to appropriately engage and/or interact in various social contexts such as recess, lunch, music class, McDonald's, church, etc.

Expressive language skills: Expressive vocabulary skills (i.e. names of items, people, places) can be taught in much the same way as receptive vocabulary skills. The teaching of categorization skills and concepts as well as pragmatic language skills (social interaction skills), can be enhanced through the use of video taping.

Self-help skills: Self- help skills such as getting dressed, brushing teeth, washing hands, even hygiene can be demonstrated through the use of videotaping.

Emotions: Facial expressions showing various emotional states can be video taped, and shown, to demonstrate the various emotions/feelings.

Academics: Writing skills, such as drawing shapes, writing alphabet letters, writing words (names of familiar nouns), story generation, etc. can also be demonstrated and taught through video taping.

COMPUTERS

Research on the use of computers with students with autism revealed the following:

- Increase in focused attention
- Increase in overall attention span
- Increase in in-seat behavior
- Increase in fine motor skills
- Increase in generalization skills (from computer to related non-computer activities)
- Decrease in agitation
- Decrease in self-stimulatory behaviors
- Decrease in perseverative responses

Many students with autism are highly interested and motivated by computers. Therefore, computers should be infused into the child's daily curriculum, not used solely for reward or recreational purposes. Computer assisted learning can focus on numerous academic areas as well as provide an appropriate independent leisure time activity for people with autism. Camilla K. Hileman states that computers are motivating to children with autism, due to their predictability and consistency, compared to the unpredictable nature of human responses. The computer does not send confusing social messages. The computer places the child in control, allowing for the child to become an independent learner.

Touch Window

Adaptive Hardware: In order to access the computer, some children with autism might require that the standard computer be adapted with certain devices. Listed below are a variety of devices that can assist a child in accessing the computer:

Touch Window: The purpose of the touch window is to allow the child to "navigate" and "interact" with the computer by touching the screen, rather than operating the mouse. Touch window/screen can be easily mounted on the computer monitor with the user simply touching the screen to replace mouse actions. The use of a touch screen can assist a student who experiences difficulty understanding the abstract relationship between the mouse actions and the resulting actions on the screen. With a touch screen, the concrete relationship between what the child sees and what the child directly activates is established (25). The Touch Window is available for Macintosh or Windows platforms from Edmark for approximately $335.00.

Intellikeys: This is a commonly used alternative keyboard that easily connects to a computer, and is available for Macintosh or Windows platforms. In order to operate the computer, the child simply pushes various locations on an overlay that is placed in the Intellikeys . Standard overlays

for the alphabet, numbers, mouse direction and a 'single switch hit' are included with the Intellikeys. However, various overlays can also be created to go with numerous software programs through the purchase and use of additional Intellitools software programs. In addition to acting as an alternative keyboard, the Intellikeys has 4 switch jacks located on the side of the keyboard, so that a single switch or multiple switches can be connected to the computer through the Intellikeys for children to access via a single switch hit. This would allow children with limited fine motor control to access the computer. The Intellikeys is available from Intellitools for approximately $350.00.

Big Keys and Big Keys Plus: This is an alternative alphabet keyboard that has been specifically designed for young children. The keys are large (1 inch square), with the various alphabet letters color coded to help children more readily find specific keys (i.e., vowels in one color, consonants in a different color). The keyboard is also arranged in ABC order for easy access for younger children. This keyboard is available from Greystone Digital for approximately $150.00.

Trackballs: Trackballs come in various sizes and shapes, and allow the child to move the mouse around the screen by rolling a stationary "ball" around with either his fingertips or hand. Some children with autism can master the mouse operations with a trackball, and eventually transfer to use of a standard mouse. Trackballs can be purchased from many retailers for approximately $40 - $100.

Software: There are numerous software programs available that focus on a variety of skill areas such as:

- Language skills
- Attending skills
- Problem solving skills
- Fine motor skills
- Academic skills
- Leisure time activities

Please note the attached Software Suggestions for programs that have been used effectively for children with autism to address various skill areas. An excellent article is "A Review of Kids Software for Children with Autism Spectrum Disorder" by Jill Fain Lehman. This article lists various software programs for children with autism, by skill area (e.g., language comprehension skills, problem solving skills, etc.). Since autism is a spectrum disorder, the effectiveness and appropriateness of each program will be child specific.

Accessory Equipment

Digital camera: A digital camera can be very beneficial in making two-dimensional visual representation systems for children who have a strong preference for the visually-presented information.

Scanner: A scanner can be used to scan in numerous materials, such as pages from books, assignment sheets, CD covers, video covers, etc. Once the item is scanned, it can be shown as text or as a graphic on the child's computer, allowing him to access it through his keyboard.

CONCLUSION

It is interesting to note that the majority of strategies listed in this article fall under the category of "low"-technology and should therefore be easily accessible to many at a relatively low cost. It is important to consider that all of these suggestions, from "low"-tech to "high"-tech should always be individualized to meet the unique needs of any child with autism. Most importantly, use of these varied modes of technology will greatly increase the child's independent functioning skills by decreasing the amount of direct support needed from another person.

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