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Using Technology to Support Individuals with ASD: A Review of the Literature

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There have been many great advances in the field of education with regard to students with special needs, especially for those with Autism Spectrum Disorder. Autism Spectrum Disorder (ASD) is characterized by deficits in social and communication skills, as well as ritualistic and repetitive behavior. To address these core deficits, students with ASD may require supports on many levels in the school setting. Technology provides a new method to address the needs of those with ASD as well as other disabilities. The use of technology is a way to connect these individuals with their mainstream peers in the classroom and provides a more discrete way of allowing them to have the supports they need. As technological advances are being made, more of these technologies can be incorporated into classroom programs for students who require additional supports.

In the 21st century, technology is becoming increasingly integrated into human society. It is not uncommon to see individuals on iPads, tablets, laptops, and smart phones at home, work, and in public. Even individuals with ASD engage with electronic screen media more than they engage with any other leisure activity (Shane & Albert, 2008). Within this context, it is logical that researchers and educators should be looking to these devices to improve supports already provided to individuals on the Autism Spectrum.

Communication

Students with ASD may present a variety of communication challenges. They may be nonverbal or have good verbal skills, but show pragmatic language deficits. These pragmatic impairments include challenges with the semantic aspect of language (the meaning of what is being said) and using language appropriately in social situations.

Therefore, many students with ASD can benefit from supports that address communication.

Sign language has been used for many years as a way for children with Autism and verbal deficiencies to communicate more effectively. Researchers showed that with well-controlled training sessions, children with ASD were able to systematically acquire specific signs for trained stimuli (Carr, Binkoff, Kologinsky, & Eddy, 1978). Sign language has also provided a way for children to engage in spontaneous requests with adults in more generalized settings, and not just in the presence of a specific object or stimuli (Carr & Kologinsky, 1983). Sign language is still in use today in classrooms and homes as a way to help younger children. Programs teaching sign language can lead to more efficient communication strategies for children with ASD, especially for older children who could have better motoric control.

In more recent years, programs such as the Picture Exchange Communication System (PECS) have also come to the forefront. The PECS is unique in that it teaches children to initiate communicative interactions within a social framework. Children are taught to exchange a single picture for a desired item and eventually to construct picture based sentences and use a variety of attributes in their requests (Bondy & Frost, 1994). This system is useful in that it can be expanded so that the children develop a broad vocabulary and improve sentence structure. Through PECS, many children also learn to use conceptual vocabulary because the lessons are motivating from the child's perspective (Bondy & Frost, 2001). PECS has proved to be important in enhancing children's spontaneous communication for instrumental requesting using pictures, speech, or a combination of both (Gordon, Pasco, McElduff, Wade, & Howlin, 2011).

New ways to support individuals with communication deficits have also begun to take shape as technology has advanced. Voice output communication aids (VOCAs) have become more commonly used for students with verbal deficiencies. Instead of using pictures and Velcro boards, educators and researchers are increasingly attempting to implement new, more efficient systems. Unlike sign language and the PECS, VOCAs don't require visual proximity between the communicating parties or specific knowledge of the augmented system (Schepis, Reid, Behrmann, & Sutton, 1998). VOCAs can be used with a range of individuals, including those younger than six, to increase requesting and comprehension skills (Brady, 2000).

Technology can be used in a variety of ways to improve on some of these earlier communication techniques. Without significant training, sign language may not always be understood by the receiver. Technology devices with voice output or picture/word functions assure that the receiver can understand communication attempts more readily. The PECS discussed earlier is an augmentative system where individual pictures are used to indicate requests. The number of pictures that an individual could require to communicate interests and needs in a variety of different environments could become laborious to identify and sort. Newer technologies, such as the iPad, can be used to develop a range of pictures that can be implemented in an effortless way to address communication opportunities in each environment or setting. For example, a student might require different sets of pictures to successfully communicate at school, at home, during meals, and in play contexts (Cafiero, 2008). This would provide more ease of use for the individual and allow him or her to master the system and communicate more efficiently. Another concern is whether the communication system provides individuals

with a variety of vocabulary they can use. Most PECS symbols are useful for learning

nouns and requesting such items, but verbs are slightly harder to depict in this format.

Schlosser and colleagues (2012) found that for preschoolers in general education classes,

animated symbols were more identifiable than their static counterparts and that animated

verbs were named more accurately than static verbs. In their study there was no

difference for the learning of prepositions. Based on their results, using picture format for

nouns and animating verbs can greatly benefit individuals with ASD. Animation can

easily be added through the use of iPads, tablets, and smart phones. This use of

technology can provide the platform for individuals to learn more words and put together

more comprehensive sentences that include more than just requests for objects (Shane,

Labscher, Schlosser, Flynn, Sorce, & Abramson, 2011).

Another benefit of moving towards more technologically augmented

communication systems is that individuals with communication deficits can more

seamlessly interact and find common ground with their mainstream peers. Students are

highly motivated by and interested in new technologies. Providing students with ASD

with something that makes them more relatable to their general education peers can

improve their spontaneous communication with others. Previous research has

demonstrated that students with ASD are able to learn how to interact with mainstream

peers, and generalize these interactions to different settings, through the use of leisure

objects (Gaylord-Ross, Haring, Breen, & Pitts-Conway, 1984). Technology devices, such

as smart phones and tablets, can be used to the same effect. Students with ASD can be

taught to approach mainstream peers and use their device as a common ground. Due to

the nature of these devices students can play games with one another and share in communicative interactions with those peers that may be unfamiliar.

Another way that students with ASD can improve social initiations is through vocal modeling. Stevenson, Krantz, and McClannahan (2000) used audio cards to record scripts for four boys with autism, aged 10 to 15 years. When their schedule cued an interaction, the participants were taught to remove the card from their notebook, pass it through a Language Master (an electronic device with a screen and audio output used to learn language), play the script, then repeat the recorded remark to an individual they had approached. Newer technology devices could provide audio cues that were triggered when an icon was swiped. In this way, students with verbal communication skills who lack initiation strategies could be supported be emerging technologies to increase social-communication skills.

Schedules

Though communication is a major area in which students with ASD require additional supports, organizing and engaging independently in the environment can also be difficult tasks. To address these needs, supports in the form of schedules are often used. Schedules can be used to aid students in a plethora of ways including: (a) to prevent problem behaviors while students make transitions between activities, (b) to allow students to perform a series of tasks independently, (c) to help students follow the sequence of activities in school, and (d) to help them manage leisure time (Mesibov, Browder, & Kirkland, 2002).

Students who do not read may utilize schedules that involve picture cues. Photographic cueing works in many ways like the PECS, in that each activity on the

student's schedule is represented with a static picture. Schmit and colleagues (2000) demonstrated that using photographic cues to signal activity changes with students with ASD diminished the occurrence of problem behaviors, including tantrums, and allowed individuals to become more involved in activities. Picture schedules are useful in that they allow a specific activity to be depicted, and when paired with verbal cues or written phrases, they give students advanced notice so that they may prepare themselves fully for activity changes. For instance, in one study, photographic activity schedules were effective in increasing engagement in a series of play activities for young, non-verbal students with ASD (Morrison, Sainato, BenChaaban, & Endo, 2002). In this study, the pictures were used to signal activity changes from one play activity to the next. Students were shown to have correspondence ability when play behaviors matched the order of his or her play selections as indicated on the photographic activity schedule.

When students are able to use schedules effectively, prompts can be slowly decreased. Thus, photographic activity schedules can be used to improve independence and assure that students are better able to engage in the same activities their general education counterparts are engaging in. Aiding students in this way helps them to better assimilate and succeed in inclusion programs. Bringing schedule systems into the new age with the use of technology can improve the efficiency of student use. The systems mentioned above could easily be translated to an iPad, tablet, or smart phone. Using these technologies allows more detailed information, including more elaborate pictures, added text, and video capabilities to help students when they are utilizing their schedules. Picture cues on a schedule can be paired with simple word phrases and auditory output to help expand learning opportunities and improve the student's ability to generalize

concepts. In this way, the use of technologies can support the broad learning of concepts that are meaningful for academic and life success.

Technology may also be highly rewarding for students with ASD and may motivate students to follow schedules more consistently. Some researchers have noted that students with ASD prefer to spend their leisure time engaging in activities centered on electronic media screens (Shane & Albert, 2008). Technology devices might also be used to motivate students to increase appropriate behaviors. For instance, when a student has completed a certain task, such as completing an academic activity or engaging in an appropriate interaction with others, the student would be able to access additional content through an application on their device. The additional content could be customizable to fit each student's interests and could include allowing them to play a game, listen to a preferred song, or watch a brief video. In this way, newer technology devices can serve as both prompters, by cueing the child to engage in appropriate school behaviors, as well as serving as the child's reward system.

Self-management

Students with ASD and other developmental disabilities may sometimes demonstrate difficulties managing themselves during scheduled activities. For example, individuals on the autism spectrum often have difficulties with directing, controlling, inhibiting, maintaining, and generalizing behaviors when required to adjust to different environments (Adreon & Stella, 2001). Self-management is designed to help individuals change or maintain their own behavior. In its most basic form, students are instructed to observe certain aspects of their own behavior and provide an objective recording of its occurrence or nonoccurrence.

Mechling (2007) showed that individuals with developmental disabilities benefited from prompting tools that were self-operated when they completed tasks. Systems like these, sometimes referred to as self-management systems, can be implemented in a number of ways, including by using pencil and paper data collection. Self-management systems have been shown to be effective for students with autism who have higher skills, even at the elementary school level (Callahan & Rademacher, 1999; Wilkinson, 2008). For students with challenging behavior, self-management improves the development of social and academic skills, as well as independent functioning. Self-management works well in conjunction with instructional and behavioral strategies used by teachers and may prove especially useful for those students in inclusion programs (Callahan & Rademacher, 1999).

Often students with ASD may have comorbid fine motor skill problems. Fine motor skill deficits may affect an individual's ability to participate in activities such as writing and drawing. It is unlikely that paper and pencil systems would prove effective for these students, as their control for writing tasks might be limited. Technology might be used to improve outcomes in using self-management for those at varying levels on the autism spectrum. For instance, students can be taught to swipe or place a mark in a check box on a screen. These tasks might be motorically difficult for a child with fine motor deficiencies if the child is required to use a pencil, however if they are allowed to use iPads or other similar devices they can be quite easy, as well as motivating, for students. Icons on media screens require little pressure and can be tailored to the size that would be beneficial to each student. Technology based self-management systems that use iPads or

tablets provide a medium where fine motor skills aren't a necessity to complete

management checklists.

Tablet and iPad based self-management systems also allow for an interactive

process. When students record an occurrence, immediate reinforcement can be

administered by giving them access to a preferred activity on the device, such as a video

game or a short video. There are numerous ways in which self-management systems can

be made more effective and enticing for students to use with the employment of

technology.

Discussion

When looking at the different types of supports available for those with verbal

deficits it's evident that using new technologies can provide many benefits. The

prevalence of technology in our society would also make these types of supports more

accessible to a variety of individuals. Schools may even find investments in these

technologies more cost effective in the long run as technological devices, such as iPads

and tablets, can be used in a multitude of ways for a variety of supports (Stromer,

Kimball, Kinney, & Taylor, 2006).

Technology provides an effective medium through which customizable supports

may be provided to students with ASD that have a variety of needs. From expanding

communication skills and opportunities, to improving participation and engagement in

scheduled activities and social experiences, technology provides a new methodology

through which the field of special education can provide supports. The prevalence of

technology in our society also allows these more advanced supports to be more accessible

for more individuals. Exposing students with ASD to technology earlier in their

education and incorporating it into their everyday routines may allow them to have more opportunities in their lives once they graduate out of the educational system. The use of technologies to create schedules and implement communication and self-management systems can benefit students even as they leave the school setting and enter careers and community life.

Schools receive several benefits from the use of technology with their students. Using current technologies as they deliver services may demonstrate to federal and private supporters that schools are attempting to provide their students with best practice programs. This shows their commitment to invest in each student's future, and to prepare students with skills that will benefit him or her outside of the school setting.

Additional research is needed and is sure to come in the near future, with the increase in popularity of iPads, tablets, and smart phones. The current research in this field is encouraging, however, adding to the existing literature with studies dealing specifically with students with ASD would help to strengthen findings. Also, research demonstrating specifically what these technologies can do to aid individuals in schools and community life would help practitioners better implement technological supports. Continued research in this area will insure that as technological advances continue, these supports will become even more efficient and refined to meet the needs of students on the autism spectrum.

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