Senior Capstone Project – May 5, 2015 – Plattsburgh, NY

Computer-Based Therapy for Children with Low-Functioning Autism

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Background

Autism is classified as a neurodevelopmental syndrome that oftentimes results in difficulties with social, cognitive, and communication abilities (Chien et al., 2015). Children with autism are also limited in intentionality which is important for language acquisition (Maljaars, Noens, Jansen, Scholte, & Van Berckelaer-Onnes, 2011). Other related symptoms include tantrums and self-injurious behaviors due to the child's lack of communication abilities or understanding (Ploog, Scharf, Nelson, & Brooks, 2013). Children that are considered to be low-functioning have an IQ score below 70 and are usually non-verbal, minimally verbal, or stay at the one-word level for their entire lives. Not only are these children characterized as having difficulties with expressive language, but they also exhibit social interaction deficits. Due to their lack of imitation or responses to social acts, their development of language suffers and oftentimes does not develop at all (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013). Lastly, children with low-functioning autism have problems with play skills which are thought to aid in the development of social and linguistic skills in normally developing children (Murdock, Ganz, & Crittendon, 2013). All of these difficulties are taken into consideration when therapy techniques are developed.

Studies have shown that children with low-functioning autism tend to respond well to therapy that incorporates visual supports (videos and computers) to enhance learning (Whalen, 2010). Children are more motivated and learn more rapidly when using these computer programs during therapy compared to traditional intervention (Whalen, 2010).

PECS vs. iCAN

The Picture Exchange Communication System (PECS) is considered to be one of the most successful therapy methods when working with children with low-functioning autism. The system consists of picture cards that have an image and description printed on them which allow children to communicate their needs and wants by creating sentences with the cards (Chien et al., 2015) (see Figure 1). However, a major limitation of PECS is the time commitment and availability of space that caregivers are faced with. Printing, cutting, and laminating the pictures is time-consuming and storage of the increasing number of cards is often not feasible. The goal of this study was to see if iCAN, a program developed on a tablet, could reduce the lengthy process of making the picture cards for caregivers and to see how it impacted children's learning (Chien et al., 2015). The results of the study demonstrated that iCAN significantly reduces the amount of time it takes for caregivers to make the cards. In fact, caregivers are able to take the tablet with them wherever they go and are able to take pictures of objects that they wish to make into picture cards (see Figure 2). Not only does this reduce the time, it also makes card-making more efficient and effective. The effects of the program on children were substantial as well because they were more attentive when this device was used compared to PECS. The use of auditory, tactile, and visual feedback was motivating and appealing for children with low-functioning autism (Chien et al., 2015). Children were able to utilize this program independently at any time compared to the limitations that accompanied PECS. Three areas of learning that this article highlighted were learning motivation, learning stability, and cognitive growth. Through the interactive and motivating program, both the children's learning potential and possible growth in language and communication increased (Chien et al., 2015).

Figure 1: PECS System (Chien et al., 2015)

Figure 2: iCAN System (Chien et al., 2015)

Independent Spelling using Technology

Augmentative and alternative communication devices are often used for children with little or no functional speech. However, these devices oftentimes do not provide auditory feedback. Therefore, the use of speech-generating devices (SGDs) provides children with not only visual feedback, but auditory feedback as well. This study was conducted to determine whether the use of SGDs would be beneficial in the development of spelling (Blischak & Schlosser, 2003). The researchers created three different feedback conditions and tested participants in each. These conditions included speech feedback only, print feedback only, and both speech and print feedback (Blischak & Schlosser, 2003). Even though the participant was able to succeed in all three conditions, the most efficient spelling achievement was seen when both the speech and print feedback were utilized. Another follow-up, replication study was conducted and the results were identical to the previous study's results. Overall, this demonstrates that the use of computers and SGDs are well-suited for children with autism and their cognitive abilities and processing preferences. The results also indicate that these children are able to spell independently without an instructor present while using SGDs (Blischak & Schlosser, 2003).

Figure 4: Animated reinforcement (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013)

Computer-Based Therapy Techniques

Figure 3: An example of one of the many options included in TeachTown: *Basics*
From: http://image.slidesharecdn.com/visschedclassallteachtown-140424214151-phpapp01/95/visschedclass-all-teachtown-1-638.jpg?cb=1398393734

Discussion

- Visual and auditory feedback seems to have been motivating in all studies. Pictures, videos, animations, and voice recordings make the programs more interactive. The child is being stimulated in various ways which is more attention-grabbing than traditional approaches.
- Computer programs allow therapy to be more flexible. The programs can be individualized to fit the client's needs and wants more easily than traditional approaches. The child is also able to work at his/her own pace.
- The computer programs can be used anywhere including at home, at school, in the Speech-Language Pathologist's private practice, etc. When the program is installed on a tablet or iPad, it allows the child to take it with him/her wherever he/she goes. The portability and flexibility of the computer-based programs may actually increase the time the child is able to work on targeted areas. This could lead to greater improvements compared to the traditional approaches that are set in a classroom or SLP's office and occur only when the child is at school/therapy.

On the left is a nonverbal child with autism using a tablet to assist with communication. Source: http://www.kansascity.com/news/local/article419644/Child-peers-digital-technology-unite-to-help-children-with-autism-learn-to-play-and-share.html

Syntactic Awareness and a Computerized Learning Task

This study raised an interesting question: could it be the structure of language that makes it difficult for children with autism to use phrases or sentences? (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013). Executive control and working memory play a role in formulating sentences, both of which children with autism have difficulty with. Therefore, the goal of the study was to determine whether nonverbal children with autism were able to overcome these executive demands. The program was designed so that children had to click on pictures on the screen in a given sequence including noun-verb, noun-verb-noun, and noun-verb-prepositional-noun. If they chose the pictures in the correct sequence, animations would appear as reinforcement (see Figure 4). The program measured game success, spontaneous syntactic production, and latent learning through an increase in correct attempts (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013). Results of the study indicated that six out of the nine participants were able to display spontaneous syntactic awareness, and that with more training, earlier exposure, and more time spent using the program, they would be even more successful (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013). This program was essentially training participants in how to establish executive control over the various parts of speech without using speech or signing (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013). Overall, the results of the study indicated that nonverbal children with autism are in fact able to formulate strings of words. Most importantly, it indicated that these children might be able to learn more about semantics than would have ever been thought possible (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013).

TeachTown: *Basics*

TeachTown: *Basics* is a computer assisted instruction program that incorporates many of the principles of Applied Behavior Analysis (ABA). The program focuses on four different aspects including receptive language, social understanding, life skills, and academic/cognitive skills (see Figure 3) (Whalen et al., 2010). As children progress through the program, they are reinforced for correct responses and are able to proceed at their own pace. The second component of TeachTown: *Basics* includes off-computer activities that are completed in the classroom or the child's natural environment. During this portion, children work on areas that are not incorporated into the computer program such as play, imitation, and motor skills. These activities are included to ensure that generalization is occurring from the computer to natural environments (Whalen et al., 2010). The results indicated that most of the children who participated in this study were able to master lessons and generalize what they learned from the program to their environment. Participants in the study demonstrated the most improvement in receptive language due to the fact that children had to listen before they were able to respond and were only reinforced whenever they responded correctly (Whalen et al., 2010). A promising area for improvement is in auditory processing skills. Even though the results of the study were not significant, this program could potentially be useful in improving these skills which would lead toward improvement in language and social skills (Whalen et al., 2010).

	Limitations	Future Research
iCAN (Chien et al., 2015)	•Slow computers, entry costs, & incorrect detection of child's responses	•Incorporating iCAN into the classroom or curriculum
Independent Spelling (Blischak & Schlosser, 2003)	•Every child benefits differently from the various types of feedback	•Can children with autism use spelling to communicate their needs and wants?
TeachTown: *Basics* (Whalen et al., 2010)	•Not all children are equally motivated by computers & using computers might be challenging for some children	•Improving the technology and integrating the program into classrooms
Syntactic Awareness (McGonigle-Chalmers, Alderson-Day, Fleming, & Monsen, 2013)	•Small sample size	•Underconnectivity in autism

Conclusions

Although the targeted areas of difficulty differed in each study and success varied among participants, the results showed that computer-based therapies can be effective. Based on research conducted, it is most beneficial to incorporate computers into traditional intervention instead of only using computers. However, many of these programs are fairly new and more research must be done to ensure that they are beneficial for children with low-functioning autism.

References

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