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The culture and the use of technology with students with ASD

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Abstract

This study aimed at exploring the research literature on children and youth with ASD with the goal of establishing a solid knowledge-base on the a) prevalence of ASD, b) instructional needs of students with ASD, c) effective interventions for students with ASD (technology-focused and computer-based included), and d) the impact of parents' culture and teachers' role, preparation and training to meet different needs and cultural backgrounds of students with ASD toward the successful use of technology with students with ASD. A review of the literature is conducted to explore

a wide range of issues concerning students with ASD. The findings showed that there are many effective interventions that can meet the needs of students with ASD, such as social stories, video modeling, and picture exchange communication system. The literature indicated that the field of studying the use of variety technologies with children with autism is still in its initial phase. Moreover, using portable electronic devices such as tablets and smartphones may also decrease a student's reliance on others and overcome the limitations of computer-based interventions

Keywords: students with ASD, culture, special education, technology, computer-based interventions

Introduction

In the past few years, autism spectrum disorder (ASD) has received increased attention from physicians, researchers, parents, and educational specialists around the world. One reason for this increase is due to the growing number of individuals who have been diagnosed with ASD. For instance, the Center for Disease Control and Prevention (2012) [3] has estimated that an average of 1 in 88 children in the United States has an ASD. ASD is considered a complex developmental disorder because children with ASD struggle with many primary common skill deficits and developmental learning difficulties. For example, these complex characteristics include deficits in communication and language skills. Hetzroni and Tannous (2004) [14] have shown that children with ASD have difficulties in the development of language and communication skills. Deficits in joint attention skills are also common in children with ASD. For instance, many children with ASD cannot make eye contact with others even if they want to ask for something they need (Tsao & Odom, 2006) [35]. Moreover, children with ASD have difficulties with many adaptive behaviors, such as the safety, dressing, and using toilets.

In addition to the complex characteristics of children with ASD, Tsao and Odom (2006) [35] noted another primary concern about children with ASD is that they have difficulties making and building social relationships with others. These difficulties in social competence are effects of other deficits or difficulties such language development and joint attention. Bass and Mulick (2007) [1] indicate that the difficulties children with ASD have with social competence and joint attention lead to problems in social play skills. Social play skills are significant in improving children's social and cognitive skills. Deficits in social play skills can impact children's communication skills, imagination, and ongoing social interactions.

The social skills difficulties that children with ASD struggle with may be addressed if they receive early intensive interventions (Strain & Danko, 1995) [32]. One type of intervention is technology-based treatment. According to the National Autism Center (2009) [25], technology-based treatment is considered as an established treatment with effective and beneficial effects when used with children with ASD. Technology-based treatment includes computer-based technology, where special software can be used on a computer, laptop, tablet, or smartphone. Teachers are more frequently using computers with students with ASD as an instructional tool or method (Bosseler, & Massaro, 2003) [2].

According to a study conducted by Yaw *et al.* (2011), computer-based instruction increased motivation and decreased problem behaviors in children with ASD when compared to personal instruction. In fact, assistive technologies may be a promising method to help improve these children's communication and social skills (Reichle, 2011) [28]. Additionally, since most of the students with ASD are ambulatory, electronic devices that are lightweight and portable are easier for students to use throughout the day, at home, and in school (Sennott, & Bowker, 2009) [31].

Examples of such portable and handheld devices include tablets and smartphones. These portable devices utilize many computer software programs, applications, and designs.

In this study, a review of the literature is conducted to explore a wide range of issues concerning students with ASD. First, the study provides a review of the literature that is focused on the prevalence of ASD, the instructional needs of students with ASD, effective interventions for students with ASD (technology-focused and computer-based included), and finally the impact of parents' culture and teachers' role, preparation and training to meet different needs and cultural backgrounds of students with ASD toward the successful use of technology with students with ASD.

Rationale

The purpose of this study is

- 1) To explore the research literature on children and youth with ASD with the goal of establishing a solid knowledge-base on the a) prevalence of ASD, b) instructional needs of students with ASD, d) effective interventions for students with ASD (technology-focused and computer-based included), and e) the impact of parents' culture and teachers' role, preparation and training to meet different needs and cultural backgrounds of students with ASD toward the successful use of technology with students with ASD.

Literature Review

Prevalence of Autism Spectrum Disorder (ASD)

The prevalence of children who have autism spectrum disorder (ASD) has markedly grown during the last ten years by approximately 173% (Sansosti & Powell-Smith, 2008) [29], for many reasons. First, the awareness of ASD has increased among parents, teachers, and others. Second, the diagnosis of ASD has become more accurate and children are being diagnosed earlier. Third, the borders of the autism spectrum are now clear and identified (Downs & Downs, 2010; Sansosti & Powell-Smith, 2008; Zager, 2005) [5, 29, 37]. In fact, ASD is considered as "the fastest growing developmental disability category in the United States" (Zager, 2005, p. 162) [37]. In 2007, it was estimated that 1 in 150 children had ASD and this year, 2012, it was just published by Centers for Disease Control and Prevention (CDC) that 1 in 88 has ASD (Downs & Downs, 2010) [5]. This increasing number of children who have ASD and the wide variety of needs they manifest requires providing excellent education that meets their different needs.

Characteristics and Instructional Needs of Students with ASD

Education for students with autism spectrum disorder (ASD) should include academic learning and also provide students with social, language, adaptive, and communication skills and techniques to reduce distracting behaviors. Students with ASD often are not able to accomplish scheduled tasks independently (even though many of these students have strong cognitive skills) because they have difficulties with memorizing, planning, organizing, and others (Gentry, Wallace, Kvarfordt, & Lynch, 2010) [9].

Communication skills needs

According to the National Research Council (NRC) (2001) [24], there are two major communication deficits in students with autism spectrum disorder (ASD): the lack of joint

attention skills and inability to use symbols. Joint attention is the ability to coordinate attention between objects and people. The NRC also points out that students with autism usually fail to point to others, get another student's attention, or share emotional moments with others. Also, according to NRC, 2011, the second communication deficit is that students with ASD have difficulties with symbol use of conventional meaning of word or gestures. Education that includes supporting social, language, adaptive, and communication skills can help students with ASD complete educational tasks independently and improve personal responsibility. In addition, educational goals of students with ASD should be established based on students' deficits such as nonverbal communication, language development, and cognitive disability (National Research Council, 2001) [24].

Social skills needs

Students with autism spectrum disorder (ASD) may also have many social deficits. Zager (2005) [37] states that the central deficit characteristic of students with ASD is an inability to develop and maintain relationships with others. In fact, students with ASD encounter difficulties when they need to respond to others or to interpret their own needs effectively in their social world. Moreover, students with ASD instead of learning from their own social life experiences as typically developing students do need direct social skills instruction.

Behavioral skills needs

Students with ASD also have many behavioral deficits. Zager (2005) [37] indicates that inappropriate and atypical behaviors, reactions, and perceptions are common among students with ASD. Also, students with ASD are hypersensitive to different stimuli such as lights, sounds, tactile, and olfactory. For instance, when students with ASD are exposed to even low intensity sounds or light, this can result in them experiencing agitation, discomfort, and distress. Students with ASD are usually not flexible with changes in daily routines or transitions. This can result in students experiencing social difficulties when dealing with real world. In addition, students with ASD produce repetitive stereotyped behaviors, such as head shaking, hand flapping, and jumping. However, it is important to note that there is no common behavioral symptom across all students with autism, as they represent a range of characteristics along a mild to severe continuum.

Academic skills needs

Students with autism spectrum disorder (ASD) vary in their academic abilities. There are students with ASD who have severe cognitive impairment. They learn academic skills by using many of traditional categories, such as functional academic, self-help skills, language development, and others. On the other hand, there are students with ASD who are HFA/AS and they need to have modifications in the curriculum and instruction process that meets their specific needs (Zager, 2005) [37].

Effective Interventions

Students with ASD require intervention programs that meet their needs, address their weaknesses, and emphasize their strengths. In addition, interventions designed for students with ASD have to be designed based on special challenges that students with ASD present (National Research Council, 2001) [24]. The National Research Council (2001) [24] recommended that interventions for a child with ASD should

start as early as possible, sometimes even prior to a formal diagnosis, even if there is a suspicion of ASD. (Downs & Downs, 2010) ^[5]. The primary education and treatment for students with ASD should be implemented at school, home, and in community settings (National Research Council, 2001) ^[24]. The National Autism Center report (2009) ^[25], which reviewed 775 studies of interventions or treatments for students with ASD below 22 years of age, determined that there are four types of interventions for students with ASD. The first type includes established treatments or interventions, which show beneficial effects and are based on well-controlled research. Examples of established interventions are social stories and video-modeling. The second type of ASD interventions are emerging interventions, which are based on studies that have produced favorable results and outcomes when used with students with ASD. The Picture Exchange Communication System (PECS) is an example of an emerging treatment (National Autism Center, 2009) ^[25]. The other two treatments or interventions are respectively named unestablished and ineffective treatments. Since research has not provided positive results or outcomes for using these two treatment types, they will not be discussed here and the focus will be on examples of established and emerging treatments or interventions.

Computer-based intervention

Mechling, (2007) states that the variety and multiple uses of assistive technology (AT) hold promising ways to meet diverse individuals' needs. Computer-based intervention has been an increasing focus of researchers and is one example of an AT. One example of assistive technology (AT) is any electronic device that can be used to assist a person by providing pictures, text, video, sound, or other technology. Using computers in the instructional process with students with ASD is considered a new area in research in the last few years. Computers act as a motivational factor with students with ASD (Sansosti & Powell-Smith, 2008) ^[29]. Computer-based interventions that use handheld devices, laptops, and computers can work for many students with autism as conditioned reinforcers because the students are very motivated by computers (Goldsmith & LeBlanc, 2004) ^[10]. Bosseler and Massaro (2003) ^[2] indicated that computer-based instruction is considered as an emerging popular method to expand the vocabulary of students with special needs. Also, computers have been used in schools as a new approach to teach students with ASD language and vocabulary skills. In fact, computer-controlled applications have the advantage of providing texts with supportive sources such as images and sounds at the same time (Bosseler & Massaro, 2003) ^[2]. Integrating these sources with a written definition improves students' ability to learn and memorize target vocabulary. The integration of sound and visual supports is an efficient method for facilitating learning and improving language and vocabularies (Bosseler & Massaro, 2003) ^[2]. "The use of computer-based system compared to paper-based systems such as picture cards, photograph albums, and lists, may hold some distinct advantage" (Mechling, 2007, p. 265). In addition, when comparing computer-based interventions to traditional methods, computer-based interventions show positive effects such as reduction of inappropriate behaviors and an increase in learning, attention, and motivation (Goldsmith & LeBlanc, 2004) ^[10].

Bosseler and Massaro (2003) ^[2] found that students with ASD

face difficulties in generalizing and applying acquired skills to real world settings. In addition, students with ASD have difficulties when they deal with new settings that include people who did not participate in the initial training. However, intensive training can help students with ASD to overcome those difficulties and be able to generalize acquired skills. Effective intensive training may contain the use of computer-based tools such as portable devices and tablets with other effective interventions such as social stories, video modeling, pictures, and PECS. Hagiwara and Myles (1999) ^[12] stated that use of a multimedia approach, such as computer-based instruction, visual symbols, and social stories, with students with autism presented possible positive effects.

Integrating interventions into computer programs. Social stories have been integrated into computer-based and multimedia formats. For example, Microsoft PowerPoint is being used to teach students with special needs by integrating activity schedules. In fact, research on this kind of integration provided favorable results even though results varied among students with ASD (Goldsmith & LeBlanc, 2004) ^[10]. Sansosti and Powell-Smith (2008) ^[29] studied the effectiveness of integrating and combining social stories and video modeling intervention via computers. They found that there might be a beneficial method for meeting social skills deficits among students with ASD. The integration of video modeling in portable devices such as iPod, Apple mp3, and video players has also been studied (Cihak, Fahrenkrog, Ayres, & Smith, 2010) ^[4]. In fact, students' independent transitions increased when they used handheld devices (Mechling, 2011). Moreover, three studies have compared results of integrating pictures into a portable device. The Palmtop personal computer, a portable device that has multimedia input and output with a touch screen has been studied and found to be more effective than manually using pictures on cards (Mechling, 2007).

Mechling *et al.* (2009) pointed out that the "use of electronic self-prompting devices by persons with ASD holds promise as a means for increasing students' independence while decreasing their reliance on prompt delivery by teachers, other adults, or peers" (p. 1420). That is, students with ASD may be able to know when to do a task without relying on others by using those types of electronic self-prompting devices. In fact, a portable computer-based system has many advantages compared to a cassette player. For instance, it (a) provides the chance of repeating steps, (b) offers visual supports to auditory instructions of a task, and (c) has a controlling option over visual and auditory prompts (Mechling, 2007).

Culture of Parents

Ennis-Cole, Durodoye, and Harris (2013) ^[8] observed that technology has been used by parents across cultural groups to entertain and educate children with autism spectrum disorder (ASD). Professionals who work with the families of children with ASD should pay attention to the cultural backgrounds of these families, given that linguistic and cultural backgrounds affect how students with ASD use technology (e.g. Augmentative and Alternative Communication devices (AAC)). For instance, some colors and symbols could be considered appropriate by one culture may not work for another, and may in fact be offensive or rude. The cultural backgrounds of the parents affect how

students with ASD use technology (Ennis-Cole & *et al.*, 2013) ^[8].

Parents' cultural backgrounds impact their decisions regarding interventions (Ennis-Cole, Durodoye, & Harris, 2013; Tincani, Travers, & Boutot, 2010; Mandell & Novak, 2005) ^[8, 34, 18]. According to Tincani *et al.* (2010) ^[34], using technology of evidence-based practices with student with ASD is "insufficient without understanding the important role that diversity plays in helping persons with ASD" (p. 81) In addition, Tincani *et al.* (2010) ^[34] founded that cultural background affects how parents respond to their children with ASD. African American mothers, for example, were found to have fewer negative feelings toward their children with ASD than did Caucasian mothers. An interpretation of that could be that these African American mothers look differently on their children's impairment because of cultural beliefs. Thus, the key to developing a successful intervention is to fully consider diverse family systems (Tincani, Travers, & Boutot, 2010) ^[34].

In addition, the cultural backgrounds of parents shape their beliefs about autism and intervention outcomes (Ennis-Cole, Durodoye, & Harris, 2013; Tincani, Travers, & Boutot, 2010; Mandell & Novak, 2005) ^[8, 34, 18]. For instance, Dyches, Wilder, Sudweeks, Obiakor, and Algozzine (2004) reported that some Latino parents see a child with autism as a gift from God—an opportunity to become better people. Another example would be that "African American children diagnosed with autism are less likely to receive regular medical and diagnostic services than their White counterparts" (Gourdine, Baffour, & Teasley, 2011, p. 460). Also, White Americans are more likely to use professional and traditional interventions, while African Americans may seek recommendations from friends and members of their church before seeking professional interventions (Ennis-Cole, Durodoye, & Harris, 2013) ^[8].

Tincani, Travers, and Boutot (2010) ^[34] noted that few systematic studies have addressed cultural issues and diverse family systems and the impact of parental culture on successful interventions. In fact, there is a strong need for additional studies on language and cultural issues affecting students with ASD (Ennis-Cole, Durodoye, & Harris, 2013) ^[8]. Ennis-Cole *et al.* (2013) and Tincani *et al.* (2010) ^[34] wrote of the need to tailor interventions to the cultural backgrounds of parents of a child with ASD. Such interventions require the active and direct involvement of parents. Finally, Dyches, Wilder, Sudweeks, Obiakor, and Algozzine (2004) noted:

"Most research has failed to identify students with autism according to culture, limited data are available to help researchers and practitioners ensure that appropriate services are provided to these students. Such limitations may reflect a lack of awareness of cultural issues (Wilder, Jackson, & Smith, 2001) and of ways that those issues affect students with autism and their families. In addition, such missing information clearly compromises the quality of the field of professionals who work with multicultural students with autism." (p. 220).

Teachers' Role, Preparation, and Training

Dyches, Wilder, Sudweeks, Obiakor, and Algozzine (2004) indicated that the diverse cultural experiences and values of students with ASD are significant considerations for teachers in improving the lives of their students. Students with ASD

and their families have many different needs that require flexibility on the part of teachers and other professionals (Ennis-Cole, Durodoye, & Harris, 2013) ^[8]. Thus, teachers of students with ASD must consider cultural identity, given its effect on the student. Finally, Oakley, Howitt, Garwood, and Durack (2013) suggested the use of varying teaching styles to meet the needs and abilities of individual students with ASD.

Previous research demonstrated that teacher preparation and training is the weakest element in the development of effective programming and services for ASD students and their families (Hart & Malian, 2013; Razali, Toran, Kamaralzaman, Salleh, & Yasin, 2013). Scheuermann, Webber, Boutot, and Goodwin (2003) founded limited formal data regarding the preparation of personnel to work with autistic students. For example, it is not known how many autism preparation programs are now available or how many autism specialists are trained annually. In fact, there are numerous challenges in teacher preparation for autism, one of which is having high-qualified teachers (Scheuermann *et al.*, 2003).

Growing rates of autism mean increased demand for well-trained teachers who can effectively teach these students (Hart & Malian, 2013; Razali, Toran, Kamaralzaman, Salleh, & Yasin, 2013). On other hand, past studies indicated that there is a lack of preparedness of teachers (Loiacono & Feeley, 2009). According to Scheuermann, Webber, Boutot, and Goodwin (2003), "there is a large body of knowledge about the most effective curriculum and strategies for teaching these students. Unfortunately, relatively few teachers are aware of these strategies, and most have not mastered them. Teachers and others who work with these students need to be well trained and supported through a variety of resources." (p. 198) Providing training and field experience for teachers of students with ASD can positively impact teacher expectations, perceptions, understanding, and knowledge of ASD students (Loiacono & Valenti, 2010). Surprisingly, few researchers focus on issues of teacher perceptions (Syriopoulou-Delli, Cassimos, Tripsianis, & Polychronopoulou, 2012).

The use of technology, such as an iPad, in a classroom with ASD students does not guarantee effective learning support because of the many considerations in integrating these new technologies (Malley, Jenkins, Welsey, Donehower, Rabuck, & Lewis, 2013). Teachers, for example, play an important role in determining which mobile technology will work for each student (Mintz, 2013). One of the most important considerations is training teachers to use the technology. Malley *et al.* (2013) found that teachers indicated that they would use integrated technology to improve student outcomes if they were trained to do so. To be well prepared a teacher should also know when and why to use technology. Special education teachers should "carefully consider each mode of communication (verbal, gestural, and graphic) for each of their students with ASDs and have an understanding that the use of one does not preclude the use of another" (Loiacono & Feeley, 2009, p. 17). In one study, teachers were found to be highly accepting and to strongly approve of the positive outcomes achieved in an iPad intervention with moderate and severely disabled students (Malley & *et al.*, 2013). Moreover, teachers have reported that an iPad intervention helped them to achieve objectives that they could not achieve with traditional instruction methods. Teachers also indicated a positive effect on student

engagement with an iPad. Finally, Malley *et al.*, (2013) reported “teachers had a strong interest in expanded use of iPads in classroom instruction.” (p. 13)

Recommendations

There are many implications in this study for future research. First of all, there is still a highly need to conduct more research on the use of technology with students with ASD and related cultural issues. Also, future research should explore types of training that would help parents and teachers’ with ASD use technology more effectively and improve their understanding and awareness about the importance of using technology with these students. In Addition, future research should explore technology and provide parents and teachers of students with ASD with a list of available assistive technologies, portable electronic devices, computer programs, and software applications that are effective when used by children with ASD. Finally, future research should include studies on technologies that are consistently implemented across the home, school, and daily life environments to measure the effectiveness in improving students’ skills in these different settings.

Conclusion

Children and youth with the ASD have various deficits in communication, social, academic, and adaptive behavior skills. There are many effective interventions that can meet the needs of students with ASD, such as social stories, video modeling, and picture exchange communication system (PECS). Incorporating these effective interventions with computer-based applications and software holds promise for students with ASD. Also, technology is a promising field for helping students with ASD improves their communication skills (Reichle, 2011) ^[28]. The literature indicated that the field of studying the use of variety technologies with children with autism is still in its initial phase. Moreover, using portable electronic devices such as tablets and smartphones may also decrease a student’s reliance on others and overcome the limitations of computer-based interventions (Mechling *et al.*, 2009; Moore & *et al.*, 2005). Technology can also help parents, teachers, and others in finding a way that eases the communication with these students with ASD. Finding a way to ease the communication with students with ASD, could also positively affect the student’s with ASD social, academic, and other skills. Thus, using interventions that use technology and related cultural issues of that use with students with ASD should be explored further and investigated in detail in order to help students with ASD have a better life.

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