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Teaching Orientation and Mobility Skills to Students with Autism and Vision Impairment in Public Schools: A Data-Based Study

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Two students with autism, vision impairment, and intellectual disability participated in an orientation and mobility (O&M) intervention to travel in school settings using their folding canes. A multiple-baseline across participants design to determine the effectiveness of the intervention was used. The dependent variable was time taken to travel the specified route. The independent variable was O&M training. Results indicated that both participants took less time to travel during the intervention compared to the baseline. Students with vision impairment and autism can be trained using systematic O&M training. The O&M specialists working with children with autism and vision impairment should collect data and make data-based decisions while providing O&M instruction.

Children with autism and vision impairment represent a population of students with unique and varied educational needs. The rising number of children with autism spectrum disorders (ASD) have received national attention and the Center for Disease Control and Prevention (CDC, 2012) estimated that 1 in 88 children in the United States are identified with ASD. Recently, the correlation of ASD with vision impairment is an area of concern (Gense & Gense, 2005).

Autism has long been characterised by its associated behavioural deficits in communication, language, and social interaction (Williams-White, Keonig, & Scahill, 2007). In recent years, however, increasing attention has been drawn to the motor coordination deficits in ASD (Nayate, Bradshaw, & Rinehart, 2005). Motor coordination deficits may cause difficulty with visual feedback during motor learning tasks (Johnson, Rinehart, White, Millist, & Fielding, 2013).

Orientation and mobility (O&M) is a set of skills used to know one's position in the environment and the ability to move independently and safely in the environment (Blasch, Welsh, & Wiener, 2010). O&M is a fundamental compensatory skill area for individuals with vision loss. Additionally, the acquisition of O&M skills is related to

cognitive development (Skellenger & Sapp, 1997) and highly correlated with functional independence (Welsch, 2010). A systematic data collection method is recommended to measure student progress and outcomes, to monitor and evaluate educational plans, to determine the efficacy of O&M instruction, and to justify the need for O&M services for school administrators (Fazzi & Naimy, 2010; Jacobson, 2013; Pogrund et al., 2012).

A review of literature indicates a paucity of intervention studies using experimental designs (e.g., group or single-subject design) concerning O&M training for students with autism and vision impairment (Banda, Griffin-Shirley, Okungu, Ogot, & Meeks, 2014). Careful methodological design considerations are necessary in studies involving low-incidence disabilities. According to the Council for Exceptional Children (CEC), single-subject design has the benefit of sufficient methodological rigor to offer adequate evidence for guiding educational practice (Horner et al., 2005; Kratochwill et al., 2010). Single-subject designs provide protection from many of the threats to internal validity and are especially effective (Odom et al., 2003). Therefore, we were interested in the efficacy of standard O&M training techniques with students with ASD and vision impairment. Our study involved a single-subject, multiple-baseline design across participants to train students with autism and vision impairment to travel using their canes to decrease travel time.

Methodology

The study included two participants who attended public schools in the Southwestern part of US. Texas Tech University Institutional Review Board (IRB) approved the study. Parental consent was obtained prior to conducting the study.

Participants

Case # 1 Lana

Lana (pseudonym) was 12 years old and attended elementary school in a self-contained classroom and was included 50% in the general education classroom. She is congenitally blind due to cortical vision impairment and nystagmus. An ophthalmological examination conducted in 2001 indicated that Lana has nystagmus since birth, probably Leber's Congenital Amaurosis, and is legally blind. A subsequent functional vision evaluation reported limited use of vision. Based on her medical history and a Full and Individual Evaluation (FIE) conducted by a Licensed Specialist in School Psychologist (LSSP), Lana met the criteria for autism. Additionally, her language assessment included informal data and a Functional Communication Profile - Revised (Kleiman, 2003). The assessment concluded that Lana had a severe receptive language impairment, profound expressive language impairment, and profound impairment in pragmatic/social language. Her assessment scores for intellectual functioning fell into the delayed range on all areas of the Developmental Profile-3 (DP-3) (Alpern, 2007), and in the low range on the Vineland II Parent-Caregiver Rating scale and The Teacher Rating Scale (Sparrow, Cicchetti, & Balla, 2005). On the Adaptive Behavior Scale (Lambert, Nihira, & Leland, 1993) Lana obtained a standard score of less than 50 which falls into the delayed range. She also displayed challenging behaviours including eye poking, self-stimulatory behaviour (stamping feet, flapping hands),

hugging, and running away. Her annual O&M goals focused on using correct two point touch cane technique in the school setting, and to find curbs and stop prior to stepping into streets. The teacher and O&M specialist indicated that Lana required training in independent travel with accompanying school personnel to and from her classroom to an outside gymnasium using her folding cane.

Case # 2 Andrew

Andrew (pseudonym) was a 19 year old male student diagnosed with autism. He was non-verbal and functionally blind due to self-inflicted traumatic injury to the eyes. He attended a self-contained classroom where he spent 100% of his day. Andrew lived at a residential facility near the high school. According to an ophthalmological eye report in 2008, his eye condition included a retinal detachment, glaucoma, and hyphemia in the right eye, and a retinal detachment, and traumatic cataract in the left eye. Andrew was diagnosed with autism and intellectual disability by an educational agency in 1996 and the test scores were not provided. His O&M lessons took place in the hall outside his classroom. Andrew displayed such challenging behaviours as self-injury (hitting his temples with his fist), screaming, striking the floor with his cane, masturbating, and spitting. His overall IEP goals for the year were to increase functional communication, improve social skills, and reduce self-injurious behaviour. He had recently received a communication board which he was learning to use. His special education teacher's goal for O&M was to learn the way to use a folding cane. However, he was not receiving O&M training at the time of assessment.

Settings

Case # 1 Lana

Lana's self-contained classroom included a special education teacher, a paraprofessional, and six students with disabilities with varying functioning levels. The physical arrangements of the classroom consisted of learning centres with tables for group activities and individual pupil desks. The gymnasium was located 200 feet from Lana's school building. Lana was required to walk 80 feet to double doors leading outside her school building then walk another 120 feet from the doors along a sidewalk to the gymnasium.

Case # 2 Andrew

Andrew's self-contained classroom included a special education teacher, three paraprofessionals, and three other students with severe and multiple disabilities. The physical arrangement of the setting included multiple rooms namely a main classroom with a kitchenette and laundry facilities, bathroom, supply room, and an activity room (e.g., bed, swing, tables for crafts, sofa, and chairs). A 67 foot corridor outside Andrew's classroom was the training environment.

Dependent Variable

The researchers wanted to teach the students to use their folding canes to travel the identified routes in reduced time. The dependent variable was the amount of time taken to complete the route. The effectiveness of the training was evaluated by comparing the pre and post-data of the length of time the participants took to travel the identified routes while using the cane. One training session was conducted per day, with at least three training sessions per week.

Ideally, each session was to include five trials and each trial included moving from the starting point of the identified route and back to the starting point. For Lana, a total of 13 sessions were conducted. For Andrew, a total of 17 sessions were conducted. On some occasions, less than five trials were conducted when the participants exhibited problem behaviours at least three times within a trial. For each trial, the time was recorded on the videotapes from when the students took their first step to when they took their last step. Time was calculated for all trials using an average time per session. All sessions were videotaped.

Design

A multiple-baseline across participants design was used to determine the functional relationship between the intervention and the dependent variable. In multiple-baseline design, a number of responses from a participant are identified and measured overtime to provide baseline conditions against which changes during the intervention can be compared and evaluated (Cooper, Heron, & Heward, 2007). This design was used because it was easily implemented in schools, and allowed for simultaneous comparison of multiple dependent variables (Richey & Wheeler, 2000).

Authors collected baseline data for both participants and began intervention with Lana after three baseline sessions. When Lana received intervention, the baseline was continued for Andrew for another three sessions. Following this, the intervention with Andrew was implemented while continuing intervention with Lana. Visual analysis (e.g., level and trend) was used to determine the functional relationship between independent and dependent variables.

Materials used for Data Collection

A range of materials was used to assess toy preferences that were used as positive reinforcement after each student had completed each trial. The toys included a clapper, noise putty, a pair of magnets, rubber bracelet, rattle, and play dough, as well as skin lotion. A video camera was also used to enable an accurate recording of each trial. Further, record sheets were used to record the time taken (in seconds) to complete the routes, and to record problem behaviours exhibited by the participants. A checklist was also used for treatment integrity data.

Procedure

The certified O&M specialist (COMS), classroom teacher, and the paraprofessional selected the training route for Lana based on her functional needs and prior O&M instruction. For Andrew, the classroom teacher decided the training route based on the student's needs as he never received formal O&M training prior to this study.

Preference Assessment

Case # 1 Lana

Five different toys were used (clapper, noise putty, play dough, pair of magnets, and rubber bracelet) to assess the student's toy preference suggested by the special education teacher. Initially, all the toys were given to Lana to engage with for two minutes before withdrawing all of them to begin the test. The tests were conducted for three days and on each day three trials/sessions occurred. During the test all the toys were arranged on a table in front of the

student. She was then asked to pick the toy she wanted to play with and then allowed her to play with it for two minutes. Using the same procedure, the rest of the toys was presented and the procedure was repeated until all the toys were picked. Lana chose the noise putty as the most preferred item followed by a pair of magnets.

Case # 2 Andrew

Four different items were used (i.e., rattle, music, body lotion, and teddy bear) as had been suggested by the special education teacher to assess the student's order of toy preference. The same procedure was used for Andrew as for Lana. Based on the preference assessment, Andrew's preferred items were the rattle and lotion. The lotion was included in the items because it was more age-appropriate for Andrew than the other items.

Baseline

Baseline data (i.e., the time taken to complete the route) was taken when observing each student navigate an O&M route that was typically followed during daily routines. During baseline data collection some verbal and physical assistance was provided. In the case of Lana, she was able to traverse the outdoor section of the route when she could hear other people near the gymnasium, but quickly became disoriented if she did not hear other people. Andrew was asked to travel with a human guide as he had never been introduced to a cane. Lana received verbal and physical reinforcement (i.e., hugs, tickles, playing with noise putty) after the completion, while Andrew's reinforcement included 'high-five' and lotion to rub on his body.

Intervention

Case # 1 Lana

A COMS greeted Lana inside her classroom and communicated the purpose of the training. Lana retrieved her cane and appropriate clothing to travel outside. The COMS and Lana exited the classroom into the corridor at the starting point of the training program (i.e., wall beside the classroom door). The COMS then instructed Lana "I want you to walk to the gymnasium five times by yourself using your cane. This is our first trip. Let's go." When Lana started her route to the gymnasium, the COMS provided verbal prompts such as "use your cane" "stay on the sidewalk" and "stay to your right/left" when needed. If Lana was not using her cane techniques correctly, then the COMS provided physical and verbal prompts. When Lana was travelling the route and using the cane appropriately, the COMS provided verbal praise (e.g., "good job, Lana"). Whenever she reached the destination she received reinforcement (i.e., hugs, tickles, noise putty) and then allowed to play for one minute. After the completion of five trials, the session was terminated and Lana engaged in her classroom activities.

Case # 2 Andrew

A COMS greeted Andrew inside his classroom and communicated the purpose of the training. The COMS instructed Andrew to get his cane and his bottle of lotion (i.e., his reinforcer according to the preference assessment). If he did not comply with the request, the COMS gave the folding cane and the lotion to him. The COMS guided Andrew to the starting point of the training route (at the end of his classroom hallway). The COMS instructed him to "square off to

the door (put your back to the door), hold your cane in front of you, and now I will show you how to move your cane from side to side. Now let's go to the end of the hall." When Andrew started his route down the hallway, the COMS provided verbal prompts such as "move your cane from side-to-side" as needed. If he did not comply then the COMS provided hand-under-hand prompting to assist him when moving his cane. When Andrew completed each route, the COMS provided reinforcers (i.e., lotion for one minute and 'high-fives'). After the completion of five trials, the session was terminated and Andrew engaged in his classroom activities. On some occasions, less than five trials were conducted and the session was terminated when he had exhibited challenging behaviours (e.g., hitting himself, screaming, striking the floor with his cane).

Interobserver Agreement

Interobserver agreement was determined by two individuals who independently viewed the videotapes of the participant's. First, one of the authors viewed all videotapes and recorded the time for each participant for baseline and intervention sessions. Second, a graduate student then independently viewed and scored 30% of the sessions for each participant for baseline and intervention sessions. The interobserver agreement was calculated by finding the percentage of agreement between the two observers on the time taken to complete the route and the percent of agreement was 94% (range 88% to 99%) for both participants.

Treatment Integrity

A checklist of the intervention procedure was developed including the steps to be accomplished by the COMS during the intervention. A graduate student independently rated each item on the checklist "yes" when that particular item was implemented correctly and "no" when it was not. Treatment integrity was calculated using the number of steps completed by the total number of steps multiplied by 100. The treatment integrity for Lana was 91% (range 86% to 100%) and for Andrew was 95% (range 86% to 100%).

Results

Figure 1 displays the baseline and intervention graph for both students. On average, Lana travelled 152 seconds during baseline while during intervention she took 120 seconds. Furthermore, the data trend was highly varied at baseline and more stable (almost flat) towards the end of the intervention. On average, Andrew travelled 64 seconds during baseline and 42 seconds during intervention. Furthermore, the trend was highly varied at baseline and more stable (almost flat) towards the end of the intervention. Overall, the participants reduced their travel time from baseline to intervention.

Discussion

This study was conducted to determine the impact of O&M training on the amount of time it took two participants to travel to a destination. Results revealed that both participants took less time post-intervention. Furthermore, anecdotal reports from the special education teachers indicated that the intervention was believed to be beneficial for the participants. Specifically, Andrew's teacher mentioned that he was walking with his folding cane under supervision and was more willing to express himself using his communication board, and was happy while

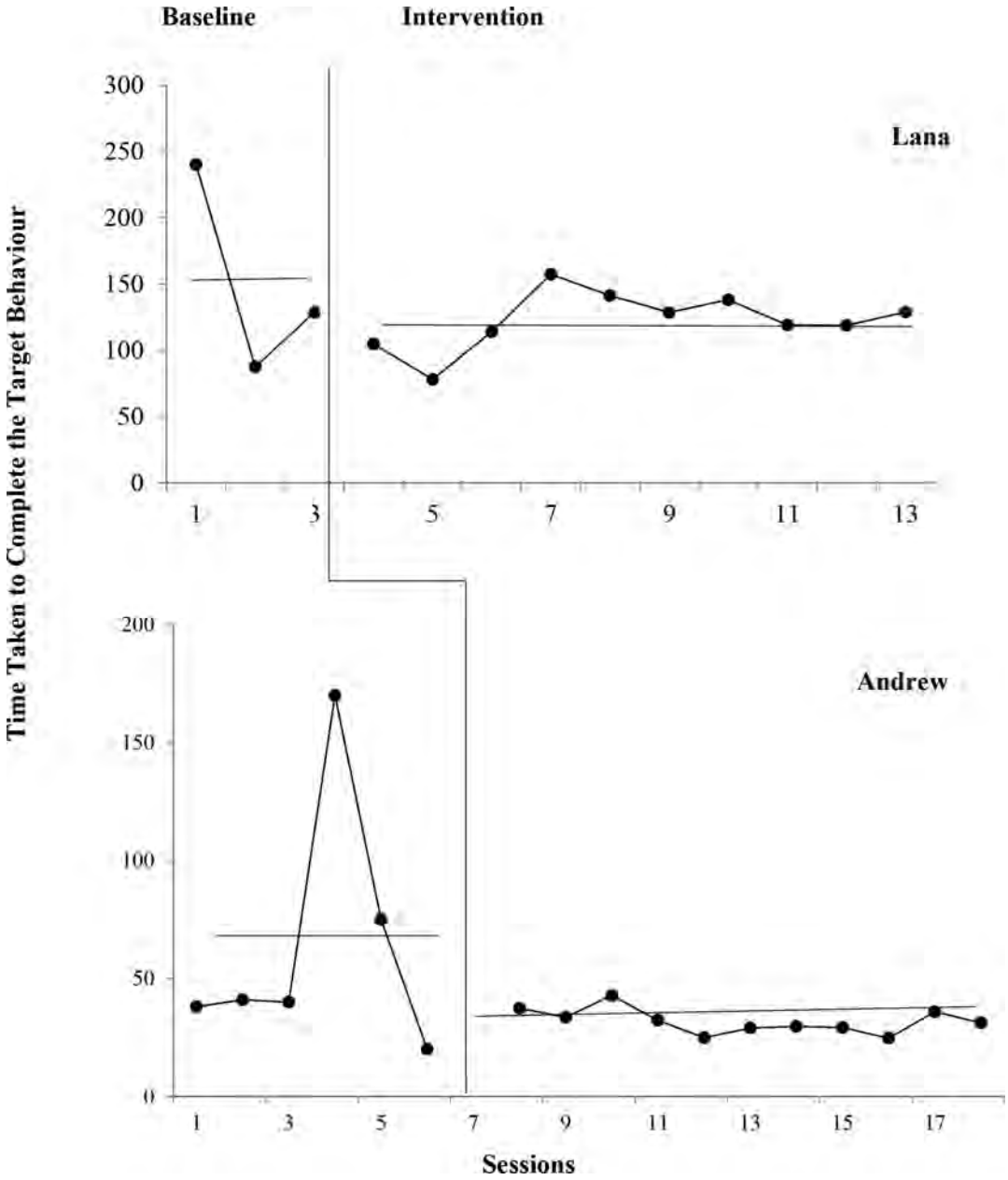

Figure 1. Time taken to complete the target behaviour.

walking. In addition, the COMS reported that Lana was able to make choices about her reinforcers at the end of the intervention during several sessions.

Possible reasons for participants' improvement may have been the use of: reinforcers through preference assessment (Lohrmann-O'Rourke & Browder, 1998);

systematic instruction including task analysis, modelling, prompting, reinforcement, and fading (Fazzi & Naimy, 2010; Jacobson, 2013; Pogrund et al., 2012; Snell & Brown, 2011); O&M instruction focusing on cane travel; and continuous monitoring through data collection. However, robust results were not evident in this study because of the participants' challenging behaviours during O&M training.

Replication of the study as well as more intervention studies with children with autism and vision impairment using single-subject designs are recommended. The use of single-subject design is prevalent in special education (Horner et al., 2005) but not evident in the O&M profession. Experimental research is needed in addition to anecdotal reports and case studies to document the efficacy of O&M instruction. Experimental research will provide a much needed foundation for evidence-based practices in O&M instruction.

Limitations

Limitations of the study should be noted. First, data collection during baseline was variable before we introduced the intervention to Lana. However, the intervention was necessary because of time constraints and teachers' requests. Second, no strong functional relation between dependent and independent variables was established, although participants took less time to travel during intervention sessions. Third, this study involved only two participants limiting generalisability. Finally, no data were collected on maintenance and generalisation because of the end of the school year.

Conclusion

The purpose of this study was to train two students with autism, vision impairment, and intellectual disability in O&M. Both participants reduced their travel time while using their folding canes during the intervention sessions. However, the results of the study should be considered preliminary and more research is needed to confirm and/or replicate the results. In the profession of O&M, interventions using the experimental designs are in its infancy, and the current study is an attempt to provide a basis for future researchers.

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