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Research to Practice

Focusing on individuals with
autism, intellectual disability and other developmental disabilities

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The *DADD Online Journal* integrates research and practice, reflecting the need for evidence-based and practice informed strategies and interventions within this diverse field. Topics include: Autism Spectrum Disorder, Assistive & Adaptive Technology, Early Childhood, Intellectual Disability, Mental Health, Multiple Disabilities, Paraprofessionals, Employment, Post-Secondary, and Transitions.

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Research to Practice in Autism, Intellectual Disability, and Developmental Disabilities

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On January 20 – 22, 2016, the Council for Exceptional Children Division on Autism and Developmental Disabilities (DADD) sponsored its Seventeenth International Conference: Research Informed Practice in Autism, Intellectual Disability and Developmental Disabilities. The conference was held at the Waikiki Beach Marriott Resort in Honolulu, Hawaii. The DADD Board of Directors decided to devote this issue of the *DADD Online Journal* to conference papers. The conference brought together educators from school and college classrooms from all over the world. The conference included pre-conference training institutes and strands on assistive and adaptive technology, autism spectrum disorder, intellectual disability, mental health, paraprofessionals, parental engagement, post-secondary transitions, and multiple disabilities. The conference provided many parents, teacher educators, researchers, teachers, and other practitioners an opportunity to gather to learn the most current information related to providing services for individuals with autism, intellectual disability, and developmental disabilities.

This issue of the *DADD Online Journal* can enable those who attended the conference to see expanded papers, prepared by presenters, and also give those who were unable to attend an opportunity to benefit from the thoughtful work done by conference participants. Presenters were

asked to submit papers based on their conference presentations. Papers submitted went under a blind review process by the Guest Reviewers and Guest Editors who selected the papers for publication. We think the selection of papers represents an interesting assortment of topics and formats ranging from discussion papers to data based research to descriptions of classroom techniques. The papers selected do not necessarily represent all the topics covered at the conference but they do give a good idea of the variety and quality of the presentations. We would like to thank those authors who submitted papers for their efforts in making this issue of the *DADD Online Journal* possible.

According to the authors of “*Parents’ Reported Use of Naturalistic Communication Teaching Strategies*,” children with developmental delays or disabilities (DD) may experience delays and impairments in their ability to speak and communicate with their parents, peers, and others. Further, these children often benefit from evidence-based, parent-implemented communication interventions aimed at alleviating the impact of their delay or disability on their communicative interactions with others. Through a web-based parent survey, Yusuf Akamoglu, Hedda Meadan, and Meghan Burke explored (a) the naturalistic communication teaching strategies that parents report using with their young children with DD, (b) the perceptions

of parents on the usefulness of the strategies they use, and (c) the types of support and resources that parents report having for learning to implement the naturalistic communication teaching strategies. The most important finding of this study is that parents reported using a variety of evidence-based naturalistic teaching (NT) strategies with their young children. This finding has implications for professionals who work with children with DD and their families in that it is important for professionals to understanding the range of naturalistic communication-teaching strategies.

Children with Autism Spectrum Disorder (ASD) may demonstrate significant deficits in communication, emotion recognition, perspective-taking, and social skills. Additionally, children with ASD may demonstrate deficits in *Theory of Mind* (ToM), also known as mentalizing, perspective-taking, or social intelligence. Of the various interventions available to improve pragmatic communication and ToM skills in children with ASD, computer assisted instruction (CAI) is gaining increased attention. In the next article "*Computer Assisted Instruction to Improve Perspective-Taking Skills of Children with High Functioning Autism*," Lindsey Balderaz and Smita Shukla Mehta evaluated the effectiveness of CAI for teaching perspective-taking skills to students with high functioning autism, to determine the extent to which skills generalized to untrained social problems situations. An additional purpose was to determine if CAI would promote task engagement compared to the use of social stories. Overall, data demonstrated a functional relation between CAI and perspective-taking for all participants.

There is considerable evidence that individuals with intellectual and developmental disabilities (IDD) have a

higher risk of obesity, lower levels of physical activity and increased risk for health complications due to their disability, demonstrating the need for appropriate interventions. Older research identified that traditional exercise programs can improve physical fitness and other health factors and need to be practiced among those with IDD. Newer trends in exercise interventions are new technologies such as wearable fitness trackers and exercise video. Researchers and developers have coined the term "exergaming," a type of entertainment that combines physical activity and video gaming. Examples of exergames include Nintendo Wii[®], Sony PlayStation[®], Dance Dance Revolution[®], virtual reality systems, among several others. In their article "*Exercise Technology Interventions and Individuals with IDD*," Amanda McMahon and Don McMahon report on a systematic review that characterized articles involving technology-based interventions to increase physical activity in individuals with IDD from year 2000 to 2015. The results of this review identified limited but promising research evidence supporting the effectiveness of exercise interventions using technology to increase the physical activity of individuals with IDD. Conclusions are discussed in the context of supporting people with IDD by using existing and future technologies, including exergaming.

In the next article, "*Autism Spectrum Disorder and DSM-V: Looking Back to Look Forward*," Allison Lawrence examines the history of ASD, to provide the backdrop for the argument that a singular cohesive definition is necessary for appropriate education for students with ASD. Autism and the related disorders, once defined as Asperger's syndrome, Childhood Disintegrative Disease, and Pervasive Developmental Disorder-Not Otherwise Specified, and now classified under the Autism Spectrum Disorder category are

some of the most elusive and difficult to diagnose due to the varied nature of the disorder. The Fifth edition of the Diagnostic and Statistical Manual of mental disorders, (DSM-V) published by the American Psychiatric Association, (APA), has sought to remedy the problem faced by researchers and clinicians of different diagnostic definitions by offering a new definition of Autism Spectrum Disorder. However, the definition of Autism hasn't changed at the federal level through IDEA definition of Autism.

Meeting the mathematics needs of children with autism spectrum disorder constitutes an ongoing educational challenge for educators. In Juliet Hart Barnett and Shannon Cleary's article "*Teaching Algebraic Problem Solving Skills to Students with Autism Spectrum Disorders*", the authors describe three research-based practices: (1) self-management, (2) visual supports, and (3) peer-mediated instruction that teachers can use to teach students with autism spectrum disorder higher-order mathematical skills such as algebraic problem solving in inclusive settings. Implementing self-management, visual support, and peer-mediated instructional strategies creates a meaningful context for all children, including those with autism spectrum disorder, which in turn may help them increase independence when solving problems in community or other applied settings.

In the next article "*Accessing Academic Instruction with iPads for Secondary Learners with Low-Incidence Disabilities*," Natalie Pullen and Elizabeth A. West explored the how special education teachers are using mobile technology as an instructional technology for high school students with low-incidence disabilities. Specifically, the Pullen and West investigated how students are using iPads to

access academic instruction, how the use of iPads during academic instruction promote self-determination skills, and what are the students' perspectives of using the iPad as a tool? They concluded that the iPad can encourage students' performance of academic learning activities and promote self-determination skills. In addition, students identified the use of iPads as an instructional tool to be a positive learning experience for them.

The motivation of students and methods used to self-direct learning in the classroom and continue additional learning are important to most educators, whether the student is in preschool or college. In A. Lynne Umbarger's article "*Motivation after Competitive Admission to a College Professional Program*", she examined the goal orientations for learning, the associated cognitive learning strategies (CLS) used, and the plans for continued professional learning (CPL) of college students in their first year studies of an Occupational therapy Assistant (OTA) program. This longitudinal study indicated that first-year OTA students had nearly equal use of mastery and performance goals as students in upper level OTA courses. The OTA students had multiple goal orientations, used both deep processing and surface cognitive learning strategies, and had many plans for CPL at admission and throughout the first year. These findings contradicted the expectation that the competitive admission process with its emphasis on high grade point average would contribute to a higher use of a performance goal orientation and surface cognitive learning strategies.

Alexandra Da Fonte, Miriam C. Boesch, Rachael E. Dodd, Brittany P. Bennett, and Meghan E. Edwards-Bowyer suggest teachers consider the use the SETT framework to evaluate and arrange their classroom to enhance student learning,

opportunities, and outcomes in their article “*The SETT Framework: SETTING the Classroom for Communication Success.*” The goal of SETT framework is for special education teachers to consider the *student’s* needs (S), the *environment* where the technology is needed (E), the *task(s)* to be completed (T), and the *tools* needed for student success within the opportunities given. Alexandra Da Fonte and colleagues describe the components of this framework and outline key considerations for increasing augmented and alternative communication opportunities to enhance communication success within the classroom.

As more and more universities add online offerings in an effort to meet the demand for quality teacher preparation programs offered in a flexible format for busy professionals and those unable to commute to a physical campus, it is important to evaluate the implications on student engagement and participation in online and hybrid formats. Research on issues related to online teacher preparation in special education in general, and low-incidence disabilities in particular, is scarce. In the next article, Jennifer Loncola Walberg evaluated two types of course delivery options to prepare teacher candidates to teach students with low-incidence disabilities in “*Teaching Low-Incidence Disabilities Online vs. Hybrid: Implications for Course Delivery.*” The results indicated that students in online classes appear to have more frequent engagement with the materials than students in hybrid classes, although the students in the hybrid courses spent more time in each module. Documenting that students are accessing all content in online and hybrid coursework in low-incidence disabilities indicates this is a viable learning method; however, the key is ensuring that students engage in a meaningful way. This study indicates that course instructors must have clearly articulated correlations between each

learning activity and a form of assessment to encourage maximum engagement with the course content.

Naturalistic social opportunities for adults with autism spectrum disorder (ASD) become rare occurrences as the transition from high school marks the end of services under IDEA. Erica Howell, Debra L. Cote, and John Kim describe the development and implementation of a multi-university project to provide social events for adults with ASD and their caregivers in “*Crafting University-Based Social Events as High Impact Practices for College Students to Meet the Needs of the Adult Autism Community.*” The authors report on survey data of 34 caregivers’ perspectives on the effectiveness of the first social event. Survey data indicate that the socials were of benefit for adults with ASD and most respondents indicated the need for additional social events. The authors suggest that the survey results demonstrate the need for increased social opportunities and indicate that the social events meet a need of the autism community.

Students with intellectual and/or developmental disabilities (ID/D) have limited access to sexuality education because of multiple barriers, including lack of sexuality training opportunities, parental or practitioner personal beliefs or stereotypes, and/or the fear that education may lead to promiscuous behaviors. In “*To Puberty and Beyond: The Impact of Awareness and Strategy Training on Perceptions of Competency Regarding Comprehensive Sexuality Education for Students with Intellectual or Developmental Disabilities.*” Ruth Eyres, Robert L. Williamson, William Hunter, and Laura Casey describe the creation and implementation of a 6-hour workshop, and the effects on the perceived competence about and actual implementation of

sexuality education by caregivers and educators. The authors evaluated 56 caregivers and educators before and after attending the workshop. Results indicate that the workshop may help to remedy the lack of sexuality instruction and improve quality of life for students with ID/D.

Risks to safety and security are present for all college students, but are greater for students with intellectual disability (ID). In the next article, “A Tiered Approach to Promote Safety and Security in an Inclusive Postsecondary Education Program for College Students with Intellectual Disability,” David L. Westling, Kelly R. Kelley, and Seb M. Prohn describe three tiers of support in place on a college campus to increase safety and security for students with ID participating in a postsecondary education program. The authors present four case studies of former students in the postsecondary education program to demonstrate how the tiered approach has been used to reduce the risks to safety and security of the students. This postsecondary education program has not had any significant safety issues and while the authors cannot specify how the three tiers have affected the safety record, they do feel that the implementation of the tiered approach has been significant in achieved levels of safety and security.

Community colleges have experienced a large influx of students with learning disabilities (LD) and autism spectrum disorders (ASD) and many face difficulties in coping in the academic, psychological, and social domains. In “*Comparison of Perception of Agency and Skills Related to Retention at Community College by Students Categorized as having a Learning Disability or Autism*,” Kathleen M. McCoy, Simon Crawford, Stanley H. Zucker, Martha Cocchiarella, and Linda Caterino investigated the perceptions of successful

community college students with LD or ASD. The authors surveyed and compared the perceptions of 10 students diagnosed with LD and 10 students diagnosed with ASD in regard to agency (i.e., empowerment) and pathways of knowledge. They found that successful students with LD and ASD quite are similar in their perceptions of agency but have significant differences in their perceptions of pathways. The findings are preliminary and raise questions for future research, but are consistent with previous research that learning centers do not seem to be effective and a greater emphasis on instructional strategies could help struggling students.

Assessment of psychopathology in individuals with intellectual disability (ID) is challenging, but important, as children with ID have higher rates of psychopathology than their typical peers. Louis Richer, Lise Lachance, and Alain Côté investigated mediating role of executive functions between age and psychopathological manifestations in school-age children with ID, taking into account gender and IQ in “*Relationship between Age and Psychopathological Manifestations in School-Age Children with an Intellectual Disability: The Role of Executive Functioning*.” During this study, 106 mothers and 83 fathers of children with ID assessed their children using behavior scales. Results indicate a higher level of anxiety and more difficulty with emotional control for girls compared to boys. The authors conclude that metacognitive capabilities of children with ID seem to develop to allow for openness to the world and to become aware of their differences, but not to the extent needed to allow proper adaptation. Recommendations include the consideration of intervention that focus on metacognitive capabilities.

The conference provided educators and researchers with the opportunity to explore current research, topical issues, and best practices relating to autism, intellectual disability, and development disabilities. We

hope readers of this research to practice issue of the ***DADD Online Journal*** find the information valuable and timely.

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Parents' Reported Use of Naturalistic Communication Teaching Strategies

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Children with developmental delays or disabilities (DD) may experience delays and impairments in their ability to speak and communicate with their parents, peers, and others. These children often benefit from evidence-based, parent-implemented communication interventions aimed at alleviating the impact of their delay or disability on their communicative interactions with others. However, it is unclear whether parents frequently use such strategies as well as how they perceive the usefulness of the strategies. The purpose of this survey study was to explore (a) the naturalistic communication teaching strategies that parents report using with their young children with DD, (b) the perceptions of parents on the usefulness of the strategies they use, and (c) the types of support and resources that parents report using as they learn to implement the naturalistic communication teaching strategies. In this study, 65 parents of young children with DD responded to a web-based survey. Findings indicate that parents use responsiveness most frequently while they use time delay the least frequently and view time delay as the least useful strategy. Implications for future research and practice are discussed.

The acquisition of communication skills is crucial to a child's development. Communication is a form of social information exchange between a sender and receiver (Downing, 2002) and thus is different than the acquisition of language. Communication has an impact on various aspects of a child's life such as making choices, sharing ideas, and developing friendships. Children who have developed communication skills can actively participate in everyday activities. In addition, a child's ability to communicate is essential for initiating and maintaining social interactions and conversations that are critical for establishing and maintaining relationships with family members, peers, and other adults (Stephenson & Dowrick, 2005). Teaching communication skills at early ages can lead

to positive outcomes in social interaction skills for children with developmental delays or disabilities (DD) (Ingersoll, 2010; Koegel, 2000). Children with DD who receive early intervention (EI) services that are based on supportive teaching strategies within natural environments (e.g., homes, preschool) are likely to make substantial gains that impact functional development that persists throughout the lifespan (Downing, 2002)

Naturalistic teaching (NT) strategies are evidence-based instructional interventions that researchers have used to promote the communication skills of children with DD (e.g., Kaiser & Hancock, 2003; Meadan, Angell, Stoner, & Daczewitz, 2014; Roberts & Kaiser, 2011; Wong et al., 2013). The goals of NT strategies are to:

(a) provide the child with verbal and nonverbal language input, (b) enhance the child's motivation to communicate, (c) increase the child's engagement in play-based and/or activity-based interactions, and (d) provide the child with opportunities to respond in a positive way to situations that the adults create (Kashinath, Woods, & Goldstein, 2006; Kaiser, 1993; Kaiser & Hancock, 2003; Koegel, 2000).

Five frequently used strategies are (a) environmental arrangement, (b) modeling, (c) mand-model, (d) time delay, and (e) responsiveness. See Table 1 for a description of these five NT strategies (Meadan et al., 2014; Roberts & Kaiser, 2011). Researchers have demonstrated that these NT strategies are feasible for parents to acquire and implement with high fidelity. Additionally, these evidence-based strategies have been shown to increase child communication skills. Parents are key communication partners and they can provide important social experiences, especially in the very early years, and opportunities to facilitate communication, language development, and social interactions within a child's natural environments (Kaiser, Hancock, & Hester, 1998).

For NT strategies to be implemented successfully, families need support from professionals. Parents should be involved in the development of the intervention and participate in individualizing NT strategies based on the children's language needs. Parents promote their children's overall development in everyday interactions and, therefore, are considered their children's first teachers (Roberts & Kaiser, 2011). Teaching parents to use NT strategies to support the communication skills of their children is acknowledged as an effective

way of helping children develop communication skills (Kaiser, Hester, Alpert, & Whiteman, 1995). Kaiser (1993) discussed three important components for parent involvement in NT strategies. First, parents usually have a central and consistent role in the child's everyday environment and activities. Second, parent-implemented NT strategies promote the generalization of newly learned language and communication skills. Third, everyday parent-child interactions are critical for facilitating the child's language and communication skill development. Communication interactions between parents and children vary depending on the child's communication functions (e.g., request, initiation, comment) and context (e.g., play, caregiving routine); such interactions impact children's language development (Roberts & Kaiser, 2012; Roberts, Kaiser, Wolfe, Bryant, & Spidalieri, 2014). For example, Kashinath et al. (2006) reported that some parents use environmental arrangement strategies more frequently than time delay. Moore, Barton, and Chironis (2013) reported that some parents were more likely to use responsiveness and modeling strategies to expand their children's vocabulary; as a result, these parents observed an increase in child vocabulary outcomes.

Given the effectiveness of NT strategies for children with DD, it is important to understand the frequency and usefulness of NT strategies as perceived by parents. The research questions that guided this study were:

1. What are the NT strategies that parents report using with their young children who have DD?
 - 1.1. Is there a relation between certain parent and child

Table 1

Descriptions of Naturalistic Teaching Strategies

Strategy	Definition and Purpose	Example
Environmental Arrangement	Selecting, arranging, and managing the physical, social, and temporal environment to increase the likelihood of the child to communicate and interact with the adult.	Parent places a favorite toy in sight but out of reach (on a shelf) to increase the likelihood the child request the toy.
Modeling	Modeling specific words, signs, or gestures to show the child a target language and/or communication behavior, so the child could imitate the word/sign/gesture.	Parent provides a verbal model by saying 'ball' while the child is playing with a ball, so the child could imitate the parent and say or sign 'ball'.
Mand-Model	Giving a direct instruction, asking a question, or giving a choice so the child has an opportunity to communicate with the adult. The mand is a vocal request for a response, a question, or a choice that is maintained by a reinforcer (e.g., obtaining a preferred item such as a toy car).	A child is given banana for snack and reaches to pick it up with his hands. The parent provides a prompt by obtaining the child's attention, and says, "Tell me what you want" (mand), provides a choice "Do you want banana or apple?" or asks a question "what do you want?"
Time Delay	Giving a child a reason to communicate and then waiting approximately 3 to 7 seconds (depending on the child's developmental level) for the child to initiate communication within a familiar routine.	During snack time, the parent gives the child a small piece of his favorite cookie and looks expectantly at the child and waits 3 to 7 seconds for him to ask for more.
Responsiveness	Responding to the child's communicative behaviors by following the child's lead, expanding on the child's language, praising, imitating, and interpreting the child's communication acts.	If the child says, "ball" the parent expands the child's language by saying, "blue ball."

- demographic characteristics and parents' use of the NT strategies?
2. What are the perceptions of parents on the usefulness of the NT strategies that they use with their children?
 - 2.1. Is there a relation between parents' reported use of NT strategies and their perceptions of usefulness of the strategies?
 3. What are the types of support and resources that parents use to learn to implement NT strategies?

Method

Participants

A total of 65 parents of children from birth to 5 years of age with DD completed the entire web-based survey regarding parents' use and perception of evidence-based NT strategies. See Table 2 for a summary of parent and child demographic information.

Recruitment

Parents were recruited from parent organizations and special education programs (e.g., Parent Training and Information Centers; the state Early Intervention Training Program) that maintain e-mail lists and newsletters, in a large Midwestern state. A letter inviting participation to this study was e-mailed to parent organizations and special education programs; most organizations and programs forwarded the letter to their constituencies via social media, e-mail lists, and newsletters. Many organizations and programs also distributed reminder e-mails to recruit parents. Upon completion of the questionnaire, participants were offered the opportunity to participate in a drawing to win one of ten \$25 gift cards. In total, 112 parents attempted to complete the survey, however only 65 parents completed the entire survey. Given this recruitment strategy, it is unclear how many parents

received the recruitment material about the study; it is also unclear how the 45 parents who did not complete the entire questionnaire differed from the 65 parents who completed the entire questionnaire.

Instrument

Survey instrument development. A questionnaire was developed to answer the research questions posed for this study. To ensure high content validity, the questionnaire was developed based on a review of the academic literature (e.g., Kaiser & Hancock, 2003; Kashinath et al., 2006; Meadan et al., 2014; Moore et al., 2014) and a search of databases of published survey instruments (Jonhston & Wong, 2002). Research revealed no existing instruments that measure NT strategies and perceptions of parents. The questionnaire designed for this study included questions with Likert scale response options, multiple choice items, and open-ended responses.

For the questionnaire, we received feedback from expert reviewers including three university professors with expertise in naturalistic language and communication interventions and survey research, and two doctoral students in special education. The experts provided written comments regarding the organization (e.g., layout of items and ratings on the forms), length, items, and wording (e.g., replacing complex wording with easier wording) of the questionnaire. Additionally, one cognitive interview was employed to test the questionnaire items (Desimone & le Floch, 2004) with a parent of a preschooler who has language delay and autism spectrum disorder. In this cognitive interview, the first author sat with the mother as she completed the questionnaire and listened to her cognitive processing as she responded to the questions.

Table 2. *Demographics of Respondents (N=65)*

Characteristics	% (n)
Parent Gender	
Female	98.5 (64)
Male	1.5 (1)
Age	
25-35 years	50.8 (33)
36-45 years	36.9 (24)
46-55 years	10.8 (7)
Older than 55 years	1.5 (1)
Marital Status	
Married	89.2 (58)
Single	9.2 (6)
Divorced	1.5 (1)
Race/Ethnicity	
Caucasian/White	89.2 (58)
Multiracial	6.3 (4)
African-American	3.0 (2)
Hispanic/Latin American	1.5 (1)
Education	
Master's	37.0 (24)
Bachelor's	27.7 (18)
Associate's	20.0 (13)
High school	12.3 (8)
Some College	3.0 (2)
Income	
\$100.000 and more	32.3 (21)
\$50.000 - \$74.999	26.2 (17)
\$75.000 - \$99.999	13.8 (9)
\$35.000 - \$49.999	10.8 (7)
\$25.000 - \$34.999	7.7 (6)
Not Reported	9.1 (5)
Child Gender	
Male	72.3 (47)
Female	27.7 (18)
Age	
49-60 months	33.8 (22)
37-48 months	30.8 (20)
25-36 months	24.6 (16)
13-24 months	10.8 (7)
Disability	
Speech and language delay	30.8 (20)
Autism spectrum disorders	27.7 (18)
Down syndrome	21.5 (14)
Developmental delay	18.5 (12)
Cerebral Palsy	1.5 (1)
Special Education Services	
Early intervention	32.3 (21)
Early childhood special education	58.5 (38)
Supplemental private speech therapy	40.0 (26)
Private speech therapy only	6.0 (4)
Years/Months receiving EI/ECSE services	
More than 1 year	72.3 (47)
6 months to 1 year	18.5 (12)
Less than 6 months	9.2 (5)
No response	0.2 (1)

Parent feedback included adding an additional question about sign language, changing the format of a question from multiple-choice to Likert scale and a few wording changes. Parent and expert feedback was incorporated to improve the clarity and accuracy of the questionnaire. Next, the questionnaire was posted on Qualtrics (Provo, UT), an online survey platform. Finally, the questionnaire was piloted with three parents of young children with and without disabilities. After receiving feedback from the pilot participants, the final version of the questionnaire was posted for data collection.

Survey structure and content. The questionnaire consisted of three sections with a total of 66 items about NT strategies and perceptions of usefulness. In addition, there were two open-ended questions that were asked at the beginning of the questionnaire. Below, we list and describe the open-ended questions and NT strategy variables.

Open-ended questions. The first open-ended question was “In general, what do you do at home to support your child’s communication skills?” The second question was, “What communication skills do you imagine your child learning within the next year?” For both questions, parents wrote their responses in text boxes.

Frequency and usefulness of NT strategies: Environmental arrangement. Using a 5-point Likert scale, ranging from *Never* (1) to *Almost Always* (5), participants responded to questions and statements about the frequency in which they engaged in the identified behaviors. Notably, the same frequency scale and question/statement format was used in all frequency questions for each NT strategy. For example, participants were asked “I intentionally

create opportunities for communication between my child and me by withholding objects/toys from my child until my child asks for them.” We used Cronbach’s alpha to assess the reliability and internal consistency of the NT and usefulness scales. Cronbach’s alpha for Environmental Arrangement was .69. For usefulness, using a 5-point Likert scale, ranging from *Not At All Useful* (1) to *Very Useful* (5) (the same usefulness scale was used in all usefulness questions for each NT strategy), participants were asked to rate the usefulness of the same six questions about Environmental Arrangement (e.g., “How useful do you think these activities are in getting your child to communicate with you?”). Cronbach’s alpha was .73.

Frequency and usefulness of NT strategies: Modeling. With a 5-point Likert scale, participants were asked six questions about Modeling. A sample question was “How often do you do the following activities to teach your child new words/signs? ... Intentionally saying or signing the word I want my child to say or do when my child is paying attention to me.” Cronbach’s alpha was .82. Regarding the usefulness of modeling, participants were asked to rate the usefulness of the same six questions about Modeling (e.g., “How useful do you think these activities are in teaching your child new words/signs?”). Cronbach’s alpha was .86.

Frequency and usefulness of NT strategies: Mand-Model. Seven questions were asked about Mand-Model using a 5-point Likert scale. For example, participants were asked, “How often do you do the following to help your child to use a new word/sign? ... Asking a choice question (e.g., “Do you want bubbles or balls?”). For this variable, Cronbach’s alpha was .85. In the usefulness section of Mand-Model, participants were

asked to rate the usefulness of the same seven questions about Mand-Model (e.g., “How useful do you think these activities are in helping your child to use a new word/sign?”). Cronbach’s alpha was .86.

Frequency and usefulness of NT strategies:

Time Delay. Participants were asked six questions about Time Delay using a 5-point Likert scale. A sample question was “How often do you do the following to get your child to initiate/begin communication with you? ...Giving my child time (up to 7 seconds) to request or ask for something.” Cronbach’s alpha was .86.

Regarding usefulness of time delay, participants were asked to rate the usefulness of the same six questions about Time Delay. For example, participants were asked, “How useful do you think these activities are in getting your child to initiate/begin communication with you?” Cronbach’s alpha was .89.

Frequency of usefulness of NT strategies:

Responsiveness. Participants were asked eight questions about Responsiveness using a 5-point Likert scale. A sample question was “How often do you do the following activities with your child during play or a daily activity? ...Talking about what my child and I are doing during play.” For this variable, Cronbach’s alpha was .79.

Parents were then asked to rate the usefulness of the same eight questions about Responsiveness. For example, participants were asked, “How useful do you think these activities are in getting your child to communicate with you during play or a daily activity?” Cronbach’s alpha was .88.

Types of support and resources for learning to implement NT strategies.

To provide context about support and resources for parents, we first examined knowledge.

Using a 5-point Likert scale, ranging from *Low* (1) to *High* (5), participants were asked three questions about their knowledge of NT strategies. For example, participants were asked, “Please rate your: ...Knowledge of practices to support my child’s communication skills.” Cronbach’s alpha was .93 for this variable. Using a 4-point Likert scale ranging from *None* (1) to *A Lot* (4), participants were asked to rate six questions related to how they learned NT strategies. For instance, participants were asked, “How did you learn about things you can do to support your child’s communication skills? ...I learned things from therapists/teachers who worked with my child on his/her communication skills.” Cronbach’s alpha was .66. Finally, parents were asked seven questions about the guidance they received from therapists or teachers. Participants were asked, “How did a speech-language pathologist, developmental therapist, and/or a teacher guide you? ... Had a conversation with me about my concerns related to my child’s communication.” For this variable, Cronbach’s alpha was .89.

Demographic information. In addition to general demographic information (e.g., “What is your annual household income?”), parents were asked to report on their children’s level of receptive and expressive language skills. A sample question was, “Compared with other children your child’s age, how would you describe your child’s understanding of others’ communication with him/her?” with response options of “Has a little trouble understanding” or “Has a lot of trouble understanding.” A sample question for expressive language was, “Compared with other children your child’s age, how well does your child make his/her needs known to you and others?” with response options of “Has a little trouble communicating” or “Has a lot of trouble

communicating.”

Data Analysis

Quantitative analysis. The quantitative data were analyzed through SPSS Version 22.0 for Mac. Data analysis consisted of descriptive and inferential statistics. First, we conducted Cronbach’s alpha for each scale to determine whether each scale represented a single construct. All variables had Cronbach’s alphas greater than .6 indicating that the items held together as a variable. For each scaled variable we used the means of the items. We then examined the dataset for missing data. None of the 65 participants had missing data so no imputation was needed. We then examined the distribution of the variables; all variables were normally distributed so we proceeded with parametric statistics including repeated measures ANOVAs to determine the difference in frequency and perceived usefulness between the NT strategies and *t*-tests to determine how parent and child characteristics were related to frequency of the strategies. For the ANOVAs, we conducted follow-up analyses using Tukey’s test and used Cohen’s *d* to calculate effect sizes. To examine the relation between frequency and perceived usefulness of NT strategies, we conducted Pearson correlations.

Qualitative analysis of open-ended item.

Responses to the open-ended questions were analyzed through a qualitative coding procedure. First, the researcher downloaded all of the responses to each open-ended question. Then, the first and second authors independently coded all of the open-ended answers, and met to develop codes and categories. For each question, all similar responses were grouped and categorized to develop a list of similar strategies reported by parents and were coded independently by the first and second author. Next, the first

and second author met again to compare codes and check reliability. Once consensus on a coding scheme was reached, the frequencies of strategies and statements were listed.

Specifically, of the 65 open-ended answers, 60 were counted as valid answers and five were counted as invalid due to incomplete and ambiguous open-ended answers. Across the 60 open-ended answers, 103 strategies were coded independently. The authors coded the responses to the first open-ended question based on the NT strategies the respondents listed (i.e., Environmental Arrangement, Modeling, Mand-Model, Time Delay, Responsiveness) and included a new category, *Support*, based on the responses. The *Support* category emerged from answers that included external support that assists the children in communicating with others such as picture books, visual aids, flash cards, augmentative and alternative communication devices, and sign language. Independent coding revealed 15 disagreements and 88 agreements. Intercooder reliability was calculated by dividing the number of agreements by the total number of agreements plus *disagreements* and multiplying by 100%. The overall intercooder reliability was calculated as 85%.

Results

Results are presented regarding parents’ reported use of NT strategies, their perceptions of the usefulness of the strategies, and the types of support and resources parents report having for learning to implement NT strategies.

Use of NT Strategies

The variable with the highest frequency was Responsiveness ($M = 4.52$, $SD = 0.43$) and the variable with the lowest frequency was Time Delay ($M = 3.87$, $SD = 0.88$). Responsiveness was used significantly more

than all other strategies except for Mand-Model (p 's < .05). Notably, Time Delay was used significantly less than all other strategies (p 's < .05). See Table 3 for a summary of the results.

In addition, in response to the first open-ended question, 22 participants indicated that they used Mand-Model strategies (e.g., asking questions, offering choices, asking to use words), and 21 participants indicated that they use Modeling strategies such as labeling objects and modeling words/signs. Twenty participants indicated they use Support strategies such as visual aids, picture books, sign language, and communication devices. Participants ($n = 17$) also reported using Responsiveness strategies such as engaging in play, talking to the child, telling the child what they are

doing, and expanding on utterances. Additionally, 16 participants indicated that they use some form of Environmental Arrangement strategies including daily routines such as reading books, singing songs, and creating opportunities for communication. Only one participant reported using Time Delay by giving the child time to communicate. Notably, from the open-ended responses, it seems that parents use multiple strategies to support their children's communication skills. For example, one parent wrote,

We encourage her to use words to express her needs. We use context clues to try and understand what she is saying. We ask her to show us or point to what it is she wants/needs. We are friendly and supportive, giving her time to communicate.

Table 3
Results of Repeated Measures ANOVA for Frequency

Scales	Min-Max	M (SD)	Comparisons
Responsiveness	3.63-5.00	4.52 (.43)	Resp>Model* Resp>EA* Resp>TD*
Mand-Model	1.29-5.00	4.39 (.63)	Mand>TD*
Modeling	2.50-5.00	4.37 (.63)	Model>TD* Model<Resp*
Environmental Arrangement	3.17-5.00	4.25 (.52)	EA>Time* EA<Resp*
Time Delay	1.50-5.00	3.87 (.88)	TD<Resp* TD <Mand* TD < Model* TD < EA*

* $p < .05$.

Note. M : Mean. Min: Minimum. Max: Maximum. SD : Standard Deviation. EA: Environmental arrangement. Resp: Responsiveness. Mand: Mand-model. Model: Modeling. TD: Time delay.

This parent indicated that she used Mand-Model by asking her child to show or point to her wants and needs; the parent also used Time Delay by giving the child time to communicate. Another parent described using multiple NT strategies, “We read books, look at pictures and label them, talk to him and ask him questions, and add signs when applicable.” This parent’s Support strategies included reading books, labeling pictures to model language, being responsive by talking to the child, and asking questions.

In response to the second open-ended question, participants indicated that they imagine their child learning to use a mode of communication, spoken language, or to improve articulation and expressive communication by expressing needs, wants, and emotions. Examples for mode of communication included learning to sign and using sounds, picture communication boards, and communication devices. Participants who indicated spoken language as a goal for their child mentioned learning more words (vocabulary), combining words (2-3 words or more), and speaking in sentences. For example, one parent wrote about her goals for expanding her child’s sign vocabulary, “Since she is sometimes putting 2 signs together, I think she will start putting 2 words together. She will continue to build her vocabulary and will learn more signs that we can use daily.”

Relation between NT strategies and parent and child demographics. Parents who indicated having annual household incomes below (vs. above) \$50,000 reported significantly greater use of Modeling, Time Delay, and Environmental Arrangement strategies with moderate effect sizes (d 's ranged from .57 to .67, respectively).

Additionally, parents of children with receptive language difficulties (versus without difficulties) reported significantly greater use of Environmental Arrangement and Modeling with a moderate effect size ($d = .53$). Finally, compared with parents of children who had vocabularies of more than 50 words, parents of children who had fewer than 50 words were associated with significantly higher rates of Responsiveness, Environmental Arrangement, and Modeling strategies with moderate and large effect sizes (d 's ranged from .69 to 1.00, respectively). See Table 4 for a summary of the results.

Perception of Usefulness

The variable with the highest rating of usefulness was Modeling ($M = 4.38$, $SD = 0.62$) and the variable with the lowest rating of usefulness was Time Delay ($M = 3.75$, $SD = 0.87$). Modeling was perceived useful significantly more than all other strategies except for Responsiveness (p 's < .05). Time Delay was perceived useful significantly less than all other strategies (p 's < .05). See Table 5 for a summary of the results.

Relation between Use of NT strategies and perceptions of usefulness. All variables had significant correlations. Except for the Responsiveness variable that had a significant moderate positive correlation ($r = .541$; $p < .01$), the four other variables (Environmental Arrangement, $r = .715$; $p < .01$; Modeling, $r = .699$; $p < .01$; Time Delay, $r = .693$; $p < .01$; Mand-Model, $r = .682$; $p < .01$) were found to have strong, significant positive correlations between their frequency of use and perceptions of usefulness.

Table 4
Results of T-test for NT Strategies Use by Income

Scales	Less than \$50,000	\$50,000 and more	<i>t</i>	<i>p</i>	<i>d</i>
	<i>M (SD)</i>	<i>M (SD)</i>			
Environmental Arrangement	4.49 (.42)	4.17 (.53)	2.30	.024*	.67
Time Delay	4.26 (.89)	3.72 (.83)	2.26	.027*	.62
Modeling	4.62 (.54)	4.28 (.64)	2.00	.050*	.57
Responsiveness	4.65 (.39)	4.47 (.43)	1.52	.132	.43
Mand-Model	4.52 (.40)	4.33 (.69)	1.06	.292	.33

Scales	Trouble Understanding Others	Understands Others	<i>t</i>	<i>p</i>	<i>d</i>
	<i>M (SD)</i>	<i>M (SD)</i>			
Environmental Arrangement	4.35 (.49)	4.08 (.54)	2.10	.040*	.53
Modeling	4.50 (.56)	4.16 (.67)	2.09	.040*	.53
Mand-Model	4.46 (.68)	4.26 (.53)	1.18	.242	.31
Responsiveness	4.57 (.38)	4.44 (.49)	1.22	.224	.30
Time Delay	3.88 (.83)	3.85 (.97)	0.13	.894	.03

Scales	Less than 50 words	More than 50 words	<i>t</i>	<i>p</i>	<i>d</i>
	<i>M (SD)</i>	<i>M (SD)</i>			
Modeling	4.71 (.36)	4.14 (.70)	3.62	.001*	1.00
Environmental Arrangement	4.47 (.43)	4.05 (.55)	2.99	.004*	.83
Responsiveness	4.66 (.36)	4.39 (.43)	2.48	.016*	.69
Time Delay	4.11 (.81)	3.72 (.67)	1.94	.057	.54
Mand-Model	4.59 (.41)	4.36 (.54)	1.64	.106	.45

* $p < .05$. Note. Variables are listed based on *d* sizes.
M: Mean. SD: Standard Deviation. NT: Naturalistic teaching.

Types of Support and Resources for Learning to Implement NT Strategies

Overall, 38.5% ($n = 25$) of the participating parents indicated that they had *somewhat high* “knowledge of practices to support their children’s communication skills”, 33.8% ($n = 22$) of the parents reported that they had *high* knowledge, and 26.2% ($n = 17$) indicated that they had *average* knowledge. Similarly, 36.9% ($n = 24$) of the participating parents indicated that they had *somewhat high* “competence in using

communication teaching strategies,” 33.8% ($n = 22$) indicated having *high* competence, and 29.2% ($n = 19$) reported that they had *average* competence.

Most of the parents indicated that they learned *a lot* (76.9%, $n = 50$) and *some* (21.5%, $n = 14$) from a therapist/teacher who worked with their child. Less than half of the parents indicated they learned *a lot* (43.1%, $n = 28$) or *some* (44.6%, $n = 29$) from reading resources (e.g., books, articles). In

Table 5
Results of Repeated Measures ANOVA for Usefulness

Scales	Min-Max	<i>M (SD)</i>	Comparisons
Modeling	2.67-5.00	4.38 (.62)	Model>Mand* Model>TD* Model>EA*
Responsiveness	3.00-5.00	4.36 (.63)	Resp>Mand* Resp>TD*
Environmental Arrangement	2.83-5.00	4.22 (.59)	EA>TD* EA<Model*
Mand-Model	1.14-5.00	4.12 (.79)	Mand>TD* Mand<Model*
Time Delay	1.57-5.00	3.75 (.87)	TD<Resp* TD<Mand* TD< Model* TD< EA*

* $p < .05$.

Note. *M*: Mean. *Min*: Minimum. *Max*: Maximum. *SD*: Standard Deviation. *EA*: Environmental arrangement. *Resp*: Responsiveness. *Mand*: Mand-model. *Model*: Modeling. *TD*: Time delay.

addition, about one-third of the parents reported that they learned *a lot* (32.3%, $n = 21$) or *some* (30.8%, $n = 20$) from the Internet (e.g., websites, Facebook, YouTube).

The majority of parents (81.5%, $n = 53$) reported that a therapist or teacher gave them information and demonstrated how to use specific strategies. Most parents (72.3%, $n = 47$) also reported that a therapist or teacher guided them in practicing specific strategies. However, less than half of the parents (46.2%, $n = 30$) reported that the therapist or teacher observed them using the strategies, and only half of the parents (50.8%, $n = 33$) reported that they received feedback following practice. Over half of the parents (60%, $n = 39$) indicated that the therapist or teacher asked if they had any problems using

the strategies and helped them solve the problem. Result of the open-ended responses also indicated that parents reported feeling knowledgeable and competent in using NT strategies because many parents indicated that they used a variety of NT strategies with their children along with the suggestions they received from service providers or teachers. As one parent noted, “We take every suggestion that our therapists give us. We also try to repeat words multiple times to help him try and say it.”

Discussion

Use of NT Strategies

The most important finding of this study is that parents reported that they are using evidence-based NT strategies with their young children. Interestingly, parents reported that they are using these strategies

in their responses to the open-ended question, even before they were introduced to these strategies in the close-ended survey questions.

In particular, the results indicate that except for Time Delay, four of the NT strategies were reported as occurring *often* or *almost always*. Specifically, the results show that the order of the most frequently used NT strategies respectively were Responsiveness, Mand-Model, Modeling, Environmental Arrangement, and Time Delay. These findings are consistent with previous reviews (Meadan, Ostrosky, Zaghawan, & Yu, 2009; Roberts & Kaiser, 2011). Additionally, the findings from the open-ended question (i.e., “In general, what do you do at home to support your child’s communication skills?”) validate the frequency results from the survey. Except for the Responsiveness strategy, which was rated as the most frequently used strategy in the closed-ended survey questions, the frequency findings from the first open-ended question correlate with the frequency of use of NT strategies that the survey results revealed. In the open-ended responses, parents reported that they engaged in several activities that they thought would promote their children’s communication skills. Responses to the open-ended questions revealed that the participating parents were knowledgeable about communication support strategies and they used a variety of evidence-based NT strategies to support their children’s communication skills and language development.

In the literature, time delay is conceptualized as an antecedent strategy that gives the child a reason and an opportunity to communicate (Kashinath et al., 2006) and, therefore, requires more intentional planning and wait time. Consistent with our results, other studies have also demonstrated that time

delay is the least frequently used strategy. For example, in a study about coaching parents to use four NT strategies (i.e., environmental arrangement, modeling, mand-model, and time delay), Meadan et al. (2014) reported that none of their parent participants used time delay during baseline. Further, despite the increased use of time delay during a coaching phase, all parents decreased their use of time delay during maintenance (see also Roberts et al., 2014 for similar findings). In the same study, parents were reported to use mand-model most frequently both before and after intervention. The authors explained, “This might be expected because in everyday interactions, people seem to use more mands (i.e., questions, choices, or mands) than the other form of communication strategies on which we focused in this study (i.e., modeling and time delay)” (p. 13).

Many participants in the current study reported that they most frequently used responsiveness strategies (e.g., expanding on child’s language, interpreting child’s actions, turn taking, and following the child’s lead). This finding is consistent with a qualitative study of the perspectives of mothers of children with Fragile X syndrome in which, Brady, Skinner, Roberts, and Hennon (2006) found that mothers of verbal children used responsiveness strategies more often compared to mothers of nonverbal children. Brady et al. (2006) found that a majority of parents reported that they talked a great deal to their children, prompted them to produce and/or imitate specific words, and expanded on their children’s utterances.

Interestingly, results revealed that parents who had a lower household income (\$50,000 and below vs. above) used Environmental Arrangement, Modeling, and Time Delay strategies more frequently. This finding is inconsistent with the literature because parents from low socioeconomic status

backgrounds (including low income families) were found to talk less with their children (Hart & Risley, 1995). This finding should be interpreted with caution due to the small sample in the income groups.

Lastly, the present study revealed that the group of parents who reported that their children use approximately 50 words or less were associated with a significantly higher rate of frequency in their use of used Environmental Arrangement, Modeling, and Responsiveness more frequently. This finding is supported by the literature and confirms that parents use the strategies that align with their children's communication skills and functional needs (Moore et al., 2014; Roberts et al., 2014). By using Modeling and Responsiveness, parents model new words, phrases, and/or signs and help their children expand their vocabulary. Also, by using Environmental Arrangement (e.g., playing with favorite toys, withdrawing favorite objects), parents give their children opportunities to use their vocabulary.

Perception of Usefulness

Understandably, perceived usefulness significantly and positively correlated with use of NT strategies. For example, time delay was reported to be the least frequently used and perceived as the least useful. It is important to note that time delay is used to encourage children to initiate communication and comment. However, it is well documented in the literature that children with disabilities generally demonstrate fewer initiations (Brady, Steeples, & Fleming, 2005). When parents elicit limited responses from their children, they might be less likely to use time delay and eventually think that this strategy is not very useful.

On the other hand, there were variations in

parents' reported use of NT strategies and perception of usefulness of the NT strategies. For example, even though parents reported using Responsiveness strategies more frequently than the four other NT strategies, they perceived Mand-Model strategies as the most useful. One possible explanation could be that Responsiveness is a broader strategy that includes many strategies (e.g., turn-taking, expansion) whereas mand-model is a single and more specific strategy.

Types of Support for Learning to Implement NT Strategies

The results showed that more than half of the participating parents reported *somewhat high* or *high* knowledge of NT strategies to support their children's communication skills. Similarly, more than half of the parents felt competent using the NT strategies. These results are not surprising considering that almost all of the parents indicated that they received guidance and support from a service provider (e.g., speech and language pathologist [SLP] or developmental therapist [DT]) or a teacher.

Results revealed that the majority of the parents felt that they learned a lot from the service providers or teachers who work with their children. In the case of a child younger than 3 years old, the family receives EI services and thus, SLPs or DTs often work with parents to increase a child's opportunities for learning communication within the context of naturally occurring routines and activities. Therefore, therapists have direct contact with parents and can help them by sharing information and supporting them to implement strategies. Similar findings were noted by Brady et al. (2006), who identified specific instances where parents indicated they were using strategies specifically taught and suggested by their child's SLP.

Another large percentage (43.1%) of parents reported learning a lot from reading resources such as books or articles and Internet sources such as web sites or social media tools. Given the fact that the present study was an online survey and that the Internet is a widely used tool to access information and resources, the parents in this study might be more likely to utilize the Internet to increase their knowledge on a broad range of topics including NT strategies. This finding could be helpful for efforts on innovative Internet-based service delivery models and in increasing parents' access to accurate and reliable information on evidence-based NT strategies (Meadan, Meyer, Snodgrass, & Halle, 2013).

Data about the guidance received from service providers or teachers revealed that a little less than half of the parents reported that therapists or teachers observed them practicing using the strategies. In addition, half of the participating parents indicated that they received feedback from a service provider or teachers with whom they work. This finding suggests guidance such as coaching could promote parents' knowledge of and competence in using NT strategies and help parents to identify appropriate NT strategies for their children.

There are several limitations that may require a more conservative interpretation of the findings. For example, this study included a small sample; additionally, the sample was not diverse. Because direct access to parents' email addresses were not available, it was not possible to contact potential participants directly. In addition, it is likely that some participants were unable to commit the time to complete the survey. Future research should include a larger and more diverse sample. Also, this survey relied on self-report. Future researchers may wish to include other modes of data collection,

such as direct observation.

Implications for Research and Practice

Collectively, these results indicate that parents are using a variety of NT strategies with their children with DD. It is important that professionals who work with children with DD and their families understand the range of naturalistic communication-teaching strategies that parents may be implementing. With this knowledge, professionals can assist families in identifying strategies that are likely to be most helpful to their children, and systematically teach and monitor parents' implementation and provide feedback to improve their implementation skills. Additionally, future research could expand upon the current study and investigate how accurately parents implement NT strategies. Understanding what factors parents consider in their decision to use particular NT strategies and how they perceive whether a strategy produces useful outcomes for their children would be of interest to EI service providers and ECSE teachers.

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Computer Assisted Instruction to Improve Perspective-Taking Skills of Children with High Functioning Autism

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Children with Autism Spectrum Disorder (ASD) show significant deficits in communication, emotion-recognition, perspective-taking, and social skills. One intervention gaining increased attention is the use of computer assisted instruction (CAI) with the purpose of improving pragmatic communication and theory of mind skills. This study evaluated the effectiveness of CAI for improving perspective-taking skills in four children (5-12 years) with high functioning autism. A single-subject multiple baseline research design across participants was utilized to evaluate the effectiveness of CAI. Software based on Skinner's (1954) programmed instruction model was delivered to participants with 22 scenarios to teach them to identify emotions of characters based on situational cues. Visual analysis revealed that all participants increased perspective-taking skills during intervention and three of four participants showed an increase in task-engagement. Additionally, the participants correctly identified emotions assessed through the use of social scenarios acted out by family members during stimulus generalization. The magnitude of effect was also large for the participants. Implications are discussed with regards to strategies for bridging the research-to-practice gap and implementation CAI by practitioners across settings.

The Diagnostic and Statistical Manual of Mental Disorders (DSM 5) defines autism spectrum disorder (ASD) as a condition with impairment in social communication across multiple contexts, failure to initiate and respond to social interactions, as well as restricted and repetitive patterns of behavior. Other associated characteristics are deficits in emotional reciprocity and understanding of body language (American Psychiatric Association, 2013). These deficits are often exhibited as an inability to understand and process subtle socio-emotional cues expressed through facial expression, voice intonation, and contextual signals (Tager-Flusberg, 2007), and limit an individual's ability to successfully participate in the social environment. A specific characteristic of individuals with ASD include deficits in *Theory of Mind* (ToM), also known as mentalizing, perspective-taking, or social

intelligence (Howlin, Baron-Cohen, & Hadwin, 1999). It is defined as an ability to infer other people's mental states that may or may not be similar to one's own, and use the information to interpret and predict their behavior in specific social situations (Hoogenhout & Malcolm-Smith, 2014). ToM includes the ability to recognize (i.e., label), understand (i.e., explain) and manage (i.e., exercise self-control) emotions (Caldeira & Edmunds, 2012).

Howlin et al. (1999) suggested the mental state creates emotions rooted in a person's understanding and interpretation of the specific social context and ability to predict emotional expressions of others appropriate to the situation (i.e., situation-based). Additionally, accurate emotion recognition and subsequent behavior in a social situation is determined by the extent to which a

person's desire is fulfilled (i.e., desire-based), and what s/he believes to be true (i.e., belief-based). Without ToM skills, individuals may be perceived as lacking empathy and may have difficulty forming and/or maintaining meaningful social relationships. Individuals with ASD usually show significant delays in achieving ToM milestones compared to neurotypical individuals (Baron-Cohen, 1989).

Existing evidence suggests that components of ToM skills can be learned by individuals with ASD through explicit teaching strategies (Adibsereshki, Nesayan, Gandomani, & Karimlou, 2015; Feng, Lo, Tsai, & Cartledge, 2008). For example, Ryan and Charragain (2010) evaluated the impact of a systematic training on emotion-recognition and emotion-related vocabulary comprehension with 30 participants (mean age 9.5 years; 20 in the experimental and 10 in the control group) with autism. Pre- and post-test measures indicated that the experimental group showed higher levels of improvement compared to their wait-list control group peers. The latter showed similar gains after exposure to the 4-week training. While the results were promising and supported the role of explicit instruction on teaching emotion-recognition skills, participants did not generalize learned behaviors to real social situations.

Understanding emotions is foundational for social understanding, perspective-taking and empathizing (Tager-Flusberg, 2007). Recently, Adibsereshki et al. (2015) implemented an emotion-recognition intervention with 7 to 12-year-olds with high functioning autism. Children were required to identify basic emotions in pictures followed by situational, desire-based, belief-based, and desire-belief-based emotions depicted in cartoons. Ratings by parents and teachers indicated improvement in social

skills of the experimental group as compared to the control group. However, results need to be interpreted with caution because the pre- and post-test measures were based on rating scales and no generalization assessment was conducted.

A recurrent challenge with ToM interventions is moving beyond basic emotion-recognition to comprehension of complex emotions (Thomeer et al., 2015) and social anticipation (Angus, de Rosnay, Lunenburg, Terwogt, & Beeger, 2015). Angus and colleagues (2015) compared 64 intellectually-able children with ASD to 67 typically developing children on complex tasks including false-belief, story-telling, imagination, and social anticipation. Results indicated no group differences in basic imaginative abilities evaluated through a structured laboratory-style task. However, children with ASD performed much lower on tasks requiring social anticipation of others' actions, predicting events based on social logic, or even responding to questions. These deficits are attributed to lack of social motivation to engage in interactions and social cognition deficits. It is suggested that using instructional methods requiring minimal social engagement may be more effective for teaching ToM skills to individuals with ASD.

With specific reference to key elements of successful ToM interventions, Howlin and colleagues (1999) suggested the need to: (a) break content into small steps, (b) provide instruction in a normal developmental sequence, (c) use systematic reinforcement of behavior, and (d) use errorless teaching. These principles of effective teaching can be easily integrated into a computer assisted instruction (CAI) format for individuals with ASD. CAI refers to the use of computers to teach a variety of skills and includes computer modeling and computer tutors

(Collet-Klingenberg, 2009). Additionally, there is evidence to suggest that high functioning children with autism respond well to interventions that combine visual supports with technology perhaps due to strong visual processing skills (Matsuda & Yamamoto 2014; Southall & Campbell, 2015). Similarly, an aversion to social interaction and reduced ability to encode verbal language may explain the preference for computerized instruction for individuals with ASD (Keay-Bright & Howarth, 2012). This point is illustrated by Stasolla, Damiani, and Caffo (2014) in a single case experimental study that evaluated the impact of a software program versus coloring preferred pictures on task engagement in two individuals with ASD. Direct observations showed that the level of engagement was higher for computer-based literacy activities than for coloring pictures. While stereotypic behavior decreased in both conditions, decreases were greater when using a computer. Results support the claim that when individuals with ASD are engaged in highly preferred activities, they have less time to engage in stereotyped behavior. Because of the strong visual processing skills and the highly engaging nature of technology-based interventions, computer-assisted instruction may be an effective intervention for teaching the complex ToM skills to children with ASD (Matsuda & Yamamoto 2014).

The use of CAI to increase emotion-recognition has been evaluated by researchers with promising results (Hopkins et al., 2011; LaCava, Golan, Baron-Cohen, & Myles, 2007). For example, Silver and Oaks (2001) utilized the *Emotion Trainer* software with 22 participants with high-functioning autism, ages 10-18 years, with 11 each in the experimental and control group respectively. Participants in the experimental group completed an average of

8.5 computer sessions over a 2 to 3 week period. A pre-post assessment showed significant reduction in the mean number of errors from the first to the last session. However, there was high variation on the number of times a participant used the program. The limited sample size and lack of procedural fidelity raises concerns about the validity of these findings. Similarly, LaCava et al. (2007) taught eight children, ages 8-11 years, to recognize emotions using a software program called *Mind Reading*. Pre- and post-intervention assessment of participants' scores on a variety of standardized measures revealed a significant improvement in emotion-recognition for all 8 participants. However, there was great variability in the amount of time participants accessed the software and little control over the impact of extraneous variables such as parental input. In another study (Hopkins et al., 2011), two groups of 6 to 10-year-olds with high-functioning and low-functioning autism were compared on their responses to *Face Say*, an emotion-recognition training software. While both groups significantly improved emotion-recognition in a photograph, only high-functioning children recognized emotions in a schematic drawing. No generalization was documented for either group.

The relative effectiveness of interventions for teaching emotions to individuals with ASD needs to be interpreted with caution given the findings of a systematic review of research by Caldeira and Edmunds (2012). The authors reported many inconsistencies across published studies on a variety of factors including how ASD was diagnosed and confirmed, mismatch between targeted intervention and subsequent skill assessment, method of instructional delivery, and specific measurement of the dependent variable. The finding most crucial to the current study was that a comparison of

existing research demands caution because it does not separately or consistently differentiate between outcomes of intervention for emotional recognition, understanding and management (p. 31). In other words, intervention effectiveness was documented for emotion recognition and basic understanding but not necessarily for advanced understanding and management. An additional issue was the assessment of generalization of skills. Caldeira and Edmunds (2012) noted that of the very few studies (8 of 24) that did measure generalization, none reported on the procedures for generalization training.

Generalization, the ability to transfer a learned behavior to another novel setting, person, or activity, has been noted as a difficult task for children with ASD (Thomeer et al., 2015). Research on social skills interventions delivered through CAI have shown mixed results regarding generalization with the majority using a “Train and Hope” strategy or failing to assess generalization entirely (Southall & Campbell, 2015). For example, Sansosti and Powell-Smith (2008) evaluated the use of computer-based social stories with embedded video-modeling to increase the social communication in three children with autism, ages 6-10 years, using a multiple baseline design across participants. Results showed that “joining in” increased for the three participants during intervention, however, only one participant’s skills generalized to a natural setting. Sansosti, Doolan, Remaklus, Krupko, and Sansosti (2014) caution researchers about the effectiveness of CAI for teaching social-emotional skills. A lack of generalization may partly be due to stimulus over-selectivity in situations where natural settings do not share common stimuli with instructional conditions (Stokes & Baer, 1977).

The relative lack of empirical documentation on generalization training to teach perspective-taking skills to children with ASD appears to be a weakness in the current research literature (Southall & Campbell, 2015; Thomeer et al., 2015). Important to intervention generalization is the use of specific strategies across settings, for example, the use of common stimuli (e.g., similar question format, “*How will ___ feel when ___ happens?*”), multiple exemplars (e.g., various types of situations per emotion to provide a range of examples plus repeated practice), sequential modification (e.g., selection of scenarios that represent the social problem situations where generalization is targeted), and natural maintaining contingencies (e.g., similar contingencies for correct or incorrect responses during CAI and in-vivo training). Such training may increase generalization of learned skills to non-trained settings and scenarios.

Generalization training should be embedded as an integral component of intervention to be most effective. Recently, Thomeer and colleagues (2015), conducted a study with 43 high-functioning children with autism (7-12 years; 22 experimental and 21 wait-list control group). Participants received CAI in mind-reading skills for 24 sessions that is, two 90-min sessions per week for 12 weeks after which the entire sequence was repeated. The instructional software program utilized 98 of 100 examples of various emotions and complexity levels based on their previous research after adjusting for age appropriateness of participants in this study. CAI was delivered through a combination of methods including text vignettes, facial-video and vocal-audio stimuli. The intervention incorporated sufficient exemplars and teaching methods designed to promote generalization. This

was followed by programmed generalization training through in-vivo trials with a trained clinician to practice newly acquired emotion-recognition skills. Individual participants were asked to identify an emotion displayed by the clinician (decode) and display one emotion (encode) during each session. A reinforcement system was incorporated to increase accuracy and task-engagement. The experimental group performed higher on 3 of 4 measures of decoding and encoding emotions that they maintained at 5-week follow-up. These findings have implications for the use of a systematic and comprehensive intervention for increasing ToM and task-engagement of children with ASD.

Purpose of the Study

Interventions for improving ToM skills are still designated as having emerging evidence of effectiveness in the National Standards Report (NAC; 2015), categorized under technology-based interventions. Also, this classification has combined all modes of technology-aided instruction including computer aided instruction, speech generating devices/VOCA, smart phone/tablets, and virtual networks. Only 5 of 20 studies focused on CAI to improve ToM skills. Additionally, based on meta-analyses of existing research, Sansosti et al. (2014) cautioned against concluding that CAI was effective for teaching social-emotional and communication skills. The purpose of this study was to evaluate the effectiveness of CAI for teaching specific perspective-taking skills to students with high functioning autism to determine the extent to which skills generalized to untrained social problems situations. An additional purpose was to determine if CAI would promote task-engagement compared to the use of social stories.

Method

Participants and Setting

The study was approved by the university's Institutional Review Board and initiated only after receiving signed informed consent from parents. Participants included four children with ASD (Evan, Ashley, Trevor, and Pranav) diagnosed by the local education agency (LEA) or a licensed psychologist using the DSM-IV criteria (American Psychiatric Association, 2000) (see Table 1). Participants were included based on the following criteria: (a) chronological age between 5 and 21 years, (b) observable verbal skills including expressing wants and needs in complete sentences (5-7 word phrases), (c) ability to use a mouse or keyboard to move a cursor on a computer screen, and (d) performance on pretest measures of basic emotion-recognition skills with at least 75% accuracy for levels 1 and 2, and a score of 35% or lower on selected items on level 3 of the perspective-taking curriculum (Howlin et al., 1999). The scenarios used for screening participants on level 3 were different from those used for CAI.

Initial screening and parent reports indicated that all participants used complete sentences to communicate (e.g., "When can we be done?" or "Can I have a candy?") in spite of some echolalic speech. They all lived in a single-family household with biological parents and a younger or older sister. The study was conducted in the homes of individual participants in a specified location at a computer desk or other area designated by the parent as quiet and free from distractions. A built-in video recording device on the investigator's laptop was used to record baseline and CAI sessions, while a handheld camcorder was used to record generalization.

Table 1

Participant Characteristics

	Evan (11 years)	Ashley (5 years)	Trevor (9 years)	Pranav (5 years)
Evaluation Year	2013	2012	2013	2014
Cognitive/ Intellectual	WISC-IV – 66	KABC-II Mental processing – 74 Long-term retrieval – 97	LIPS-R – 73	KABC-II Nonverbal Index – 82
Academic Achievement	WIAT-III Math problem solving – 96 Word reading – 91 Spelling – 100	DAYC – 77	KTEA-II Letter/word recognition – 105 Phonological awareness – 69	KTEA-II Letter/word recognition – 143 Math concepts – 97
Adaptive Behavior	NA	DAYC – 89	VABS-II – 65	SIB-R – 72
ASD Determination	CARS-II 38 (mild- moderate)	CARS-II 40 (mild- moderate)	GARS 94 (very likely probability)	GARS 122 (very likely probability)
Language	Complete sentences	Complete sentences	Complete sentences	Complete sentences
PTC* L:1-2	87% ; 100%	75% ; 75%	87.5% ; 100%	75% ; 75%
PTC* L: 3	32%	27%	23%	5%

*Perspective-Taking Curriculum Levels (Howlin et al., 1999)

Measurement of Dependent Variables

Perspective-taking. Perspective-taking was the primary dependent variable used for phase change decisions. It was operationally defined as the ability to correctly identify the emotion of a person based exclusively on contextual cues in a picture where the facial expressions of characters was masked and no audio clues were provided. During baseline and intervention, perspective-taking was measured in terms of a mutually exclusive correct or incorrect response. A correct response was recorded when a participant used the cursor to click the icon representing the emotion (shown through a line drawn face) that matched the social situation displayed in the picture on the computer screen. Non-examples included a participant choosing an incorrect emotion, displaying or verbally stating an emotion but not clicking on the computer icon, or responding to distractors (e.g., items in the picture like “his hands are up”).

Data for baseline and intervention were collected using a frequency-based system embedded in the computerized software that indicated the number of correct responses

for each assessment. The software was programmed to randomly select any 10 scenarios from a pool of 22 social problem scenarios at each assessment immediately following an instructional session. During the simulated generalization assessment, perspective-taking was measured when a participant, at the first attempt, correctly verbalized the emotion that the parent or sibling might feel in a specific role-played social situation.

Task-engagement. Task-engagement was defined as the participant (a) sitting with his/her shoulders, head, and eyes oriented towards the source of instruction (i.e., person or computer monitor), (b) having hands on the lap, table top, or the computer mouse as appropriate, and (c) verbally responding or clicking the icon on the computer screen within 10 seconds of presentation of the stimulus. All other behavior topographies were classified as non-examples. Task-engagement for baseline and CAI was measured using 30-s partial interval recording. A video camera built into the laptop was used to record each session and reviewed to obtain percentage of

task-engagement by the first author. These video clips were subsequently reviewed and coded for reliability by the secondary observer.

Interobserver agreement. The first author was the primary observer. The secondary observer was a doctoral candidate who was trained in direct observation and data collection prior to initiating the study. Both observers watched preliminary videos of participants in order to practice coding task-engagement. Data collection was initiated only after an interobserver agreement (IOA) of 90% was recorded over three consecutive practice sessions. IOA was established by comparing the percentage of correct answers for each assessment session per participant (i.e., 100% of the logs) as recorded by the primary observer and cross-checked by the secondary observer based on the data logs stored in the CAI software program (Hutcherson, Langone, Ayers, & Clees, 2004). An agreement for task-engagement was noted when both observers marked its occurrence (+) or non-occurrence (-) using an interval recording system. IOA was collected for 34% of sessions equally distributed across experimental phases.

IOA for each dependent variable was calculated by dividing the number of agreements by the sum of agreements plus disagreements and multiplying by 100 to obtain a percentage value per session. Results of IOA for perspective-taking are as follows: Evan ($M = 100$); Ashley ($M = 98.75$; range = 90-100); Trevor ($M = 100$); and Pranav ($M = 99.7$; range = 90-100). IOA of task-engagement are: Evan ($M = 98.96$; range = 93.75 - 100), Ashley ($M = 97$; range = 85-100), Trevor ($M = 95.83$; range = 75-100), and Pranav ($M = 98.5$; range = 91-100). At the end of the study, Cohen's kappa was used to compute overall reliability for both variables. Cohen's kappa adjusts the

observed proportion of agreement by taking into account the amount of agreement that can be expected by chance (Cohen, 1960). Results indicated a strong internal reliability (.98) across baseline and intervention. Additionally, the IOA for task-engagement was .93 which also indicates strong internal reliability and meets the guidelines specified by Landis and Koch (1977) (greater than .80).

Social validity. Social validity was assessed through a questionnaire given to parents and a brief interview with the child. The questionnaire was a self-report measure that included five questions with response options on a 5-point Likert-type scale (from strongly disagree to strongly agree). Child participants were asked about their perspective on CAI using open ended questions that assessed their enjoyment and overall satisfaction with CAI. Results showed that all mothers indicated agreement to strong agreement that CAI (a) was effective in teaching their child to predict the others' emotions in daily life, (b) was more enjoyable to promote learning, and (c) added a critical level of instruction that the child did not obtain from social stories. Perhaps most importantly, all parents were satisfied with the outcome of CAI. The children also indicated that they enjoyed and found it easy to use using the computer to learn about emotions. Three of them indicated that they would use computers to learn additional concepts.

Materials

Original curriculum. The materials for the intervention were adapted from the curriculum, *Teaching Children with Autism to Mind-Read: A Practical Guide*, originally developed by Howlin and her colleagues (1999). This curriculum comprises five levels of instruction on ToM skills beginning with the least complex level 1

focused on teaching the foundation skill of identifying emotions in photographs. Level 2 raises the difficulty of the task requiring participants to identify emotions in schematic drawings; levels 3, 4, and 5 significantly increase the complexity of the task requiring individuals to identify emotions based on social situations for perspective-taking, desire, and beliefs respectively. The least complex levels (i.e., levels 1 and 2, identifying emotions in pictures and schematic drawings) have been demonstrated multiple times in the CAI literature (Golan et al., 2010; Hopkins et al., 2011; Lacava et al., 2010; Silver and Oakes, 2001) as not effective for promoting generalization to real social situations (Golan & Baron-Cohen, 2006). These two levels were used as prerequisite screening criteria. Level 3, which includes more complicated perspective-taking, was the focus for this study.

The goal of level 3 was to teach individuals to predict how a character felt given the emotional content of the scenario displayed in the picture. These emotions are referred to by Howlin et al. (1999) as “situation-based” emotions. Schematic black and white drawings of a variety of situations are included in this level. Although it is recognized that identifying situation-based emotions is not the most complex level required for successfully demonstrating ToM, it is the next level of complexity, which is a pre-requisite skill for mastering levels 4 and 5. In each of the scenarios in level 3, the character’s facial features (i.e., eyes, facial expressions, lips) are masked, requiring participants to determine the emotion based solely on cognitively processing situational cues. Each scenario contains a text description of the scene and a question, for example: “The big dog is chasing Dan down the road. How will Dan feel when the dog chases him?” Each picture

is paired with schematic emotion faces from which to select the correct response: happy, sad, angry, and frightened (scared).

Computer Assisted Instruction. The original curriculum described above (Howlin et al., 1999) was modified and converted into an electronic format (referred to as the Perspective-Taking Curriculum from this point onwards). It was then saved on a university server to make it accessible from any computer or geographical location. The process of modification and conversion was steered by a collaborative team consisting of the authors, another doctoral student, and the university’s software programmers. Levels 1 and 2 from this curriculum were modified by adding real photographs and clearer line drawings depicting the four emotions (i.e., happy, sad, angry, scared) and used for initial screening. For intervention, 22 of the 48 available scenarios from the level 3 were selected to equitably represent each of the four emotions [i.e., happy (5); sad (6); angry (6); scared (5)] based on cultural appropriateness. An additional modification was made in the presentation of the response options (i.e., the four emotion icons) below the image that depicted the social scenario presented to participants electronically.

Content validation was conducted prior to data collection to ensure that the scenarios incorporated into the software program portrayed the emotion they were intended to represent. Content validators included three local autism interventionists with a BCBA, one faculty member in special education, and a supervisor of autism services at a local school district. They reviewed the 22 scenarios used for CAI and selected the emotion portrayed for each. The results indicated a mean agreement of 92.5% (range = 77.35 – 100) across the five experts.

Next, the scenarios were integrated into the CAI software in two separate files. The software file utilized for CAI included audio cues and performance feedback for each correct or incorrect response option, whereas the one used for baseline and CAI assessment did not provide audio feedback. The audio cues were created and inserted into the software package by the study's collaborative team and not based on interactive tools developed by Howlin et al. (1999).

Materials for role plays. During simulated generalization assessment, siblings and parents were trained to role play problem situations experienced at home using a script developed by the authors based on previous work on teaching perspective-taking skills (Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012). Other materials used during this phase were items readily and normally available at home (e.g., board game, craft supplies, food, etc.).

Experimental Design and Procedures

A multiple baseline design across participants was used to evaluate the effectiveness of CAI on perspective-taking and task-engagement.

Baseline (social stories). During baseline, picture-based stories involving social situations and related emotions were read to the participant. Social stories were created using PowerPoint and printed on white paper to present content in a booklet format. A booklet format was used to control for variation in the method of presentation of the content on perspective-taking. Each social story included a picture (with and without facial expressions) and a brief text of a social problem situation for each emotion (i.e., happy, sad, angry and scared). The first author read the story to each participant and required him/her to identify

the emotion felt by a character as part of the instructional session. Each session was about 7 mins in duration, included scripted prompts for incorrect answers and verbal praise for correct answers. At the end of each session, participants were asked to take the computerized assessment with 10 of 22 randomized scenarios (drawn from the Perspective-Taking Curriculum) with no visual or audio feedback as described above. Correct or incorrect responses were recorded by the computer software's internal data collection system in a manner identical to what was used for CAI.

Computer Assisted Instruction (CAI). The intervention involved the participant sitting at a desk or table with a laptop computer. The first author turned on the software program using the participant's specified identification number. For each session, participants first viewed 22 instructional trials with embedded visual (i.e., green check mark for correct selection or red "x" for incorrect) and audio feedback (e.g., *Look at the picture; could the girl be upset? or Good job!*). The 22 scenarios were displayed in systematic succession with scenarios for each emotion being displayed in sequence (i.e., all scenarios for "scared" were displayed together). The order of presentation differed across sessions. Once participants completed the instructional session, they took the computerized assessment as noted above.

Generalization probes. Generalization probes were conducted during both baseline and intervention for all participants to assess the effectiveness of social stories or CAI on perspective-taking. In order to conduct generalization probes, 16 social situations were developed by the authors based on common problems identified by parents. Each situation described a different social problem (e.g., "Your sister dropped her

phone and it broke. How do you think your sister feels? Does she feel happy, sad, angry, or scared?”). For each probe, the child listened to a total of four scenarios and presented his/her perspective on the correct emotion based on contextual comprehension. Accuracy below 50% resulted in generalization training.

Generalization training. Generalization training was provided to only one participant (i.e., Pranav). The first author presented Pranav with 16 social scenario questions not part of CAI but related to problem situations described by the mother and older sister. There were four scenarios for each emotion (e.g., “*Your sister is reading a book and her friend pulls it away. How will your sister feel?*”). A logical explanation for the correct answer was provided to Pranav (e.g., “*Yes, your sister feels angry when her friend pulls the book because the page got ripped.*”). This was continued until the participant reached 100% accuracy for three consecutive scenarios (Pranav reached 100% accuracy after two training sessions).

Simulated generalization assessment. In this phase, direct instruction on perspective-taking through CAI was discontinued and an assessment of generalization was conducted to evaluate the extent to which social problem-solving skills transferred to daily life situations. The family members of each participant identified various problem situations at home. Given the challenges of being present for data collection at all times, generalization assessment was conducted through simulated problem scenarios. The authors developed a short role-play script for each of these situations (different from the ones used during generalization probes and/or generalization training). These scripts were provided to the parent and sibling with an explanation of the purpose and procedure. They were subsequently asked to

role-play scenarios they had already experienced with the target child in natural settings. They were asked to provide verbal praise for correct responses and error correction for incorrect responses. The parents and sibling practiced role-plays on various social situations until all steps were completed with 90% accuracy (as recorded by the first author).

During the simulated generalization assessment, when the parent and sibling were ready to role-play, the first author ensured that the participant was present in the setting (i.e., living room, kitchen, or dining room) and seated in close proximity (about 10 feet). A camcorder was mounted in a safe but unobstructed area. After the role play, unlike the computerized assessment used for baseline and CAI, the first author asked the participant verbally to state how the parent or sibling would feel in a particular situation and provide an explanation for the answer (e.g., “*How will ___ feel when ___? Why will ___ feel ___?*”). The format of the question was similar but the method of assessment differed. Data on response accuracy was recorded by the first author and the video recording was assessed for reliability by the secondary observer.

Procedural fidelity. Procedural fidelity for baseline, CAI, and generalization was conducted to ensure consistent implementation with accuracy and integrity (Gast & Ledford, 2014). For baseline, procedural fidelity was assessed to ensure that the social story sequence incorporated the use of prompts, social praise for correct responses and error correction for incorrect responses for each story with four stories per session (on different emotions). For CAI, the software was pre-programmed to deliver the same type of stimuli at each trial even if the order of presentation of scenarios was

randomized. Thus, procedural fidelity was assessed to ensure accuracy in using the correct login for each participant, recording the session on the laptop, and saving the data on the software program. For the simulated generalization assessment, procedural fidelity was completed using a checklist to ensure (a) the parent and sibling completed the role play according to the script, (b) the participant was asked a question after presentation of the scenario, and (c) corrective feedback or verbal praise was provided after the participant answered the question.

Procedural fidelity for each phase of the study was calculated on an ongoing basis by dividing the number of items on the checklist completed accurately by the total number of items on the checklist and multiplying by 100. The outcome showed 100% accuracy for each participant on all the steps in all experimental conditions. IOA on procedural fidelity of social stories, CAI, and generalization probes and simulated assessment was computed for 39% sessions for Evan, 37.5% sessions for Ashley, 33% sessions for Trevor, and 37% sessions for Pranav). Data showed 100% IOA on all steps of the experimental conditions.

Results

Visual analysis was conducted to establish effectiveness of CAI while nonoverlap of all pairs (NAP; Parker, Vannest, & Davis, 2011) was used to determine the magnitude of effect.

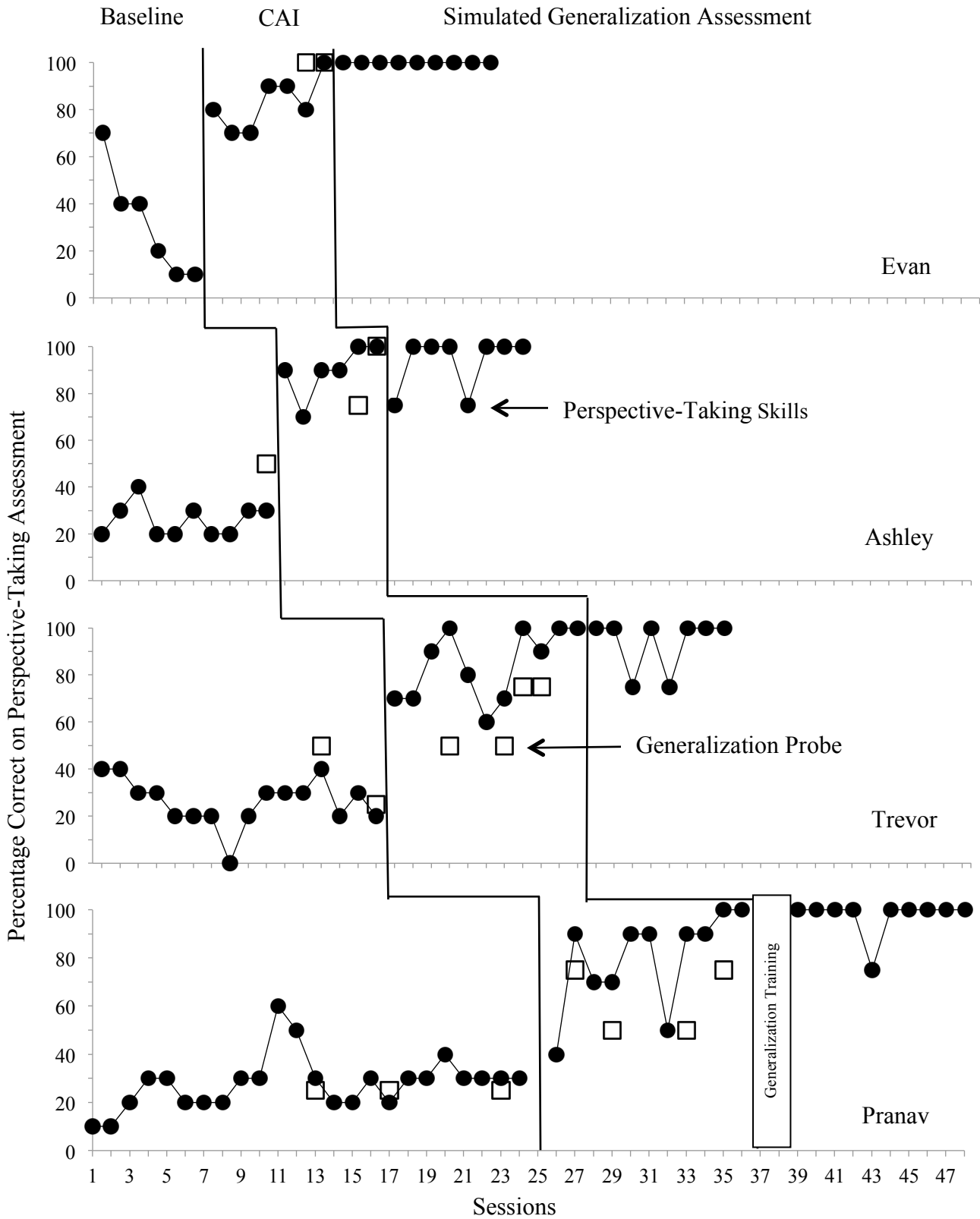
Effectiveness of CAI on Perspective-Taking Skills

Baseline for Evan indicated a mean of 31.66% correct answers and a steadily decreasing trend. With intervention, data showed an immediate increase, from an average of 13% in the last three baseline

sessions to an average of 73% for the first three sessions of CAI. Evan's mean level increased to 82.86% during CAI with 100% correct on the seventh session. The percentage of non-overlapping data was 71.4% (only two overlapping data points). Overall, Evan's data appear to indicate effectiveness of CAI on perspective-taking (see Figure 1). Following an increasing trend during CAI for Evan and a concurrent stable baseline for Ashley, intervention was initiated with her. Her correct responses increased immediately upon intervention, from an average of 27% in the last three baseline sessions to 83% average for the first three sessions in CAI. The mean level change during CAI was 90% with an accelerating trend and ceiling performance (100%) after four sessions with no data overlap across adjacent phases. Overall, data for Ashley clearly indicate effectiveness of CAI on perspective-taking skills.

Similarly, Trevor's rate of responding increased from a mean baseline level of 26.25% to 84.55% during intervention showing an immediate response to CAI (i.e., absolute change from 23% to 76.66%). He too reached the ceiling level of 100% correct on the fourth session. Given the increasing trend starting the seventh CAI session and no overlapping data, overall results indicate that CAI had a positive, functional effect on Trevor's perspective-taking skills. Pranav's data showed a stable but variable pattern in baseline with a mean of 27.91%, which increased to 80% during CAI. Additionally, an increasing trend in correct responses and low percentage of overlapping data (14%) appear to indicate intervention effectiveness for Pranav as well. Overall, data demonstrated a functional relation between CAI and perspective-taking for all participants.

Fig. 1. Percent correct on questions to assess perspective-taking skills of participants



Effect of CAI on Stimulus Generalization

When each participant showed a steadily increasing trend and an average of 80% or higher for CAI with at least one session at criterion (100%), the simulated generalization assessment phase was implemented. Each participant was exposed to at least one scenario per emotion for a total of four role-play situations per session. Each social situation required the participant to label the emotion likely experienced by a family member after the role-play ended.

During this phase, all participants demonstrated mastery (mean 93% or higher) in perspective-taking. Evan immediately showed 100% correct responses and maintained mastery level for all nine generalization sessions. Ashley began the phase at 75% correct answers, missing only the scenario (i.e., scared) ($M=93.75$; range = 75-100). Trevor immediately reached 100% and maintained the rate for 8 of 10 sessions ($M=93.75$; range = 75-100). Generalization assessment for Pranav was initiated after implementing two generalization training sessions. He immediately responded with 100% accuracy which maintained for 9 of 10 sessions ($M=97.5$; range = 75-100). Overall, results demonstrate effectiveness of CAI on stimulus generalization.

Effect of CAI on Task-Engagement

Although task-engagement was a secondary dependent variable, it was assessed to determine performance difference between social stories and CAI. Results showed higher variability across participants than expected. Two of four participants showed a higher mean level of task-engagement during CAI (see Figure 2). Evan displayed a variable rate during baseline ($M=13$; range = 0-29) and intervention ($M=50$; range = 30-68). Ashley did not display a significant change in task-engagement across the

experimental conditions. She showed a mean of 56.9% during baseline which increased to 73.8% during CAI. Her data were variable during both conditions and 87.5% of the data across phases overlapped, demonstrating that task-engagement was not impacted by the method for skills-instruction.

Trevor displayed a very stable (93.75% within the stability envelope) mean level of 2.4% task-engagement during baseline which increased to a mean of 30% during CAI. He also demonstrated a decelerating trend for task-engagement during CAI. In spite of variability during CAI, visual analysis indicates Trevor's task-engagement increased when compared to baseline. Pranav displayed a stable level of task-engagement during baseline ($M=6$; range 0-33). His task-engagement levels increased during CAI ($M=57.5$; range = 25-84). Data showed multiple trend lines but overall, Pranav's data indicated a mean increase of 51.5% during CAI.

Magnitude of Effect of CAI

The benefit of including measures to determine the magnitude of intervention effect is now receiving attention in single subject research (Kratowill et al., 2013). Effect size was calculated for perspective-taking and task-engagement for all participants using NAP (Parker et al., 2011). NAP is considered to be a robust measure because it individually compares all data points in baseline and intervention by identifying positive pairs (i.e., no overlap), negative pairs (i.e., overlap), and tie (i.e., identical data across phases). It yields the percentage of improvement data across phases making it "a complete index" (Parker et al., 2011, p. 312). NAP is "scaled from 50% to 100%, where 50% is a chance-level result (Parker et al., 2011, p. 312).

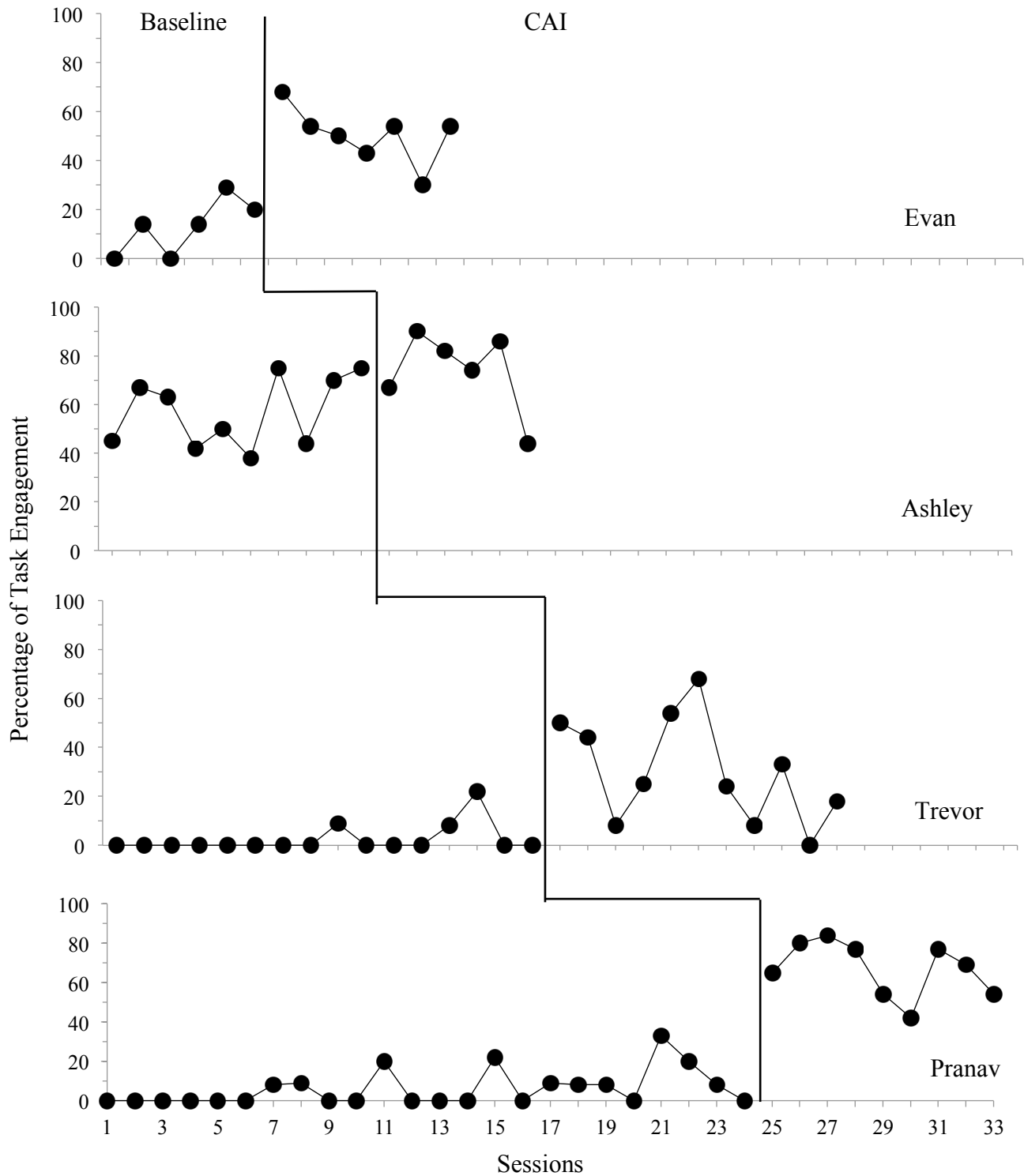


Fig. 2. Percentage of task engagement for participants.

The NAP for all participants for perspective-taking was large: Evan=97%; Ashley = 100%; Trevor=100%; and Pranav=98%. The NAP for task-engagement appears to be large due to pair-by-pair comparisons: Evan=100%, Ashley=82%, Trevor=91% and Pranav=100%.

Discussion

Results indicated a functional relation between CAI and perspective-taking skills of children with high functioning autism. It is likely that the requirement to cognitively analyze the social problem situation without visual cues (e.g., facial expressions), may have contributed to the high rate of correct responses as opposed to teaching basic emotion-recognition alone (Hopkins et al., 2011; Matsuda & Yamamoto, 2014). The problem-solving scenarios were designed to promote comprehension of the nature of the social problem prior to naming the emotion (Thomeer et al., 2015). Also, the randomized presentation of stimuli through CAI decreased the probability of rote memorization of correct responses. Additionally, because social scenarios for simulated generalization assessment were based on real life problem situations (i.e., sequential modification), participants seem to have been able to transfer the logic of problem-solving to untrained social situations. Generalization results may also be attributed to programming common stimuli and presenting sequential and sufficient exemplars of each emotion during CAI training. Results also showed higher levels of task-engagement for three of four participants when CAI was used, most likely because of no social interaction demands as well as the self-paced nature of computer-based learning (Sansosti et al., 2014).

The CAI software was a unique instructional tool that presented material systematically at an individual pace with built in

predictability and immediate performance feedback. The program was also easy to navigate allowing children to access the program successfully regardless of age. The social situations can easily be individualized by teachers and parents by utilizing images from Howlin et al. (1999), creating electronic images, and delivering these on computers through PowerPoint presentations at any location.

Another valuable factor in the implementation of the current study was the participation of a parent and a sibling during planning and implementation of simulated generalization assessment. Engaging family members through role-plays allowed them to learn how to structure everyday problem situations into teaching tools. This increased the probability of practicing social problem-solving in natural settings beyond the study. These interpretations are also supported by social validity outcomes. Also, findings contribute to the existing literature that has documented emotion recognition in pictures, not real social problem situations.

Limitations and Directions for Future Research

Although this study meets criteria for the number of participants necessary to demonstrate experimental effect in a multiple baseline design (Horner et al., 2005) the small sample size can be a potential limitation to external validity of the study (Gast & Ledford, 2014). Another limitation is that generalization probes were implemented during baseline for only three of four participants. This limits the ability to make judgements about the reason for overall increases in Evan's perspective-taking skills. That said, the three participants for whom generalization probes were conducted in baseline, all showed significant improvement in perspective-taking after CAI was implemented. A third limitation

was that generalization assessment had to be simulated rather than be conducted in the natural course of daily events to avoid invasion of each family's privacy by being present at all times of the day or asking parents to shoulder the responsibility of video-recording in the midst of a problem situation. Future research may address such issues through remotely operated recording devices.

The current study evaluated the effects of CAI to teach perspective-taking from level 3 of the Howlin et al. (1999) curriculum (i.e., predicting emotions from social situation); however, ToM extends much further beyond this skill set. Future research should evaluate effectiveness of CAI for teaching more complex skills such desire- and belief-based emotions to understand how subsequent behavior in a social situation changes as a function of fulfilled or unfulfilled desire or

what s/he believes to be true. These areas are the focus of instruction in levels 4 and 5 of the original curriculum. These were not evaluated in the current study because participants demonstrated a limited ability to attend to lengthy instruction, necessitating sessions to 5-10 mins in duration. Future research may evaluate the use of CAI to teach more complex emotions and assess if participants are equally capable of generalizing the skills to untrained natural social scenarios. While the scope of the current study was to evaluate perspective-taking skills of participants, future research may explore the use of CAI for teaching appropriate social responses and social reciprocity in real situations after correctly identifying a person's emotion and comprehending their mental state.

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Exercise Technology Interventions and Individuals with IDD

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The purpose of this systematic literature review was to explore the available research on exercise interventions using technology to support the physical activity of individuals with intellectual and developmental disabilities. Previous research demonstrates that individuals with intellectual and developmental disabilities are at increased risk for obesity and other health-related risks due to low levels of physical activity. Technology based exercise interventions sometimes called exergaming are a promising area of health related interventions. The results of this review identified limited but promising research evidence supporting the effectiveness of exercise interventions using technology to increase the physical activity of individuals with intellectual and developmental disabilities. Conclusions are discussed in the context of supporting people with intellectual and developmental disabilities by using existing and future technologies including exergaming.

People with intellectual and developmental disabilities (IDD) have a higher risk of obesity and lower levels of physical activity (Maiano, 2010). Not only do people with IDD experience cognitive and perceptible limitations, but their disability can put them at an increased risk for several health complications. For example, Pitetti, Baynard, and Agiovlasitis (2013) report that people with Down syndrome (DS) suffer from an increased risk of congenital heart disease (50%), hearing loss (75%), eye disease (60%), obstructive sleep apnea (75%), thyroid disease (15%), and gastrointestinal conditions (10%). Persons with IDD exhibit an increased prevalence of chronic health conditions associated with inactivity such as high cholesterol and high blood pressure (Rimmer & Yamaki, 2006). In addition, compared with their peers without disabilities, those with IDD have shown they are more prone to higher body mass index, lower maximal oxygen consumption, and reduced muscle strength and power (Frey, 2004).

Leading a more sedentary lifestyle is likely to be a major contributor to the health risks discussed previously. Most individuals with IDD are not exercising regularly, whether individually or participating on a sports team. Rimmer, Braddock, and Marks (1995) reports that only 24% of those with IDD are physically active three to four days per week, unlike 51% of the general population. The large-scale literature analysis covering surveys from Australia, Canada, England, and the USA reported that out of the 2,170 persons with IDD, only 4-5% were getting the recommended health-related criteria of physical activity (Temple, Frey, & Stannish, 2006). This included taking 10,000 steps per day or 30 minutes of moderate-to-vigorous physical activity at least 5 days per week. In addition to reported lower levels of physical activity, several barriers to physical activity for those with IDD have been identified. Bodde and Seo (2009) states transportation issues, financial limitations, and lack of awareness of options are primary social and environmental barriers to physical activity. Other barriers include negative support from

caregivers and authority figures, such as teachers, coaches, and parents (Bodde & Seo, 2009).

The considerable amount of evidence that persons with IDD have a lower level of physical fitness demonstrates the need for intervention to increase their physical activity. Earlier research has shown that the physical and psychological advantages of exercise can aid those with IDD (USDHHS, 2000). Researchers have reported that exercise training induces positive changes in cardiovascular fitness and muscular strength (Rimmer, Heller, Wang, & Valero, 2004). Exercise interventions targeting specific physical fitness, such as endurance and strength, have shown to improve physical activity of people with IDD (Golubovic, Maksimovic, Golubovic, & Glumbic, 2012). Researchers Mann, Zhou, McDermott, and Poston (2006) report that increased knowledge about a healthy diet and exercise had a significant effect on BMI and health. Not only are there health benefits, people with IDD who exercise report an improvement in self-esteem, social interaction, and maintenance of a higher level of independence (Vissers et al., 2008). Clearly, exercise programs can improve physical fitness and other health factors and need to be practiced among those with IDD.

One trend in exercise interventions are new technologies such as wearable fitness trackers and exercise video games often called “exergaming,” which is an interactive video game. Researchers and developers have coined the term “exergaming,” a type of entertainment that combines physical activity and video gaming (Bonetti, Drury, Danoff, & Miller, 2010). Examples of gaming systems in which exergames may be used include Nintendo Wii[®], Sony PlayStation[®], virtual reality systems (VR), among several others. The Wii Fit[®] and

Dance Dance Revolution[®] are some popular examples of exergames. The use of exergaming can potentially increase physical activity and improve other physical activity measures, such as energy expenditure and heart rate. One study demonstrates that exergaming is an effective type of exercise for sufficient energy expenditure among college students (Siegel, Haddock, Dubois, & Wilkin, 2009). Another study reports that an exergame-based intervention can reduce body fat and bone mineral density (BMD) in overweight and obese adolescent girls (Staiano et al., 2016). Other studies reveal that exergaming can provide alternative opportunities to enhance children’s physical activity and used as a light or moderate physical activity intensity (Lau et al., 2015). In addition to improved physical fitness, exergames have the potential to increase exercise capacity in cardiac patients and a feasible rehabilitation option for patients with heart failure (Klompstra, Jaarsma, & Stromberg, 2014). Another benefit of exergames is that these technology devices can be used as a means to motivate and engage users in physical activity (Song, Peng, & Lee, 2011). This concept is especially important for those that do not prefer traditional exercise.

These technologies are being explored as interventions for individuals with disabilities other than IDD. People with Parkinson’s disease (PD) can improve balance from the use of exergames, such as Nintendo Wii (Barry, Galna, & Rochester, 2014). Another study exhibits improvement in balance from virtual reality training in children with cerebral palsy (CP) (Lazzari et al., 2015). Technology interventions, such as exergaming tools like the Nintendo Wii and VR systems, could be used to motivate and aid physical fitness among those with IDD as well. Routine instruction and exercise have not proven to be sufficient motivation

for a person with IDD (Gignac, 2003). Most studies are using technology interventions to improve executive function and motor skills for people with IDD, not physical activity (Hilton et al., 2014). More research needs to be conducted that uses technology interventions to improve physical fitness levels and increase a person with IDD participation and contribution in a physical activity or sports-related setting.

It is clear that people with IDD need to improve their physical fitness in order to lead a healthier lifestyle. It is important to continue researching the benefits of using VR systems and other technological devices that provide assistance and motivation to improve the physical fitness of those with IDD. Therefore, the objective of this investigation was to review research studies that focus on supporting the exercise needs of individuals with intellectual and developmental disabilities through the use of technology. This review was conducted to provide a research foundation for a future line of research on improving physical activity and fitness for individuals with intellectual and developmental disabilities.

Method

Search Strategy

A systematic review was conducted that characterized articles involving technology based interventions to increase physical activity in individuals with IDD from year 2000 to 2015. This publication range was chosen to limit the study to relative recent technologies and because in the early 2000's several exergaming platforms became commercially available such as the Dance Dance Revolution and Wii Fit. The following two electronic libraries were searched, Education Resources Information Center (ERIC) and PubMed. The database ERIC was used for its collection of articles that involve those with intellectual and

developmental disabilities. The database PubMed was used for its collection of articles that involve interventions that promote exercise and physical activity. The following search terms were used for ERIC and adapted for PubMed database as well: 'experimental study', 'technology intervention', 'exercise', 'physical activity', 'physical fitness', 'learning disabilities', 'developmental disabilities', and 'intellectual disabilities'. The search term mental retardation was also used in order to check for older research publications or international publications which may have used the legacy term "mental retardation" to describe individuals with intellectual disability.

Selection

A total of 323 articles from ERIC and 152 articles from PubMed databases were retrieved by using the previously mentioned search terms. This selection was narrowed down by excluding studies based on the following criteria. Articles were reviewed to see if they were experimental studies. Studies could use quantitative, qualitative, or single subject methods for their experimental designs. Due to a limited amount of research on this topic, any of these three types of studies could be included in order to get a broad understanding of the available research. Reviews or secondary data analysis articles were excluded. These experimental studies were then reviewed to determine if they incorporated technology-based interventions as the primary feature of the intervention. For example, using virtual reality systems or the Nintendo Wii to increase or improve certain physiological measures among those with ID. Studies that used technology to only measure participant's physical activity such as using digital pedometers to track activity were not included. Studies that were not focused exclusively on individuals with

intellectual or developmental disability were then excluded. After following these procedures two articles from ERIC and seven from PubMed databases were accepted.

Results

Nine articles satisfied the above criteria mentioned earlier that investigated the use of technological devices to promote exercise and physical activity of individuals with intellectual and developmental disabilities. Table 1 provides details for the articles reviewed and other observed measures.

Lancioni et al. (2003) investigated the effects of an automatically delivered stimulation on the participant's activity level and mood, while exercising on a stepper and stationary bicycle. The stimulation included favorite stimuli, such as music and songs, which were delivered automatically through an electronic control system. The authors conducted an A-B-A-B study design and used three participants diagnosed with IDD. For the baseline, an electronic control system was used to record the students' stepping and pedaling responses, yet the students experienced no motivational stimulation. For the intervention, the same electronic control system was used to measure stepping and pedaling responses, however, the stimulation was introduced to the students. The stimulus events included music, air blowing, excited encouragement messages, hand clapping, and vibratory stimulation. The stepping and pedaling responses were significant with a $p < 0.05$.

Weiss, Bialik, and Kizony (2003) investigated the use of VR systems to determine if it could increase the participant's self-esteem and motivation, therefore leading to over-all better health and fitness. The pilot study consisted of five male adults that were confined to a

wheelchair. Each subject experienced three game-like virtual scenarios through the VividGroup's Gesture Xtreme video capture VR system. The images the VR system produces react to the subject's movement response in real time. A five-item presence questionnaire, a six-item task specific questionnaire, and observation of the participant's performance on video were used as measurements for the study. All of the participants demonstrated a high degree of enthusiasm during each intervention with the inclusion of the VR system, rather than at baseline with no VR system.

Lotan, Yalon-Chmovitz, and Weiss (2009a) investigated the use of a VR system to increase the physical strength of those with IDD. Participants comprised of 59 adults with mild IDD using assistive equipment to aid movement (wheel chairs, rollator, crutches, and walking stick). The VR system used for the study was Sony's PlayStation II EyeToy video. Three different tests were used to measure fitness efficacy, including THBI, EEI, and the modified 12 minute walk-run test. Conclusions from the study show significant improvements for the THBI and modified 12 minute walk-run test ($p < 0.05$), however this was not the case for EEI when compared to the control group.

Lotan, Yalon-Chamovitz, and Weiss (2009b) implemented a VR system to improve the opportunity and participation of engaging an ID individual in physical activity. Three studies were conducted and results of the studies and changes in physical activity were measured by the Energy Expenditure Index (EEI), the modified 12 minute walk-run, and the Total Heart Beat Index (THBI). Study one consisted of a group of 33 subjects that participated in a 12-week program of two to three 30 minute exercise sessions per week. The exercise regime included game-like exercises, such

Table 1. *Articles identified from systematic review*

Author	Title	Date	Study Design	Technology Intervention	Activity Measures	Outcomes
Cai, Kornspan	The use of exergaming with developmentally disabled students	2012	Case Study	Exergaming (Nintendo Wii Tennis)	Tennis Skills	Improved exercise performance and correct tennis warm up/cool down
Lancioni, et al,	Persons with multiple disabilities exercise adaptive response schemes with the help of technology-based programs	2012	Single Subject	Micro switches/sensors and computer/control systems	Movement (head, hand, & eye coordination)	Increased range of motion (ROM)
Shih, Chen, Shih	Assisting people with disabilities to actively improve their collaborative physical activities with Nintendo Wii balance boards by controlling environmental stimulation	2012	A-B-A-B	Nintendo Wii Balance Board	Joint physical activity response and walking	Improved target response and movement
Shih, Chung, Shih, Chen	Enabling people with developmental disabilities to actively follow instructions and perform designated physical activities according w/ Nintendo Wii Balance Boards by controlling environmental stimulation	2011	A-B-A-B	Nintendo Wii Balance Board	Response rate	Improved target response and movement
Lotan, Yalon-Chamovitz, Weiss	Virtual reality as means to improve physical fitness of individuals with severe level of intellectual and developmental disability	2010	Quasi Exper.	VR System (IREX/GX video capture VR system)	Heart rate	Improved heart rate
Lotan, Yalon-Chamovitz, Weiss	Lessons learned towards a best practices model of virtual reality intervention for individuals with intellectual and developmental disability	2009	Quasi Exper.	VR System (IREX video capture VR system,	Energy expended, walking, heart rate	Increased energy expenditure and walking. Improved heart rate
Lotan, Yalon-Chamovitz, Weiss	Improving physical fitness of individuals with intellectual and developmental disabilities through a virtual reality intervention program	2009	Quasi Exper.	VR System (Sony's Play Station II Eye Toy video)	Energy expended, walking, heart rate	Improved walking and heart rate
Lancioni, Singh, Olivia, Campodonico, Groeneweg	Assessing the effects of automatically delivered stimulation on the use of simple exercise tools by students with multiple disabilities	2003	Multiple Probe Across skills	Battery-powered Electronic Control System (case steeper and bicycle)	Pedaling cycles and mood	Increased pedaling cycles and mood
Weiss, Bialik, Kizony	Virtual reality provides leisure time opportunities for young adults with physical and intellectual disabilities	2003	Descriptive Case Study	VR system (Gesture Xtreme video capture VR system)	Leisure experience	Improved leisure time and engagement

as walking in place, provided by the GestureTek's IREX VR system. The second study included a group of 30 participants exercising to the Sony PlayStation II EyeToy VR system, which includes practicing balance, during six weeks for three 30 minute sessions per week. The third study included 24 participants in an 8 week program, three times per week, exercising to the GestureTek's IREX video capture VR system. For the VR group, their THBI and EEI scores had both decreased. The VR group experienced a significant difference in the modified 12 minute walk-run and group participation, compared to the control group.

Lotan, Yalon-Chamovitz, and Weiss (2010) used a GestureTek IREX video capture VR system on 44 individuals with ID, to determine the effectiveness of a VR system for improving the participant's physical fitness. The research group participated in an eight-week fitness program consisting of two to three 30 minute sessions per week. The GestureTek provided interactive games to encourage the participants to complete the exercise. In order to keep track with heart rate and changes in physical fitness, a Polar F11 fitness heart rate monitor was used. The results of the study show a significant ($p < 0.005$) reduction in heart rate with the research group. Another important result showed there was no change in heart rate with the comparison group, which lead the researchers to believe that the exercise group's physical fitness improved compared to the sedentary group.

Shih, Chung, Shih, and Chen (2011) tested to see if Wii Balance Boards could be used to improve the participants' exercise performance by controlling their favorite environmental stimulation. The two subjects were obese and diagnosed with ID. This study was conducted using an A-B-A-B design and three pre-defined Wii Balance

Board destinations. These destinations would detect the participants' target response (physical activity). The differences between the baseline responding frequencies and the intervention responding frequencies were significant ($p < 0.01$). As demonstrated in the study, the Wii Balance Board can be turned into a high performance assistive device that can assist those with special needs, due to their special motion sensors.

In this case study, Cai and Kornspan (2012) use the Nintendo Wii Tennis as a means of improving physical fitness in students with ID. The authors designed a lesson plan, made up of four parts, to increase exercise fitness and improve the student's tactical understanding of tennis. One of the most important aspects of this lesson plan is for the student to stretch his or her muscles for a proper cool down. The conclusions of the study are based on the author's observations, which is that the Nintendo Wii Tennis can be an accommodating tool for students with ID to enhance their physical fitness and learn the sport of tennis. The Nintendo Wii Tennis is an effective teaching tool that motivates those with ID to exercise in an enjoyable environment.

Lancioni et al. (2012) conducted three single-case studies to investigate the effectiveness of technology-based programs with three individuals with ID. The three individuals were diagnosed with ID and were confined to a wheelchair, and the researchers proposed that a technology-based program could hopefully improve their movement and thus, their exercise. All three studies used a type of stimuli, such as songs or comedy pieces, to create an adaptive response through the use of assistive technology, such as microswitches, to monitor the person's response. Also, all three studies recorded a baseline, with no stimulation, and an intervention with the

chosen stimulus. The first study involved trying to make a man move his head from left to right, who normally kept his head stationary. The second study involved a woman using left and right arm movements, who normally would keep her arms to her side. The third study investigated the response of using stimuli for a woman to touch object cues on a computer screen, since she rarely used her residual vision for directing her hand responses. The results of the study showed the subjects responded increasingly more to the schemes during the intervention with the stimuli, than at baseline with no stimulation.

Shih, Chen, and Shih (2012) investigated if a modified Nintendo Wii Balance Board could help improve physical activity performance for four individuals with ID. The Wii Balance Board detected the participant's physical activity, such as a target response, so the researchers could assess if their physical activity, such as walking, improved. The four subjects were split up into two groups of two and were diagnosed obese, with very little exercise in their daily routines. Each individual's weight allowed the Wii Balance Board to determine which subject it was testing. An Eee Box mini-computer was used as the control system that activated the subject's stimulation, such as a favorite video. The study design included a baseline having no stimulation and an intervention phase where a stimulation was introduced. The results of both groups were significant ($p < .01$).

The articles discussed show that technology devices can improve physical activity performance of people with IDD. Several of the studies used exergaming technologies to motivate the participants to engage in physical activity. Even though there was a very limited number of studies identified in this review several of the studies shared the

same authors. This is an important finding because in addition to a limited amount of research on this topic there appears to be approximately three research groups publishing research on this topic. The Nintendo Wii was one of the most common exercise interventions identified in the studies. All of the studies demonstrated improved measures of physical activity for their participants. The studies demonstrate that exercise technology interventions can increase the physical activity of individuals with IDD.

Discussion

This review confirms that technology based interventions to increase physical activity for individuals with intellectual and developmental disabilities provide positive outcomes. This review also identified a need for additional research in this field because it only identified nine articles that met the criteria. Exercise technology interventions are less studied compared to established evidence-based practices using technologies such as AAC devices (van der Meer, sigafoos, O'Reilly, & Lancioni, 2011), video modeling (Bellini & Akullian, 2007), computer based instruction (Pennington, 2010), or other assistive technologies (Alper & Raharinirina, 2006) for students with IDD. While these established evidence based practices addressing academic, social, and functional skills are critical areas of research, there is a need for additional research and development for exercise, fitness, and health related interventions for individuals with IDD. The technology interventions in these studies all led to improved physical activity outcomes. Some of these physical activity measures included heart rate, range of motion (ROM), energy expended, and walking. However, there are several other physical activity measures that can be used for these technology studies (Caspersen, Powell, & Christenson, 1985).

Since this broad systematic review only identified nine articles in sixteen years, this clearly identifies a gap in the research relating to students with IDD.

Importance

Physical activity is an important aspect of overall health that has proven connections to positive psychological wellbeing and improved academic achievement for peers without disabilities (Tremblay et al., 2011). Exercise and fitness are complex topics that impact health, learning, and social factors (Heller, McCubbin, Drub, & Peterson, 2011). Finding interventions that improve measures of physical activity for individuals with IDD is one aspect of advancing research to address the needs of individuals with IDD. Exergaming and wearable technology for fitness are technology fields that are expanding rapidly but need to be examined as tools for individuals with disabilities. The commercial availability of the Nintendo Wii clearly impacted exercise interventions being used with this population. As new commercial exercise technologies on mobile devices, wearable devices, and other platforms become more common they will likely be explored as intervention tools for future researchers. This limited literature review identified nine articles and three research teams examining this topic.

Limitations

This systematic review would benefit by being expanded beyond the ERIC and PUBMED databases. The conservative approach of only including technology interventions for exercise where the participants used the technology in a meaningful way to increase exercise limited the number of studies identified. A broader search and broader research questions may identify additional studies that were not included in this review. Another limitation

of these findings is that the some of the exercise intervention technologies used may be difficult to replicate because of current lack of commercial availability. Many studies were excluded from this review that were using technologies especially exergaming interventions to measure outcomes that were not exercise measures such as improved behavior, academic achievement, or social emotional goals. For example, Hernandez, Ye, Graham, Fehlings, and Switzer (2013) investigated the feasibility and enjoyment of a designed action-based exergame for children with cerebral palsy, yet no physical activity factors were measured. Using searches for specific types of disabilities, such as Fragile X, down syndrome, and cerebral palsy could provide a more comprehensive review of this topic. A broader search and broader research questions will identify additional studies that were not included in this review to provide a more comprehensive review of this area of research. The range of study designs and various types of interventions limits the ability to do comparisons between the studies.

Future Research

This review is a part of a developing line of research for the authors to explore novel methods of using technology to increase the physical activity and health of individuals with IDD. Future areas of research include examining the effectiveness of new exergaming technologies, virtual reality, and wearable devices to support increasing the physical activity of individuals with IDD. For example, the popular augmented reality mobile app Pokémon Go requires users to be physically active by walking around their communities to play the game (Larson, 2016). In addition to looking at other technologies these interventions can be examined across a variety of ages, settings, and outcome measures such as fitness,

academic achievement, memory, social/emotional skills, and functional skills.

Increasing the number of subjects could produce results that could be applied to the general population of those with IDD. More conclusive results will help more individuals with disabilities receive the appropriate technological resources that they can use to increase their fitness. In addition to increasing the subject size, different types of technology can be used as well. Most of the technology used in the studies are bulky fixed location systems. Although these systems are beneficial, they are not mobile and cannot really be used outside of a classroom or household setting. The use of mobile device apps on iPhones or iPads has the potential to help those with IDD depending on the type of IDD the person is

diagnosed with, due to the device's flexible range of apps. Devices such as the Nike Running App can allow a person with IDD to be able to exercise outside of the classroom, without any restrictions. Smartphones and mobile exercise apps frequently gather exercise data and present it in accessible ways including providing graphs, awards, and, achievements based off of the user's exercise levels. These progress monitoring tools have direct connection to presenting information in an accessible way and providing strong reinforcement for people with IDD to exercise. As more research is conducted on technology interventions for people with IDD and physical activity, future literature reviews on this topic can present results in categories based on technology used, participant characteristics, and other measures.

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Autism Spectrum Disorder and DSM-V: Looking Back to Look Forward

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Autism and the related disorders, once defined as Asperger’s syndrome, Childhood Disintegrative Disease, and Pervasive Developmental Disorder-Not Otherwise Specified, and now classified under the Autism Spectrum Disorder category are some of the most elusive and difficult to diagnose due to the varied nature of the disorder. The Fifth edition of the Diagnostic and Statistical Manual of mental disorders, (DSM-V) published by the American Psychiatric Association, (APA), has sought to remedy the problem faced by researchers and clinicians of different diagnostic definitions by offering a new definition of Autism Spectrum Disorder. However, the definition of Autism hasn’t changed at the federal level through IDEA definition of Autism. This paper examines the history of the diagnosis, to provide the backdrop for the argument that a singular cohesive definition is necessary for appropriate education for students with Autism Spectrum Disorders.

Autism and the related disorders, once defined as Asperger’s syndrome, Childhood Disintegrative Disease, Rett Disorder, and Pervasive Developmental Disorder-Not Otherwise Specified, now classified under the Autism Spectrum Disorder category, are the some of the most elusive and difficult to diagnose disabilities due to the varied nature of the disorder. Since 1801 researchers and practitioners have struggled to define, and properly categorize Autism and disorders related to Autism. Jean Itard, Leo Kanner, and Hans Asperger spent their careers seeking to remediate this problem, which continues to plague researchers and practitioners today. Autism and related disorders, often referred to as Autism Spectrum Disorders or ASD, have been defined by many different groups serving many different purposes which presents a large scale problem of divergent definitions of a single disorder. In a 2013 publication the American Psychiatric Association suggests that the recent revision to the Diagnostic and Statistical Manual (DSM),

“represents a new, more accurate, and medically and scientifically useful way of diagnosing individuals with autism-related disorders” (APA, 2013 pg.2). However, the U.S. Department of Education has made no moves to change their definition within the Individuals with Disabilities Education Improvement Act, (IDEA) to align with the APA. Through this paper, I will examine the history of classifying and diagnosing Autism Spectrum Disorders in children, recent changes to the DSM-V, and then discuss the differences in the definitions and the implications these changes have for children diagnosed with an Autism Spectrum Disorder. I will conclude by offering a method for arriving at a definition, inclusive of the DSM-V and IDEA diagnostic criteria for ASD and pose questions to further this discussion through a research lens.

History of ASD

One of the earliest accounts of a child with autism comes in 1801 when French medical student Jean Itard worked with Victor, also

referred to as the “Wild Boy of Aveyron,” a child found wandering in the woods of France. The French government classified Victor as “mentally defective” and sent him to Paris to be studied and observed by scholars of the time (Itard, 1081 pg.16). Victor was entrusted to Itard who argued that his behaviors were not due to a mental deficit, but rather were the result of a lack of human contact. Itard worked with Victor on his communication and socialization using symbols and made great gains in Victor’s socialization and self-care abilities. Then, in the early 1900’s Swiss Psychiatrist Eugene Bleuler coined the term autistic when referring to children with schizophrenia and their incessant obsession with self and sameness. Building on Bleuler’s work, Leo Kanner conducted the first publicized case study of children with autism, calling it “early infantile autism” in 1943 while working at Johns Hopkins Hospital. He documented the behaviors these children displayed and found striking similarities in all 11 children. The behaviors he found to be evident in all the children were;

- Inability to relate
- Isolation from the outside world
- Language deficits, including echolalia
- Fear reactions to loud noises
- Obsessive desire for repetition and insistence on sameness
- Few spontaneous activities, such as typical play behaviors
- Self-stimulatory behaviors

Separate from Kanner’s research, Hans Asperger, considering a different view of the origin of the disorder, coined the term “Autistic Psychopathy” in 1944 to refer to children he believed suffered from personality disorder. Asperger changed his definition several times after his original publication, refining the behavioral characteristics of students, including high

intelligence and special abilities in his 1979 publication.

The first account of confusion in the definition of autism came in 1956 when Eisenberg and Kanner defined the following two essential symptoms of autism: extreme self-isolation, and preoccupation with the perseveration of sameness. Building on Kanner’s and Eisenberg’s work, in 1968 Rutter described four defining characteristics of infantile autism as follows;

- Lack of social interest and responsiveness
- Impaired language, ranging from absence of speech to peculiar speech patterns
- Bizarre motor behavior
- Early onset, before 30 months of age

In 1980 autism first appeared in the American Psychiatric Association’s DSM III, and in the World Health Organizations, International Classification of Diseases, ICD-9-CM, which brought about the problem mentioned earlier, divergent definitions of the disorder. The DSM III categorized Autism as a type of Pervasive Developmental Disorder (PDD) while ICD-9-CM categorized it as “psychoses with origin specific to childhood.” The revision of the DSM III in 1987 included Asperger’s Syndrome, adopting Lorna Wing’s 1981 theory which built upon Hans Asperger’s work stating that Asperger’s Syndrome was “part of the autistic continuum,” or a mild-variant of autism (Tsai & Ghaziuddin, 2013, pg. 323). The DSM III-R included this definition of Asperger’s Syndrome, but failed to mention any criteria for inclusion in the diagnosis of Asperger’s Syndrome, and ‘lumped’ it into the autism diagnosis. With the revision of the DSM III, several diagnostic criteria with guidelines of a minimum requirement of criteria for diagnosis were listed for autism spectrum disorder. Rather than allowing for different

sub-groups for each disorder, (e.g., Asperger's, Rett's), the DSM III-R Pervasive Developmental Disorders (PDD) Work Group set two sub-groups in the DSM III-R for PDD: autism and pervasive developmental disorder – not otherwise specified (PDD-NOS). The decision to have one specified and outlined diagnosis for autism, and the other a 'catch-all,' (PDD-NOS) set the stage for the divergent and complicated definitions leading to a muddled criteria for the diagnosis of autism spectrum disorders.

In 1992, the APA continued to refine their definition of autism through the DSM-IV and included the following five sub groups under the Pervasive Developmental Disorder (PDD) category: Autistic disorder, Rett's disorder, Childhood disintegrative disorder, Asperger's disorder, and PDD-NOS. While providing diagnostic criteria for the sub groups, it was found that the diagnoses were varied and unreliable due to the subjective nature of the criteria, and the varied nature of the disorder (APA, 2013, pg.1). In 2013, the APA published the DSM-V which included significant changes to the PDD category, specifically around the autism diagnosis. The change to the DSM-V criteria is the result of 6,000 hours of work by the DSM PDD Work Group. This work group determined that there was "sufficient evidence to replace the term 'PDDs' with 'Autism Spectrum Disorder (ASD)' and to subsume Asperger's disorder, childhood disintegrative disorder and PDDNOS into the overarching category of ASD" (Tsai & Ghaziuddin, 2013, pg.324). This work group found that symptoms of these three disorders represented a continuum from mild to severe forms of autism and stated "a single umbrella disorder will improve the diagnosis of ASD without limiting the sensitivity of the criteria, or substantially changing the number of children being diagnosed" (APA,

2013, pg.1). With this substantial change to the ASD diagnosis researchers and practitioners alike are left wondering if the criteria outlined in the section of IDEA focused on autism will follow suit. Much controversy surrounds the decision of APA to change their definition. Many see this as a step back to the methods used in the DSM-III (Tsai & Ghaziuddin, 2013) while others, namely APA, see this as a step in the right direction. In the following section, I will analyze the differences between the APA and IDEA classifications of Autism Spectrum Disorders and discuss the implications for children diagnosed or displaying symptoms of ASD.

Divergent Definitions

Wing and her colleagues published a paper in 2010 discussing their concerns with the new DSM-V criteria for an Autism diagnosis. Their worries surrounded the merging of all sub groups into one diagnosis level, utilizing the sub-groups as a type of severity scale, and the abandonment of the "triad of impairments" in favor of "persistent deficits in social communication and social interaction across multiple contexts, and restricted, repetitive patterns of behavior, interests, or activities" (APA, 2013, pg. 2). They are concerned with the deletion of sub-groups and offer that "the sensible solution would be to retain in the DSM-V a list of sub-group names that have been used, any of which will place the recipient within the autism spectrum. No specific diagnostic criteria need be attached, though it would be helpful to have a brief description attached to Asperger's disorder, and childhood disintegrative disorder" (Wing, Gould & Gillberg, 2010, pg. 771). While the argument in their 2010 paper was valid, the APA did not concur in their 2013 publication of the DSM-V, choosing instead to subsume the related disorders under the PDD umbrella to ASD as described earlier.

The worries of Wing and her colleagues are worth discussion, however, the consistency, and therefore validity, of diagnosis became an issue in the DSM III-R where all sub groups were delineated. To avoid the confusion of practitioners and researchers alike, the DSM-V eliminated the sub-groups and created a severity scale rating system. To receive an Autism Spectrum Disorder diagnosis a child must meet each of four Criterion, then be evaluated based on three levels of severity focused on their individual needs. See Table 1 for a simplified diagnostic criterion matrix based upon the information provided in the online version of the DSM-V (APA, 2013).

By contrast, IDEA has the following broad scope definition of autism; “Autism is a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age 3 that adversely affects a child's educational performance.

Other characteristics often associated with autism are engagement in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences” (34 CFR Section 300.8 (c)(1)(i-iii)). Problems lie with wide-ranging definitions when the diagnostic criteria are vague and therefore irregularly applied to children with similar behavioral characteristics. These divergent definitions allow for researcher and clinician interpretation in the diagnosis of children. A subjective method of diagnosis can lead to the disproportional identification of children specifically those from ethnically diverse backgrounds. Travers, Tincani, and Krezmien explored this issue in their 2011 research and found that the subjective nature of the diagnosis led to a disproportionate under identification of autism between white children and children from ethnically and racially diverse backgrounds. They went on to discuss the implications of these findings

Table 1.

	Social Communication Deficits	Restricted Repetitive Behaviors	Early Onset (yes/no)	Impairs daily functioning (yes/no)
Level 1 “Requiring support”	<ul style="list-style-type: none"> • With no supports in place deficits in communication cause noticeable impairments • Lack of social interest 	<ul style="list-style-type: none"> • Inflexibility of behavior interferes functioning in one or more contexts • Difficulty with organization and switching between tasks 	YES or NO	YES or NO
Level 2 “Requiring substantial support”	<ul style="list-style-type: none"> • Marked deficits in verbal and nonverbal communication skills • Social impairments even with supports in place 	<ul style="list-style-type: none"> • Inflexibility of behavior • Difficulty coping with change • Behaviors appear frequent and interfere with functioning in a variety of contexts 	YES or NO	YES or NO
Level 3 “Requiring very substantial support”	<ul style="list-style-type: none"> • Severe deficits in verbal and nonverbal communication skills • Limited initiation of social interaction • Minimal response to social overtures of others 	<ul style="list-style-type: none"> • Inflexibility of behavior • Extreme difficulty coping with change • Behaviors markedly interfere with functioning in all spheres 	YES or NO	YES or NO

and noted that because the students were not diagnosed early on, they did not have access to the same early intervention supports. (Travers, et al., 2011)

Statement of the Problem

With all of the controversy surrounding the defining criteria of autism and the disproportionate under-identification of students, the question to ask is how does this impact children with autism and their ability to receive an appropriate education, a right under Individuals with Disabilities Education Improvement Act, 2004? The American Psychiatric Association states that children will be diagnosed in the same manner using the DSM-V as they were using the DSM IV (APA, 2013 pg.2). They suggest in a 2013 publication that “the criteria change encourages earlier diagnosis of ASD but also allows people whose symptoms may not be fully recognized until social demands exceed their capacity to receive the diagnosis” (APA, 2013 pg.2). This definition allows for a continual look at the child in line with the student rights set forth in IDEA of an appropriate education and early intervention supports for children with disabilities. With different definitions from IDEA 2004 and the DSM-V, the question is twofold: how can different definitions be applied evenly to the same population of students with disabilities, and what steps should be taken to provide a comprehensive, research based definition which will provide the most accurate diagnosis and the best possible services to students with autism? While the two entities serve different purposes, the DSM primarily being used for medical diagnosis and insurance purposes and IDEA used for educational placement and support decisions, they are not exclusive of one another. If the subjective nature of the diagnosis continues, children will fail to

receive the medical and educational services and supports in a timely manner.

Statement of Need

With all the debate surrounding the need for a concise, comprehensive and consistent definition of ASD it is essential to examine the population of children that fit within the ASD diagnosis. The old adage, that if you have met one child with ASD, you have met one child with ASD, speaks to the broad range of defining characteristics for this specific population. Therefore, it is important to focus on a sub group of this population, with similar characteristics and functioning to validate research. It is important to understand who the stakeholders are when conducting said research. The stakeholders are those that will benefit the most from the outcomes and the personnel essential for implementation of the research outcomes.

Stakeholders

In the research needed to examine these issues a variety of stakeholders exist, each with different goals and outcomes. Children are the major stakeholder. The right of an appropriate education and support for children with ASD should be of upmost concern. Children are the main benefactors of the decisions made in Washington or through University based research projects. These decisions impact them in their daily lives; therefore, it is vital to keep in mind during the design, development and implementation of any research project. Parents, Researchers, Clinicians, and Practitioners are secondary stakeholders in this research. Researchers and Clinicians alike are concerned with how their decisions impact the ability of the educational agencies, and educators, to appropriately accommodate students with ASD, specifically in the areas of conducting non-discriminatory evaluations and providing an

appropriate education through a variety of specialized supports.

Impacts of Change

Early research conducted on the DSM-V diagnostic criteria suggests that there were “no significant changes in the prevalence of the disorder” (APA, 2013 p.1). A 2012 study from Marisela Huerta and colleagues found that the DSM-V criteria retained 91 percent of students with a PDD diagnosis under DSM IV. This suggests that the impact to children in general is minimal, as their diagnosis remained the same for the majority of the sample under the new criteria. The goal of a consistent definition touches upon the concept of anti-discrimination by providing an equal opportunity for students with ASD to participate in meaningful education. Furthermore, the student’s ability to receive a non-discriminatory evaluation from medical and educational professionals, and provide children an appropriate education and supports. Questions remain surrounding how the new criteria will impact students with “high-functioning autism” or those that display minimal characteristics, but still need services to experience success academically and socially.

These questions can be answered through further research with large sample sizes over the next several years to examine the prevalence of ASD diagnosis and the ability of children diagnosed with ASD to receive a free and appropriate education. Studies should focus on the criteria used under previous versions of the DSM and the current version to see if students once diagnosed with ASD would still retain their diagnosis with the new criteria, and consequently their ability to receive appropriate services. An outline for such research follows.

Criteria for Research

A cross-content team including, educational professionals, psychologists, psychiatrists, medical professionals, researchers, and autism advocates should comprise a research team to examine this problem through multiple lenses. The individual team members would each represent different views of child development, psychology, and curriculum, and therefore would bring their expertise and add a unique perspective to the conversation. It will be essential that defining characteristics of the subject population of students with ASD are agreed upon by all members, as that will lend to more valid and rigorous research. This cross-content team would examine the projected consequences of the application of each definition of ASD, from the DSM-V, WHO, and IDEA. They would compare the reliability of diagnosis between the three definitions. Through the research process each member will seek to better understand these issues and reflect upon how the varied definitions will impact, both positively and negatively, the ability of students with ASD to receive appropriate educational and medical services and supports.

Ongoing evaluation of services provided to students diagnosed with ASD as well as an examination of their growth, academically and socially, is an area that needs to be examined in future research. These elements of a student’s education, their social-emotional growth and their ability to meet their educational goals are core to their ability to receive an appropriate education. It is imperative that future research examine thoroughly the impact of each definition on the diagnosis and eligibility of students to receive services in the future.

Conclusion & Recommendations

Through this paper the history of the ASD diagnosis has been discussed leading up to

the current DSM-V criteria for diagnosis. Following the historical look the divergent definitions were discussed, which concluded with the analysis of the effects on the stakeholders, namely children with the ASD diagnosis. Through this paper, I have offered the opinion that a singular, all-encompassing definition of ASD should be provided to policy makers, clinicians, researchers, practitioners, and families. While a clear definition is desired, it will be difficult to come to a consensus with all of the players involved. The definition must be written in clear language so that practitioners and parents are not caught up in the jargon used by researchers and clinicians. The definition should list behavioral characteristics of

ASD, with the caveat that the nature of ASD is that all children present different characteristics at varying times. The new DSM-V diagnostic criteria for ASD provides for this caveat, as it makes available an ASD diagnosis for children over the age of three. With a broad scope definition, such as the one in IDEA, a provision for later diagnosis, and defining characteristics with attached severity levels, the diagnostic criteria for ASD could be easily understood, validly applied, and universally accepted by all groups seeking to provide appropriate educational experiences for students with Autism Spectrum Disorders.

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Algebraic Problem Solving Strategies for Students with Autism Spectrum Disorders

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Students with autism spectrum disorders (ASD) are included more frequently in general education classrooms, and are increasingly expected to access and master core curricular content, including mathematics. However, mathematics often presents challenges to students with ASD. Academically-oriented interventions to improve the mathematics skills of students with ASD have been recommended, particularly related to higher-order skills such as algebraic problem solving. Herein, we present how three research-based practices: self-management, visual supports, and peer-mediated instruction can be implemented in the context of teaching algebraic problem solving specifically to students with ASD. By employing such strategies, teachers can assist their students with ASD to benefit more fully from mathematics interventions, which in turn may help them strengthen their mathematics skills, increase independence when completing problems, and use acquired skills in community or other applied settings.

Educating students with autism spectrum disorders (ASD) in inclusive classroom environments is becoming increasingly common (Cihak, Fahrenkrog, Ayres, & Smith, 2010). Inclusion of students on the spectrum in general education has increased more quickly than all other disability categories combined (Sansoti & Powell-Smith, 2008). Currently, 36% of students with ASD spend more than 80% of their school day in general education classes, which constitutes a significant increase from their 4.8% inclusion rate in 1991 (Whitby, 2013). There is a rising expectation that these learners will access and master the same core curricular content as their typically developing peers and ushers in a related demand for effective educational interventions to promote students' successful content acquisition (Knight, Smith, Spooner, & Browder, 2012).

Nonetheless, instructional programs for students with ASD tend to focus primarily on communication and social skills (Plavnik

& Ferreri, 2011; Wang & Spillane, 2009) as well as functional and life skills as opposed to traditional age and grade level subject matter (Cihak & Grim, 2008; Rayner, 2011). Within the relatively small research base related to academic content, the focus for students with ASD is largely related to reading (Bouck, Satsangi, Taber-Doughty, & Courtney, 2014; Delano, 2007). Although mathematics education is a national priority for all students (Ellis & Berry, 2005), there are fewer comparable, empirically supported interventions in mathematics than in literacy for students with ASD (Bouck et al., 2014).

Yet, mathematics is an area of academic concern for students with ASD. Nearly 25% of students with ASD have a mathematics learning disability (Mayes & Calhoun, 2006). In addition, although many of these learners maintain adequate mathematics performance in the earlier grades when rote memorization of facts and procedures is important (Chiang & Lin, 2007), the same students may struggle as they enter middle

school when the content becomes more abstract, cognitively complex, and emphasizes problem solving, higher level thinking, and mathematical reasoning, which have been identified by researchers as areas of weakness for children with ASD (Mayes & Calhoun, 2003; Whitby & Mancil, 2009).

The difficulties students with ASD encounter in mathematics likely stem from challenges in executive functioning skills, such as planning, organization, working memory, mental flexibility, attention, self-monitoring, and impulse control (Happé, Booth, Charlton, & Hughes, 2006; Hughes, Russell, & Robbins, 1994). Additionally, the language impairment associated with ASD may also negatively impact mathematics development across several areas including number-word sequence, calculation, fact retrieval, and in particular, problem-solving (Donlan, 2007; Zentall, 2007), which requires students to utilize both semantic and numeric information (Rockwell, Griffin, & Jones, 2011). However, the general education mathematics curriculum and state assessments increasingly emphasize the importance of developing the conceptual understanding and problem solving described and recommended by the National Council for Teachers of Mathematics (NCTM) across domain areas (Bottge, 2001; NCTM, 2002; Rockwell et al., 2011), which students with ASD in general education will likely encounter.

With respect to higher-order mathematics such as algebra, successful progression from concrete arithmetic to symbolic mathematics and abstract reasoning is crucial (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) which may pose difficulties for students with ASD. For example, students are introduced to complex story problems that require understanding of

foundational concepts such as ‘placeholder’ (i.e., variable) and its use in equations. This conceptual knowledge then must be applied to translate problems posed in text into an algebraic expression in order to produce a solution (see Common Core Standards (2014);

www.corestandards.org/assets/CCSSI_Mathematics). On the other hand, algebra also involves pictorial representations, pattern recognition, and numeric problem solving that may advantage students with ASD with strengths in processing visual objects (Iuculano et al., 2013). Therefore, strategies to facilitate algebraic learning for students with ASD should account for both students’ strengths and weaknesses.

With the rise of students with ASD in inclusive settings, their documented difficulties in mathematical understanding and problem solving, and the importance the NCTM has placed on conceptual understanding and problem solving across skill areas, examining evidence-based practices in mathematics for learners with ASD is a research priority. We present how three research-based practices in ASD: *self-management*, *visual supports*, and *peer-mediated instruction* can be implemented in the context of teaching higher-order mathematics skills. Using algebraic problem solving specifically, we illustrate how teachers of students with ASD can apply research-based practices so that their students can more readily acquire the mathematic skills identified on their IEPs and those being taught in the general education classroom.

Research-based Teaching Strategies

Three evidence-based practices implemented with students with ASD have specific application to teaching higher-order, algebraic skills. *Self-management*, *visual supports*, and *peer-mediated instruction*

were selected based on their empirical evidence and projected success in helping students with ASD achieve higher-level mathematics skills. See Table 1 for a summary of each evidence-based practice, rationale for use with students with ASD, and example studies from the experimental literature to support use of each approach in algebraic teaching. It is important to note that research on the use of these strategies in the area of mathematics is limited to students with learning disabilities (LD), as empirical research in mathematics for students with ASD is still in its infancy and has not tended to focus on higher-order skills such as those taught in algebra (Hart Barnett & Cleary, 2015). Nonetheless, we make application of the LD research since it is estimated that a substantial proportion of students with ASD also contend with mathematics learning disability. Therefore, evidence-based practices from this related field may be helpful in addressing learners with ASD who display similar mathematical difficulties.

Each of these instructional methods was included in the recent *Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorder* meta-analytic literature review, which was published by the National Professional Development Center on Autism Spectrum Disorders (Wong et al., 2014). This review examined 29,105 peer-reviewed articles published in journals between 1990 and 2011, and resulted in close review of 456 intervention articles based on inclusion criteria for research rigor and quality established by the National Professional Development Center on Autism Spectrum Disorders (Wong et al., 2014).

According to the Common Core State Standards, all high school students should master algebraic problem solving skills

(Common Core, 2014). Many of the mathematics Common Core State Standards for high school students address algebraic reasoning with equations and inequalities (Common Core, 2014). Particularly, one of these standards states that students should be able to solve one-variable linear equations (Common Core, 2014). In order to effectively teach students with ASD to solve linear equations with one variable, three selected teaching strategies will be illustrated and applied to solve the example problem, $2x + 8 = 20$.

Visual Supports

Use of *visual supports* is a common evidence based practice for aiding students to grasp mathematical concepts and ideas. Visual supports are comprised of concrete cues that provide information about an activity, routine, or expectation and/or support skill demonstration (Wong, et al. 2014). Incorporating visuals and other concrete supports assists individuals with ASD whose strengths include processing visual and/or written information (Marans, Rubin, & Laurent, 2005). These supports are beneficial to students with ASD because they “provide cues” to aid students when performing academic tasks (Wong et al., 2014). This visual instruction can help guide students with ASD through the process of completing a simple algebraic problem.

Creating an acronym to which students can refer during classroom activities and independent problem solving effectively assists students as they acquire algebraic skills. Further, creating a picture or graphic in conjunction with an acronym is a useful way for teachers to utilize visual supports to enhance the learning of challenging mathematic concepts, including algebra, as doing so builds the conceptual understanding necessary for success at the symbolic or abstract level (Strickland &

Table 1
Evidence-based Instructional Strategies in ASD

Instructional Strategy	Description	Rationale for Using the Strategy	Example from Literature
Visual Supports	Students are introduced to a picture, diagram, chart, or other visual aid that has been developed to support students in achieving a specific academic task (Wong et al., 2014).	Visual supports aid students with autism spectrum disorders because they provide prompts and help organize material. These supports are beneficial in developing expectations and providing instructions for a task. Visual supports include photographs, written words, scripts, and graphic organizers (Wong et al., 2014).	Strickland and Maccini (2010): Recorded study by Ives (2007), which demonstrated that students who used a visual support to solve three linear equations with three variables performed higher than students without access to the visual aid.
Self-Management	Students are taught to work independently to complete a task by managing their time, assignment progress, completion, and behavior (Lee, Simpson, & Shogren, 2007; Odom, Brown, Frey, Karasu, Smith-Canter, & Strain, 2003).	As students with ASD get older, it is crucial that they learn to be self-sufficient to complete their necessary daily tasks without requiring the support of others. By teaching students to memorize a checklist, they can write down this list and check off each step of the problem as it is completed. This tool helps students with ASD to monitor their own progress independently (Wilkinson, 2008).	Maccini, McNaughton, and Ruhl (1999): Reviewed study by Hutchinson (1989), which provided students with cue cards containing four questions to ask themselves when solving algebraic problems. Results showed that after problem-solving instruction with the cue cards, students provided more precise verbalization of answers, proving this method of teaching algebraic concepts to be effective.
Peer-Mediated Instruction	Students are assigned pairs or small groups to collaborate when learning new material and practicing problems (Wong et al., 2014).	Having students work with their peers allows them to discuss their ideas when working through problems. Peer-mediated instruction is beneficial to students with ASD because it allows them to work on social skills as well as communication skills (Wong et al., 2014).	Foegen (2008): Analyzed study by Allsopp (1997), which implemented class-wide peer tutoring during which one student assumed the role of the “player” while the second student assumed the role of the “coach.” During this exercise, the “coach” possessed an answer key to aid the “player” in completing the problem. Students revealed that this collaborative learning approach was enjoyable and aided in their learning algebraic skills, suggesting this teaching strategy to be effective.

Maccini, 2010). Graphic and pictorial representations will visually support students in memorizing ideas and steps, helping them to be successful in remembering concepts long term. Furthermore, visual cues can augment receptive/expressive communication during an activity (Mirenda & Erikson, 2000; Quill, 1995), and increase independence in a given task among students with ASD (Koegel, Koegel, & Parks, 1995; Quill, 1995).

Implementing Visual Supports in Algebraic Problem Solving

When teaching students with ASD how to solve algebraic problems, an acronym that represents the steps of solving this type of mathematics problem is key. Acronyms are often used to aid students in the understanding of challenging mathematical concepts. For example, PEMDAS, which represents the order of operations and signifies Parentheses, Exponents, Multiplication or Division, and Addition or Subtraction, is used when solving equations (Golembo, 2000). The acronym we developed for solving one-variable linear equations is COSMIC. This acronym is based on traditionally accepted algebraic problem-solving procedures in the mathematics literature (Kieran, 2006). The steps represented by each letter of the

acronym are described by the visual aid shown in Figure 1.

After students are introduced to the acronym, they can initially be allowed to utilize the figure as a visual support reference that can cue them to the required steps of solving one-variable linear equations. COSMIC is also a helpful mnemonic device that can assist students in recalling the specific steps of the problem-solving process. Mnemonic devices are learning strategies that enhance memory and improve recall. They may typically come in the form of acronyms, pictures, or key words intended to be easier to remember than the word or concept they stand for (Hart & Whalon, 2008). Students can check off each step as it is completed in order to observe and monitor their progress in solving the problem, maintain attention to the task, and reach their goal.

Self-Management

Self-management involves teaching learners to independently regulate their own behavior (Wong et al., 2014). Self-management strategies can be designed to teach children with ASD to monitor their academic engagement, participation, and performance during the learning task. Self-management teaches students to identify appropriate

Figure 1. *COSMIC Problem Solving Procedures*

COSMIC

Copy down the problem

Operation choice of addition or subtraction needed to isolate the variable term

Subtract or add constant from each side of the equation

Multiply or divide to remove the coefficient of the variable

Isolate the variable

Circle your answer

behaviors, record their own behavior, and reward themselves for performing the appropriate behavior (Hart & Whalon, 2008). Self-management can reduce dependence on adults (e.g., the teacher or paraprofessional) thereby increasing independence and generalization of the skills to other settings (Simpson & Otten, 2005).

By promoting self-monitoring and reinforcement, self-management can help prompt a student with ASD to achieve successful behavior (Wong et al., 2014). Providing a checklist for algebraic problem solving can be a beneficial form of self-monitoring as the student can measure his progress while determining the problem's solution, thereby decreasing student dependence in independent or group activities. Checklists may include such concrete supports as a written cue or visual that explicitly depicts the interactions or steps needed to complete activities (Wilkinson, 2008). Checklists can be altered to reflect various student roles needed in different content areas or activities, facilitate the learning of an individual goal/skill, and capitalize on student strengths.

Implementing Self-Management in Algebraic Problem Solving

When teaching algebraic skills, self-monitoring checklists can be implemented by requiring students to follow a step-by-step procedure for executing this specific type of mathematics problem. To implement self-management, teachers can create a numbered checklist of steps with a stated final objective, clearly laying out the procedure for students to follow. Procedural steps are progressively introduced to students one at a time until the student is able to complete all problem steps. This process allows students to master the understanding of each individual step, and to

gradually recognize the procedures and patterns needed to solve an algebraic problem. By providing a self-management checklist, the student can be successfully guided through each step without requiring the direct intervention of a teacher and can promote overall learner autonomy (Myles & Simpson, 2003). Additionally, having a concrete list of steps allows students to track their progress in completing a problem. This list increases students' concentration and attention because they are aware of the goal to be achieved and can visually see which behavioral steps need to be performed in order to accomplish the objective (Busick & Neitzel, 2009). Moreover, the activity of focusing attention on one's own actions and the self-recording of these observations can have a positive reactive effect on the task being monitored (Cole, Marder, & McCann, 2000). As students memorize the checklist through practice, it can gradually be faded until the students successfully complete the problems independently. This checklist tool can be effective in promoting self-management. Self-management is a critical life skill for students with ASD because it serves as an organization tool and enhances students' quality of life by empowering them to direct their behavior (Lee, Simpson, & Shogren, 2007).

Once the students have demonstrated problem-solving mastery when using with the visual aid for support, the visual aid is gradually removed, requiring students to memorize the six listed steps required for problem solving. Prior to solving problems, students can be taught to write down the six problem solving steps represented by the acronym. Teachers can also provide students with a checklist of directions to accompany problem solving (see figure 2). Using these steps as a reference, students can independently guide themselves through the problem solving process in order to

accurately derive the solution. Additionally, utilizing the checklist to monitor one's progress will keep students motivated because they will possess an understanding of the final goal, and can view the steps to be completed in order to successfully reach the solution.

Peer-Mediated Instruction

Peer-mediated instructional models involve preparing one or more peers without disabilities in the same class to provide targeted academic, social, and behavioral supports to their classmate with disabilities (Carter, Cushing, & Kennedy, 2009). Peers are often shown methods to engage students with ASD through educational exercises, while supporting social and communicative interactions (Wong et al., 2014). Peer mediated approaches can take the form of integrated playgroups, peer buddy, and peer tutoring. This strategy is beneficial when

teaching students with ASD because it not only provides an environment for students to collaborate, but it also provides opportunities for students to develop social and communication skills while participating in a group setting (Sperry, Neitzel, & Engelhardt-Wells, 2010).

To enhance peer-mediated instruction, scripts can be implemented as tools to support socialization and communication between two students. *Scripts* are defined as direct written and/or visual prompts intended to initiate or sustain an interaction (Hart & Whalon, 2008). Visual scripts are implemented in classroom activities during which students with ASD would be expected to display language skill and are effective in cueing communication (Ganz & Flores, 2010). Moreover, scripts have been shown to be effective in increasing question answering (Charlop-Christy & Kelso, 2003).

Figure 2. Algebraic Problem-Solving Checklist

<input type="checkbox"/>	Copy down the problem
<input type="checkbox"/>	Operation choice of addition or subtraction needed to isolate the variable term
<input type="checkbox"/>	Subtract or add constant from each side of the equation
<input type="checkbox"/>	Multiply or divide to remove the coefficient of the variable
<input type="checkbox"/>	Isolate the variable
<input type="checkbox"/>	Circle your answer

When using a script form of peer-mediated instruction to guide students through solving a simple linear equation, students with ASD can benefit from communication with peers through the opportunity to answer questions, verbalize their ideas and discuss problem-solving processes. Guidelines for teachers to follow when creating scripts for students are described in Figure 3.

After learning to follow a script, children with ASD not only increase the frequency of scripted initiations, but also of non-scripted or spontaneous initiations (Krantz & McClannahan, 1993; Krantz & McClannahan, 1998; Stevenson, Krantz & McClannahan, 2000). Although typically used to promote social interaction, scripts can be applied in classroom settings by offering an immediate way for the children with ASD to participate in academic interactions.

The use of scripted prompts during *peer-mediated instruction* encourages students to reiterate their reasoning behind each problem-solving step performed, providing them opportunities to communicate

mathematic processes and ideas. Moreover, verbalizing problem solving processes and procedures assists in developing conceptual understanding. This form of mentoring with the aid of scripts can help students expand their own meta-cognitive skills and become more self-directed, suggesting that students benefit from skill growth and development during this type of lesson in which the student is an active participant (Miles & Forcht, 1995).

Implementing Peer-Mediated Instruction in Algebraic Problem Solving

To promote student collaboration, a peer-mediated exercise can be implemented that provides students with the opportunity to further practice solving linear equations with one variable. Teachers can develop scripts to guide a pair of students to solve such a problem. Using the scripted questions, the pair can be prompted through the steps necessary to successfully solve the given problem (Ganz et al., 2012). After problem completion, the script directs students to explain their reasoning, encouraging them to verbalize their problem-solving process.

Figure 3. Guidelines for creating a script

Guidelines for Creating a Script:

1. Assign a pair of students to either the “Mentor” or “Student” role.
2. Include multiple sample problems for the students to attempt using the scripted instruction guide.
3. Formulate the dialogue of the script.
4. Include dialogue questions to prompt the “Student” to identify the problem type, explain the steps required to solve the problem, and justify his/her problem-solving reasoning.
5. Instruct the two peers to switch roles and repeat the scripted process to solve the next problem.

A script (shown in Figure 4) can be provided to students. The script contains one “mentor” role and one “student” role. After being assigned pairs by the teacher, the student with ASD will initially assume the role of the “student,” while his partner will assume the role of the “mentor.” The script will prompt the “mentor” to ask the “student” questions regarding the type of mathematics problem shown and the strategies that should be used to solve this problem. Posing these questions prior to the student beginning to solve the problem promotes critical thinking and reasoning, which is vital in students’ developing comprehension (Whalon & Hart, 2011). The script provides exemplar responses to each question posed to the “student,” so that the “mentor” can effectively test the students’ understanding of concepts. Furthermore, arranging for students to work together in peer-mediated exercises promotes student discussion (Carter & Kennedy, 2006). The sample script shown in Figure 4 demonstrates how one “mentor” can prompt the “student” to successfully complete the problem, while encouraging critical thinking.

In conclusion, although a substantial number of students with ASD contend with mathematical difficulties, research addressing the mathematical knowledge and skills of children and youth with ASD is in its infancy and is generally limited. Meeting the mathematics needs of children with ASD constitutes an ongoing educational challenge. However, there are several evidence-based strategies available to teachers for improving the academic skills of children with ASD in general and other educational settings. Many students with ASD possess the requisite academic skills to engage in higher-order problem solving. Implementing visual support, self-management, and peer-mediated instructional strategies creates a meaningful context for promoting such higher-order, algebraic learning of all children, including those with ASD.

Figure 4. Peer-mediated script to promote algebraic problem solving

Script for Peer Mediated Instruction

SAMPLE PROBLEMS:

- 1) $2x + 8 = 20$
- 2) $10x - 10 = 40$
- 3) $-3x + 5 = 8$
- 4) $-6x - 8 = 4$

MENTOR: What type of mathematics problem is shown?
STUDENT: The problem shown is an algebraic problem featuring a linear equation with one variable.

MENTOR: What is your goal? In other words, what are you trying to solve for?
STUDENT: The goal is to isolate the variable "x". Once this variable is isolated, the value of the variable "x" is determined by the number that it is equal to.

MENTOR: What is the acronym that is used to help solve linear equations with one variable?
STUDENT: The acronym is COSMIC.

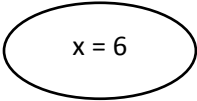
MENTOR: Solve the first problem using the steps of the acronym.
STUDENT:

$2x + 8 = 20$ *Copy down the problem.*

Choose subtraction to isolate the variable term. *Operation choice of addition or subtraction needed to isolate the variable term.*

$$\begin{array}{r} 2x + 8 = 20 \\ - 8 = - 8 \\ \hline 2x = 12 \end{array}$$
 Subtract or add constant from each side of the equation.

$$\begin{array}{r} 2x = 12 \\ \underline{2 \quad 2} \\ x = 6 \end{array}$$
 Multiply or divide to remove the coefficient of the variable. Isolate the variable.

 *Circle your answer.*

MENTOR: Explain how you solved this problem and why you performed each step.

STUDENT: My first step in solving this problem was writing down the acronym COSMIC, and the steps represented by each letter of the acronym. By writing down this acronym, I created a checklist of steps to help me track my progress when completing the problem. Writing down this checklist of steps also helped me to successfully evaluate the equation and reach my goal of determining the “x” variable’s value.

After writing down the problem, as described by the first acronym letter **C**’s step, I analyzed the problem to determine if addition or subtraction needed to be used to eliminate the constant from the left hand side of the equation. I determined that subtraction needed to be used to cancel the addition of the constant number 8 to the left hand side of the equation, implementing the second acronym letter **O**’s step.

Next, I performed the third acronym letter **S**’s step by subtracting the constant 8 from each side of the equation. This step resulted in the problem simplifying to $2x = 12$.

To remove the coefficient from the variable “x”, I divided both sides of the equation by 2. This computation implemented the fourth problem-solving step represented by the acronym letter **M**.

Dividing each side of the equation by 2 resulted in the variable “x” becoming isolated, revealing its value of 6. Recognizing this isolation completed the acronym letter **I**’s step.

Finally, I circled my answer of $x = 6$ to complete the final step of the linear equation with one variable problem-solving checklist, represented by the acronym **COSMIC**.

****Now switch roles with your partner and complete the next sample problem!****

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Accessing Academic Instruction with iPads for Secondary Learners with Low-Incidence Disabilities

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With the growth of mobile technology and its integration into the classroom, special education teachers and students with low-incidence disabilities (LID) are accessing mobile touch pad tablets and instructional technology in various ways. This qualitative case study examined how devices were integrated into academic instruction in a high school for students with LID and considered students' perception of the technology. Research questions included: how are the students using iPads to access academic instruction; how does the use of iPads during academic instruction promote self-determination skills; and what are the students' perspectives of using the iPad as a tool? Participants included three special education teachers and nine students with LID. Data were derived from observations of students and teachers during classroom activities, interviews with teachers and students, and artifact collection and analysis of students' work. Results suggest that the iPad can enhance students' performance in academic learning activities and promote self-determination skills. In addition, students felt the use of iPads as an instructional tool resulted in a positive learning experience.

For students with low-incidence disabilities (LID), mobile touch pad tablets (such as iPads) can maximize their abilities to perform functional skills, such as communicating basic needs or wants. Prior studies of students with LID and the use of iPads have focused on measuring the efficacy of iPads as a voice-output device (McNaughton & Light, 2013), an intervention for behavior management (van der Meer et al., 2013), or a method for providing one-to-one instruction on a specific academic skill (Cumming & Draper Rodriguez, 2013). Special education teachers are now viewing technology, such as mobile touch pad tablets, as a means to support not only communication and behavior management, but also academic instruction (Flewitt, Kucirkova, Messer, & Flewitt, 2014; Johnson, 2013; Retter, Anderson, & Kieran, 2013).

effective tool for students with LID, focusing on the use of iPad as an assistive technology for speech, communication, and behavioral management (Kagohara et al., 2013). Several single subject design studies suggest that iPads can be used for academic interventions for students with LID (Burton, Anderson, Prater, & Dyches, 2013; Cumming & Draper Rodriguez, 2013; Jowett, Moore, & Anderson, 2012). Most of the students involved as participants in the aforementioned studies showed positive effects using the iPad. However, minimal research exists on students' perception of the experience. The present study focused on the students' voices by gathering their input about perceptions and experiences with the iPad. Gaining an understanding of students' perspectives honors the students' right to advocate and speak for themselves regarding methods that help them learn best.

Previous research suggests iPads can be an

Self-Determination

The use of an iPad may promote communication for individuals with LID, which can enhance self-determinations skills. Technology can allow students to practice self-determination through self-expression (Wehmeyer, 2007). For example, a student can practice self-advocacy by using an iPad to access a digital version of literature and by independently controlling font size, volume, and screen brightness.

Self-determination is a philosophy that highlights the need to explicitly teach students with LID how to use their voice. This is an essential part of students' lives, especially when planning for life after high school. Some students with LID may be nonverbal or have limited verbal skills and may use a variety of methods to communicate (Snell & Brown, 2011). This greatly limits a student's ability to share his or her preferences, opinions, or ideas. These students must receive specially designed instruction to learn and repeated opportunities to practice self-determination skills. With this type of instruction, students with LID can graduate from the school system with skills that will support their roles as contributing and valuable individuals in society. Students' ability to express their ideas and control events in their lives (e.g. choice-making and self-advocacy) is imperative, especially as students are preparing for career- and college-readiness (Wehmeyer, 2007).

Research on self-determination in schools focuses on classroom instruction, IEP designing, and transition planning (Lee et al., 2012; Wehmeyer, 1999; Wehmeyer, Palmer, Shogren, Williams-Diehm, & Soukup, 2013). This study extends the self-determination research to examine the specific self-determination skills exercised by students using iPads for academic work.

Specifically, this study focused on two self-determination skills within academic work while honoring students' voice: students' self-advocacy and choice-making.

Universal Design for Learning

The mobile touch pad tablet (such as the iPad) is rapidly becoming a more common technology in schools. Previous research suggests that the iPad, in particular, is an effective tool in designing curriculum based upon the Universal Design for Learning (UDL) framework (Izzo, 2012; King-Sears et al., 2015). UDL is a framework that can promote inclusive learning environments for all learners as it guides the development of flexible learning environments that can accommodate individual learning differences (Lapinski, Gravel, & Rose, 2012). When teachers implement the UDL principles during curriculum planning, they can design learning experiences for students with disabilities that meet the unique goals of each learner (CAST, 2011). Unlike traditional curricula, UDL-based curriculum plans for students' specific abilities and limitations. The use of an iPad for universally designed lessons can have powerful implications for students with LID. With the use of iPads, teachers can provide "personalized learning" experiences for students to participate in activities that are differentiated according to their individual needs (Cumming, Stmadová, & Singh, 2014; Flewitt et al., 2014; Johnson, Adams Becker, Estrada, & Freeman, 2014).

Although UDL does not require use of technology as part of its framework, the integration of mobile technology allows for customization of lessons and activities, based on students' unique needs (Edyburn, 2010). In addition, with the rise of mobile technologies and student "media ecologies" ever increasing, educators can incorporate those technologies into learning activities in

the classroom setting (Ito, 2010). Research on UDL indicates that mobile devices can be used to transform “traditional” forms of curricula (e.g. printed books) into innovative forms that meet the unique needs of all students (Rose, 2000).

Purpose of Study

Unlike previous studies, this study was designed to examine a larger group of students with LID using iPads in a more organic instructional setting, whereas previous studies were conducted in highly controlled environments. In addition, this study included student voice (i.e., perspectives on use of the tool) as an important variable. The purpose of this study was to explore how iPads were integrated into academic instruction in one high school for adolescents with LID, to generate an understanding of the students’ perspectives of using the device as a tool, and to solicit student voice related to iPad use. A variety of aspects were examined, including: content area, students’ individual abilities, types of learning activities, student perspectives and learner outcomes. Questions guiding this research were as follows:

1. How do secondary students with low-incidence disabilities use iPads to access academic instruction?
2. How does the use of iPads during academic instruction promote self-determination skills?
3. What are the students’ perspectives of using the device as a tool?

Method

Participants

Purposive sampling was used to identify participants who met the criteria for the study (Merriam, 2009). Three teachers (one male and two females) and nine students (four males and five females) from one

secondary school’s special education program were included in this study. All teachers and students from this program were invited to participate in the study. Three of the four teachers agreed to participate. Students’ parents/guardians were contacted by the researcher and invited to participate in the study. Upon receiving parents’/guardians’ permission, the researcher asked for the students’ permission. Student participants were diagnosed with LID, were in Grades 10-12, and were between the ages of 16 -18 years old. Accessing a program with so many students with LID and several teachers provided itself as an ideal maximum variation sample (Patton, 2002). This type of sampling reflects the diverse characteristics of students in a typical special education classroom.

The teachers in this study had three or more years of experience, were certified in Grades K-12 Special Education, and taught at the high school’s special education program designed for students with LID. This program focused on providing functional academics and life skills education for high school students. All teachers held leadership positions within the school and district community, including department chair, district committee members, and National Board Certification. Teachers’ reported experience with mobile technology in their personal and professional life varied. One teacher described herself as “a techie teacher” and had personally owned several iPads since its first launch. Another teacher stated that this was the first year she used an iPad for any purpose. All teachers expressed their eagerness to integrate iPads into the classroom as an innovative approach to teaching students with LID. Table 1 displays the teacher and classroom characteristics.

Table 1
Teacher and Classroom Characteristics

Teacher Name	Teaching Experience	Class Period	Content Taught	Special Designed Instruction Content Area	Lessons Taught During Research
Mr. Bowie	2 years as a paraeducator and 3 years as a teacher	English	Practical literacy skills used in personal, academic, and vocational areas of life	Reading, Written Expression, and Math	The Travel Project
Ms. Maxwell	20 years	Pre-Vocational Skills	Foundational skills that prepare students for future success in vocational settings, such as self-advocacy, articulating one's disability, and independently following a list of tasks	Reading, Written Expression, and Math	IEP Transition Plan Project
Ms. Summer	15 years	Math	Functional math skills, such as telling time, counting money, and using a calendar	Math	One-on-One discrete trial training sessions

All student participants had documented disabilities that significantly impacted their daily functioning and qualified them for specially designed instruction in the areas of reading, written expression, math, and adaptive skills; most qualified for communication skills, as well. Students' cognitive and adaptive scores were in the low to extremely low range (see Table 2). Gender ratios of participants were balanced, with 56% female and 44% male. Five of the nine students used speech as their main mode of communication, while the other four had limited speech and relied on other modes of communication, such as gestures. The discrepancy among students' disabilities, cognitive abilities, adaptive abilities and learning goals was large. These intentional variations provided a deeper understanding of the individualized use of the iPad with students with LID as iPad use was differentiated according to the unique needs of each student.

Setting

This research was conducted in a Pacific

Northwest high school, which served over 1,500 students. The school has a special education program designed to meet the specific needs of students with LID. Student participants were enrolled in special education classes for pre-vocational skills, English, and math. Each student had an iPad for the academic year and was solely responsible for the device. Students would retrieve the device from the charging dock each morning, take it to classes, and place it back on the charging dock at the end of day. Students and teachers received iPads at the beginning of the school year (prior to this study). Teachers reported that the district provided optional teacher training on the basics of the iPad. They also reported that students received minimal in-class training on the iPads in September, and if a learning activity required the use of a new tool/app, they taught them how to use the tool/app as part of that learning activity.

Design

There is a need for further research using a method that encompasses data collection in

Table 2
Student Characteristics

Student	Gender	Chronological Age	Ethnicity/ Race	Mode of Communication	Eligibility Category	Cognitive Score	Adaptive Score
Brooklyn	Female	17.6 years	Russian	Speech	Intellectual Disability	48	<0.1 percentile
Judy	Female	17.0 years	African American	Speech	Multiple Disabilities	69 ^a	54 ^b ; 0.1 percentile
Luke	Male	18.3 years	African American	Gestures; Limited Verbal	Multiple Disabilities	40 ^c	57 ^b ; 0.2 percentile
Robert	Male	18.8 years	Caucasian/ Japanese	Limited Verbal	Health Impairments	n/a ^d	58 ^b ; 0.3 percentile
George	Male	16.5 years	Caucasian	Gestures	Health Impairments	79 ^a	51 ^b ; <0.1 percentile
Dorothy	Female	17.7 years	Caucasian	Speech	Health Impairments	41 ^e	52 ^b ; 0.2 percentile
Susie	Female	16.7 years	Caucasian	Gestures; Vocalizations	Health Impairments	n/a ^d	61 ^f ; <1 st percentile
Zack	Male	16.4 years	Caucasian	Speech	Intellectual Disability	43 ^e	75 ^b ; 5 th percentile
Isabelle	Female	16.8 years	Caucasian	Speech	Health Impairments	64 ^c	64 ^f ; 1 st percentile

Note. a = Test of Nonverbal Intelligence, 3rd ed.; b = Adaptive Behavior Assessment System-II, 1st ed.; c = Stanford-Binet Intelligence Scales, 5th ed.; d = no scores on file, parent/guardian did not give consent; e = Wechsler Intelligence Scale for Children, 4th ed.; f = Vineland Adaptive Scales, 2nd ed.

a naturally occurring instructional setting and focuses on understanding behavior using participants' perspectives; qualitative research is the most appropriate methodology given the focus of this study (Merriam, 2009). The goal of this case study was to observe students and to explore the factors that influenced their use of the iPads, in relation to accessing academic instruction. The purpose of this qualitative case study was to allow for data collection and analysis that could extend the field's knowledge into the areas of acquisition of core academic content and self-determined behaviors for students with LID.

A qualitative design affords the opportunity to examine a variety of variables, such as a whole class setting, teacher's background knowledge in technology, and student's perspective of using technology (Anderson-Levitt, 2006). This design allows for the researcher to consider the complex factors of the classroom experience, such as peer interaction, teachers' teaching styles, and school culture.

Data Collection

Data collection included observations, interviews and artifact analysis.

Observations. The observations focused on

the teachers' instruction and students' use of the iPads, based on the learning activity for that class period, and their ability to articulate their perspectives. Observations were the primary source of data for answering the research questions: How are the students using iPads to access academic instruction? How does the use of iPads during academic instruction promote self-determination skills? Observations were performed in three different classrooms to investigate differences in how students used iPads across class settings. The context of each classroom provided insight into the other factors that influenced students' use of the iPads (i.e. personality of peer group, subject matter, aspects of the classroom instruction, teacher's comfort level of iPad.) Each class was observed one to two times per week, 45 minutes per each observation, from February to April 2015 for a total of 11 weeks. Observations were not videotaped as the researchers felt that participants might have been uncomfortable in the presence of a recorder. Notes generated from the observations and audio recordings were handwritten and then organized into two categories: field notes and memos. Field notes included what the researcher observed and memos included the researcher's ideas/informal analysis about what was observed (Merriam, 2009). Upon completion of the interview, notes were summarized into initial themes.

An Observation Guide Protocol was created and used as a guide for field notes. Fifteen learning activities were observed and notes were collected related to teacher instruction, types of learning activities, student conversations, and students' independent work time. On some days, two classrooms were observed (depending on external factors such as assembly schedule or teacher absence). A rotation schedule was set so that all three classrooms were observed equally

throughout the entire course of the study.

These observations allowed the researcher to experience the instruction firsthand, providing a contextual background for subsequent interviews. The researcher discussed specific aspects of the observation as a launching point for exploring topics during later interviews. The researcher acted as a participant observer (Erickson, 1986). After three observations, a student approached the researcher to ask for assistance on his iPad. With the teacher's permission, the researcher answered the student's question. From that point, the researcher actively participated in the classroom as students frequently approached with questions or comments. Students seemed to respond better to the role of the researcher as a classroom participant, as researcher participation seemed to alleviate their awareness of being watched or evaluated. This participation appeared to yield more honest and unselfconscious data about students' uses and perceptions of the iPads.

Semi-structured interviews. Interviews supported the observation data. Initial teacher interviews consisted of questions, such as "Can you describe your students' needs?" "How do you integrate student iPad usage during your instruction?" and "What kind of apps and/or tools do they use on the iPads?" Although interviews were designed to be individual semi-structured interviews for the teachers, the teachers asked if interviews could be conducted as a group. Consequently, the interview protocol designed for the individual semi-structured interview was adapted for the group interview. The group interview occurred during the second week of observations and the semi-structured nature of the interview allowed for flexibility in adding follow-up questions and a more casual feeling, without

losing focus on collecting specific data (Merriam, 2009). All interviews were audio-recorded and transcribed by the researcher. However, at the end of the study, the researcher conducted individual teacher interviews as a debrief, to ask clarifying questions and gather information from teachers who may not have answered a question during the group interview.

Student interviews were the primary source of data collection to answer the research question: What are students' perspectives of using the devices as a tool? Interview questions were posed to elicit data related to the research questions (i.e. Tell me about a time when you created your best work on the iPad). Among the three classes, eight students volunteered to be interviewed. Each interview lasted approximately 10 to 20 minutes, depending on the students' communication and processing skills. Student interviews were conducted during the last three weeks of observations which allowed time for the researcher to build rapport with students and to become comfortable with the researcher's presence in the classroom (Erickson, 1986).

Interview Considerations. In order to capture all of the students' opinions, interviews were conducted with students' individuality in mind. The researcher is a former teacher with eight years of teaching experience working with students with LID. She tailored the mode of communication to meet the students' unique needs. For example, she used picture representations to support her words and asked the student to select the picture that best represented his or her answer. In addition, on several occasions the researcher translated students' gestures as communication (e.g. George's head nod and smile was interpreted to mean that he agreed with a comment or answered "yes" to a question). Further, some students could not

answer open-ended questions, and so the researcher asked in such a way that allowed students to formulate an answer (e.g. Instead of asking, "What are some things you like about the iPad?", researcher asked "Can you point to an app you like to use on the iPad?").

Artifact Review. Digital artifacts of student work were collected to provide a deeper understanding of how iPads were being used to access academic instruction. Artifacts included: iPad screenshots and pictures of iPad apps while in use.

Data Analysis

Typical of qualitative inquiry, the researcher engaged in practices associated with analytic induction (Wolcott, 2009). Various forms of data were collected in an effort to increase validity of the findings from this study. Field notes were analyzed and teacher and student interview transcripts and notes were used to triangulate the findings from the field notes. In addition, the digital artifacts were used to validate findings, specifically examples of the student work that was observed and discussed by the teachers during interviews.

Coding. Microsoft Excel software was used for all coding and data analyses. Field notes were coded first, followed by the interviews, and finally the artifacts. Artifacts of student's work and photos were analyzed to identify codes aligned to the interview and observation data. For example, a photo of a student working on addition problems was coded as *math*, which supported observation data of students working on math skills. The coding process included deductive coding and open coding (Emerson, Fretz, & Shaw, 1995).

Deductive coding. Deductive coding included referring to UDL and self-

determination frameworks. Examples of UDL solutions were used (Rose & Meyer, 2002), as well as key components of self-determined behavior: choice-making, decision-making, self-instruction, self-advocacy, and internal locus of control (Wehmeyer, 1999). For example, data that exemplified students taking ownership of the iPad were coded as *internal locus of control*; and students learning how to copy and paste images were coded as *intuitive*.

Open coding. During the initial review of data, open codes were created based on the direct readings of the data (Miles & Huberman, 1994). These codes were recorded directly into the margins of the field notes, interview notes, and artifacts. During this coding activity, the researcher coded students' reactions and behavior while using the iPads, academic content accessed with the iPads, and the specific tools/apps used. For example, when a student made a happy exclamation about her shopping activity, "enthusiastic" was identified. And, when a student eagerly raised his hand to share his work, "excited" was noted. These codes did not follow a specific structure. Instead, they were freehand notes to "entertain all analytic possibilities" (Emerson, et al., 1995, p. 151).

From the open coding activity, the researcher organized the recurring open codes into themes (Ryan & Bernard, 2003). For example, the open codes of "excited" and "enthusiastic" were grouped into a theme called "pride." For another example, the open codes of "addition," "shopping," and "time" were coded into the theme called "math". Data were entered into a matrix of various themes. The matrix provided visual support as it displayed which themes occurred most and which were prevalent in specific classrooms.

Results

Nine themes emerged from this research, grouped below under the larger categories of Academic Instruction, Self Determination, and Student Input.

Academic Instruction

The first research question was, "How do secondary students with LID use iPads to access academic instruction?" Two themes emerged from the data that align with this question: (1) Students were using iPads to access academic instruction; and (2) iPad use varied based on academic content area. Over the course of this study, the researcher observed students using iPads on a daily basis for English Language Arts (ELA) and math activities utilizing a variety of tools and apps (see Table 3). The data in this table also exemplifies how teachers designed UDL-based learning activities that enabled the iPad to be used as a tool that scaffolded individual learning. Students accessed the activities and the iPad differently, based on their individual learning needs, abilities, and preferences.

English language arts (ELA). Students utilized the iPads during ELA learning activities, by using Google as a search engine and organizing the data by taking screenshots or entering them into Notability or Excel (see Table 3). In addition, students used accessibility tools, such as a stylus for limited fine motor skills, text-to-speech for limited writing skills, timer for promoting on-task behavior, and pinch-and-zoom feature to enlarge text on a webpage.

One main function of the iPad was its use as a research tool. In Ms. Maxwell's pre-vocational skills class, students participated in a Transition Planning project. In Mr. Bowie's English class, students were completing a Travel Project. During these projects, students used their iPads to conduct

Table 3
iPad Apps and Tool Usage

Tool/App	Content Area	Examples
Google Images/ Notability	ELA	Search for photos that represent dreams and transition goals to import into Notability; Search for images of appropriate social skills and non-examples, copy/paste into Notability, add captions
Google Search	ELA	Research various aspects of Travel Projects (flight prices, attractions, restaurant menus)
Screenshot	ELA	Take screenshots of webpages to refer to information later
Excel	ELA	List out trip details into Excel (activity, price, duration)
Notability	ELA	Type full name, address, and phone number with correct spelling; Adding captions for Transition Project images; Using app as main source of “folders” and “paper” for creating documents
Text-to-speech	ELA	Tap on microphone icon and speaking words that student wants as printed speech into any word processing app on iPad
Auto spell check	ELA	Tap on word with red underline and correct spelling options appear, then selecting the correct spelling
Stylus	ELA	Write and tap with stylus due to limited fine motor skills
Timer	ELA	Self-regulate work time/on-task behavior while doing work
Screenshots/Notability	ELA	Take screenshots of specific webpages and importing them into Notability for final product
Zoom	ELA	Pinch and zoom on a webpage to make text and image larger
Google Images	Math	Search for images of item student would like to “buy”
Calculator	Math	Add money amounts; Type money amounts (decimal use) into calculator
Grocery store website	Math	Find food items on website to practice paying for them with paper money (practicing dollar-up method)
Notepad/Calculator	Math	Write out number sentence of prices ($\$120.50 + \$249.79 =$), while gathering prices from various websites, enter numbers into Calculator from number sentence, add them up, then return back to Notepad app to write down answer
Calendar	Math	Complete various calendar activities (days of week, dates, and months)
TouchChat	Math	Complete various calendar activities (days of week, dates, and months)
FeelClock	Math	Match analog time to digital time then refer to school schedule (i.e. “What activity do you do at this time?”)

research. All students had access to the Internet on their iPads and used Google as their main search engine. Students tapped on the Internet icon and the Google page automatically opened. This tool allowed students to participate independently by gathering information from the web (text or images) and organized them into one document using Notability. Students quickly learned to copy and paste images from the Internet into their document or they would take screenshots of the webpage and insert that as an image. This process was particularly valuable for students who had limited reading abilities.

The iPad also supported the students’ writing process. Since most students wrote slowly, writing assignments were laborious tasks and students quickly lost interest. For this reason, students preferred utilizing the iPad to type or speak into the microphone instead of writing with pencil and paper. For example, Dorothy, an 18-year-old student with difficulty articulating thoughts and spelling words, expressed “I like it [iPad] a lot because it helps me write things so I don’t have to write a lot.”

Another tool most used during the ELA lessons was the auto-spell check feature. In

fact, Mr. Bowie reported “due to the assistive aspect of tools, such as auto spell check, students are more receptive to revising their written work because it is not as much of a burden for them.” The iPad’s writing tools allowed students the freedom to focus on expressing their ideas and thoughts compared to wrestling with the mechanics of spelling.

The timer also proved to be a worthwhile iPad tool. Some students would choose to set a timer to manage work time or break time. During an observation of Ms. Maxwell’s Transition Project lesson, students were asked to research images and text related to goals and dreams. Throughout the 45-minute class period, only two of the nine students needed redirection to stay on task. Three of the students were motivated to stay on task through the use of timers.

Math. The researcher observed math lessons in calendar, money, calculation, and time telling skills where the iPad was integrated (see Table 3). Math lessons in Ms. Summer’s class consisted of one-on-one instruction and Mr. Bowie’s class utilized small group instruction.

During time telling activities, the FeelClock app was frequently used. This app was preferred for one student participant, Susie. She learned to match analog to digital time using this tool. The immediate feedback of this tool was observed to increase engagement with the lesson.

The calendar app was a versatile tool Ms. Summer used for calendar lessons, as it provided a visual support where calendars were easily accessed with different monthly, weekly, or daily views. This app assisted Luke, an 18-year-old student, with limited working memory, to participate in repeated learning activities to master a skill. The

variety of the calendar activities with the iPad kept Luke engaged throughout all of the lessons. Luke was frequently observed eagerly scrolling through the calendar, answering Ms. Summer’s questions.

A variety of tools and apps were used to teach money skills. For example, during Mr. Bowie’s Travel Project, Zack calculated how much it would cost for two people to attend an amusement park as he used the calculator for assistance. He relied on the notepad to type out the number sentence then referred to it when typing into the calculator. These tools supported Zack during math activities in a fast and efficient manner.

During all math activities, the iPad served as a useful instructional tool. Without the iPad, the teacher and student would have to retrieve numerous items for the lessons described above, including an analog clock, digital clock, calculator, newspaper clippings of items for sale, monthly calendar, and weekly calendar. Retrieving these tools might otherwise be time consuming. The iPad, by contrast, presented to be a powerful device, as it had all these tools in one mobile location. The immediacy of digital tools allowed the teacher continuously to present new and creative lessons, which kept students engaged. In addition, the ease of the tools allowed students to use them independently, instead of relying on an adult to help, which constituted a clear display of self-determined behavior.

Self-determination

Students were observed to be practicing self-determination skills as they used the iPads for learning activities. The iPads promoted self-determination as students could use them as a means to express their interests, make choices, and work independently.

Three themes emerged from the qualitative data analysis process related to self-determination, which were: internal locus of control, choice-making skills, and leadership skills (Wehmeyer, 1999).

Internal locus of control. Across all classrooms, students exhibited behaviors that demonstrated internal locus of control. They were in control of their learning experiences and the iPads. Specifically, Robert, Judy, and Susie were frequently observed with their iPads, ready for a lesson without prompts being required. Dorothy and Robert carried the iPads in their backpacks throughout the school day. Several students personalized their iPads to represent unique interests. Isabelle made her home screen a Hello Kitty image because she loved that cartoon character. All students independently navigated among apps during activities. Specifically, during a

research activity, Brooklyn was observed to be independently switching between Google Images and Notability. Mr. Bowie reported that several students changed the font color and style of their written work, giving them ownership of their iPads and work.

Choice-making skills. Use of the iPad promoted opportunities for students to practice making choices during learning activities. Students were given a choice to use the iPads or other tools in the class (traditional calculators, notebooks). In Mr. Bowie’s class, two students chose not to use iPads for the Travel Project. Instead, they chose to conduct research on the desktop computer due to the large monitor. Some learning activities embedded choice-making skills. For example, during Ms. Summer’s money math lessons, students used iPads to visit shopping websites of their choice and choose items to “purchase.” Isabelle would

Table 4
Self-Determination Skills Practiced During Academic Instruction

Self-determination Skill	Academic Content	Student Behavior/s
Internal locus of control	Math & ELA	Carried iPad in location of choice (backpack, corner of desk, or stored in charger cart)
Internal locus of control	Math & ELA	Independently got out iPad to use for learning activity
Internal locus of control	Math & ELA	Personalized homescreen of iPad to reflect individual interests
Internal locus of control	Math & ELA	Created bookmarks on internet app of individual favorite websites
Choice-making	Math	Selected shopping website for money lesson
Choice-making	Math	Chose items to “buy” for money lesson
Choice-making	ELA	Freedom to choose locations to visit during Travel Project
Choice-making	ELA	Completed project of pictures and captions of students’ dreams, plans, and interests (connected to students’ IEP Transition Plans.)
Leadership	Math	Helped each other tap on correct answers on FeelClock app
Leadership	ELA	Independent work and raised hands to ask for help finding information on webpage
Leadership	ELA	Peer offered to help a table partner who had hand raised to ask teacher for help
Leadership	ELA	Work on iPad displayed on classroom whiteboard via Reflector software. Student displayed and spoke about her work to the class.
Leadership	ELA	Student volunteered to display iPad on whiteboard via Reflector software. Student taught class how to copy and paste cells in Excel.
Leadership	Math	Shared screens with table partners to show what s/he “bought” during money lesson.

often visit her favorite department store website and choose items of her own interest (fashionable shirts). Through this activity, Isabelle practiced making choices on websites to visit and items to buy.

Leadership skills. Students repeatedly demonstrated leadership skills while using the iPads. When Ms. Maxwell announced that class was ending in five minutes, Judy took a leadership role among her peers by volunteering to collect iPads and put them into the charging cart since it was the end of the day. On another day, students were finding text and images on *Google* that represented their life goals (job, pets, home, transportation, hobby, and family.) Brooklyn was the only student who finished her assignment within the class period and upon completion, asked Ms. Maxwell if she could show her work to the class. Ms. Maxwell projected Brooklyn's iPad onto the whiteboard and Brooklyn presented her work to her peers. She independently navigated through her assignment and spoke publicly about each goal.

Overall, the integration of the iPad into learning activities naturally encouraged students to practice self-determination skills; teachers did not need to teach the specific skills. Instead, teachers provided students with the opportunity to use the iPad as a learning tool, allowing students the freedom to use the iPads to have control of their learning experiences, make choices about how to learn, and lead peers.

Student Input

Findings from interviews and conversations during observations revealed that students' enjoyed using the iPad as a learning tool as well as an entertainment tool. Themes are detailed below and relate to the students' perspectives, where they identified that the iPad was easy to use (intuitive), displayed

pride in their work, saw the iPad as a useful tool, and also noted that use of an iPad can be frustrating.

Intuitive. Multiple students stated the iPad was "easy to use" and "easy to learn." Robert, who tends to have difficulty following multi-step directions, reported that the iPad was easy to learn and agreed that there was "nothing hard about it." When describing the ease of use for the iPad, Zack stated it was "easy to look up information on Google." George, who has atypical shape/formation of his fingers, expressed that the size of the iPad was easy.

Although the researcher heard consensus from teachers and students that the iPad was an easy instructional tool, one of the nine students interviewed stated that the iPad was difficult to learn. Judy, a student that chose to use the iPad often for lessons, expressed that the iPad is "all right." She said she had never used an iPad prior to being provided with one at school. When asked to elaborate on why the iPad was not always easy for her, she responded by saying that sometimes she would rather "do things on paper and pencil."

Pride. Students were proud of the work they created using their iPads. Students were delighted when they were asked to show the work of which they were most proud. Every student displayed at least one activity, however, most shared two to three. Specifically, Dorothy shared with the researcher her work titled "Scavenger Hunt," an assignment that included images found online of her favorite interests (pets, movies, leisure activities, etc.) and one-word captions for each image. She scrolled through the document to show the entirety of all her "favorites" while narrating each image. Isabelle shared with the researcher several activities she completed, one for a

mythology lesson in English and another lesson on the human bones from biology. When Robert was asked about the work he was most proud of, he answered “everything in English – to type and paste pictures.”

Useful. Students conveyed that the iPad helped with schoolwork as it fostered organization, provided assistive tools, and allowed them to access information at a fast rate. Dorothy showed the researcher how she organized her work, apps, and tools in folders. Isabelle expressed similar satisfaction: “Last year I couldn’t use iPads. I was getting really stressed out because I couldn’t find stuff in my binder.” Four students described how they liked using the calculator in math class. Judy and George used the timer tool on the iPad to keep them on task during schoolwork. Judy explained, “The timer helps me manage my breaks.” George showed the researcher how the Internet is “fast” at finding information that he needs.

Frustrations. When asked about aspects of the iPad that were challenging, several students expressed frustration with the Internet. Isabelle explained, “Sometimes the Internet doesn’t work.” Brooklyn expressed, “Sometimes I get frustrated when the iPad gets stuck.” Upon further questioning, she revealed that while researching online, the district’s web filter would block websites and she would have to ask the teacher to override the security. Four of the nine students interviewed expressed this same frustration of the blocked websites while researching.

Discussion

This study contributes to the field of special education for students with LID in several ways. First, this study promoted the perspectives of students who have limited verbal ability and provided different ways

for the students to communicate their perspectives. This study honored the students’ voice and opinions about their experiences. This is particularly meaningful as individuals with LID have historically faced great challenges being heard (Herr, Gostin, & Koh, 2003; Oliver, 1990).

Second, most research pertaining to UDL refers to students with disabilities, but does not refer to specific disabilities (Basham, Israel, Graden, Poth, & Winston, 2010; Lapinski, Gravel, & Rose, 2012; Murawski & Scott, 2015). This study contributed to the growing research in UDL based curriculum and extends its application to learners with LID (Coyne, Pisha, Dalton, Zeph, & Smith, 2012). Specifically, this study explored UDL and mobile technology for students with LID as a particular group of learners with unique learning styles and abilities. The initial findings from this study are an example of how UDL can be applied within special education programs that serve adolescents with LID.

Third, the results of this study revealed that students are inherently practicing self-determination skills while participating in UDL-based academic instruction. Years of literature and research establish the importance of teaching students with LID self-determination skills (Gaumer Erickson, A.S., Noonan, P. M., Zheng, C. & Brussow, 2015; Sands & Wehmeyer, 1996). Recent literature suggests that UDL can be a way for students with LID to practice self-determination skills (Wehmeyer et al., 2011). This study presents examples of how students used UDL based curriculum and the iPad’s specific tools and apps to practice self-determination skills.

Implications for Practice

Students with LID may benefit from use of an iPad as it can encourage their

performance during academic learning activities and may promote self-determination skills. In addition, students with LID may enjoy using the iPad as an instructional tool. Several areas are highlighted below that seemed to be critical aspects related to iPad use, namely, teacher attitudes, experience with technology, instructional grouping, and student motivation.

Teacher Attitudes. In 1999, Ertmer distinguished between two types of barriers that impacted teachers' uses of technology in the classroom. First-order barriers were defined as those that were external to the teacher and included resources (both hardware and software), training, and support. Second-order barriers comprised those that were internal to the teacher and included teachers' confidence, beliefs about how students learned, as well as the perceived value of technology to the teaching/learning process. Internal barriers include attitudes, beliefs, and self-efficacy with technology, which all impact teacher technology integration (Kim, Kim, Lee, Spector, & Demeester, 2013). Specifically, one barrier that prohibits teachers from integrating technology into their practice is teachers' own beliefs and comfort levels with technology. Results from this study suggest that the iPad itself did not impact student learning and that factors internal to the teacher played a role. Specifically, teachers had an optimistic disposition towards the iPads and felt they had sufficient ability to modify curriculum. The pedagogical choices that the teachers made to integrate the iPad into learning experiences influenced the classroom. The teachers' pedagogical support of UDL was apparent. Activities were designed with varying access points and students were allowed to gain and display their knowledge, based on their abilities and preferences. All

three teachers had similar beliefs - that their students were capable of meeting academic expectations and that learning activities must be designed to meet the unique needs of each student. Teachers' attitude and pedagogical beliefs influence how they integrate curriculum for students with LID.

Experience with Technology. Currently, little research has examined teacher appropriation of mobile touch pad tablets into pedagogical practices (e.g., Fleisher, 2012; Greaves, Hayes, Wilson, Gielniak, & Peterson, 2012). Many teachers are resistant or not sure of how to integrate technology into their everyday teaching (Greaves et al., 2012). When teachers lack the knowledge of how to use technology, their attempts to integrate it successfully are often limited (Koehler, Mishra, Kereluik, Shin, & Graham, 2014).

Teachers in this study reported a range of experience with the iPad - from novice to expert. Despite this range of experience these teachers were successful in integrating the iPad for learners with LID. Their success may be attributed to two factors: training and product design. It would be beneficial for teacher educators to consider these aspects as they design programs to support teachers in the field. Training programs on technology could be developed with professional learning communities established to support technology implementation.

Student Motivation. By providing students with access to tablet technology in the classroom, student motivation to learn and to achieve may increase (Kunzler, 2011). Students' motivation to use technology plays a large role in the technology's effectiveness. By the time students with LID reach high school, they experience over a decade of instruction focused on their

academic deficits and are aware that they cannot do the same work as their typically developing peers. Over the years, students' motivation for academic achievement can plummet (Wigfield, Ho, & Mason-Singh, 2011). In this study, students clearly enjoyed using the iPads. Because students had autonomy over how to use the iPads (such as freedom to choose tools and apps), they were motivated to use them as a learning tool. Teachers can harness students' excitement of mobile technology by designing academic activities that require the students to use the technology.

Future Research

Future research can focus on similar research questions but should include more school districts, specifically districts with different student demographics, and they should expand the age range of students to include junior high students. This added variety in setting and participants can increase the validity of the findings and may provide new insights that were not discovered through this study. This study included teachers that supported UDL when designing curriculum. Future research should examine teachers' varying pedagogical philosophies and how those philosophies inform how they design curriculum vis-à-vis technology. In addition, pre-service teacher training aspects may influence the use of technology for learners with LID; this would be an area worthy of investigation. Teacher educators can expose preservice teachers to the use of iPads to facilitate academic learning activities, which may influence technology integration during their early career. Lastly, the design of the iPad (and other mobile touch pad devices) is continuously changing. Future research must keep up with this pace and examine

whatever tool is being use at that moment.

Limitations

As with any study there are limitations to this research. First, students were observed for approximately three months of the nine-month school year. There were many other learning experiences that students had with the iPads that were not observed. Second, data collection only occurred while students accessed specialized instruction in the special education setting. This study did not consider students' iPad usage in the general education setting. Third, a reliability check was not performed; however, every effort was made to triangulate the data to increase trustworthiness. Clearly, this sample does limit the extent to which the findings can be generalized to other students in other settings but it does highlight particular areas of potential interest.

Results of this study suggest the iPad can enhance students' performance in academic learning activities and promote self-determination skills. In addition, students may enjoy using the tool during academic instruction. Use of the iPad may be a beneficial tool for educators as it provides them with the flexibility to design personalized curricula and engage students in academic lessons. Designing curricula that meets the unique needs of students with LID is integral to any instructional program. Mobile touch pad technologies can be used as a tool to differentiate curricula and it is important for educators to obtain students perspectives on the use of this or any other technological tool. The iPad is a common yet specialized tool that can play an essential role in students with LID accessing academic content and may foster self-determination skills.

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Motivation after Competitive Admission to a College Professional Program

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The purpose of this longitudinal study was to use the achievement goal theory of motivation to examine the goal orientations for learning, the associated cognitive learning strategies (CLS) used, and the plans for continued professional learning (CPL) of students who had faced a highly competitive admission process for a professional educational program. The focus on high grades for admission suggested these students would have a strong performance goal orientation, greater use of surface CLS, and few plans for CPL. The 108 occupational therapy assistant student participants responded to surveys three times during their first year of classes. These associate degree students had nearly equal use of mastery and performance goals and non-significant differences in the use of deep processing and surface CLS, findings previously associated only with students in upper level discipline classes. They also had a high number of CPL plans. A unique finding was that OTA students who showed increased mastery goal orientation also increased the use of surface CLS. Implications for further research are discussed.

The motivation of students and methods used to self-direct learning in the classroom and continue additional learning are important to most educators, whether the student is in preschool or college. Achievement goal theory (AGT) allows examination of the social-cognitive reasons or underlying motivations for students' achievement oriented behaviors in the classroom (Ames & Archer, 1988, Maehr & Midgley, 1991; Nicholls, 1984). Nicholls (1984) noted that students want "to develop or demonstrate – to self or to others – high ability, or to avoid demonstrating low ability" (p. 328). AGT theory posits that students use primarily mastery and performance goal orientations for learning, with some students adopting multiple or both goals. Mastery goals are self-referenced and aligned with learning for the sake of learning or enjoyment in the process of learning. Performance goals are other-referenced and associated with learning to achieve the recognition of someone like a teacher, to demonstrate competence through

getting a good grade or to avoid getting a bad grade.

Assessing learning goal orientations can be accomplished using a standardized evaluation such as the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000). However, the questions in the PALS are written to be most pertinent to teachers and students who interact in classes throughout the school day at the elementary level or daily at middle and high school level. Because college students attend classes less frequently and hopefully learn more independently, these students are more likely to be identified as having mastery and performance learning goals based on the cognitive strategies used for learning. Cognitive learning strategies are methods used by all students to manage their learning, mentally for understanding and recall, and for setting up an effective learning environment. Students in professional educational programs are expected to learn in the classroom and in the

future after graduation. More effective learning strategies for long-term retention and planned future professional learning are associated with mastery than performance goal orientations. The choice of goal orientation, cognitive learning strategy use, and plans for continued professional learning can be influenced by an instructor's use of mastery and performance instructional activities.

Some longitudinal studies conducted with elementary, middle and high school students have examined how consistent use of mastery and performance instructional activities facilitated alignment of students' goal orientations, while most studies with college students have been conducted at one time point or over one semester. The college subjects have been primarily convenience samples of introductory psychology students who did not face a significantly competitive admission to participate in those classes.

College students enrolled in programs such as medicine, pharmacy, and nursing have gone through competitive admission processes which emphasize grade point average for initial consideration and may benefit students with performance goal orientations. The AGT studies with these students were conducted over a single semester or encounter and incorporated instructional methods provided to large lecture classes of 100 to 400 students. Occupational therapy students also face a highly competitive admission process but are typically enrolled in smaller cohort classes of 20 to 40 students.

There are two levels of OT education, graduate level for occupational therapists and associate degree for occupational therapy assistants (OTAs). OTA students typically have about two years to complete classes, six months of supervised fieldwork, and pass a national certification exam to

enter the OT profession. It is important to the profession and clients that OT professionals continue to learn for best practice after graduation. This article describes a longitudinal study of the motivational learning goals, cognitive learning strategies, and plans for continued professional learning (CPL) of OTA students in their first semesters after a competitive admission process. A more complete review of achievement goal theory is presented to more completely explain the mastery and performance goal orientations, associated cognitive learning strategies, and instructional activities that influence students' adoptions of those goals and strategies.

Achievement Goal Theory

John Nicholls (1984), one of the first achievement goal theorists, defined achievement behavior "as behavior directed at developing or demonstrating high rather than low ability" (p. 328). Nicholls also noted that students exhibited learning behaviors and motives to reach some goal or reward, generally described as mastery and performance goal orientations. Other theorists have related these learning goal orientations to interest (Hulleman, Durik, Schweigert, & Harackiewicz, 2008), procrastination (Wolters, 2003), and cognitive learning strategies (Pintrich, 1999). The following text offers an explanation of the mastery and performance goal orientations, associated cognitive learning strategies, and the classroom instructional and feedback methods that encourage students' mastery and performance goal orientations.

Learning Goal Orientations

Briefly, people who want to learn to increase their own knowledge, enjoy the process of learning, or wish to challenge themselves in a learning task are described as having mastery goal orientations (Ames & Archer,

1988; Elliot & McGregor, 2001). Students who wish to show ability by comparison to others, through achieving good grades or by not appearing less able than others in the classroom, are described as having performance goal orientations (Barron & Harackiewicz, 2000; Elliot & McGregor, 2001). Students who use both mastery and performance goals have multiple goal orientations (Barron & Harackiewicz, 2001).

Mastery goal orientations include intrapersonal and self-referenced assessments of achievement, with successful and competent accomplishment of a learning task as an end to itself (Elliot & McGregor, 2001; Nicholls, 1984). Students with mastery goal orientations have been found to have higher levels of interest in a subject, increased perseverance, cognitive engagement, and pursuit of additional study in a discipline (Elliot & McGregor, 2001; Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997; Harackiewicz, Barron, Tauer, & Elliot, 2002; Pintrich & DeGroot, 1990). A mastery goal orientation is associated with learning for “skill development and self-improvement” (Van Yperen, 2006, p. 1433), along with effortful engagement in the classroom or task (Elliot & McGregor, 2001).

Performance goal orientations are associated with learning to show one’s ability by getting high grades in comparison to others and with demonstrating competence to avoid the appearance of inability or low ability (Ames, 1992; Nicholls, 1984). Students with performance goal orientations are focused on grades, public recognition, and comparisons with others, relying on public recognition of their accomplishments or pleasing the teacher (Meece, Blumenfeld, & Hoyle, 1988).

Webster-Wright (2009) described the educational activities that are undertaken

after graduation and certification as a professional to maintain best practice as continued professional learning (CPL). The activities may include participation in work inservices, attending professional conferences, learning from colleagues, and reading professional journals (NBCOT, 2013; Webster-Wright, 2009). Participation in such education depends on the self-awareness of current knowledge for the professional with a mastery goal orientation or on the licensure requirements set by a state’s regulatory board for the professional with a performance goal orientation. The learning goal orientations of students and professionals are also characterized by the use of deep processing and surface cognitive learning strategies.

Associated Cognitive Learning Strategies

Cognitive learning strategies are the thoughtful activities used by students to manage their cognitive, behavioral, contextual, and motivational resources for learning (Pintrich, 2004; Sitzmann & Ely, 2011; Zimmerman, 2002). They help students input knowledge about a subject, retrieve the information, and integrate the new knowledge with prior and future learning (Pintrich, McKeachie, & Lin, 1987). Pintrich, McKeachie, and Lin (1987) found that many college students had limited knowledge of these strategies and outlined a course to teach freshman students to use strategies that were most effective in the college environment. The use of deep processing and surface cognitive learning strategies are associated with mastery and performance goal orientations respectively; however, students who have a stronger mastery or performance goal orientation may use both deep processing and surface cognitive learning strategies.

Students with mastery goal orientations are reported to have a higher use of deep processing cognitive learning strategies such

as integration of new material with prior learning, critical thinking, concept mapping, and comprehension monitoring (Pintrich et al., 1987). Positive actions included interpersonal help-seeking discussions with peers and teachers to clarify understanding as well as writing about concepts in one's own words to compare with class or text notes. The use of deep processing cognitive learning strategies also encourages students to relate information learned in different classes and to better understand past experiences while planning for future use of the material.

Students with performance goal orientations tend to use more surface cognitive learning strategies such as rote memorization and asking instructors how many facts they need to memorize to pass a test (Meece et al., 1988). These students may seek help from teachers or other students by asking for quick definitions or essential points of a concept without effort to clarify personal understanding. Students who use surface cognitive learning strategies may forget the material more easily when they determine that the need for recall has passed or don't foresee future usefulness of the material. These students may choose to rely on getting by with current knowledge or plan to look up information on the internet should the need arise in the future. The goal orientations of teachers influence their use of mastery and performance instructional practices in the classroom and the subsequent goal orientations of the students.

Instructional and Feedback Methods

Achievement goal theorists have demonstrated how the instructional and evaluation practices used in the classroom have some influence on students' achievement goal adoption (Meece, Anderman, & Anderman, 2006). Research indicated that students are more likely to assume mastery goal orientations for

learning when teachers promoted classroom activities such as individual thinking assignments, small group activities, content mastery, a focus on criterion grading, and student self-improvement (Ames, 1992; Ames & Archer, 1988; Kumar & Maehr, 2007; Pintrich, Marx, & Boyle, 1993). Mastery evaluation encourages students to use self-critique, personal growth determination, and essay-style testing of knowledge. The primary focus is on intrapersonal growth as compared to interpersonal comparisons encouraged by performance practices.

In classrooms with performance instructional practices, the focus is on interpersonal comparisons for determining growth of knowledge. Teachers used normative grading and social comparison for evaluation, offered no choices to students for learning activities, and grouped students according to ability while limiting student interactions at the same time (Maehr & Midgley, 1991; Meece et al., 2006). True-false tests and providing definitions are performance evaluative methods.

While elementary teachers have more flexibility to provide a mastery goal focused environment, junior high and high school classrooms have been found to be more performance goal oriented (Maehr & Midgley, 1991). University classrooms were "predominantly performance oriented" (Harackiewicz, et al., 2002, p. 571), particularly in larger lecture format classes. Students with a mastery goal orientation and interest in an introductory college class were found to continue their choices for learning in the discipline of psychology seven semesters later (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008) and in engineering two semesters afterward (Lent et al., 2003). Given that the professional educational programs for occupational therapy have fewer large

lecture-style classes, the smaller classes were anticipated to have instructors using more mastery instructional practices to encourage students' stronger mastery goal orientations and use of deep processing cognitive learning strategies for learning, even if the students needed a high grade point average for admission which could be associated with a stronger performance goal orientation.

Method

This two-semester longitudinal study examined the influence of a competitive admission process on the achievement goal orientations, cognitive learning strategies used, and plans for continued professional learning (CPL) of students in their first year of a professional education program. Occupational therapy assistant (OTA) students were chosen as subjects because of the uniformity of educational programs at the associate degree level and highly competitive admission processes. Students must acquire knowledge from disparate courses and integrate the information for comprehensive treatment planning in the clinic and to pass the certification exam to begin practice. The coursework provides an entry level of competence, and further education is expected for professionals to provide the best treatment for their clients. The OTA students completed surveys at the beginning and end of the first semester and four weeks into the second semester. Paired-sample *t*-tests and hierarchical linear analysis using growth curve modeling were used to analyze the data.

Participants

Five OTA programs in Ohio and Pennsylvania agreed to participate, with an averaged acceptance rate for applicants of 41%. Two of the programs were housed at community colleges, and three programs were associated with universities. One indicator of the competitiveness for

admission was the OTA program director in Michigan who reported an average of 200 to 250 applicants for 35 yearly admission spots (P. Clements, personal communication, November 12, 2012).

Students are accepted in most programs only once per year and complete a prescribed sequence of classes together as a cohort. Students who drop out after beginning the program are not replaced, and a student who fails a class may be dismissed from the program or must wait another year to retake the class and resume the program. Participation was voluntary, and students who failed to return surveys after the first wave were not identified as dropouts or failed out. Of the 143 potential subjects enrolled in the OTA programs, there were 108 students who provided usable data for an averaged response rate of 64%. Of the 78 students who reported prior degree completion, they listed degrees from high school (68%), associate (5%), bachelor's (24%), and master's (3%) levels. The averaged grade point average was 3.47 as reported by 51 of the students.

Instrumentation

Students completed paper surveys that were distributed, collected, and returned by mail with the assistance of a contact person in the OTA program. To assure anonymity, students were instructed to return completed and blank surveys in sealed envelopes and to use coded identifications on the surveys. Likert-style ratings (1 = Not at all like me, to 7 = Very much like me) were used for achievement goal orientation and cognitive learning strategies (CLS) scales from the Motivated Strategies for Learning Questionnaire (Dunn, Lo, Mulvenon, & Sutcliffe, 2012; Pintrich, Smith, Garcia, & McKeachie, 1991). Forty-two of 77 items in that section of the survey were used in analyses to determine goal orientation and CLS applicable to this study. The scale for

Table 1

Average Psychometric Properties for Goal Orientations, Cognitive Learning Strategies, and Plans for Continued Professional Learning Scales across Time 1, Time 2, and Time 3 (N = 108)

Variable	α	M	SD	Range		Skew
				Potential	Actual	
Mastery Goal	.69	5.60	0.79	1.00-7.00	2.75-7.00	-0.43
Performance Goal	.70	5.56	0.95	1.00-7.00	1.00-7.00	-1.18
Deep Processing CLS	.90	4.94	0.79	1.00-7.00	2.69-6.77	-0.12
Surface CLS	.68	5.13	0.82	1.00-7.00	2.38-6.88	-0.36
Plans for CPL	.64	11.44	3.00	0-14	1-14	-1.41

Note. CLS = cognitive learning strategies, CPL = continued professional learning.

CPL plans included 14 check-off options derived from the National Board for Certification of Occupational Therapists website (NBCOT, 2013). Table 1 summarizes the psychometric properties for the scales.

Results

Achievement Goal Orientation

Students had mastery and performance goal orientations almost equally from the beginning of the OTA program and into the second semester. There was no significant difference between the means for mastery ($M = 5.48$) and performance ($M = 5.41$) goal orientations at the beginning of the students' OTA educational program, $t(68) = 0.58$, $p > .003$, $d = .08$, 95% CI [-0.18, 0.32]. Paired sample t -tests showed no significant differences in students' mastery goal and performance goal orientations from Time 1 to Time 2, from Time 2 to Time 3, and from Time 1 to Time 3.

Growth curve modeling indicated no significant difference over time for the mastery goal orientation intercept of 5.51; however, the mastery goal orientation (a) within student variance (0.27) significantly accounted for 45% of the total variance ($df(67)$, $\chi^2 = 130.45$), (b) between-student variability accounted for 48% of the total variance for the intercept, and (c) slope did not vary significantly between students and

accounted for only 7% of the total variance ($df(67)$, $\chi^2 = 72.79$). Using growth curve modeling, the performance goal orientation intercept of 5.46 also did not change significantly over time; the performance goal orientation (a) within student variance (0.37) significantly accounted for 45% of the total variance ($df(67)$, $\chi^2 = 155.90$), (b) between-student variability accounted for 89% of the total variance for the intercept, and (c) slope did not vary significantly between students and accounted for only 7% of the total variance ($df(67)$, $\chi^2 = 80.34$). The growth curve modeling results are shown in Table 2 for the changes in mastery and performance goal orientations.

Use of Cognitive Learning Strategies

Students had nearly equal use of the deep processing and surface cognitive learning strategies (CLS) from the beginning of the program into the second semester. There was no significant difference between the means for the use of deep processing ($M = 4.74$) and surface ($M = 4.88$) CLS at the beginning of the students' OTA educational program, $t(67) = -1.71$, $p > .003$, $d = .68$, 95% CI [-.037, 0.03]. With paired-sample t -tests, there were no significant differences in students' use of deep processing CLS from Time 1 to Time 2, from Time 2 to Time 3, and from Time 1 to Time 3. The same was true for the use of surface CLS except for a significant increase in the use of surface

Table 2
Changes in Mastery and Performance Goal Orientations over Time

		Within student (unconditional) model	
		Mastery	Performance
<i>Estimation of fixed effects</i>			
Average goal orientation (intercept)		5.51*	5.46*
Change in goal orientation		0.05	0.06
<i>Estimation of random effects</i>			
Level 1: Within student variance		0.27	0.37
for intercept (σ^2)			
Level 2: Between-student variance		0.29	0.72
for intercept (β_{00})		χ^2 130.45*	155.90*
Level 2: Between-student variance		0.04	0.06
for slope (β_{10})		χ^2 72.79	80.34
Deviance statistic		482.51	565.14

* $p < .001$

CLS at the specified .003 level from Time 1 ($M=4.88$, $SD=0.85$) to Time 2 ($M=5.33$, $SD=0.85$), $t(44) = -3.14$, $p = .003$, $d = -0.53$, 95% CI [-0.60, -0.13].

Growth curve modeling indicated no significant difference over time for the deep processing CLS, with the initial intercept of 5.46; however, the deep processing CLS use (a) within student variance (0.37) significantly accounted for 45% of the total variance ($df(65)$, $\chi^2 = 181.39$), (b) between-student variability accounted for 89% of the total variance for the intercept, and (c) slope did not vary significantly between students and accounted for only 7% of the total variance ($df(65)$, $\chi^2 = 75.55$). Model 1 of Table 3 shows the results of the growth curve modeling.

The use of surface CLS had an initial intercept of 4.97 did not change significantly over time; in addition, the surface CLS use (a) within student variance (0.37) significantly accounted for 31% of the total variance ($df(66)$, $\chi^2 = 184.43$), (b) between-student variability accounted for 68% of the total variance for the intercept, and (c) slope did not vary significantly between students and accounted for only 1% of the total variance ($df(66)$, $\chi^2 = 62.14$). Model 1 of

Table 4 shows the growth curve modeling results for changes in use of surface CLS.

Plans for Continued Professional Learning

Students had a fairly even number of plans for continued professional learning (CPL) from the onset of the educational program and into the second semester. Students had an average of 11.44 ($SD = 3.00$) plans for CPL across all three time periods. With growth curve modeling, the average number of plans (intercept) was 11.17, with a significant but small increase of 0.17 plans over time. The within student variance significantly accounted for 32% of the total variance ($df(68)$, $\chi^2 = 210.79$), the between-student variability accounted for 59% of the total variance for the intercept, and the slope did vary significantly between students and accounted for 9% of the total variance ($df(68)$, $\chi^2 = 103.19$). The growth curve modeling results for the number of plans for CPL are shown in Model 1 of Table 5.

Effects of Mastery and Performance Goal Orientations on the Use of CLS and Plans for CPL

Growth curve modeling was used to determine the effects of students' mastery and performance goal orientations together

Table 3

Changes in Use of Deep Processing Cognitive Learning Strategies over Time with Mastery and Performance Goal Orientations as Between-Student Predictors

	Deep Processing CLS		
	Model 1 Within student	Model 2 Mastery and Performance Predictors	Model 3 Mastery Predictor
<i>Estimation of fixed effects, β</i>			
Average use (SE) (intercept)	4.76 (0.08)**	4.75 (0.08)**	4.74 (0.08)**
<i>Between-student predictors of average use (intercept)</i>			
Mastery GO (SE)		0.54 (0.13)**	0.64 (0.09)**
Performance GO (SE)		0.01 (0.09)	
Change in use	0.15 (0.04)**	0.14 (0.04)*	0.14 (0.04)**
<i>Estimation of random effects, π</i>			
Level 1: Within student variance (σ^2)	0.21	0.21	0.21
Level 2: Between-student variance for intercept (β_{00})	0.39	0.26	0.26
	χ^2 (df) 181.39**(65)	151.77**(63)	153.90**(64)
Level 2: Between-student variance for slope (β_{10})	0.02	0.02	0.02
	χ^2 (df) 75.55 (65)	75.10 (63)	76.17 (65)
Deviance statistic	451.96	410.09	399.00

Note. CLS = Cognitive learning strategies, GO = Goal orientation.

* $p < .01$. ** $p \leq .001$.

Table 4

Changes in Use of Surface Cognitive Learning Strategies over Time with Mastery and Performance Goal Orientations as Between-Student Predictors

	Surface CLS		
	Model 1 Within student	Model 2 Mastery and Performance Predictors	Model 3 Mastery Predictor
<i>Estimation of fixed effects, β</i>			
Average use (SE) (intercept)	4.97 (0.09)*	4.96 (0.09)*	4.95 (0.09)*
<i>Between-student predictors of average use (intercept)</i>			
Mastery GO (SE)		0.43 (0.12)*	0.48 (0.09)*
Performance GO (SE)		0.10 (0.12)	
Change in use	0.16 (0.04)*	0.16 (0.04)*	0.16 (0.04)*
<i>Estimation of random effects, π</i>			
Level 1: Within student variance (σ^2)	0.25	0.26	0.26
Level 2: Between-student variance for intercept (β_{00})	0.56	0.31	0.32
	χ^2 (df) 184.43*(66)	350.56*(105)	373.19*(106)
Level 2: Between-student variance for slope (β_{10})	0.01		
	χ^2 (df) 62.14 (66)		
Deviance statistic	473.38	454.57	450.95

Note. CLS = Cognitive learning strategies, GO = Goal orientation.

* $p \leq .001$.

on the students' use of CLS and plans for CPL. When one goal orientation was determined to be not a significant predictor for CLS use and plans for CPL, it was removed from the equation, and the significant goal orientation predictor was used alone.

Mastery and performance goal orientations together significantly accounted for 33% of the total variance for the use of deep cognitive learning strategies. The mastery goal orientation was the only significant predictor for the intercept. Mastery goal orientation, with the performance goal excluded, explained a significant 33% of the variability for the use of deep processing cognitive learning strategies. Models 2 and 3 of Table 3 show these growth curve modeling results for the relationships of mastery and performance goal orientations on the use of deep processing CLS.

Mastery and performance goal orientations together significantly accounted for 45% of the total variance for the use of surface cognitive learning strategies. The mastery goal orientation again was the only significant predictor for the intercept. Mastery goal orientation, with the performance goal excluded, explained a significant 43% of the variability for the use of surface cognitive learning strategies. The growth curve modeling results for the relationships of mastery and performance goal orientations on the use of surface CLS are shown in Models 2 and 3 of Table 4.

Mastery and performance goal orientations together significantly accounted for 40% of the total variance for the number of CPL plans. The mastery goal orientation was the only significant predictor in this model for the number of CPL plans. Mastery goal orientation, with the performance goal

Table 5
Changes in Number of Plans for Continued Professional Learning (CPL) Over Time with Mastery and Performance Goal Orientations as Between-Student Predictors

	Plans for CPL		
	Model 1 Within student	Model 2 Mastery and Performance Predictors	Model 3 Mastery Predictor
<i>Estimation of fixed effects, β</i>			
Average CPL plan numbers (<i>SE</i>)	11.17 (0.36)**	11.14 (0.36)**	11.15 (0.35)**
<i>Between-student predictors of average use (intercept)</i>			
Mastery GO (<i>SE</i>)		0.10 (0.37)*	0.94 (0.38)*
Performance GO (<i>SE</i>)		-0.03 (0.25)	
Change in number of plans	0.17 (0.20)*	0.18 (0.20)	0.18 (0.20)
<i>Estimation of random effects, π</i>			
Level 1: Within student variance (σ^2)	3.70	4.84	4.84
Level 2: Between-student variance for intercept (β_{00})	χ^2 (df) 6.83 210.79**(68)	4.12 281.37**(105)	4.06 281.06**(106)
Level 2: Between-student variance for slope (β_{10})	χ^2 (df) 1.07 103.19*(68)		
Deviance statistic	1071.85	1068.50	1069.75

Note. GO = Goal orientation.

* $p < .05$. ** $p \leq .001$.

excluded, explained a significant 41% of the variability for the number of CPL plans. Models 2 and 3 of Table 5 show the growth curve modeling results for the relationships of mastery and performance goal orientations on the number of CPL plans.

Discussion

This longitudinal study of mastery and performance goals for learning, cognitive learning strategy use, and plans for continued professional learning included a population of college professional program students who had completed a highly competitive admission process that emphasized high grade point average. At the same time, a stated standard of the educational program was to develop professionals who would be lifelong learners. The competitive admission and high GPA emphasis were anticipated to attract students with strong performance goal orientations who would use more surface cognitive learning strategies and have few plans for continued professional learning. The professional education's accreditation premise to develop lifelong learners suggested that instructional activities should increase students' mastery goal orientations, use of deep processing cognitive learning strategies, and number of plans for continued professional learning.

The results showed that students entered the occupational therapy assistant (OTA) educational program with nearly equal mastery and performance goal orientations, and those multiple goals continued throughout the first year in the OTA program. College students with multiple goals were found in advanced seminar classes in psychology by Barron and Harackiewicz (2001), but the students in this study had a variety of prior educational achievement and were in introductory classes in the discipline. The multiple goals of the OTA students may have been helpful

in achieving the grades necessary for admission and at the same time contributed to an interest in learning new information to benefit future employment and skilled practice. In addition, most professional programs have a requirement for students to not fall below a certain GPA for continued participation in classes and permission to take the certification exam after program completion, which benefits the student with a performance goal orientation. At the same time, students are expected to build upon learning throughout the program and to integrate all classroom instruction for best practice as a professional, which benefits the student with a mastery goal orientation. The multiple goal orientation may be present in and beneficial to other professional program students, and further investigation is warranted especially at the graduate program level. As more students with learning differences enter higher education, future studies may reveal differences in their goal adoption and guide instructors to meet their needs.

The students also had nearly equal use of deep processing and surface cognitive learning strategies at the beginning and throughout the first year of classes. These strategies may help the OTA student in memorization of factual information, such as muscle and nerve facts, while integrating the functional use of those muscles and nerves in treatment activities for a person with a physical injury. The slight increase in the use of surface cognitive learning strategies reported at the end of the first semester may be an indicator of the stressful learning load in the OTA program or might be due to the completion of the second survey just prior to exam week. A unique finding in this study was that students who increased in the mastery goal orientation also increased in the use of surface cognitive learning strategies. An investigation of the changes in the use of cognitive learning strategies

throughout the professional program may provide support for the educational standard for the development of lifelong learners who make an effort to pursue and integrate new information into the prior learning for the benefit of the profession and its clients.

The students had fairly even numbers of plans for continued professional learning (CPL) from the onset of the OTA program and throughout the first year. This finding indicates that students were perhaps introduced to the concept of CPL during observation of professionals prior to application, a typical admission requirement, or had investigated the profession fairly well. The number of plans for CPL did not significantly waver throughout the first year, which may indicate that the instructors emphasize the need for CPL after graduation; there were no queries to instructors about CPL information provided in the classes. Of note, the state licensure boards in Ohio and Pennsylvania differ in the requirements for documented CPL after licensure. Ohio requires 20 hours of CPL biannually for OTA professionals, and Pennsylvania requires no CPL for OTA professionals after initial licensure. Students in the two states did not differ in their plans for CPL even though most students planned to work in the same state as the college after graduation. Other professional program students may be similar, but there is no research about this topic to date.

Conclusion

This study provided an initial examination of the learning goal orientations, use of cognitive learning strategies, and continued professional learning plans of college students in a professional educational program after completion of a competitive admission process. The OTA students had multiple goal orientations, used both deep processing and surface cognitive learning strategies, and had many plans for CPL at admission and throughout the first year. These findings contradicted the expectation that the competitive admission process with its emphasis on high grade point average would contribute to a higher use of a performance goal orientation and surface cognitive learning strategies. While these findings are limited to the OTA student in the first year of education, further investigation is warranted with other professional students in graduate and undergraduate programs after a competitive admission process. Additionally, an investigation of changes in goal orientations and use of cognitive learning strategies for students throughout their professional program, in completion of any certification exam, and through the first five years of practice may contribute to the selection of students who will successfully complete the educational program and competently enter their chosen professions.

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The SETT Framework: SETTING the Classroom for Communication Success

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Augmentative and alternative communication strategies are vital in supporting the communicative development of students. To increase opportunities for the use of AAC, special education teachers should consider using the SETT framework to evaluate and arrange their classroom to enhance student learning, opportunities, and outcomes. The goal of this framework is for special education teachers to consider the student's needs (S), the environment where the technology is needed (E), the task(s) to be completed (T), and the tools needed for student success within the opportunities given. This paper describes the components of this framework and outlines key considerations for implementation to enhance communication success within the classroom.

Students with significant disabilities often have accompanying complex communication needs (CCN). In this article, CCN is defined as an impairment of speech or language that cannot meet the demands of the individual in physical, social, or academic environments (King & Fahsl, 2012; Light & Drager, 2007). Some students with CCN may not develop speech and language skills similar to their typically developing peers due to deficits in the areas of cognition, motor, and language (Light & Drager, 2007). To increase these students' abilities to communicate and overcome barriers related to communication across environments and communication partners these individuals may benefit from interventions that include assistive technology (AT) or augmentative and alternative communication (AAC; Dietz, Quach, Lund, & McKelvey, 2012). AT can be defined as a device that maintains or improves the functional capability of an

individual within his or her environment (Marino, Marino, & Shaw, 2006) whereas, AAC "attempts to study and when necessary compensate for temporary or permanent impairments, activity limitations, and participation restrictions of individuals with severe disorders of speech-language production and/or comprehension, including spoken and written modes of communication" (ASHA, 2005, Position Statement section, para 1). Often times, this compensation of written or spoken communication are accomplished with the use of AT systems.

According to the Individuals with Disabilities Education Act (IDEA, 2014) Individual Education Program (IEP) teams must consider the use of AT and AAC for students with disabilities. The purpose for using AT or AAC should be to take into account the student's strengths, needs, their environment, and task demands in order to

promote the student's communicative competence (Beukelman & Mirenda, 2013). Communicative competence is defined as:

...relative and dynamic, interpersonal construct based on functionality of communication, adequacy of communication, and sufficiency of knowledge, judgment, and skill in four interrelated areas: linguistic competence, operational competence, social competence, and strategic competence. Linguistic and operational competencies refer to knowledge and skills in the use of the tools of communication; social and strategic competencies reflect functional knowledge and judgment in interaction (Light, 1989, p. 137).

Communication competence emphasizes the need to acknowledge multiple levels of supports necessary for successful communicative interactions. An underlining goal is for students with CCN to have the knowledge and skills to decrease potential communicative barriers that they may experience during a communicative interaction. Beukelman and Mirenda (2013) described *opportunity barriers* that students' with CCN encounter in their communicative settings. These barriers are factors that influence how the special education teacher or the communicative partner implement or acknowledge the need of AAC strategies and supports within the communicative setting (Beukelman & Mirenda, 2013). Specifically, they identified five opportunity barriers that often impact the communicative interactions of these students: (1) *Policy barriers* occur as a result of legislative or school-based decisions that hinder students' access to communication in the classroom; (2) *Attitude barriers* emerge when a special education teacher perceptions about individuals who use AAC impacts the communication opportunities given to those particular students; (3) *Practice barriers*

arise when the special education teacher does not engage in best practices in the classroom; (4) *Knowledge barriers* occur when the opportunity to complete a task is hindered by a special education teacher's lack of information about appropriate content or supports; and (5) *Skill barriers* emerge when a special education teacher with initial knowledge of an AAC device continues to struggle with the implementation of the device within the classroom environment (Beukelman & Mirenda, 2013). Unfortunately, when the opportunity barriers are not addressed, it may potentially impede the development of students' communicative competence (Beukelman & Mirenda, 2013; McNaughton et al., 2008). Additionally, *access barriers* refer to individual limitations due their specific skill level, that is, impairment related to physical or motor (e.g., grasp, reach, point), cognitive functioning (e.g., difficulty with abstract concepts), visual abilities (e.g., color-blindness, cortical blindness), auditory (e.g., hearing impairment, auditory process difficulties), among others. These access barriers may have an impact on the student's communicative interaction, participation, and independence (Beukelman & Mirenda, 2013). To assist special education teachers and other practitioners in fostering students' communication skills and interactions, this article introduces the four aspects of the SETT framework. The goal is to outline key elements of the four components and provide a case scenario throughout each *implementation* section that illustrates a practical approach to using the SETT framework.

SETT Model Framework

“It is important to keep in mind that, no matter how great the needs, everyone has abilities which can be built upon and enhanced - and not necessarily replaced”

(Zabala, 2005, p. 2). The SETT framework, that is, the *student*, the *environment*, the *task*, and the *tools* is a collaborative decision-making model, which can assist IEP teams in the initial selection and reevaluation of AAC systems and strategies for a student with CCN. One of the goals of the SETT framework is to keep the main focus on the *student*, that is, student’s preferences, abilities, and needs to determine current levels of communicative competence (Wissick & Gardner, 2008). In other words, the SETT framework places the student, not the device, at the center of the AAC decision-making process (Newton & Dell, 2011), with additional consideration on the *environment* and *task*, and ultimately, the *tool* the student will be using to actively participate in any setting (see Table 1).

Student

The first consideration of the SETT framework is the *student* (Zabala, 2005). In this process, data is collected about the

student’s current level of functioning. This level of functioning also includes identifying any communication barriers that may be contributing to the student’s communicative competence (Light & McNaughton, 2013; Sigafoos, 1999). A student’s communication competence is based on the “quality or state of being functionally adequate in daily communication, or of having sufficient knowledge, judgment, and skill to communicate” (Light, 1989, p. 138). As part of evaluating a student’s communicative competence, focus should be on identifying the student’s operational, social, strategic, and linguistic competences (Light, 1989; Light & McNaughton, 2013).

Data collection should focus on obtaining a well-rounded assessment profile for the student. This will provide the special education teacher and the IEP team with a holistic understanding of the student’s abilities, behaviors, characteristics, and preferences. Evaluating the student’s

Table 1
Teacher Actions on Components of the SETT Framework

SETT Framework Components	Teacher Actions
Student	Assess expressive and receptive skills (informal and formal assessment) Observation of student during classroom activities Identify barriers (access and opportunity barriers) Conduct preference assessment Assess frequency of interactions between peers and/or adults across environments
Environment	Complete ecological inventory Evaluate environment (influence of lighting, time, seating, movement, space, and sound) Consider potential environmental arrangements
Task(s)	Identify representation of information available to other students participating in task Strategically plan for communication opportunities to occur within the existing routines and classroom activities
Tool(s)	Determine system/device to be used (low vs. high technology) Determine type, size, and number of symbols Determine trial period Collect data on each trial

strengths and areas of needs is an essential component of the SETT framework. This supports the identification of an appropriate AAC system and the development of a suitable instructional program (Zabala, 2005).

Both commercial and informal assessments may be helpful in assessing communicative abilities such as vocalizations, gestures, or symbol recognition (Beukelman & Mirenda, 2013; Boesch & Da Fonte, 2014; Dietz et al., 2012). Having knowledge of the student's expressive and receptive communication abilities will allow special education teachers to better understand the student's linguistic competence and cognitive development (Light, 1989). Informal interviews with the student's primary caregivers may highlight other areas of consideration including any medical needs, challenging behaviors, or motor capabilities. Special education teachers should also use direct preference assessments to identify the student's preferred items or activities (Roche et al., 2014; Sigafoos, 1999). This also, could support the identification of initial highly motivating and familiar vocabulary (Rowland & Schweigert, 2000). In general, the assessment findings should focus on the student in order to develop a plan focused on decreasing any communicative barriers being encountered by the student (Wissick & Gardner, 2008).

Implementation. Jamie is a new student recently added to Ms. Grubb's caseload. Jamie is an 11-year-old female with cerebral palsy, co-existing intellectual disability, and complex communication needs (CCN), which is more significant to unfamiliar communication partners as her communication attempts are very difficult to understand. Given her current level of functioning and to maximize the amount of

special education services she receives, the IEP team, which consists of Ms. Grubb as the case manager, Jamie's grandmother (Mrs. Caylor), the school's speech-language pathologist (SLP), occupational therapist (OT), and physical therapist (PT) concluded that Jamie's primary placement is in a self-contained classroom with a low teacher to student ratio. However, it was also concluded Jamie would attend regular education classes with her typically developing peers for Social Studies, Music, and Art. After reviewing documents pertaining to Jamie's demographic, medical, and educational background, Ms. Grubb collaborates with several IEP team members to implement the SETT framework and evaluate several critical skills necessary in further refining Jamie's educational program.

Ms. Grubb begins the process by working with the SLP to obtain additional information about Jamie's overall communication skills through a commercially available communication assessment tool. The OT and PT also conducted some observations in the classroom to help determine motoric and physical barriers presented in all settings. Lastly, to identify highly motivating items and activities for Jamie, Ms. Grubb also partnered with Jamie's grandmother and to complete a preference assessment. Results obtained through observations and assessments suggested that Jamie enjoys participating in activities with her peers, but can become easily fatigued in activities longer than 20 minutes. Jamie is able to extend both arms fully as well as grasp, lift, and pass objects. Jamie uses 'some some functional speech' (i.e., reliable yes and no, word approximations with emphasis on initial vowel sound mostly after adult model), but it is challenging to understand by unfamiliar communication partners.

Jamie can also receptively identify items (approximately 50-55 words). Beyond these assessments, Ms. Grubb and the SLP also identified the current communicative barriers being presented to Jamie using the *Activity Participation Inventory* (API; Beukelman & Mirenda, 2013), during the math intervention block (See Figure 1 for an example). Jamie was observed while participating in tasks that involved identifying time on an analog clock. Results suggest that opportunity barriers specifically toward ‘teacher skill’ (i.e., Ms. Grubb does not yet have a comprehensive understanding of Jamie’s needs to independently navigate a task). Additionally, they also identified some access barriers that include visual (i.e., using a small clock), fine motor (i.e., pinching, writing), linguistic (i.e., inability in verbally stating the time), and strategic impairments (i.e., inability in asking for help or clarification when solving for time). Lastly, Ms. Grubb conducted a reinforcer assessment which indicated Jamie is highly motivated by stickers (75%), riding the adapted bike (50%), and playing with her friends (50%) with less preference given to music (25%) and pretzels (0%; see Figure 1 for a completed example of the reinforcer identification process).

Environment

The next consideration of the SETT framework is the student’s *environment* (Zabala, 2005). In this step, the special education teacher and IEP team analyze the general environment and potential environmental barriers to determine which *environmental arrangements* need to be made to increase communication opportunities for the student with CCN. When exploring the environment, consideration should be given to areas in which the AAC system is expected to be used (Zabala, 2005). A carefully designed

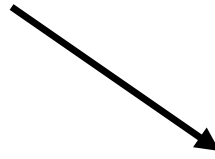
environment can increase the availability and use of AT and AAC systems needed to promote a student’s functional independence. This evaluation and environment arrangement process will help the special education teacher and IEP team make appropriate accommodations and arrangements important in promoting skill development, independence, participation, and communication success (Laraway, Snyckerski, Olson, Becker, & Poling 2014; Michael, 1982). With strategic planning on the part of the IEP team, students with CCN can learn to communicate successfully when given opportunities in various situations and settings (Hancock & Kaiser, 2002; Lloyd, Fuller, & Arvidson, 1997). In essence, the environment should be engineered to promote student independence and communication success.

For students who have limited motor capabilities, they may encounter barriers that limit the way they learn and socially interact with others (Iverson & Wozniak, 2007). As a result, special education teachers and IEP teams may need to use ecological inventories (Brown, Lehr, & Snell, 2011). Ecological inventories are useful in identifying how a student interacts within various environments and routines (e.g., morning circle, related-arts, recess, and lunch). Ecological inventories may also highlight discrepancies between the student’s active participation and any potential access barriers within the environment (Brown, Lehr, & Snell, 2011). Special education teachers in collaboration with the IEP team will need to assess other components such as the physical space, safety, temperature, lighting, glares, and noise that may impact any communication attempts by the student (Bonnett, 2015; Lloyd et al., 1997).

Figure 1. Step 1-Student

ACTIVITY PARTICIPATION INVENTORY													
Student: <u>Jamie</u>		Observation Site: <u>Self-Contained Classroom</u>			Completed by: <u>Ms. Grubb</u>						Date and Time: <u>3/7/16 1:20</u>		
Activity/Task	Levels of Participation				Discrepancy	Opportunity Barriers				Access Barriers			
	Independent	Independent w/ set-up	Verbal prompts	Model		Policy	Attitude	Behavior	Knowledge	Skills	Motor	Sensory	Communication
This Talking Time should stick to the half hour													
Number of steps: <u>Sixty</u>													
New task: <input checked="" type="checkbox"/> Routine task: <input type="checkbox"/>													
1 Visually track analog clock				X									
2 Find and look at hour hand (read)				X									
3 Determine which of the hour hand is closer			X		X								X
4 Write hour in frame on dotted line		X							X	X			
5 Find and look at minute hand (read)				X							X		
6 Count by fives from "12" to determine minutes		X			X								X
7 Write minutes in frame on dotted line			X						X	X			
8 Verbally state time											X		

Adapted from: Beukelman & Mirenda (2013). *Augmentative and alternative communication: Supporting children and adults with complex communication needs* (4th ed.). Baltimore, MA, Paul H. Brookes. Blacksten, Alder, S. (2003). *Training school teams to use the Participation Model: Evaluation of a training-trainer model* (Unpublished master's thesis). Ontario Institute for the Study of Education, University of Toronto.



Name: Jamie Completed by: Ms. Grubb Date: 3/9/16

Instructions: Complete the Preference Inventory Checklist by selecting and rating items in which the student demonstrates interest. Items should be rated as follows: 1=Does not demonstrate interest; 2=Slightly motivated/interested; and 3=Highly motivated/interested. It is highly suggested that at least three items from each category be identified for further evaluation. The notes section should be used to provide specific information on the item/activity being selected (e.g., brand, type, name). Additionally, when possible it is highly recommended that multiple people complete the Preference Inventory Checklist in order to gather information on preferences across setting and individuals.

Activity	1	2	3	Edibles	1	2	3	Sensory	1	2	3	Social	1	2	3	Tangible	1	2	3
Books	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Chocolate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Jumping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Adult attention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Blanket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cookies	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Music	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Alone time	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Coins/token	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Crackers	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Shaving cream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	High 5s	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fidget	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Movie	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Drink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Swing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Peer attention	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Stamps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Play game	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Gummies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Therapeutic toy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Praise	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Stickers	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Walk	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Pretzels	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Water play	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Smile	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Stuffed animal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: <u>riding bike</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Note: Jamie loves pretzels, music, stickers, spending time with her peers, and riding her adaptive bike!

From: Da Fonte, M. A., Boesch, M. C., Edwards-Bowyer, M. E., Restrepo, M. W., Bennett, B. P., & Diamond, G. P. (2016). A 3-step reinforcer identification framework: A step-by-step process. *Education and Treatment of Children, 39*(3), 389-409.



Name: Jamie Completed by: Ms. Grubb Date: 3/9/16

Instructions: Complete the Choice-Based Preference Assessment Form (CBPA) by writing items that were identified as highly motivating on the preference inventory checklist under the preference column. The number associated with these items must remain consistent during the assessment. While conducting the assessment, items must be presented to the student as indicated on the table from right to left, under the choices column. Student selection will be recorded by circling/markings the item selected under the response column. If the student does not make a selection, NS (no selection) must be indicated. Results of assessment will be calculated for each item using the following formula: (number of times item was selected / total number of trials) * 100 = %. After calculating the percentages, items will be ranked in order from the most preferred to the least preferred item. Additional relevant information may be reported under the heading anecdotal data.

Preferences	Trials	Choice-Based Assessment				Anecdotal Data
		Choices (Right-Left)	Response			
1. Riding Adaptive Bike	1	1 and 3	(1)	3	NS	It is interesting that Jamie did not choose an item during trial 10. Because neither peer attention nor riding the adaptive bike were highly preferred items.
	2	5 and 2	(5)	2	NS	
2. Music	3	3 and 4	3	(4)	NS	
	4	5 and 1	(5)	1	NS	
4. Peer Attention	5	2 and 3	(2)	3	NS	
	6	1 and 2	(1)	2	NS	
5. Stickers	7	4 and 5	4	5	NS	
	8	2 and 4	2	(4)	NS	
	9	3 and 5	3	(5)	NS	
	10	4 and 1	4	1	(NS)	

Results:

Percentages	Rank Order
1 = 50%	1 st Stickers (75%)
2 = 25%	2 nd Peer attention (50%)
3 = 0%	3 rd Riding bike (50%)
4 = 50%	4 th Music (25%)
5 = 75%	4 th Pretzels (0%)

Note: Jamie could have also become tired by the time trial 10 occurred.

From: Da Fonte, M. A., Boesch, M. C., Edwards-Bowyer, M. E., Restrepo, M. W., Bennett, B. P., & Diamond, G. P. (2016). A 3-step reinforcer identification framework: A step-by-step process. *Education and Treatment of Children, 39*(3), 389-409.



Name: Jamie Completed by: Ms. Grubb Date: 3/9/16

Instructions: Complete the Reinforcer Assessment Form by indicating what activity or task the student will be performing while evaluating the preferences. Under the preference column write the items that were identified as highly preferred on the Preference Assessment. While conducting the assessment, items must be presented to the student immediately after the completion of the identified task or task steps. Student responses will be recorded by marking 'Y' for yes the student completed or performed the task or 'N' for no the student did not complete or performed the task after the preferred item was offered under the Response heading. A total of five (5) trials must be collected on student's response for each pre-identified preference (a total of three) when presented or requested to complete the identified task. Additional relevant information may be reported under the heading anecdotal data.

Preference	Trials	Response		Anecdotal Data
		Y	N	
1. Stickers	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Jamie really enjoyed collecting the stickers she earned!! The stickers were also really quick and easy to give.
	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2. Riding Adaptive Bike	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Jamie was motivated to ride her bike first thing in the morning. However, she lost motivation to ride her bike after the class went out for recess.
	2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3. Interacting with Peers	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Jamie was not motivated to interact with her peers during trials 1, 2, 3 and 4, which occurred directly after recess and lunch. Jamie was motivated to interact with her peers while in her reading small group which occurred during trial 5.
	2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

From: Da Fonte, M. A., Boesch, M. C., Edwards-Bowyer, M. E., Restrepo, M. W., Bennett, B. P., & Diamond, G. P. (2016). A 3-step reinforcer identification framework: A step-by-step process. *Education and Treatment of Children, 39*(3), 389-409.

Implementation. Ms. Grubb, with the assistance of the SLP and occupational therapist (OT) conduct an ecological inventory of the self-contained classroom, cafeteria, and art room to identify any potential access barriers (i.e., mobility barriers, cognitive barriers, visual barriers, literacy barriers), and target priority skills for instruction (see Figure 2 for an example of the completed ecological inventory form). In the classroom setting, Ms. Grubb observes Jamie participating in arrival procedures, morning work activities, and math centers. They note that Jamie's peers are able to lift, grasp, and carry necessary materials (e.g., manipulatives, books), and engage in verbal conversations with peers during small group activities. From here, Jamie transitions to lunch with her classmates, and then joins them in related arts. Across these settings, the team observes that Jamie is required to achieve similar demands (i.e., walk between locations, manage materials independently, initiate and respond to communication partners). They speculate that possible access barriers may arise as a result of physical limitations (i.e., inability to complete fine motor skill task), cognitive impairments (e.g., encoding written language), and literacy impairments (e.g., inability to read directions). Ms. Grubb suggests that independent transitions between activities, requests for help and requests for materials during class activities and lunch-time are priority skills that should be targeted for instruction. They also determine that it is critical to identify strategies to enhance Jamie's peer-to-peer interactions, increase vocabulary skills, and repair communication breakdowns.

Task

The third component of the SETT framework considers the student's *task(s)* (Zabala, 2005). Tasks are the activities taking place within the student's current

routine that enable him or her to be an active participant during instruction, play, or social experiences (Zabala, 2005). The goal is for the student to experience maximum participation in the classroom (Bonnet, 2015). At times, the student with a CCN may find it challenging to actively participate in classroom-related tasks and activities due to physical limitations (Machalicek et al., 2010; Smith & Ryndak, 1996), limited peer interactions (King & Fahsl, 2012), or the complexity of a task (Zabala, 2005). It is not uncommon for students with CCN to receive fewer opportunities to actively participate in classroom activities while students with greater communication skills may naturally receive more opportunities (Sigafoos, 1999). Hence, it is important for the student to have an appropriate AAC system to maximize successful engagement in various tasks and activities. Furthermore, the IEP team should examine the critical elements within each task to increase student participation by modifying or adapting content or instruction when necessary (Watts, O'Brian, & Wojcik, 2004). To do so, the special education teacher will need to gather data on the critical elements of the activities before a potential AAC system is selected (Beukelman & Mirenda, 2013).

Adaptations to existing activities can promote participation for the student with CCN through modified content delivery (Hudson, Browder, & Wakeman, 2013) and active engagement strategies that promote communicative interactions (King & Fahsl, 2012; Sigafoos, 1999). These adaptations should focus on differentiation (e.g., language, presentation, speed, location) based on individualized needs (Bonnett, 2015; Merbler, Hadaduan, & Ulman, 1999). Through appropriate accommodations and modifications of activities, a student with CCN may be able to actively participate

alongside classroom peers (Bonnett, 2015).

Increased communication competencies and repertoires are possible for a student as a result of purposeful instructional opportunities within daily tasks and routines (Hester, Kaiser, Alpert, & Whiteman, 1995; Sigafoos, 1999; Yoder & Warren, 2002). Research shows five instructional strategies successful in increasing task engagement and communicative interactions. The instructional strategies include: (1) missing item format (Choi, O'Reilly, Sigafoos, & Lancioni, 2010; Sigafoos, 1999);

Kraayakamp, & Visser, 1994; Zayac & Johnston, 2008); (4) delayed assistance (Choi, O'Reilly, Sigafoos, & Lancioni, 2010; Sigafoos, 1999); and (5) wrong item format (Sigafoos & Roberts-Pennell, 1999). These strategies support the natural environment, routines, and activities while also promoting communicative opportunities (Sigafoos, 1999).

Implementation. Ms. Grub decides to contrive communication opportunities by making accommodations for Jamie to make a sandwich (see Figure 3 for an example of a

Figure 2. Step 2 – Ecological Inventory

ECOLOGICAL INVENTORY				
Student: <u>Jamie</u>		Observation Site: <u>Self-Contained Classroom</u>		
Completed by: <u>Ms. Grubb</u>		Date and Time: <u>3/7/16 9:30</u>		
DOMAIN	ENVIRONMENT	SUB-ENVIRONMENT	ACTIVITIES	SKILLS
	CURRENT	<u>Reading center</u>	<u>Story book reading</u>	<u>Vocabulary</u>
		<u>Kitchen area</u>	<u>Meal prep</u>	<u>Ask for help</u>
	<u>Classroom</u>	<u>Art Table</u>	<u>Painting</u>	<u>Requesting for more</u>
<u>Daily Living Skills/Communication</u>				
	FUTURE	<u>Grocery store</u>	<u>Buying groceries</u>	<u>Ask for directions</u>
		<u>Shopping mall</u>	<u>Buying clothes</u>	<u>Requesting size</u>
	<u>Community</u>	<u>Rec center</u>	<u>Working out</u>	<u>Ask for help</u>

task completion form). To increase Jamie’s opportunities to request or respond during the activity, Ms. Grubb’s uses the *missing item* instructional strategy, which entails withholding one or more items required to engage in a highly preferred activity. This instructional strategy creates a natural requesting opportunity for the student. When making the sandwich, Jamie may initially be provided with all of the ingredients necessary to prepare her meal (e.g., bread, peanut butter, and jelly), but no knife. Given the need for the knife, Jamie has an opportunity to request the knife so she can make a sandwich. Ms. Grubb also uses a *blocked response* strategy to increase Jamie’s initiation and communicative

attempts by placing the knife out of Jamie’s reach. This strategy creates another requesting opportunity. Additional opportunities to solicit help are created by using a *delayed assistance* approach. This is accomplished by tightening the lid of the peanut butter jar and then delaying assistance until Jamie requests help. Additionally, presenting the student with the *wrong item* may create a natural need for the student to reject the undesired item (e.g., a fork is given when she requests a knife). These strategies enhance communication opportunities within natural activities and increase the frequency of communicative interactions.

Figure 3. *Step-3 Task*

TASK ANALYSIS

Student: Jamie

Observation Site: Self-Contained Classroom

Activity/Task: Making a Sandwich

Completed by: Mx. Grubb

Date and Time: 3/8/16 8:30

STEPS	LEVELS OF PARTICIPATION						
	Independent	Independent w/ set-up	Verbal prompt	Model	Gestural prompt	Physical assistance	Does not participate
1 Gather ingredients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 Separate bread slices	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 Open peanut-butter jar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4 Grab knife	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 Spread peanut butter on slice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6 Close peanut butter jar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7 Open jelly jar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8 Grab knife	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 Spread jelly on slice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10 Close jelly jar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
11 Place one slice on top of the other	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
INSTRUCTIONAL FACTORS							
Grouping							
<input type="checkbox"/> Large group <input checked="" type="checkbox"/> Small group <input type="checkbox"/> Independent work <input type="checkbox"/> Centers <input type="checkbox"/> One-on-one <input type="checkbox"/> Other: _____							
Access							
<input type="checkbox"/> Original format <input type="checkbox"/> Accommodations <input type="checkbox"/> Modifications <input checked="" type="checkbox"/> Adaptations							
<input type="checkbox"/> Presentation <input type="checkbox"/> Level <input type="checkbox"/> Materials							
<input type="checkbox"/> Format <input type="checkbox"/> Content <input type="checkbox"/> Device/system							
<input type="checkbox"/> Timing <input type="checkbox"/> Performance criteria <input checked="" type="checkbox"/> Set-up							
<input type="checkbox"/> Other _____ <input type="checkbox"/> Other _____ <input type="checkbox"/> Other _____							
Environment							
<input checked="" type="checkbox"/> Lighting <input checked="" type="checkbox"/> Acoustic <input checked="" type="checkbox"/> Time of the day <input type="checkbox"/> Positioning <input checked="" type="checkbox"/> Scent							
Other Considerations							
<i>Jamie can independently grab the knife.</i> <i>Consider using a missing item format to encourage Jamie to ask for the knife.</i>							

Adapted from Giangreco, M. F., Cloninger, C. J., & Iverson, V. S. (2011). *Choosing outcomes and accommodations for children* (3rd ed.). Baltimore, MA, Paul H. Brookes.

Tools

The final portion of the SETT framework addresses the selection of *tool(s)* (Zabala, 2005). Tools include systems, devices, services, and strategies that help the student succeed (Zabala, 2005). This is unfortunately where most IEP teams begin their planning rather than focusing on the student first (Bonnet, 2105). IEP team members should maintain a student-centered mindset when brainstorming system features that will benefit the student (Bonnett, 2015). It is important to recognize that “there has never been one piece of AT that meets the needs of all students with disabilities” (Newton & Dell, 2001, p. 48). Taking this into account, the system should augment the student’s current functional and communicative capabilities (Merbler et al., 1999). When low-technology and high-technology options are available, it is recommended to initially default to the least restrictive method (Kroth & Edge, 2007; Merbler et al., 1999). Once the system is selected, the IEP team should determine if any training is required for the student to use the device. It is important to note that a lack of adult training can be a barrier in the effective use of an AAC device (Newton & Dell, 2011).

“The words with which people communicate are greatly influenced by different communication contexts and modalities” (Beukelman & Mirenda, 2013, p. 24). With this in mind, IEP teams can determine the appropriate representation of language (e.g., objects, line drawings, text) as well as, the vocabulary needed for the activities and communicative interactions (Smith & Ryndak, 1996). Vocabulary can be individualized or standardized (Trief, Cascella, & Bruce, 2013). Vocabulary selection will become a vital piece in the tool selection, as this will support the student’s interaction.

Implementation. In collaboration with Jamie’s grandmother and other IEP team members, Ms. Grub assessed Jamie’s environments and daily tasks. Based on this information, a low-tech 20-cell speech-generating device (SGD) was selected to further develop Jamie’s communication skills. Vocabulary words were identified that included Jamie’s highly preferred activities and materials (e.g., stickers), general expressions (e.g., ‘more’), and socially engaging expressions (e.g., ‘come over here’). Additionally, Ms. Grubb hopes that Jamie’s exposure to speech through the output component of her device may increase her verbal speech capacity. Now, Ms. Grubb can monitor the frequency with which Jamie uses her new SGD across settings and activities to promote communication success (see Figure 4 for an example of a completed device data collection form). Through critical analyses of tasks and strategic environmental arrangements, Ms. Grubb is able support Jamie in resolving barriers so that Jamie’s communication competence increases with the use of her new SGD.

Discussion

The SETT framework is based on the premise that everyone has abilities that can be built upon and enhanced (Zabala, 2005). This is grounded on the importance of individualization, differentiation, and independence which is made possible when the assessment and instruction is student-focused (Newton & Dell, 2011; Wissick & Gardner, 2008). The SETT framework is one of the most widely implemented assessment strategies used for the initial selection and evaluation of students with CCN (Edyburn, 2000; Wissick & Gardner, 2008). It allows special education teachers and IEP teams to identify opportunity and access barriers, which in turn, facilitates effective instructional decision-making for

students with CCN (Bonnet, 2015, Wissick & Gardner, 2008, Zabala, 2005).

Successful communication for students with CCN does not occur upon the initial selection of the AAC system (Newton & Dell, 2011). Rather, it is only one aspect of a multifaceted assessment framework. It is equally important to note that reassessment of the student, environment, task, and tool is an ongoing process (Zabala et al., 2000). Yet, it is not uncommon for IEP teams to use the SETT framework once to identify and implemented the tools without evaluating its effectiveness (Zabala et al., 2000). To fully assess the effectiveness of the tool (i.e., AAC system) the student needs to be given sufficient amount of time to explore and learn the system in context to the environment and task (Merbler et al., 1999).

Special education teachers and IEP teams can further enhance the communicative opportunities for students with CCN through communication partner training (King & Fahsl, 2012). This can be accomplished through increased knowledge of multimodal communication, developed understanding of barriers related to AAC communication and fostered proficiency of communication interactions (Beukelman & Mirenda, 2013; Kent-Walsh & McNaughton, 2005; King & Fahsl, 2012). A student's communicative experience may be facilitated by the four components of the SETT framework. Through ongoing monitoring and data collection, teachers ensure that selected systems are tailored to the students' needs across environments and tasks while identifying the efficient modes for communication.

Although the SETT framework has anecdotal evidence to support its utility, it should be noted that future research is

necessary to validate the findings. For example, studies could focus on comparing the SETT framework to other assessment strategies that also evaluate the student needs, the environment, tasks, and assistive technologies. Another potential area for further investigation may be to discern how the SETT framework can be used to develop effective instructional strategies that embed technology in the classroom environment. Lastly, it may also be helpful to evaluate the impact of specific technology used during the implementation of the SETT framework. In other words, it is important to know if differences exist when using low-technology or high technology systems during classroom instruction. Identifying these potential differences will help in addressing future considerations.

Figure 4. Step 4-Tool

Completed by: Ms. Grubb

TOOLS DATA COLLECTION FORM

Student: Jamie Task/Activity: lunch Communication Partner: Peer

Device/System: <u>SGD</u>				Symbols: <u>20</u>			Size: <u>1 inch</u>	# per page: <u>20</u>
Date: 3/21/2006	Trials	I	ISU	VP	M	GP	PA	Communicative Attempt
	1						X	<input checked="" type="checkbox"/> Request <input type="checkbox"/> Reject <input type="checkbox"/> Protest
	2				X			<input type="checkbox"/> Comment <input type="checkbox"/> Initiate
	3				X			Notes
	4			X				<i>Jamie needed some physical assistance to initially request items while at lunch with her peers. She then began to need modeling and was fairly consistent with verbal prompts until she began to reach independence to request items at lunch.</i>
	5			X				
	6			X				
	7			X				
	8	X						
	9	X						
10	X							
Date: 8/23/2006	Trials	I	ISU	VP	M	GP	PA	Communicative Attempt
	1						X	<input type="checkbox"/> Request <input type="checkbox"/> Reject <input type="checkbox"/> Protest
	2						X	<input type="checkbox"/> Comment <input checked="" type="checkbox"/> Initiate
	3						X	Notes
	4				X			<i>Jamie needed some physical assistance to initially initiate conversations with peers at lunch. She then needed teacher and peer modeling. Jamie gradually needed a few verbal prompts when using her SGD device to initiate conversations with some set up until she reached independence.</i>
	5				X			
	6				X			
	7			X				
	8		X					
	9		X					
10	X							
Date: 8/18/2006	Trials	I	ISU	VP	M	GP	PA	Communicative Attempt
	1				X			<input type="checkbox"/> Request <input checked="" type="checkbox"/> Reject <input type="checkbox"/> Protest
	2				X			<input type="checkbox"/> Comment <input type="checkbox"/> Initiate
	3				X			Notes
	4			X				<i>Jamie only needed a few model prompts to reject items while at lunch. She quickly worked her way to independence to use her device to reject while at lunch.</i>
	5		X					
	6		X					
	7	X						
	8	X						
	9	X						
10	X							
RECOMMENDATIONS								
<i>Jamie initially needed physical assistance to use her device while at lunch to request, reject, and initiate conversation with teachers and peers. Jamie seemed hesitant at first, but then gradually needed modeling and verbal prompts in communicative attempts. It seemed that Jamie became more comfortable with her device and needed a few set-ups until she reached independence. The device seemed appropriate for Jamie's abilities and to help her find communicative success.</i>								

Note. GP = gestural prompt; I = independent; ISU = independent with set-up; M = model; PA = physical assistance; VP = verbal prompt.

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Teaching Low-Incidence Disabilities Online Vs. Hybrid: Implications for Course Delivery

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The purpose of this research study is to compare course material usage across two types of low-incidence course delivery options: fully online and hybrid. Both courses were required for a Learning Behavior Specialist (LBS-I) Professional Educator License in the State of Illinois. Data related to student usage in the course management system Desire to Learn was pulled from 10 different sections of a low incidence disability course representing either a fully online or hybrid delivery format and resulting in 179 unique student profiles. Results were analyzed according to class type (online or hybrid). Additionally a survey was sent all 179 students. Results indicate that students in both types of courses regularly access materials but students in online courses do so more frequently.

Research on issues related to online teacher preparation in special education in general, and low-incidence disabilities in particular, is scarce. As more and more universities add online offerings in an effort to meet the demand for quality teacher preparation programs offered in a flexible format for busy professionals and those unable to commute to a physical campus, it is important to evaluate the implications on student engagement and participation in online and hybrid formats. In a fully face-to-face format, there is an expectation of attendance and participation that implies a level of commitment on the part of the student. In a hybrid course (in this case, meaning at least 3-7 online modules in an 11 week course) participation can be measured in face-to-face meetings. Fully online courses must consider other methods for judging engagement with the materials. This study, based on the work of Murray, Perez, Geist, and Hedrick (2013), analyzes patterns of engagement for online learners in hybrid and online courses.

Previous studies related to online special education courses have explored the design of online special education coursework (Bullock, Gable, & Mohr, 2008); compared student evaluations of online verses lecture based courses (Spooner, Jordan, Algozzine, & Spooner, 1999) looked at students perceptions of online, hybrid and lecture based coursework (O'Brien, C., Hartshorne, R., Beattie, J., & Jordan, L., 2011); considered online and lecture based coursework as it relates to later teacher efficacy in teaching students with severe disabilities (McDonnell, Jameson, Riesen, Polychronis, & Crockett, 2011); and assessed new teacher's feeling of efficacy combined with the application of online course materials to practice in working with students with severe disabilities (Hanline, Hatoum, & Riggie, 2012). There is, however, a gap in the literature related to student engagement in low-incidence online coursework.

There are three types of interaction that promote learning, student/teacher, student/student and student/content (Moore,

1989). This concept is a major theme in the work of Murray, Perez, Geist, and Hedrick, who wrote in their 2013 paper, “Studies of student/content interaction have primarily investigated the education impact that results after student engagement with a content-based educational resource. In other words, these studies only look at those situations where students have actively interacted with course content. They do not attempt to assess whether or not a student will engage with a course resource if given a choice; without access, there is no interaction...Identifying which resources students access is of particular interest in hybrid and online courses, wherein students independently decide which materials to access.” Murray et al. (2013) compared patterns of access in their online and hybrid digital literacy courses. They also administered a survey to all participants. Results from both the data and survey indicated that students were carefully choosing what parts of the course to access based on positive impact.

The implication of what content is accessed in a low-incidence course offered as part of a teacher preparation program is particularly important. If a student missed content will they still be able to complete a visual schedule, collect appropriate data, design an effective lesson? The work of Murray, Perez, Geist and Hedrick (2013) heavily influenced the design of this study and the research questions that follow are adapted, with permission, from the authors.

Research Questions

1. Does an online or hybrid low-incidence course have a higher rate of use of similar course material? Usage being a measure of engagement.

2. Is there a difference in achievement, as measured by course grades, between online and hybrid courses?
3. What are reasons students might not access course materials? Are student perceptions of access patterns consistent with actual access patterns?

Method

This study was conducted in two parts: Phase One and Phase Two. Phase One involved archival data collection and analysis while Phase Two consisted of a survey sent to all students from Phase One. Prior to beginning this study, the author completed the Internal Review Board process and was approved under protocol JW101515EDU.

Phase One

Design. Phase One of the study involved analysis of usage patterns (access to specific parts of the course management system) by students in 10 different sections of LSI 468 Online and LSI 468 Hybrid. LSI 468 is a low incidence methods course taken by all candidates for a professional educator license in special education, called a Learning Behavior Specialist I or LBSI, in both pre-service and in-service graduate programs. The course consists of a homepage with weekly messages in a news feed, a content area that contains important information for being successful in the course (including technology requirements, syllabus, course schedule, discussion board requirements, etc.), and weekly modules. The course also contained a discussion area with weekly discussions, a question and answer section and a quiz section. Students in the online sections completed 10 weekly modules. Students in the hybrid sections completed 5 online modules in weeks 2, 4, 6, 8, and 10. The online and hybrid modules were the same for both versions of the

course meaning that all sections of the course complete the same work. Further, each weekly module was designed using SoftChalk. SoftChalk is a desktop authoring software that allows instructors to create visually engaging and interactive lesson for online content (n.d., retrieved from <http://softchalk.com/>). The lesson can then be uploaded into a course management system. This allowed for consistency of presentation of information across all modules regardless of content.

The LSI 468 course is Quality Matters reviewed. According to the Quality matters website, "QM is a nationally recognized, faculty-centered, peer review process designed to certify the quality of online course design and online components. The QM Rubric is used in course reviews that result in continuous improvement and faculty development." (n.d., retrieved from <https://www.qualitymatters.org/reviews>). The instructor of the course has undergone extensive professional development in online teaching and has completed work that allowed her to become a Quality Matters reviewer.

Introductory information, weekly modules in SoftChalk, discussion board materials and quizzes were uploaded into Desire2Learn, a course management system used by the author's university. Desire2Learn or D2L, has the ability to provide statistical information at the individual student level. An Instructional Technology Consultant embedded in the author's home college and the college-level Center for Education Technology gathered, de-identified and randomly coded all individual student data ($N=179$) prior to placing it in a secure Excel file for the author to analyze. The data included information about how many visits a student made to each area of D2L, how long they spent in each area, number and

type of discussion board posts and grades. Visits were calculated based on number of times a student clicked on a particular area and accessed the content. Time spent in modules was automatically calculated by d2L based on time spent in module before navigating away or closing a browser.

Phase Two

Design. Phase two of the study involved a short online survey sent to the same students in LSI 468 Hybrid and LSI 468 Online that were a part of Phase One. As the data in Phase One was delivered to the author in deidentified form, there was no intent in Phase Two to link the survey results with individual student data. This confidential survey was administered through Qualtrics. Students were sent recruitment e-mail through the D2L site. All students in the online and hybrid courses were invited to participate. If a student clicked on the link to Qualtrics contained in the recruitment e-mail, they were taken to the first page of the survey which contained an information sheet. If after reading the information sheet, they wished to participate, students clicked on the button that stated, "By clicking here I agree to be in the survey." If they did not agree to be in the survey they clicked on the button that stated, " I do not agree to participate" and the browser was closed. Upon completion of the survey, students were shown a page that contained the statement, " Thank you for your participation. If you would like to be entered in the drawing to win a \$75 Amazon gift card, please click here to take you to a new page. This allows you to participate in the drawing while keeping your answers confidential. We do not collect IP addresses and your e-mail will not be connected to your survey."

Survey questions can be seen in Appendix 1. The Qualtrics survey site allowed students to

participate in the survey on a computer or mobile device. Students were sent initial recruitment e-mail and then all students were sent a reminder 2 weeks later. After 4 weeks the survey was closed. All participants who completed the survey and desired entry into the drawing for a \$75 Amazon gift certificate were directed to a separate site Rafflecopter.com. This site was not linked to the Qualtrics site and there interested students entered names and e-mails for the drawing. After the survey was closed, the author used the raffle function on the Rafflecopter site to randomly generate a winner. The winner was sent an electronic \$75 gift card directly from Amazon.com. All students who submitted an entry were then sent an e-mail thanking them for participation and letting them know a winner had been selected and notified. Data from the survey was summarized using Qualtrics software.

Results

Phase One

Simple frequency counts and descriptive statistics were used to analyze the data from Phase One and answer the first two research questions. The first research question, “Does an online or hybrid low-incidence course have a higher rate of use of similar course material?” was answered by looking at usage patterns across the two types of classes. Overall investigation indicated that students in the online classes accessed more areas of the D2L site than hybrid students even when comparing only access to modules that both online and hybrid students had to complete. In comparing average visits across course areas such as Online Learning Requirements (information about computers requirements, discussion board etiquette, etc.), Syllabus, Course Calendar (when things are due), and week 2, 4, 6, 8 and 10 modules, students in online courses made more visits to each area, though sometimes

only slightly. Average visits to the online learning section were 1.99 for online students and 1.85 for hybrid students. Syllabus visits averaged 8.24 for online students and 6.46 for hybrid. Accessing the course calendar resulted in an average of 8.68 visits for online and 6.32 for hybrid students. Students access the week 2 module on average of 8.94 times if they were online or 6.99 if they were hybrid. Similar patterns are displayed in weeks 4 (8.52 O vs. 6.74 H) and 6 (7.62 O vs. 6 H). In week 8 both groups accessed the materials at roughly the same rate with hybrid students access slightly more for an average of 6.8 visits while online students accessed at an average of 6.78 visits. In week 10 the online students average almost doubled the visits of hybrid students at 8.06 and 4.94 respectively. See Figure 1 for details.

Though students in online sections of the course made more visits to each area, they appear to spend less time in each module than students in hybrid sections (Figure 2). In all but one module in the course, online students spent less time in each content area. As is shown in Figure 2, online students spend more time in the week 6 module 776.38s or almost 13 minutes versus 622.56s or about 10 minutes for the hybrid students.

When posting on the discussion board students in the online classes again have higher rates of participation and started more threads and made more replies to threads started by other students (Figure 3). This is most pronounced in the week four discussion board response data which indicates online students responded an average of 2.8 times versus 1.93 times for hybrid students. It is also interesting to note that in three of four discussion boards, the hybrid students did not even average one thread. In weeks 2, 8 and 10 posts averaged

Figure 1. *Average Visits by Module*

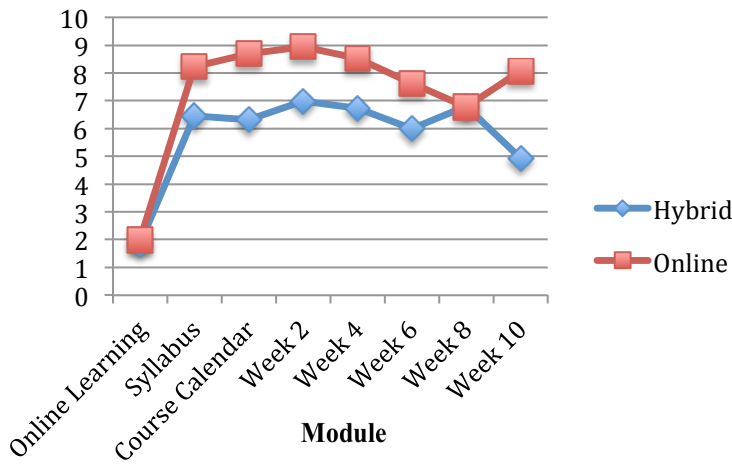
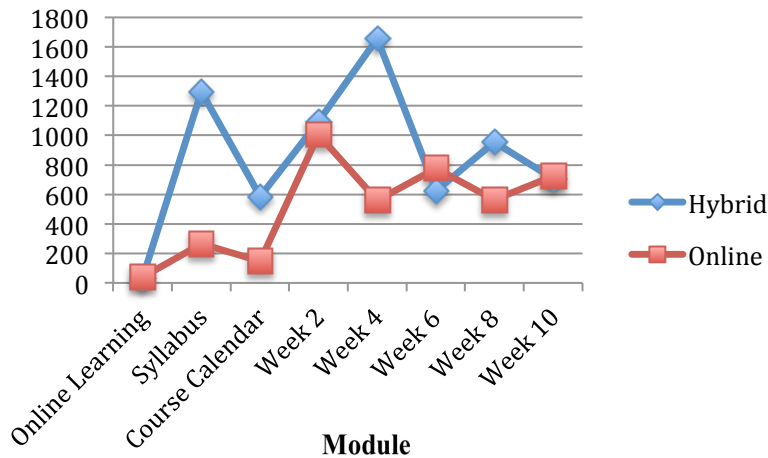


Figure 2. *Average Time (in seconds) Spent in Module By Class Type*



.92, .92 and .81 respectively. Overall, students in online classes made more discussion board posts even when the requirements for the DB were the same in both classes.

When looking at how many students in both types of classes read discussion board posts, we again see that on average online students

read more posts in each discussion board area than students in hybrid classes (Figure 4). Particularly noteworthy is that online students read posts in the General Course Question Topics at more than seven times the rate of hybrid students, with online students reading an average of 45.58 posts in this area and online students reading an average of 6.11 posts.

Figure 3. Average Discussion Board Posts by Type (Starting a Thread - ST and Responding - R)

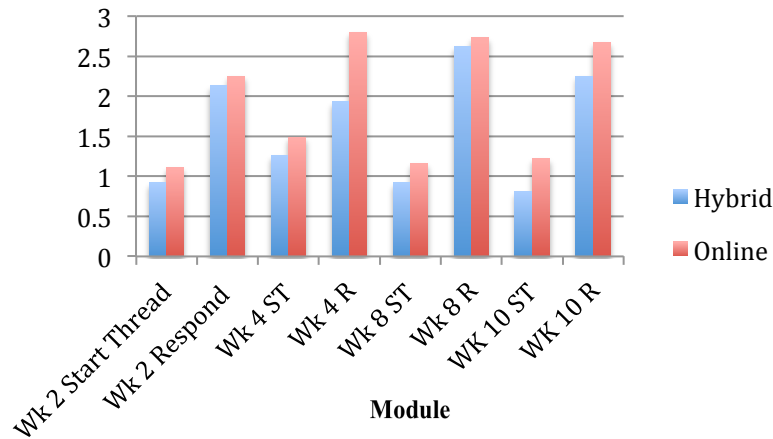
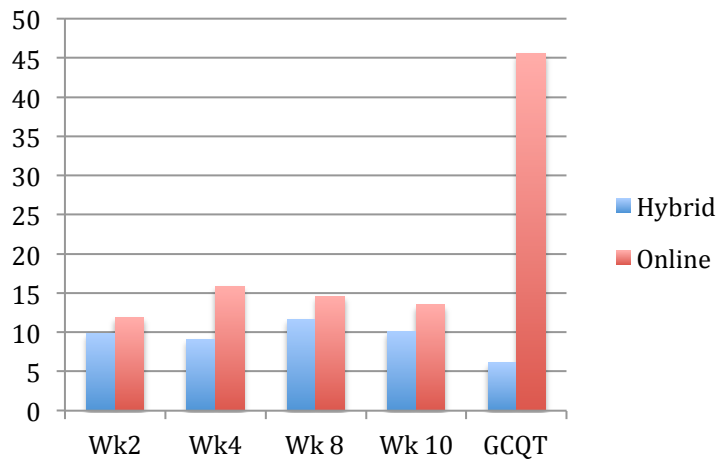


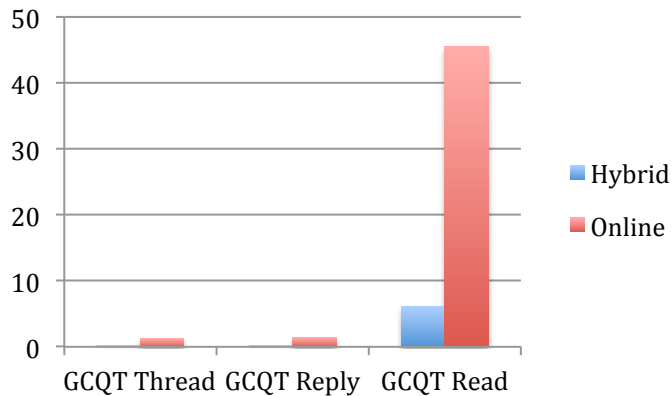
Figure 4. Average Posts Read



The General Course Question Topic (GCQT) is an area on the discussion board where students can post general course questions and they are answered by the instructor. A deeper analysis of the General Course Question Topic area was conducted and data reveals that hybrid students rarely start a thread or reply to a thread in this area while online students average at least 1.32 posts in each area (Figure 5).

Finally, to answer the second research question, “Is there a difference in achievement, as measured by course grades, between online and hybrid courses?” a comparison was made between the average grade for online students and the average grade for hybrid students. Students in the online courses averaged 95.54 out of 100 ($n=79$) and students in the hybrid section averaged 95.26 out of 100 ($n=100$). There did not appear to be a difference in average course grades between the two groups.

Figure 5. *General Course Question Topic (GCQT) Number of Threads Started, Replied to and Read*



Phase Two

Phase two data was collected in Qualtrics automatically after students completed the survey. After sending out invitations to 179 individual students, 33 surveys were completed. This resulted in a response rate of just over 18%. The majority of participants (57%) completed the survey on either the day the first e-mail invitation was sent or on the day of the reminder e-mail. Most participants completed the survey in less than seven minutes (83%).

In order to answer part of the third research question, “Are student perceptions of access patterns consistent with actual access patterns?” data was analyzed from a particular set of question on the Qualtrics survey. The questions asked participants to rate whether they (1) never, (2) occasionally, (3) very often or (4) always completed or did the following activities: open and read the modules; read the supporting materials; made required posts; or found the materials useful in understanding the topic for the week (Figure 6). None of the participants marked “never” in any of the categories, indicating that they had at least opened and looked at the materials. The majority of

participants marked “very often” or “always” in response to all four questions.

Answering the second part of the third research question, “What are reasons students might not access course materials?” was done by looking at the qualitative responses to the prompt, “If you did not generally access course resources, list the major reason(s) why. (List as many reasons as you like.)” Only 14 participants gave an answer in this section. Of those, two answers were students writing N/A and four were students reinforcing that they did access the materials most of the time. The remaining 12 gave various answers, but lack of time to complete all of the work was a theme in four responses. Other reasons reported by a single student included lack of accountability, that is, the student did access all materials except for the Instructional support section as they didn’t need it, and that the student accessed all the materials in the module but did not read the text.

A final question from the survey worth noting can be seen in Figure 7. The questions asked participants if there was an explicit connection between a module and

Figure 6. *Student Perceptions of Materials*

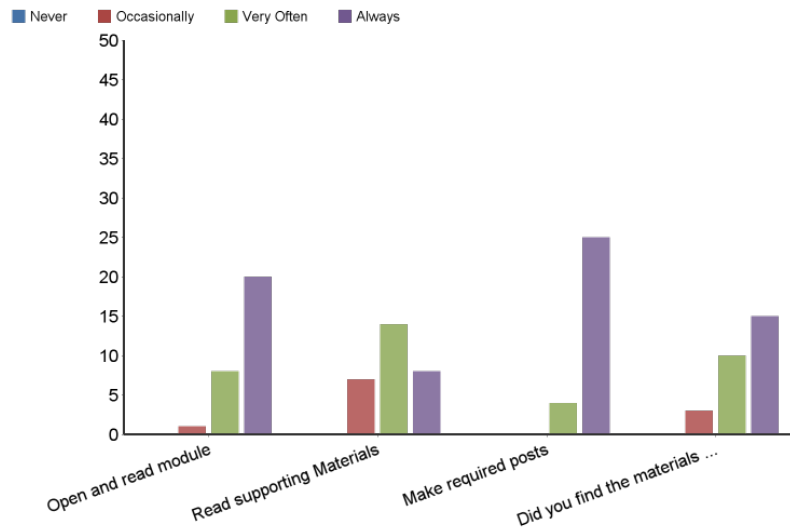
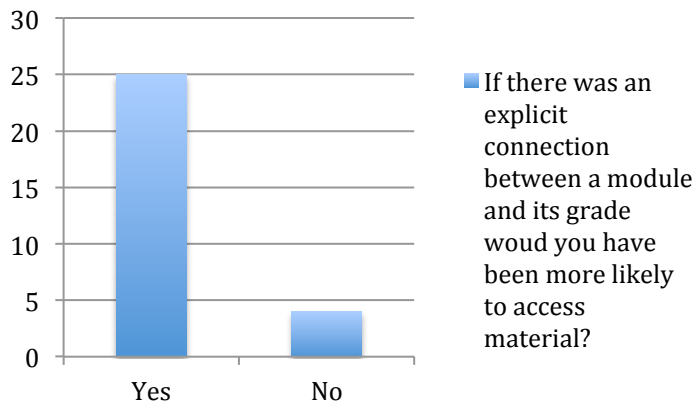


Figure 7. *Tying grade to materials*



its grade, would they have been more likely to access the material. With 29 participants responding to the question, 86% indicated they would have been more likely to access material if there was an explicit connection to their grade.

Discussion

The purpose of this research study was to compare course material usage across two types of low-incidence course delivery options: fully online and hybrid. Results

indicated that students in online classes appear to have more frequent engagement with the materials than students in hybrid classes. They explore more areas of the course and explore individual modules more frequently than students in hybrid classes. Interestingly, the students in the hybrid courses spend more time in each module but access the module less frequently.

Students in online classes start more threads in the discussion board area, reply more to

threads that others have started and read more discussion board posts than students in hybrid classes even when the rubric for participation is the same for both groups. This may be because students in online classes are using the discussion boards as a place to build community. The discussion boards are the only opportunity for interaction with other students in the course. Hybrid courses allow students to build community in the face-to-face portions of their coursework so they may view the discussion boards as just a means to earn points.

Data from the course management system pointed to the General Course Question Topic (GCQT) as a major discussion board tool used by students in online courses to ask questions and more importantly read answers to questions posted by themselves and others. Hybrid students rarely utilize this tool. Again, this pattern makes logical sense as students in hybrid courses have access to the instructor every other week in a face-to-face class. It may also be that students in hybrid classes feel more comfortable e-mailing the instructor directly with questions as they may have built up a rapport in class.

Finally there did not appear to be a difference in the two groups in terms of average course grades. One reason for this may have to do with the nature of the course. Because learning the content is critical to future success as a special educator, the instructor allows students to resubmit work for feedback prior to submission and also allows for resubmissions of previous assignments. The intent is for every student to master the content so they can use the strategies in their work with students with low-incidence disabilities. Again, while you would expect there to be a correlation with course

engagement and earned grade, even students who may have had lackluster course engagement were likely afforded an opportunity to work with the instructor outside of the parameters of the course management system in order to improve their grade.

The survey component of the study was intended to help understand how students in both online and hybrid courses view their engagement with materials and explore what barriers they see to engagement. Ideally this would have also been a way to corroborate that student's views on how they participate in online and hybrid courses matched up with the data in a general way. Unfortunately, due to a low response rate, it is hard to generalize the anecdotal evidence. Qualitative and survey data do indicate that students would be more likely to access additional material if it was specifically tied to grades. A takeaway from this is that for maximum student engagement, material must be tied to assessment.

There were limitations to the study that prevented further analysis. One limitation was that the survey was conducted independently of course participation. All but a few dozen of those invited to participate had been out of graduate school for up to four years. Getting already practicing special education teachers to participate in an online survey was very difficult even when there was an incentive. The researcher sent 179 invitations and participants completed 33 surveys for an 18% response rate. Another potential limitation was that one instructor taught all sections of the included hybrid and online courses. It is possible that it was something other than the course materials that encouraged students to engage with the materials such as the instructor's reputation

or status as a faculty advisor to many of the students.

If research has shown that learning can be measured by the interaction of students and content in online coursework and through the interactions of students with each other, with the teacher and the content in hybrid classes (Moore, 1989) then documenting that students are choosing to access all content in online and hybrid coursework in

low-incidence disabilities indicates this is a viable learning method. The catch is ensuring that students engage in a meaningful way as they list time constraints and lack of accountability as reasons they may not read in all the materials. This study indicates that course instructors must have clearly articulated correlations between each learning activity and a form of assessment to encourage maximum engagement with the course content.

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Appendix A Survey Questions

Which version of LSI 468 did you take? Fully Online Hybrid
With which gender do you prefer to be identified? M F

Did you have a teaching license prior to taking this class? Y/N
Were you licensed to teach in any area (for example, early childhood education, elementary education, secondary education) before you took the course? Y/N

Thinking about the online modules in your LSI 468 class, please answer the following questions. Choices: Never, Occasionally, Very Often, Always

1. For each course module, did you open and read the materials in the Module?
2. For each course module, did you read the supporting materials (Textbook chapter, additional readings, or lecture notes)?
3. For the Discussion Boards, did you make the required number of posts?
4. Did you find the materials in the online modules useful in helping understand the topic for the week?
5. At the beginning of the course, did you read the materials posted in the folder Get Started with the Technology? Y/N
6. If the instructor had made an explicit connection between a module and your grade would you have been more likely to access materials? Y/N
7. Why did you take LSI 468 ONLINE or LSI 468 Hybrid?
I was in the online endorsement program
I was looking for an online class
It was the only format offered
Other:

The following questions were open-ended.

8. If you did not generally access course resources, list the major reason(s) why.
(List as many reasons as you like.)
9. Is there anything the instructor could have done to make you more likely to access the materials?
10. Is there anything else you would like us to know that we did not ask about?

Thank you for your participation! If you would like to be entered in the drawing to win a \$75 Amazon gift card, please [click here](#) to take you to a new page. This allows you to participate in the drawing while keeping your answers confidential. We do not collect IP addresses and your e-mail will not be connected to your survey.

Crafting University-Based Social Events as High-Impact Practices for College Students to Meet the Needs of the Adult Autism Community

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This report provides a description of a multi-university collaboration to provide cost-free socials to adults with autism spectrum disorder (ASD) and their caregivers. Description of the social event development provided a framework for other universities to replicate this model. In addition, outcome research on the inaugural social event examined caregivers (n = 34) perspectives on the effectiveness of the university-based social and needed community supports for adults and for caregivers. Caregiver reports indicated that university-based social opportunities were of benefit for adults with ASD (100% of respondents) and the majority of caregivers indicated the need for subsequent events (97% of respondents). Social skills supports were the most frequently listed support caregivers perceived adults as needing with the opportunity to network listed as the highest need for caregivers of adults with ASD.

Naturalistic social opportunities for adults with autism spectrum disorder (ASD) are rare occurrences as the transition from high school signals the termination of services entitled to students with ASD under IDEA. This transition is further complicated in that only one in five post-secondary young adults receives services through vocational rehabilitation (McDough & Revell, 2010). These findings highlight the existing concerns for young adults with ASD to achieve varying levels of independence that includes quality of life milestones such as community involvement, employment, leisure skills, and friendships (Friend, Summers, & Turnbull, 2009). Researchers note mobilizing university and community resources in a collaborative service model can provide needed supports for adults with autism and their caregivers (Mancil, Boyd, & Bedesem, 2009). The aim of this article is two-fold: (1) to describe the development and implementation of a multi-university

collaboration providing social events for adults with autism and (2) to report on outcome survey data examining the effectiveness of the inaugural social event.

Characteristics of Adults with ASD

National conversation has centered on the increasing prevalence of ASD with specific emphasis on identification in early childhood (Downs & Downs, 2010). While this focus has fostered gains in the education and scientific communities, children do not outgrow ASD and face the same characteristic challenges of ASD in adulthood plus the addition of new concepts such as employment, leisure skills, and independence. Rates of improvement in related deficit areas tend to slow down after high school (Taylor & Seltzer, 2010) and young adults with ASD are reported to experience additional co-morbid health conditions such as depression and anxiety (Schall & McDonough, 2010).

Characterizations of adults with ASD include maladaptive behaviors of self-injury and aggression (Taylor & Seltzer, 2011), poor success with employment (Yokotani, 2011), and deficits in social skills (Hendricks & Wehman, 2009). A recent investigation by Chamak and Bonniau (2016) examined trajectories and long-term outcomes of adults with disabilities. Of the 78 participants in the investigation, none were living independently and improvements in outcome were associated with degrees of autistic impairment; individuals described as high functioning experienced more long-term success. In light of these findings, there is large utility in examining how local supports can collaborate and mobilize services specifically to the unique needs of adults with ASD.

Impact of ASD on the Family System

Caregivers of adults with autism encounter unique stressors related to characteristics of the disability. Parental stress related to raising a child with ASD begins during early childhood and centers on poor social outcomes, low rates of employment, financial concerns, and long-term care for their child (Hastings et al., 2005) all which is exacerbated as school-based services cease upon receipt of a diploma or the age of 22. The majority of adults with ASD live with family members and research investigating care-giving experiences indicated that 68% of parents reported being physically exhausted. Exhaustion was linked to sleep loss, restricted social life, money problems, and maladaptive behaviors exhibited by the adult child (Grant, Ramcharan, McGrath, Nolan, & Keady, 1998). Although challenges were associated with caregiving for an adult with autism, parents also expressed joy in their care-taking role (Baker et al., 2003; Estes et al., 2009; Herring et al., 2006; Karst & Van

Hecke, 2012) and found that professionals who were astute to the demands and reward of caregiving may provide beneficial support (Llewellyn, Dunn, Fante, Turnbull, & Grace, 1999).

The need for parental support or coping strategies becomes apparent when parents/caregivers experience elevated stress levels from attending to the specialty services required for their child (Mancil et al., 2009). Researchers found: “The pervasive nature of ASD require a breadth and depth of flexibility and specialty services that often sets it apart from other disability services” (Lee, McCoy, Zucker, & Mathur 2014, p. 581). Literature stresses that services must not only support an individual with ASD, but the supports must be provided to parents/caregivers as their voices and perspectives weigh heavily on the life-long outcomes of an individual with ASD (Lee et al., 2014; Mancil et al., 2009). While data are limited on the effects of various programs, the importance of support for both individuals with autism and their caregivers/parents is evident (Llewellyn et al., 1999; Mancil et al., 2009)

Purpose of the Article

The purpose of this report is to describe a university-based high-impact practice offering collaborative social events for adults with ASD and their caregivers. This article will provide an overview of the event structure in order to disseminate information to other universities. Furthermore, data examining the effectiveness of the university-based socials will be presented. Three primary research questions were posed:

1. To what extent do caregivers of adults with ASD rate the effectiveness of a university-based social event?
2. What specific social activities did

caregivers rate as successful for their adult child and for themselves?

3. How do caregivers describe needed supports for themselves and for the adults with ASD?

Social Event Development

Starting fall 2013, California State University, Fullerton's Center for Autism partnered with a community organization, Family Autism Network (FAN), in Orange County, California to provide a free day of fun at a local church tailored to adults with ASD and their caregivers. After two events, the collaboration was expanded to include the University of California, Irvine, and Chapman University and the events were moved to university campuses. These three universities, in collaboration with FAN, pledged to host one free social event per school year on campus with university students utilized as hosts. The aims of the social events entailed: (1) providing a needed social support to the adult autism community utilizing university and community resources, (2) building partnerships between universities and community organizations, (3) expanding university high-impact practices for students, and (4) embedding research opportunities for faculty and students.

Using University and Community Resources

The socials for adults with ASD and their caregivers were created in order to increase the social opportunities for adults with ASD to interact with similar-aged peers with and without ASD. In regard to the social event location, many universities have facilities on campus that provide fun activities. At CSUF, the Titan Student Union (TSU) offered CSUF students and community members bowling, pool tables, and video games at a natural location for attendees to have fun. However, there are many location

options at universities that would lend to a successful event including a field of grass, large conference rooms, a sporting event, etc. For the inaugural social event at CSUF, the TSU was utilized. A point of interest is that the social events are cost-free to the attendees and to the organizers through the use of campus resources and community support. Donations from local businesses included prizes for caregivers, food, paper goods, and a DJ for dancing and music. A campus club, Autism Speaks U, supported the event by booking the TSU at no cost. Thus, all of the amenities were supplied at no-cost to the organizers. Although the events at each University vary based on the local resources and theme, a recent social event schedule is described in Table 1.

Partnerships with Community Organizations and Local Universities

The social events were conceptualized by a local community partner, FAN, in Orange County, CA which aims to increase access to resources for families affected by ASD. FAN realized the need to offer specific supports to the adult population with ASD and their caregivers in Orange County. As a result they contacted CSUF's Center for Autism for collaboration. The initial two events were held at a church facility and were highly successful. The organizers contacted two other local universities, UCI and Chapman University, to create a collaborative model where faculty and students worked together to plan three social events during the school year, with each university hosting one time. The inaugural multi-university collaborative event was held during the fall 2014 at CSUF.

The collaborative nature allowed for faculty working in the field of autism, but in disciplines relating to education, psychology, communicative disorders, and medicine to offer their assistance and

Table 1
Sample Social Event Schedule with Activity Descriptions

Time	Activity	Description
12:00-2:00	Set-up and Orientation	Volunteers arrive, help with set-up, and receive orientation.
2:00-2:30	Check-in	Adults and Caregivers checked-in. During check-in, the adults with ASD were assigned a college-aged student to act as a host for the event.
2:00-4:15	Choose an Activity	Adults and their college host chose between bowling, food, pool table, foose ball, board games, and a quiet room.
3:00-3:30	Line Dancing	A DJ donating his services led half an hour of line dancing.
3:30-4	Free Dance	Attendees had an hour to dance to music. During this time they could also engage with the other available activities in the TSU.
4:00-5:00	Focus Groups for Caregivers	Caregivers had the option of participating in focus groups examining the Caregiver role or life experiences of adults with ASD.
3:30-4:15	Pictures with Star Wars characters	A troupe of individuals who perform and dress up as Star Wars characters donated 45 minutes of their time to perform and take pictures with guests
4:15-5:00	Interest Groups	Tables in the TSU had signs with hobbies or activities listed such as movies, gaming, books, and sports. Adults with ASD independently or with the assistance of their host choose one interest group to join. During the interest group time, participants shared about their specific interest and exchanged contact information in order to foster relationships outside of the social event.
4:30-5:00	Prize Drawing for Caregivers	Local businesses donated events that were displayed on a table. throughout the event. Upon registration, each Caregiver was given one ticket to leave with the item he/she wanted. At the end of the day, students drew names and most of the Caregivers were able to leave with a prize.

expertise. Students earning degrees and completing graduate work in these fields across multiple universities were integral to planning and working the event. The universities and FAN developed specific roles to share planning responsibility and increase organization. Some responsibilities included material development and promotion, volunteer recruitment, securing the venue and event activities, online registration of guests with autism and their caregivers, and volunteer assignments. Students, university faculty and community leaders/members collaborate 12-months in advance for each campus event. The importance of students learning from and receiving training from faculty and community members with expertise in ASD supported the need for university faculty to develop criteria for the high-impact practice (i.e., volunteerism at the social event). A

protocol for volunteer participation was developed and adopted across universities.

High-Impact Practices for University Students

Educators nationwide are embracing experiential learning or high-impact practices for their college students which can be defined as hands-on practices utilizing study abroad, service-learning, internships, community engagement, undergraduate research and other outside-the-classroom, innovative instructional experiences. The development and implementation of the social events provides students a strong high-impact practice to take part of. Students are integral to the success of the social events and student participation is woven in to every aspect of the social events. Led by faculty, students create a planning committee at least six-

months prior to the event and many of the students are interested in working with ASD in some capacity upon graduation. The planning committee decides on a theme for the social, coordinates event activities, solicits donations and vendors, develops promotional materials, and publicizes the event across the campus and into the community.

Student volunteers receive an orientation prior to the start of the social and receive a variety of volunteer assignments based on their level of knowledge and/or expertise of ASD. This information is gathered during volunteer registration before the event. During the social, students may welcome guests, greet and usher attendees from the parking lot the event, supervise the food, and, most importantly, be paired with an adult with ASD as a host for the event. Hosting duties are typically assigned to those individuals most skilled to support the adult with autism. Our goal is for the adult with ASD to be paired with someone in his/her age-range who can engage with him/her with a fun and naturalistic approach.

Faculty and Student Research Opportunities

An additional component of the social event is providing attendees the opportunity to participate in a structured research investigation. For example, the inaugural social event examined outcomes of the event in relation to perceived benefit. Subsequent socials have held focus groups and future socials will examine the effects of college student participation in the adult autism community. A research committee led by university faculty and staffed with undergraduate and graduate students develop a central research idea and work under the mentorship of faculty to design and implement a research investigation. Outcomes are presented at peer-reviewed

conferences. Many of the students working collaboratively with faculty on research and event planning are affiliated with CSUF's Center for Autism and enrolled in a 3-unit course providing credit for fieldwork or internships. Research outcomes from the inaugural collaborative event will be discussed in the remainder of this article.

Method

Participants

The inaugural three-university collaborative event occurred at CSUF and caregivers of adults with autism (19 mothers, 9 fathers, 2 siblings, 4 others) were asked to complete questionnaires at the end of the event. Caregivers completed the questionnaires from their perspectives and also answered questions in relation to the adults with autism they cared for (22 men, 12 women, $M_{age} = 23.5$, age range: 14-54 years). Caregivers described the adult attendees as having mild ($n = 20$), moderate ($n = 12$), or severe ($n = 2$) deficit characteristics. Demographic information can be found in Table 2.

Materials and Procedures

At the beginning of the social event, caregivers were informed they would be given the opportunity to complete a survey at the end of the event. Attached to the survey was a CSUF approved IRB consent letter that was distributed for caregivers to review. Consent letters were returned to a labeled manila envelope when completed and caregivers were each assigned a subject identification number. The questionnaire asked open-ended questions probing caregiver descriptions of supports needed and questions specific to the social event such as a description of what activities were enjoyed most by both the caregiver and adult with ASD and suggestions for future events. Completed questionnaires were returned to a manila envelope.

Table 2
Caregiver and Adult with Autism Demographics

Characteristic	<i>n</i> (%)
Caregivers	<i>n</i> = 34
Mothers	19 (55.8)
Fathers	9 (26.5)
Siblings	2 (5.9)
Other	4 (11.8)
Gender of adults with autism	<i>n</i> = 34
Male	22 (64.7)
Female	12 (35.3)
Age of adults with autism	<i>n</i> =27
Age range (years)	14-54
Mean age (years)	23.5
Parent-rated autism impact	
Mild	20 (58.8)
Moderate	12 (35.3)
Severe	2 (5.9)

Measure

The researchers developed an open-ended survey to gain information about the caregivers' perceptions of the social event. Demographic information related to caregivers' role, and the age and perceived ability level of the adult with autism were asked. Furthermore, caregivers answered from yes/no/maybe response options as to whether the adult with ASD benefitted from the social and if the social would be recommended others. Open-ended survey questions examined specific activities that the caregiver and adult with ASD enjoyed and needed supports that caregivers and adults have.

Results

Caregiver Perspectives on Benefit of Attending Social Event

In order to understand if the university-based social events were providing benefit to the autism community, caregivers were asked to indicate their opinion of the social. All of the caregivers reported that the guests benefitted from attending. Subsequent questions probed if participants would attend other socials and recommend the socials to other families. As shown in Table

3, of the respondents, 97% (*n* = 34) indicated they would attend and recommend future socials to others.

In order to understand specific activities that were successful at the social event, caregivers were asked for feedback. An open-ended question asked the caregivers to reflect on the activities they perceived the adult with ASD to enjoy the most. Bowling was listed as the favorite event, followed by dancing. Some caregivers listed multiple activities as favorites.

Caregivers were also asked to indicate the activities that they enjoyed most at the social event. The question was open-ended and caregivers provided various responses to what they enjoyed. Networking with other caregivers was listed from most of the caregivers followed by watching the adults with ASD have fun.

Caregiver Perspectives on Needed Supports

The aim of the social events is to provide social opportunity and support for adults with ASD and their caregivers. In addition to understanding the benefits of the social

Table 3

Caregiver rated benefits of Socials for Adults with Autism and Their Caregivers

Parent Response (n = 35)	n (%)
Guests benefitted from attending	
Yes	35(100)
Attend another Social	
Yes	34(97)
Maybe	1(3)
Recommend Social to Others	
Strongly agree	34(97)
Agree	1(3)

Figure 1. Caregiver reported favorite social activities for adults with ASD. Bowling was listed as the favorite activity of adults with ASD.

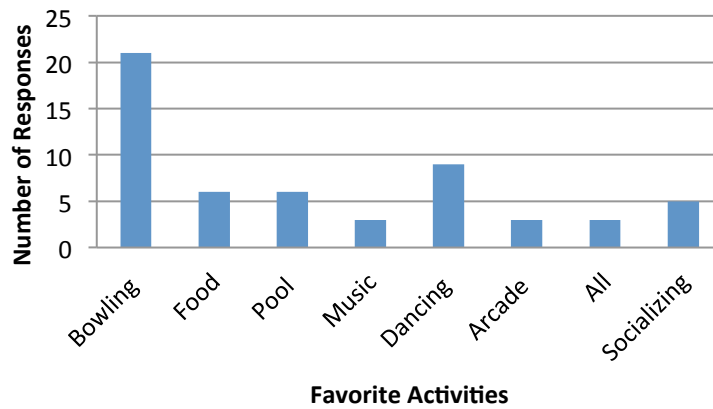
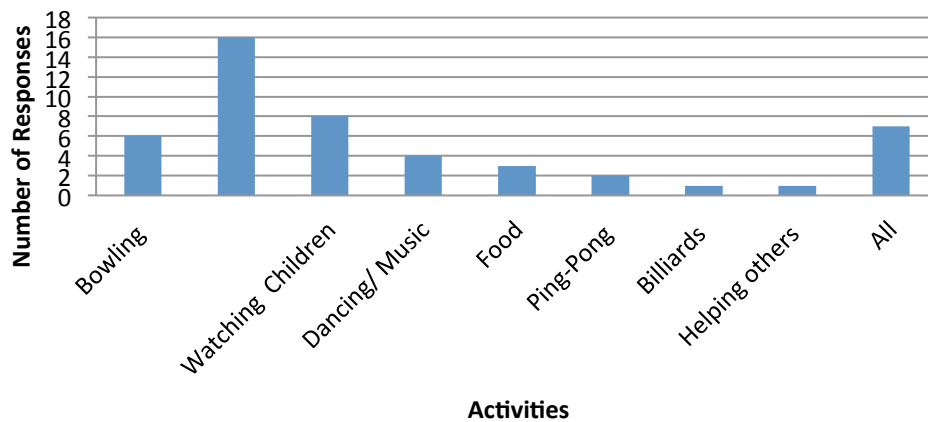


Figure 2. Caregiver ratings on enjoyed social event activities. Networking with other caregivers was the most frequently mentioned activity.



events themselves, the researchers also investigated the needed supports that adults with ASD have in addition to the needs of their caregivers. When examining needed supports for adults with ASD, the categories that caregivers listed encompassed social skills, employment, rehabilitation, and self-help with social skills being the most frequently mentioned. Caregivers were able to list multiple areas of need. On the survey, caregivers were instructed to respond “not applicable” (NA) if no additional community supports were needed for the

adult with ASD. Interestingly, most of the caregivers ($n = 13$) reported that no supports were needed. Other areas mentioned in the survey questionnaire were respite, transportation, and future social events.

Discussion

This study sought to determine the efficacy of a college-based social event for adults with ASD and their caregivers. In addition, caregivers were asked about needed supports for the caregiving role and for the

Figure 3. Caregiver reported needed supports for adult children with autism.

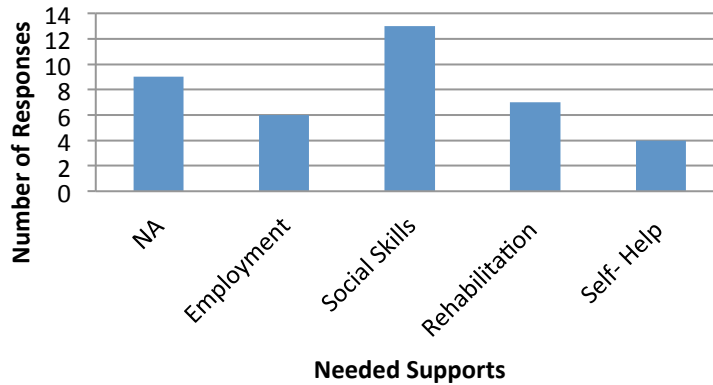
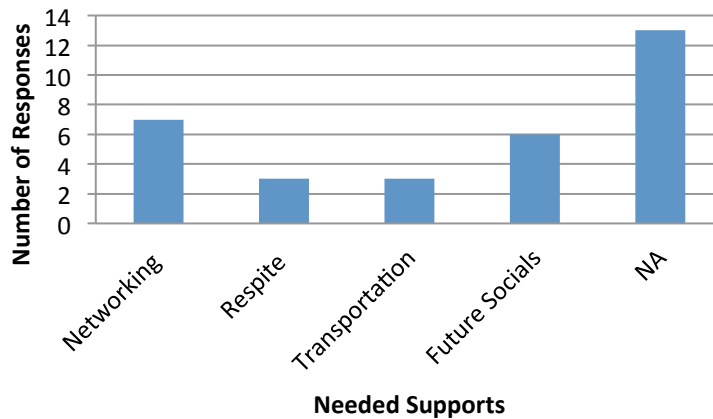


Figure 4. Responses reflecting caregiver needed supports.



adult with autism. Prior investigations indicated that adults with ASD do not have access to or participate in social environments similar to what neurotypical adults experience (Orsmond, Shattuck, Cooper, Sterzing, & Anderson, 2013). Caregivers also describe feeling isolated from peers who do not understand the role of a caregiver and, at times, burdened by the caregiving role (Kelly, Garnett, Attwood, & Peterson, 2008), however researchers indicated supportive social networks provide beneficial reductions in stress for parents of children with ASD (Dunn, Burbine, Bowers, & Tantleff-Dunn, 2001; Mackintosh, Myers, & Goin-Kochel, 2005). In response, three universities in Orange County, CA and a community organization partnered to provide college-based social events once a trimester for adults with ASD and their caregivers.

Event structure was shared so that other institutions of higher education could adapt this model to their campus. The cost-free nature of the event and the harnessing of student volunteers are key features to making this replicable. In addition, universities are often in close proximity to other campuses, yet rarely consolidate resources to collaboratively serve individuals with ASD in their local community. The collaborative relationship between CSUF, UC Irvine, and Chapman University has fostered greater access to social opportunities for caregivers and individuals with ASD.

Exit survey responses indicated that 100% of the caregivers felt that attending the event was beneficial. Ninety-seven percent of the caregivers indicated they would like to attend the event again and that they would

recommend future events to others. Only one caregiver indicated s/he would “maybe” attend the event and no caregiver indicated he/she would not come back. When probed about needed supports, the majority of responses surrounded networking and social opportunities for caregivers and social skills opportunities for adults with autism. Questions specifically examining aspects of the social event found that bowling for the adults with ASD and networking for the caregivers were the most frequently mentioned responses. The current research suggests that the social was effective for a group of caregivers of adults with ASD.

However, limitations include the small sample size of caregivers and the limited time of the research that may not allow for generalization of findings. Further study should include a larger sample size and investigate changes in caregiver perceptions over a longer period of time (i.e., one-two years). It would be interesting to survey caregivers who attend socials at the other university settings to discern the extent to which data can be generalized. More research should look at the effects of other university/community-sponsored events that may help in our understanding of the impact of these social events and to increase generalizability. Lastly, effort should be made to investigate the *adults'* with ASD perceptions of the social.

These findings not only highlight the need for increased community opportunities to provide social interaction, but also validate the utility of the social events in meeting a need of the autism community. College students and university campuses hold great opportunity to mobilize groups of people to implement fun and naturalistic activities.

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Providing Comprehensive Sexuality Education to Students with Intellectual and Developmental Disabilities: Preparing the Trainer

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Barriers often prevent individuals with developmental disabilities from receiving adequate, if any, instruction regarding sexuality. This is despite an analysis from the United States National Longitudinal Transition Study Part II reporting that a majority of K-12 educators (68%) felt students with mild intellectual disabilities would benefit from sexuality instruction. Unfortunately, most teachers (93%) had not received formal education regarding methods to teach sexuality facts and concepts. Thus, the authors of this study created and conducted a six-hour training to directly teach skills and increase perceptions of competence as it relates to teaching students with intellectual disability a comprehensive sexuality program. This workshop included information and activities related to the key concepts for comprehensive sexuality education identified by SIECUS. A pre- and post-workshop Likert scale survey was utilized to gauge findings. In addition, 30 participants chose to participate in follow-up phone interviews approximately 6 to 12 weeks following the workshop. These participants were asked open ended questions to elicit descriptions of continued perceived competency and to better understand if such participants actually provided any sexuality education to students with I/DD following the workshop. Study results indicated that workshop participation resulted in an overall positive change in participants' perception of personal competency to teach students with I/DD sexuality education content. Seventy percent of follow up phone participants indicated that they had actually provided sexuality education to a person or persons with I/DD following the workshop. Future directions, limitations, and implications are discussed.

Students with intellectual and/or developmental disabilities (I/DD) typically do not have access to formal or even informal sexuality education (Barnard-Bark, Schmidt, Chesnut, Wei, & Richman, 2014; Sinclair, Unruh, Lindstrom & Scanlon, 2015; Swango-Wilson, 2009). Access to sexuality education is often limited by multiple barriers: practitioner or parental personal beliefs and stereotypes, lack of sexuality training opportunities, and/or unfounded fear by others that such education may lead to promiscuous behaviors by those they teach (Healy, McGuire, Evans &

Carley, 2009; Lafferty, McConkey & Simpson, 2012; McConkey & Ryan, 2001; Sinclair et al., 2015; Wilkenfeld & Ballan, 2011). These barriers often prevent individuals with developmental disabilities from receiving adequate, if any, instruction regarding sexuality (Wilkenfeld & Ballan, 2011).

Barnard-Bark et al. (2014) analyzed data from the United States National Longitudinal Transition Study Part II. These authors found that a majority of K-12 educators (68%) felt students with mild

intellectual disabilities would benefit from sexuality instruction, with only 25% perceiving that sexuality education would benefit students with moderate to profound intellectual disabilities (ID). Further, most educators (93%) had not received formal education regarding methods in which to teach sexuality facts and concepts to those same students (Barnard-Bark et al., 2014; Howard-Barr, Rienzo, Pigg, & James, 2005; Swango-Wilson, 2009). These results suggest that not knowing what or how to teach this delicate subject may result in many educators providing limited or no sexuality education to their students with I/DD (Aunos & Feldman, 2002; Barnard-Bark et al., 2014; Howard-Barr et al., 2005).

According to the findings of Franco, Cardoso, and Neto (2012), caregivers and educators often assume that teaching sexuality education is primarily concerned with male and female sexual anatomy and the act of sexual intercourse. Such assumptions may be perpetuated with non-comprehensive sexuality education programs which heavily focus on sexual abuse prevention with minimal focus on skill development of positive relationships (Anderson, 2015). In actuality, comprehensive sexuality education reaches well beyond the physical aspects of intercourse and encompasses many topics (Murphy & Elias, 2006). Some of these topics include issues of self-awareness and body image, interpersonal social skills, personal care and hygiene, developing relationships, risk prevention, and sexual expression, as well as legal aspects of sexual activities (Murphy and Elias, 2006; Sinclair et al., 2015).

The Sexuality Information and Education Council of the United States (SIECUS) asserts that all people have the right to accurate information and

age/developmentally appropriate education concerning sexuality (SIECUS, 2004). Sexuality education should address the biological, sociocultural, psychological, and spiritual dimensions of sexuality within the cognitive learning domain (information), the affective learning domain (feelings, values, and attitudes), and the behavioral learning domain (communication, decision-making, and other skills) (SIECUS, 2004). The six key SIECUS concepts to include in comprehensive sexuality education are identified as human development, relationships, personal skills, sexual behavior, sexual health, as well as society and culture (SIECUS, 2004). Sinclair et al. (2005) indicated that three themes may exist concerning barriers to sexuality for students with I/DD. These three themes were identified as: 1) Parents and caregivers often misunderstand the sexuality needs of individuals with I/DD; 2) Individuals with I/DD often lack control over their own relationships and sexuality related decisions; and 3) Individuals with I/DD often lack required knowledge of sexuality and related issues, concepts, and skills.

More importantly, a dearth of comprehensive sexuality education for individuals with I/DD likely limits these individuals' relationship experiences and may often restrict their ability to make sexuality related decisions (Dukes & McGuire, 2009). It is asserted that this often results in a negative impact in their perceived quality of life (Lockhart, Guerin, Shanahan, & Coyle, 2010). Parents note a risk of isolation and loneliness for their children with I/DD resulting from limited opportunities for them to experience relationships (Löfgren-Mårtenson, Sorbring & Molin, 2015). Quality of life has been shown to improve with increased opportunities for individuals with I/DD to engage in more meaningful healthy

relationships, including avenues of sexual expression (Lockhart et al., 2010). Kempton and Stiggall (1989) asserted that sexuality education is especially important for children with I/DD because of the ability for such knowledge to enhance quality of life and decrease the chances of experiencing sexual abuse. For individuals with I/DD, it is often necessary to support these quality of life issues by systematically planning instruction to meet individual student strengths/needs and by using individualized assessment or person centered planning methodologies (Dukes & McGuire, 2009; Lumley & Scotti, 2001; Tice & Harnek, 2008). Incorporating comprehensive sexuality education into students' typical educational programs and instructional goals likely provides opportunities to make the learning meaningful for such students (Blanchett & Wolfe, 2002) in ways that will likely have a positive impact on their quality of life.

Both educators and caregivers have expressed a need for guidance and support to know how to carry out the task of integrating comprehensive sexuality education into their children's educational programs and formal instructional goals (Aunos & Feldman, 2002; Barnard-Bark et al., 2014; Howard-Barr et al., 2005). Support for educators and caregivers can be provided through training opportunities designed to reduce barriers in access to sexuality education (Blanchett & Wolfe, 2002; Dukes & McGuire, 2009; Meaney-Travares & Gavidia-Payne, 2012). Previous researchers indicate that sexuality education can improve the recipient with I/DD's understanding of self, understanding of safety skills and ultimately increase their perceived capacity to make sexually related behavior decisions (Dukes & McGuire, 2009; Meaney-Travares & Gavidia-Payne, 2012; Wilkenfeld & Ballan, 2011).

This investigation responds to barriers identified in current literature indicating that caregivers and teachers often do not feel prepared to teach sexuality education to students with I/DD (Healy et al., 2009; Lafferty et al., 2012; McConkey & Ryan, 2001; Wilkenfeld & Ballan, 2011). This investigation examined the effectiveness of a workshop aimed at providing caregivers and teachers knowledge of what and how to teach sexuality education to students with I/DD. Specifically, the purpose of the current investigation examined how participation in a six-hour sexuality education workshop for caregivers/teachers of individuals with I/DD affect a workshop participant's perceptions of competency to teach sexuality education to students with I/DD. Information analyzed and reported in this investigation fills a gap in current literature related to the need to explore whether awareness and skills training regarding sexuality education topics has an impact on sexuality education provided to students with I/DD. A workshop format correlates with mitigating the perceived skill deficits that have been identified as barriers that prevent such caregivers and teachers from teaching sexuality education to individuals with I/DD.

The specific questions guiding this work were: 1) To what extent, if any, is there a difference in feelings of competence to teach sexuality education to persons with I/DD between pre- and post- sexuality workshop participation? 2) To what extent, if any, is there a difference between post-workshop perceived competency and competency perceptions approximately six to twelve weeks post workshop? 3) Do workshop participants provide sexuality education to students with I/DD within approximately 6 to 12 weeks following completion of the workshop?

Method

Definition of Terms

For this investigation into sexuality education for students with developmental disabilities, the following definitions were utilized. A student with a developmental disability was defined as one who experiences substantial restrictions in functioning in cognitive, interpersonal, safety, and self-care activities of daily living (Baladerian, 1991). The authors of this current study defined a *caregiver* as any person who works with the student with a developmental disability on a regular basis at school and/or home who is not a certified educator. This could include family members and para-educators. Personal competency was defined as the comfort level a workshop participant felt about teaching a single student or group of students the sexuality education components taught in the workshop presented (Swango-Wilson, 2009). Learning opportunities referred to the structured time designated by a teacher or caregiver to systematically teach sexuality education to a student or students with developmental disabilities (Wilkenfeld & Ballan, 2011).

Curriculum

Participant attendance at a six-hour workshop reflects the independent variable of this quasi-experimental study. Participants were required to attend the entire workshop in order to meet participation status for the purposes of the current study. The sexuality education workshop was presented by the lead author of the investigation. The lead author represented a licensed special education teacher with 18 years of experience, using the established components held as important for comprehensive sexuality education by the Sexuality Information and Education Council of the United States

(SIECUS, 2004) (see Table 1). Howard-Barr et al. (2005) identified SIECUS as the authority concerning what needs to be included in comprehensive sexuality education. SIECUS identified components necessary to consider sexuality education as a comprehensive curriculum. These components served as the basis for the curriculum used in the one day trainings provided as the independent variable of the current study. The sexuality education workshop provided specific information on what and how to teach sexuality education components to students with I/DD by teaching how to utilize developmental and age appropriate instructional strategies for teaching self-awareness, safety and social skills. Participants actively engaged in multisensory learning activities developed to teach the sexuality education concepts of public/private, personal hygiene, recognizing healthy relationships, and personal space. Basic accessible curriculum, materials, and lesson plans were demonstrated and practiced by workshop participants. Objectives for participants following completion of the workshop were: identifying important components for appropriate sexuality education, utilizing developmentally appropriate strategies to approach hard to teach concepts, incorporation of strategies for teaching one on one and group lessons, and finding, accessing, and adapting sexuality education curricula, lesson plans, and materials to meet the needs of individual students with I/DD.

Participants

Workshop attendees consisted of adults over the age of 21 and included parents, teachers, teacher assistants, speech therapists, occupational therapists, counselors, and administrators who attended the six-hour (train the trainer) sexuality education workshop in the state of Arkansas located

Table 1
Workshop Content & Development

SIECUS Key Concepts	Workshop Information	Workshop Activity
Human Development	Puberty Personal Hygiene Self-Awareness	Personal Hygiene Products- What is it/What is it used for? Game
Relationships	Relationship Types Behaviors in different relationships Social Skills Self-Awareness	Relationship Chart- Categorizing People in My Life
Personal Skills	Communication Self-Determination Social Skills	Personal Space Circle Lesson- Practicing Personal Space using Hula Hoops and Self- Determination Language
Sexual Behavior	Sexuality from birth through adulthood Sexual experiences Masturbation	Masturbation Discussion- including instructional strategies for teaching the concept of privacy
Sexual Health	Health Care Needs Contraception Sexual abuse	Teaching How to Say No Activity Personal Care Protocols
Society and Culture	Family/Community Values Sexuality and the Law Social Skills Safety Skills	Person/Family Centered Decision Making Guidelines Safety Awareness Game Sexuality and Consent Guidelines

Table 2
Demographics of Participants from Workshop Presentations

Position	Number of Participants (%)	Findings					
		P-2	3-5	6-8	9-12	Adult	Multi-Level
Teacher	26 (46.4)	0	0	7	7	0	12
Teacher Assistant	7(12.5)	0	0	3	1	1	2
Therapist	13(23.2)	0	0	1	1	0	11
Parent	3(5.3)	0	0	2	1	0	0
Administrator	7(12.5)	0	0	1	0	3	3

within the mid-southern region of the United States. Of the 56 workshop attendees who volunteered to complete pre- and post-survey questionnaires on the day of the workshop, all worked with students/children with disabilities ranging from sixth grade through adult age. A comprehensive

inventory of participant demographics collected is shown in Table 2.

Recruitment. The sexuality education workshop was advertised on the Easter Seals (Arkansas) training website and the Arkansas Learn (State Local Education

Agency Resource Network) website. Flyers and emails were sent to the Special Education Directors/Departments of every school district in the state of Arkansas as well. In total, six workshops were offered in multiple regions of the state of Arkansas between the time period November 2014, and April 2015. Participants attending the workshop were charged \$110.00 USD to cover workshop expenses. The trainer/lead author of this study did not receive any compensation associated with the workshop. The non-profit entity Easter Seals Arkansas received the fees to assist in covering costs such as venue rentals and other associated workshop costs at no profit to the agency.

Participants that attended each workshop were asked prior to the beginning of the workshop to volunteer to take part in the research aspect of the workshop. During this request, information regarding the subject of the research, the role of the lead presenter as the researcher and other mandated information was provided per ethics board mandates. Once consent was obtained, volunteering participants completed one pre-workshop evaluation assessment instrument regarding his/her perception of their sexuality education competency skills, and

the importance of sexuality education for students with developmental disabilities, and sexuality education implementation efforts. See Table 3 for the assessment.

The pre-workshop assessment. The pre-workshop assessment consisted of five basic Likert scale questions (see Table 3). Items asked workshop participants to respond to questions by indicating their perception of confidence, or competence, to teach components of sexuality education curricula. Confidence/competency survey questions were based upon the main topics presented during the workshop and included an overall confidence question, “Do you feel confident in your ability to teach sexuality education to the students/children you serve?” Additional questions included breaking “sexuality education” into the main topics of safety skills, social skills, self-awareness, and implementation of instructional activities. Safety skills, social skills, self-awareness, and instructional activities as parts of the workshop were determined by using the SIECUS key concepts – human development, relationships, personal skills, sexual behavior, sexual health and society and culture.

Table 3
Pre and Post-Workshop Assessment Questions

Items asked workshop participants to respond to questions by indicating their perception of confidence, or competency, to teach components of sexuality education curricula.

Statements

-
- Do you feel confident in your ability to teach sexuality education to students with I/DD?
 - Do you feel confident in your ability to teach sexual safety skills essential for sexuality education to students with I/DD?
 - Do you feel confident in your ability to teach social skills essential for sexuality education for students with I/DD?
 - Do you feel confident to teach self-awareness skills essential for sexuality education for students with I/DD?
 - Do you feel confident to implement sexuality education instructional activities in your classroom/home for students/children with I/DD?
-

Also included on the pre- and post-test survey on the day of training was an opportunity for participants to rank in order of importance, a list of sexuality education components. Open ended prompts were used to elicit more in-depth responses from workshop participants regarding what information they hoped to learn, why they felt sexuality education was important or not important for their children/students, what was the most important information they learned at the workshop and how they planned to use the information. These pre-workshop, open-ended questions were used only to assist the workshop facilitator to present the material of the workshop (for informational purposes only) and were not included in an examination regarding this current study. Pre-workshop questions were: 1) What do you hope to learn from today's training? and 2) Why do you think sexuality education is important or not important for the students who serve?

Post-workshop assessments. The Likert scale component within the post-workshop assessment was identical to the pre-workshop assessment. Open-ended questions differed however. Post survey open-ended questions were: 1) What was the most important thing you learned from the workshop? 2) How do you hope to use this information? 3) Have you changed your opinion regarding why you think sexuality education is important or not important for the students who serve? 4) If so, what do you think now? and, 5) If you have an opportunity to teach sexuality education to your students, describe what approach you will use. These post-workshop, open-ended questions were used to characterize any overall trends seen in the quantitative analysis of the Likert scale questions used as a primary means of analysis in the present work.

Post workshop follow up phone interviews. Thirty participants chose to participate in follow-up phone interviews approximately 6 to 12 weeks following the workshop by volunteering their phone numbers and indicating this preference on the post-workshop questionnaire. These participants were asked open-ended response questions to elicit descriptions of continued perceived competency and implementation of sexuality education. Interviews were scheduled for approximately a 20 minute period per respondent with responses being documented on the phone survey questionnaire by the lead researcher. Each interview began with asking the survey questions followed by an opportunity to share any experiences of teaching sexuality education to students with I/DD. The follow up telephone interview open-ended responses with workshop participants were coded to discover possible themes regarding barriers to implementation and perceived competency levels.

Data Analysis

An analysis of the five Likert scale type questions (Table 3) was used to determine any pre- and post-workshop differences in responses to survey items. Each of the five questions were identical on both the pre- and post-survey. The pre-workshop survey was completed immediately before the workshop and the post-workshop survey was completed immediately after the workshop on the day of attendance by participants. Each of the survey questions utilized a six-option Likert type scale. Likert type survey items are appropriate when measuring attitudinal scales (Boone & Boone, 2012). The categories of responses provided included extremely confident, somewhat confident, slightly confident, unsure, not confident, and "I'd rather avoid the topic." For data analysis purposes, the choice of

these six options were considered as Likert-scale type data. Boone and Boone (2012) define Likert-scale data as "...composed of a series of four or more Likert-type items that are combined into a single composite score..." (p. 2). As Likert-scale data, each participant's answers to each of the five questions were summed to provide a total confidence score for each participant on the pre- and then post-workshop basis. Extremely confident scored 5 points, somewhat confident scored 4 points, only slightly confident scored 3 points, unsure scored 2 points, not confident scored 1 point and 'I would rather avoid the topic' scored 0 points. A maximum score would be represented by answering 'extremely confident' on all five confidence questions and thus would result in a score of 25 points while a minimum score would be 0.

These summed scores were then examined for pre-workshop and post-workshop means and standard deviations. Then a dependent measures *t*-test was conducted to examine if a significant difference ($p < .05$) existed between the group's pre-workshop total confidence (the sum of all five question responses) mean scores and the post-workshop total confidence mean scores. Lastly, these same five confidence questions were asked of phone participants. For these participants, a dependent measures *t*-test was used to examine if any significant ($p < .05$) difference existed between the phone interview scores and the post-workshop scores for only the phone interview participants.

Importance rankings were summed for each of the 10 items ranked by each participant. The topics with the higher scores as summed for all participant responses resulted in a rank order of importance for pre-workshop and post-workshop viewpoints of the group. Difference in the rankings were analyzed to

examine if different topics moved up or down in such rankings in the post workshop responses.

Phone interviews took place following the workshops, anywhere from 6 weeks to 12 weeks after participant attendance (dependent on availability). The phone interview participants also answered a follow up question as to if they had actually provided sexuality education to persons with I/DD between the workshop session and the date/time of the follow up phone call interview. Totals were summed as to the number of participants that had provided such education and those that did not. For those that did provide sexuality education, additional questions explored what topics were covered, if the participant used any specific resources from the workshop (and if the participant felt such resources were helpful) and if parents/guardians attended the educational training. Additionally, participants that reported that they had provided sexuality education to at least one individual with I/DD between the workshop and the follow-up interview were asked to qualitatively share their perceptions regarding the receptiveness of the individuals to the topics presented. This data is discussed within a framework of social validity. In regard to the follow up phone interviews, participants that had not provided sexuality education to individuals with I/DD, were asked if they planned to do so in the future. These answers were also summed as to "yes" and "no" and reported.

Results

Fifty-six of the workshop attendees agreed to participate in the research. Twenty-six teachers, seven teaching assistants, 13 therapists (speech and occupational), three parents and seven administrators. All of the participants reported that they work with students within grade 6 or higher/older. The

workshop was conducted in five different geographic regions of Arkansas. Participant pre-workshop and post-workshop survey results showed changes in rating of personal competency to teach social skills, safety skills, and self-awareness skills as components to teaching sexuality education. Study results indicated that workshop participation resulted in an overall positive change in participants' perception of personal competency skills to teach their students sexuality education content components. Participant competency ratings changed in a positive direction for all five questions between pre-test and post-test surveys. The percent of participants that rated their perception of confidence in their ability to teach sexuality education to the students they serve at the highest levels rose from 54% pre-test to 96% post-test (Table 4) Likewise the percent of participants indicating their perception of competency to teach self-awareness skills and social skills at the highest levels both went from 64% pre-test to 96% post-test. The percent of participants that indicated their confidence level of being able to implement sexuality education to the students they serve at the highest levels went from 52% pre-test to 95% post-test while participants indicating their perception of ability to implement sexuality education instructional activities at the highest levels rose from 55% pre-test to 95% post-test. Statistically, pre-workshop confidence scores resulted in a group mean of 13.18 ($n=56$; $SD=6.495$). Paired post-workshop confidence scores resulted in a group mean 20.46 ($n=56$; $SD=3.308$). In this way, results indicate that confidence scores increased overall and the standard deviation of the scores narrowed. A paired-samples t -test was conducted to compare the confidence scores in the pre- and post-workshop conditions. Results indicated that a significant difference existed between the scores in the two conditions; [$t(55)=-9.849$,

$p=.000$]. Changes between pre- and post-test survey responses showed that access to sexuality education training positively correlated to increased perception of competency to teach sexuality education components as measured by the Likert type questions posed.

Of the 56 participants, 30 completed the rank order section of the pre- and post-workshop survey. Pre-workshop and post-workshop results indicated that 20 participants showed only a few changes in rank order when considering the importance of sexuality education content components. Of the 10 sexuality education content components, only four reflected changes in the rank order. Table 5 shows the rank order movement that took place with sexuality as a positive aspect of self and how to say no exchanging rank order placement from pre-test to post-test. Use of condoms/other contraceptives and sexual behavior (including sexual intercourse) also changed rank order placement between pre-test and post-test survey results (see Table 5).

Thirty attendees volunteered to participate in follow-up phone interviews after attendance at the workshop. Participant follow up phone interviews indicated that sexuality education curriculum components were made available to some students with I/DD by their caregivers and/or educators after such caregivers/educators had participated in the sexuality workshop. Twenty-one of the 30 phone interview participants (70%) indicated that they had implemented sexuality training for students with I/DD since attending the workshop. Analysis of follow-up interview data responses revealed several noted themes. Participants who did teach sexuality education concepts to their students following the training taught concepts related to the topics of personal space, body part terminology, personal

Table 4

Personal Competency Skill Ratings

Survey Question:	Scale Responses				Difference <i>Pre-test</i> to <i>Post-test</i>
	Slightly to extremely confident <i>Pre-test</i>	Unsure to avoid the topic <i>Pre-test</i>	Slightly to extremely confident <i>Post-test</i>	Unsure to avoid the topic <i>Post-test</i>	
Do you feel confident in your ability to...					
Teach sexuality education to the students you serve?	30(54%)	26(46%)	54(96%)	2(.04%)	24(43%)
Teach sexual safety skills essential for sexuality education?	36(64%)	20(36%)	54(96%)	2(.04%)	18(34%)
Teach social skills essential for sexuality education?	36(64%)	20(36%)	54(96%)	2(.04)	18(34%)
Teach self-awareness skills essential for sexuality education?	29(52%)	27(48%)	53(95%)	3(.05%)	24(43%)
Implement sexuality education instructional activities in your classroom/home?	31(55%)	25(45%)	53(95%)	3(.05%)	22(39%)

Note: Participants rated perception of personal competency to teach sexuality education content components before and after workshop participation using the following answer choices: 1-extremely confident, 2-somewhat confident, 3-only slightly confident, 4-unsure, 5-not confident & 6-I would rather avoid the topic

Table 5

Sexuality Education Content – Rank Order of Importance

Content	Findings	
	Pre-test	Post-test
Gender Differences	4	4
Dating and Marriage	6	6
STD/HIV Prevention	7	7
Relationships/Social Skills	1	1
Sexuality (Pos. Aspect of self)	5	3
How to say 'No'	3	5
Sexual Orientation	10	10
Protection against abuse	2	2
Use of condoms/contraceptives	8	9
Sexual Behavior (Including-intercourse)	9	8

Note: Twenty six of the 56 participants did not complete the rank order of importance for sexuality content section of the survey. The chart shows the average responses from the thirty participants who indicated rank order on the surveys.

safety, appropriate touch, menstrual care, masturbation, relationship skills, public/private concepts, and personal hygiene. Participants indicated using workshop presented resources, especially visual supports. Overall, open-ended phone interview responses noted a reduction in

their perceived barriers to teach sexuality related content to individuals with I/DD and felt their competence to do so had increased by attending the workshop. One phone interview respondent stated that “I learned that teaching about sexuality does not have to be about teaching sex – lots of topics can

be covered.” Another phone respondent stated, “I am now more confident to be very open and honest about teaching my sons – I am candid and know better how to approach the subject.” All comments were positive in nature concerning the workshop and its’ effects on the respondent’s confidence levels to teach sexuality concepts to individuals with I/DD with none being negative in nature.

Finally, in regard to the phone interviewees, a paired-samples *t*-test was conducted to compare the confidence scores in the post-workshop and phone interview conditions. Results indicated that no significant difference existed in the scores between the two conditions; [$t(29)=.911$; $p=.370$]. Changes between post-test and phone interview survey responses showed that confidence levels to teach sexuality education that had previously increased from pre-workshop to post workshop conditions did not decrease or increase significantly between the time of the post workshop survey ($\bar{x}=20.46$; $SD=3.308$) and the time of the phone interview ($\bar{x}=21.13$; $SD=2.897$).

Discussion

Original research questions examined if participation in the specific sexuality education workshop affected participants’ personal levels of perceived competency to teach sexuality education to students with I/DD and if workshop participants actually provided sexuality education to students with I/DD within approximately 6 to 12 weeks following completion of the workshop? The answer regarding the participants attending this workshop would appear to be supportive. Attendees noted a significantly increased confidence score ($p<.01$) based on the confidence questions asked in the pre-post and post-workshop questionnaires. In the 6 to 12 weeks

following the workshop, 70% of the follow-up phone interviewees indicated that they had actually taught sexuality trainings to individuals with I/DD after attending the workshop. This overall increase in the perceived competency to teach sexuality related topics to individuals with I/DD directly addresses assertions in previous literature (Lafferty et al., 2012; Healy et al., 2009; McConkey & Ryan, 2001; Wilkenfeld & Ballan, 2011) that concluded a perceived lack of confidence in teachers/caregivers to teach this subject to such individuals represented a barrier to the information transfer. It can be logically concluded then, that this six-hour workshop content and process represented a relatively quick and inexpensive way to impact that perceived barrier in caregivers/teachers and may result in an increase in actual sexuality education to individuals with I/DD. While one cannot definitively link the provision of the sexuality educational components by 70% of the phone interviewees directly to the workshop, the fact that such a number did actually provide some sort of training to those with I/DD in their charge serves as support that increases in perceived competence in the content may result in actual provision of the content.

In regard to the question as to if a difference existed between pre- and post-workshop participation regarding the rank order of importance sexuality education content participants feel is most important to teach to students with I/DD, results would seem to indicate that such content was less changed between the two conditions. As indicated by the only modest changes in overall ranking of importance of the 10 indicated sexuality related items between the pre- and post-workshop questionnaire, the importance of each item did not notably change to any logically significant degree.

Lastly, was there a difference between post-workshop perceived competency and competency perceptions approximately 6 to 12 weeks post workshop? The answer here would appear to be no. This would indicate that confidence obtained remained high after 6 to 12 weeks post-workshop. Notably, although 70% of the phone interviewees indicated that they had actually provided such education to one or more individuals with I/DD, this did not seem to significantly increase the overall competence rating. This should be viewed in relationship to the score cap of 25 possible competency score results. Mean confidence scores did increase by .67 however such minimal positive movement did not meet statistical significance text standards. Of more interest is that the confidence levels did not appear to diminish over that time frame.

Limitations

As with all studies, the current work is not without limitations in the interpretation of results. First, we must acknowledge the limited geography in which this study took place. This study took place in only one southern state (Arkansas) within the United States. Geographic differences regarding how one approaches the topic of sexuality exist and can be stark. For example, the SIECUS State Profiles Fiscal Year 2014 explains that some states do not allow sexuality education to be provided to students in public schools while others mandate that only abstinence be included as a means of contraception (SIECUS, 2014). It was for this and other reasons of logistical convenience that only the state of Arkansas was included in this initial study of the workshop provided. Should this study take place in geographic locations in which sexuality education is more conservative or more liberal in allowed content, results could be significantly different. This remains true for other analysis of

demographics in attendees. Attendees with different cultures and religious backgrounds may view this topic differently and thus may experience differences in how the workshop content might affect their overall confidence levels to provide education on this topic. For this reason, results of this work should be viewed with the geographic region in mind thus limiting the generalizability of results. Additionally, religious and cultural demographic information was not collected in the current study and thus was not analyzed. Still, the results indicating that a short workshop can increase confidence to teach this subject remain relevant. Future research should be conducted from more geographic areas and should collect more extensive demographic information from participants to compare and contrast as well as add to results in interpretation of the current work. Additionally, larger *n* studies should be conducted to examine any differences between demographic variables. Such studies should ask a greater number of participants more about their personal demographics prior to the workshop to specifically include religious affiliations, personal pre-dispositions on the topic of sexuality, and even gender, race and age in order to see if differences exist when examined within each demographic group.

Second, we must understand the limitations to the actual pre-and post-workshop surveys used to collect the data examined. These surveys did not obtain actual measures of sexuality workshop content. The surveys asked only about each participant's *perceptions* of confidence regarding teaching the content. One may be more confident in teaching any content after attending a workshop on the topic while still not understanding actual methods and materials needed to do so with effective efficiency. Conclusions about content and method competency are outside the scope of

the current study. Future researchers may add this component to this discussion by directly examining content and method knowledge on a pre- and post-workshop basis. Additional studies should also examine pre- and post-workshop content acquisition in workshop attendees. It is the acquisition of this knowledge by students/persons with I/DD that is the ultimate goal of this sort of effort and thus is worth direct examination in relationship to this workshop's training.

Implications for Practice

Information gathered from participants regarding perceptions of competency to teach sexuality education topics and reports of participant provision of sexuality education following the workshop help inform current practices. Implications from the current research include suggestions on how to break down some barriers and provide sexuality education training for educators and parents. Specifically, suggestions on what and how to teach the participants to ensure that the curriculum spans the broader aspects of sexuality education were highlighted. Because it is paramount that the stigma dissipates surrounding this topic and the I/DD population, results of this research should inform current teachers, counselors, and caregivers that expanding the focal points to include self-awareness and body image, interpersonal social skills, personal care and hygiene, and developing relationships makes this topic unavoidable and one that needs no special barriers regarding instruction. One way to increase the likelihood that this critical instruction reaches its intended population is to merge this curriculum into existing social skills programs. Ultimately, practitioners can utilize these results to explore and consider the many ways to

incorporate sexuality education into schools, after school programs, counseling, and other arenas where self-care, interpersonal relationships, and social situations may be difficult to navigate.

Conclusion

Students with I/DD often do not have access to information concerning issues of sexuality (Barnard-Bark et al., 2014; Sinclair et al., 2015; Swango-Wilson, 2009). This is often the case because this content is avoided by teachers/caregivers that do not feel adequately prepared to teach it to those with I/DD (Aunos & Feldman, 2002; Barnard-Bark et al., 2014; Howard-Barr et al., 2005). This study indicates that the workshop format as provided may positively influence a teacher/caregiver's perceptions of confidence in teaching sexuality concepts to those with I/DD. Data further indicated that many participants did provide sexuality education to their students/children after attending the workshop. Although further studies are required, these results support the hypothesis that a small amount of time (six hours) engaged in learning about providing comprehensive sexuality education by educators/parents/caregivers may greatly impact the relative lack of sexuality instruction provided to those with I/DD and thus holds promise to positively impact their quality of life (Lockhart et al., 2010). While the issues surrounding sexuality education will likely remain controversial for many years to come, such efforts should continue in an effort to at least provide the same content to those with I/DD as is mandated to be provided to their typical age peers in any particular geographic location. Short workshops concerning how to teach this content to those with I/DD may help to bring this worthwhile goal closer to a reality.

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A Tiered Approach to Promote Safety and Security in an Inclusive Postsecondary Education Program for College Students with Intellectual Disability

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We describe three tiers of support employed on a college campus to promote safety and security for fully included students with intellectual disability (ID) participating in a postsecondary education (PSE) program. The tiers include strategies directed toward all college students to insure safety and security, strategies proactively directed to students with ID as preventive measures, and strategies used with specific students with ID who are actually experiencing, or are perceived to be experiencing, a high degree of risk; or students with ID who are engaging in behavior that places others at risk. Four case examples are provided to show how the tiered approach was used to prevent or mitigate against the occurrence of risks to safety or security.

In the last 20 years there has been a steady increase of post-secondary education (PSE) programs for students with intellectual disability (ID). Currently, Think College (2016) reports 250 college programs for students with ID distributed throughout the U.S. and Canada. The development of inclusive PSE options for college-age persons with ID presents new opportunities for these individuals. In the college environment, students with ID may experience self-determined activities, personal decision-making, and new levels of independence in addition to developing new knowledge and skill sets. The University Participant (UP) Program at Western Carolina University (WCU) is an example of such a program (up.wcu.edu). This program started as a pilot project in 2007 among the special education faculty within the College of Education and Allied Professions and has evolved into a university-wide initiative with numerous devoted stakeholders. Over a 2-year period, students in this program engage in many college and college-related

activities, and while natural supports (undergraduate students) are often present during these activities (Kelley & Westling, 2013), at other times UP students may operate independently, that is, without the presence of a support person. Natural support needs increase and/or fade based on individualized student needs in less familiar or more challenging college experiences. Typical settings and related activities in which UP students may operate, either with support or independently, include:

- Living in a dorm room in a university residence hall
- Preparing snacks and meals in common areas of residence halls
- Traveling on campus either on foot or using campus-wide transportation
- Traveling off-campus in a private automobile or using public transportation
- Eating meals in campus dining halls and in on-campus or off-campus restaurants

- Attending classes located in different campus classroom buildings
- Working in a part-time job or in an unpaid internship on or off-campus
- Engaging in various on-campus and off-campus social activities
- Belonging to various clubs or organizations and taking part in their activities
- Communicating by phone, text, or social media to various persons

As the students with ID exhibit more and more success in these activities, it becomes possible for them to operate in more of them without the presence of support persons. In fact, we have shown that over a year, supports for students may decrease by as much as 15 hours per week when a systematic process is used to reduce support hours (Prohn, Kelley, & Westling, 2015).

Safety and Security Issues on College Campuses

Whether students with ID are operating independently, or are accompanied by peers without disabilities as support persons, it is possible that risks to safety and security may occur for them, or for others who interact with them. Of course such risks are present to some degree for all college students. Typical college students are at an age when risky behavior increases and when they are exposed to various situations that lend themselves to breaches of safety and security for themselves and others (College Parents of America, 2015). But for students with ID, the risks and the consequences of those risks may be greater. Some will not have developed good decision-making skills, some will over rely on the judgment of others, and some will not have experienced novel environments without supervision. To the extent that these factors increase risks, the presence of students with ID on a college campus may be considered a

liability issue to college and university administrators and higher education policymakers (Plotner & Marshall, 2015). This concern may be heightened when students are fully included and experience more freedom on campus.

The purpose of this paper is to address how the UP Program staff has attempted to promote safety and security and to reduce risks to UP students, and risks to other students that might be attributed to UP students. We believe that the strategies we use could be incorporated into many inclusive on-campus PSE programs and might allay many of the safety and security concerns raised by administrators and others. The paper concludes with four examples of how our efforts have prevented the occurrence of potentially dangerous or disturbing situations, or have lessened their impact.

A Three Tier Model for Promoting Safety and Security

For our purpose, a “risk to safety and security” related to students with ID would be a risk that could potentially cause physical or psychological harm to a student with ID, or cause such harm to another student because of the actions of a student with ID. Risks that are commonly recognized for students without disabilities would certainly be of concern for students with ID. These could include the presence of weapons, excessive drinking, drug abuse, physical violence, sexual abuse or exploitation, and sexually transmitted diseases. Additionally, other behaviors or activities that may not be as serious to most students might be of concern if exhibited by students with ID. These could include leaving an area without someone having knowledge of the departure or not being in a place where expected to be, engaging in late night binge eating, “borrowing” someone’s

belongings without asking them, or various other activities that could result from poor judgment. If such behaviors are exhibited by students without disabilities, they may be thought of as inconsiderate. However, if a student with ID engages in such behavior, they might be considered as a potential danger to the student or others.

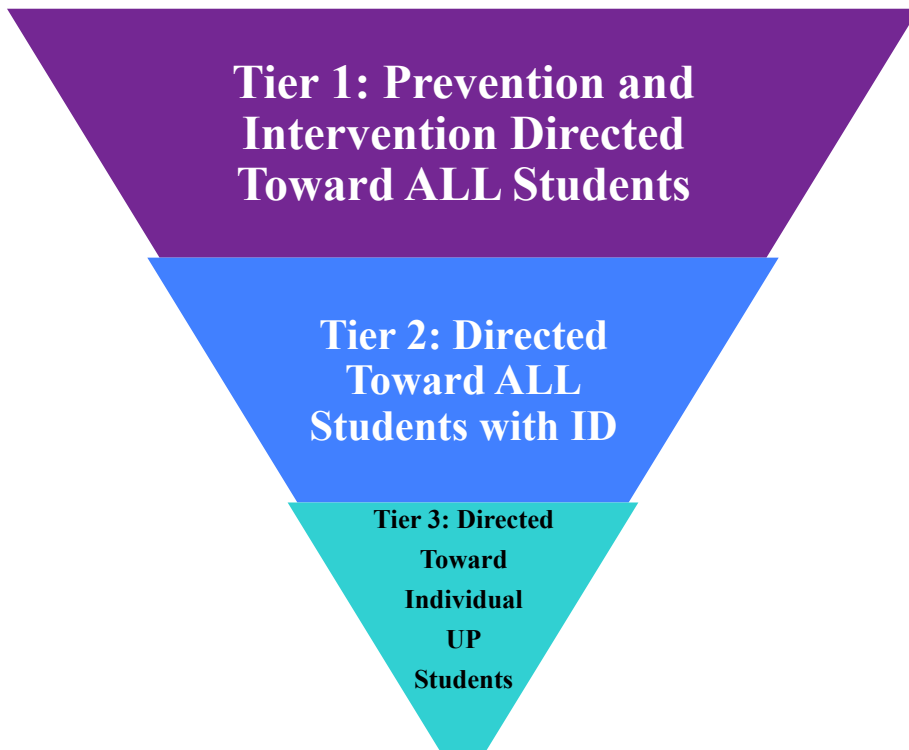
Similar to Multi-Tiered Systems of Support (MTSS) used in K-12 schools (Shapiro, 2016), we have viewed the students with ID within the UP Program as being buffered by three tiers of support that increase safety and security and mitigate against danger for themselves and others. Tier 1 offers universal preventions and interventions that affect *all* students on campus. Tier 2 is proactive interventions directed specifically at students with ID. Tier 3 interventions are specifically developed for individual UP

students who have exhibited risky behaviors that have affected, or potentially could affect, their own or another's safety or security. The three tiers are discussed below.

Tier 1: Prevention and Intervention Strategies Directed Toward *All* Students

The 1990 Clery Act (20 U.S.C. § 1092(f)) required most colleges and universities in the United States take actions to keep their campuses safe, and annually report crimes and other incidents that have affected the safety of their campuses to the U.S. Department of Education. Some of the other actions required under the law include having emergency notification and evacuation procedures, issuing timely warnings about crimes, and having missing student notification procedures (U.S. Department of Education, 2011). The implication is that most campuses make

Figure 1. A three tiered model promoting safety and security on a college campus for individuals with intellectual disability



efforts intended to keep *all* students safe.

In order to maintain this safety, colleges and universities typically include in their operations a number of departments with specific policies and responsibilities to promote safety and security. For example, on the WCU campus these departments and their responsibilities include:

- Department of Student Community Ethics: Educates students about their rights and responsibilities as stated in the *WCU Community Creed and Code of Student Conduct*.
- Residential Living Department: Enforces *Community Living Standards and Residential Living Conduct*.
- University Police Department: Employs state-certified police officers to provide security and enforce laws for all persons on campus.
- University Health Services: Meets the healthcare needs of the academic community and enhances the physical, psychological, environmental, and health education needs of the campus.
- Department of Safety and Risk Management: Provides support for university activities and assures a safe and healthful environment for employees, students, and visitors.
- Emergency Services Department: Responsible for developing and implementing institution-wide programs and projects that promote safety for all hazards and emergencies that affect the campus.
- Campus Security Authority (CSA): Persons designated by the university to notify the university Police Department of alleged Clery Crimes reported to them. (CSAs need not be employees of the University but may

include students and other volunteers).

- University Office of Disability Services: Ensures equal access for students with disabilities.

In accordance with the intention of full-inclusion, UP students on the WCU campus have the same status as all other students. When admitted, they follow the same guidelines as other college students (e.g., issued student identification cards, register for courses which they audit, reside in the same residence halls as other students). Further, to do these things UP students also must pay the same tuition and fees as all other WCU students. As such, they have the same rights as all other students including the right to safety and security and being eligible for services by the above listed departments, just as are all other students.

To the extent that a college or university offers a safe environment for all its students, it should offer the same degree of safety for students with ID and therefore can be considered the first tier in a series of protections against risks for students with ID. The *Campus Safety and Security Data Analysis Cutting Tool* is an on-line tool that allows anyone to assess the safety of any college or university affected by the Clery Act (1990). This on-line tool allows any potential applicant to any college or university to access a database that will report on recent Clery crimes for specific institutions. Similar information about campus safety is available at Niche.com (2005).

In addition to the formal support systems on a campus, safety and security can also be increased by the social ambience of a college environment related specifically to overall attitudes on-campus about PSE programs for students with ID. Various

studies have shown that in general, faculty and students without disabilities are supportive of students with ID who are enrolled in PSE programs, and their support increases as they become more familiar with these students (Griffin, Summer, McMillan, Day, & Hodapp, 2012; May, 2012; Westling, Kelley, Cain, & Prohn, 2013). As a community then, it might be expected that many college campuses are somewhat safer for persons with ID than are other communities.

Tier 2: Prevention and intervention strategies directed toward *all* students with ID.

In the UP Program, Tier 2 interventions add an additional layer of safety and security specifically for students with ID. Students are exposed to various counseling and instructional activities intended to bolster, enhance, and complement Tier 1 provisions. These are viewed as proactive steps that are intended to present information and guidance to students at a level they can comprehend and apply in their day to day lives on campus. Tier 2 interventions are not presented as special rules or restrictions for students in the UP program. In fact, we scrupulously avoid placing any limits on our students that are not applicable to the entire student body. We do, however, want to make sure they have the necessary supports to avoid possible painful or unforgiving consequences that could occur because of poor decisions. The Tier 2 interventions that are used in the UP program include the following:

- Discussion of campus safety and related policies by a University Police officer at beginning of the student's time in the UP program.
- Review and discussion of a modified version of the *WCU Community Creed and Code of Student Conduct* prior to beginning

the program and periodically while in the program.

- Monthly person-centered planning (PCP) meetings to discuss progress on goals, effective learning practices, areas needing improvement, support needs, and next steps.
- Required ownership and skillful use of a cell phone with an understanding that the phone must be answered when a UP staff person is calling, and with the UP emergency cell phone number available for quick dialing as necessary.
- Use of natural supports (student volunteers) as necessary to assist UP students in traversing the campus, going to classes, and attending social events.
- Placement of natural supports in neighboring rooms in residence halls who can be aware of the UP student's presence at night and to provide any necessary support.
- Providing courses and training in key areas such as sexuality issues and self-defense. This kind of activity, while considered important and offered to all UP students, is attended voluntarily and students may opt out.
- Using a systematic approach to reduce support time provided by volunteer students based on demonstration of safety-related skills by UP students (e.g., before allowing support-free, independent travel and other activities).

The reduction of support time noted in the above list, though applied to all UP students and therefore considered a Tier 2 intervention, is an individualized process. As we have explained elsewhere (Prohn et al., 2015), the process consists of removing support persons for specific activities,

occurring at specific times, and in specific locations. There are three criteria that must be met for the reduction of specific support:

- The student must have a recent history of appropriate, competent, and safe behavior during the activity, based on the reports of student supports.
- There must be a consensus by the UP student, current support persons, the UP staff, and the student's parents or guardians that the student can independently engage in the activity.
- And, as stated previously, the student must reliably answer his or her cell phone when called by a UP staff member.

By using these guidelines, we err on the side of caution, but also allow students to gain as much independence as possible in the campus environment when it is reasonable to assume it is relatively safe to do so.

Although not considered a Tier 2 intervention per se, our first proactive strategy to reduce risk is to review and screen out applicants with a history of criminal, troubling, or challenging behavior. Although some might argue that this could prevent some worthy students from attending the UP program (and we might agree), with a full-inclusion program on a college campus we must be cognizant of and responsive to the entire campus community. Because such characteristics would prevent students without ID from entering the university, we cannot expect differential treatment for applicants to the UP Program. The members of the campus community who form our Advisory/ Admissions Committee clearly convey the need for us to lean on the side of safety with regard to this issue. For example, the Director of Residential Living would be resistant to providing a room to someone known to have history of destroying others' property.

Tier 3: Prevention and intervention strategies directed toward *individual students in the UP Program.*

As a supplement to Tiers 1 and 2, Tier 3 strategies help to promote a safe and secure experience for individual UP students who are actually, or perceived to be, at risk. This level of intervention will not be required for all UP students, nor for any UP student all the time. Tier 3 strategies are only required for UP students who: (a) demonstrate public behavior that raises concern among one or more members of the campus community, or behavior that actually violates the student code of conduct or the law (e.g., being abusive or aggressive toward others, stealing, underage drinking); or (b) are intentionally or unintentionally perceived to be consistently in places or situations that could be dangerous to themselves or others (e.g., walking home alone along a secluded route late at night).

It should be noted that a Tier 3 intervention isn't only necessary based on the behavior of a UP student, but may also be necessary if a student is the subject of potential danger, such as being bullied or harassed by another individual. If a UP student falls into one of the two categories above, our approach is generally to pursue a least-to-most intrusive form of Tier 3 intervention in order to address the problem. Our list of options include the following:

- Giving advice and suggestions during PCP meetings or holding personal, individual meetings with the student;
- Developing behavior intervention plans (such as self-monitoring or a behavior contract) to help the student correct his or her own actions;
- Enforcing the student code of conduct through an appropriate university channel;
- Requiring temporary withdrawal from the program; or

- Requiring permanent withdrawal from the program.

Very often, talking to the student about his or her behavior or recent situations of concern, and why it is of concern, is sufficient. Occasionally, when the message to the student does not have the desired effect, we will attempt to assist the student in modifying his or her behavior by creating and presenting a behavior intervention plan. If there is still an inadequate change in the behavior we have the option of enforcing the student code of conduct including temporary or permanent withdrawal from the program and the university.

If it is not the UP student’s behavior that is of concern, but the actions of another person regularly directed toward the student, then our focus naturally shifts to assure that the UP student will not be subjected to psychological or physical harm. If, for example, a UP student was being frequently bullied or threatened by another person and this came to our attention, based on the student code of conduct, we would immediately report the person to the appropriate university authorities and request that action be taken. Taking this approach is greatly enhanced by the presence of Tier 1 and 2 strategies. In other

words, we are likely to know about such a scenario (i.e., bullying) because we learn about it from a member of the campus community, or the UP student, aware of the code of conduct, reports it to us. Table 1 summarizes the three tiers described above.

Effects of the Tiered System and Lessons Learned

The UP Program began in 2007, and to date 30 students with ID have enrolled in the program. Of this number, none have experienced any known physical or psychological harm while on the WCU campus; none have been subjected to any punishments or sanctions because of violating the student code of conduct; and none have been detained or arrested by the university police or the local sheriff’s office or police department. Still, there have been several instances when Tier 3 interventions have been necessary. In each case, the effect of the intervention has been to prevent the occurrence of harm to UP students or others associated with the UP program. Four cases are described below.

“Joey” was a young man in our program who enjoyed exercising and staying fit. When he entered the program, the UP staff

Table 1
Safety and Security Model with Three Tiered Descriptions

Tiers	Tiered Descriptions
1: Prevention and Intervention Towards All Students	Student Community Ethics, Residential Services Police Departments/Campus Safety, Health Services, Safety and Risk Management, Emergency Services, Campus Security Authority, Disability Services
2: Prevention and Intervention Directed Towards All Students with Intellectual Disability	Initial orientation and campus safety training, Review and discuss campus Code of Conduct, Conduct monthly person centered planning (PCP) meetings, Cell phone training and efficiency, Natural supports, Resident hall support, Relationship and self-defense training, Systematic approach to reduce or increase support needs
3: Prevention and Intervention Directed Toward Individual Students in the UP Program	Not time or student specific, Uses least-to-most intrusive interventions, Offers advice and suggestions in PCP and individual meetings, Development of behavior intervention plans for error correction, Enforcing code of conduct, Potential temporary or permanent withdrawal from the UP program, Follows appropriate university systems when someone is bullied or threatened

respected Joey's desire to exercise and supported him in developing a physical fitness routine that included working out in the campus fitness center and running laps on the track. On his own initiative, however, Joey decided one morning before dawn to jog across campus, and did so on a route that was unfamiliar to him. While he was running in the dark, it began to rain heavily and he lost his way. Soon, however, he found shelter and used his cell phone to call the UP emergency number. A UP staff person answered the phone, learned Joey's location, and, despite the early hour, told him that she would be there soon to pick him up. She instructed Joey to stay where he was. Not being certain of this arrangement, however, Joey elected to also call the university police.

The situation was soon remedied, but not without a great deal of concern on the part of the UP staff, the university police, Joey, and his parents. At the next opportunity, the event was discussed in Joey's PCP meeting with a clear explanation of why Joey's behavior was of concern: he was running alone during the dark and could have been intentionally or accidentally hurt; he called and woke up a UP staff member from a much needed sleep; he called the police and could have delayed or interrupted their service to someone in true need; and had he not called, no one would have known of his whereabouts. Subsequent to the meeting, Joey and all the attendees reaffirmed the importance of Joey being able to exercise and re-established a schedule and connection with the Running Club on campus to which Joey agreed. The agreement did not include running across campus during the predawn hours. This resolved the issue and ended the potential danger of Joey running off schedule in the dark.

"Monica" was a lovely young lady in our program whose grace and charm led to her being elected homecoming queen during her first year in the UP program. Needless to say, she was very popular among the many students who provided her with support, and easily developed many friends both within and outside of her support group. But the concern of the UP staff arose when they and some of Monica's friends informed us that a particular male student, one who happened to be 20 years older than her, had started spending an inordinate amount of time with her and contacting her excessively to offer her private instruction in a student organization/club on campus in which they had both been actively involved as club officers. This individual always seemed to know where Monica would be and would show up unexpectedly in various situations.

Although all UP students have the same right to privacy and relationships, as does any other student on campus, there was concern among the UP staff about Monica's safety because the man's behavior seemed to border on stalking. This concern was shared with Monica and her parents, and a meeting was arranged with the student supports who had observed this behavior along with Monica, her parents, and a university official. We explained that we wanted all university students to be supportive of the UP students and wanted the UP students to have friends among the student body, but we frankly stated that the man's forms of interaction with Monica were inappropriate and should cease. The university official, Monica, and Monica's parents agreed with us and requested that the man keep his distance from her and also stop all contact with her. While Monica continued to need some reassurance for safety with UP staff and her supports, the man complied with the request and the situation was resolved.

“Shirley” was another student in our program who was also well liked by many students and by UP staff. However, things often did not go well for Shirley and this was usually described as her having a “poor attitude” toward some of the program requirements, particularly the requirement of participating in a work-related internship. Shortly after Shirley began the second year of the program, her behavior worsened and began to be considered as an infraction of the student code of conduct. Not only did she resist going to classes and participating in her work requirement, but she engaged in behavior that would have been considered unacceptable had it come from other traditional students on campus. Although not dangerous to herself or others per se, her behavior caused concern because it jeopardized the support aspect of the UP Program. In effect, Shirley was driving away her supports because she lied, was not where she was supposed to be, locked people out of her room, was rude to supports, ran away from people, cried and whined in public areas when asked to do something, and generally drew unfavorable attention toward herself.

During the first term of the second year, we attempted to resolve Shirley’s behavioral issues through discussions with her during her PCP meeting, and then by developing a behavior intervention plan which consisted of self-monitoring and the use of positive reinforcement for appropriate behavior. We found that Shirley would show short-term improvement, but would ultimately revert to previous behavior. Ultimately we came to the conclusion that the UP Program could not positively affect the outcome for Shirley, and further, that Shirley did not want to continue participating in the program. We gave serious consideration to asking Shirley to leave the program, and arranged a

meeting with her and her parents to discuss our thoughts.

At the meeting, both Shirley and her parents assured us that she wanted to continue the program and asked that she be allowed to do so. After much discussion, we dismissed Shirley from the program for the first week of the second semester. We informed her and her parents that when she returned that she should do so with an intention of participating successfully in the program and working to achieve the goals of the program. We further informed them that if she did not do so, that our only remaining alternative would be to dismiss her permanently. Shirley returned and successfully completed the program with her peers.

“Nathaniel” was a student in the UP Program who did not successfully complete the program. Shortly after beginning the program and throughout his first year, Nathaniel demonstrated several behaviors that constituted violations of the code of conduct: including touching himself in the genital area in public, touching others inappropriately, and exposing himself to others; stealing candy, food and money; making inappropriate statements to others (e.g. saying shut up or cursing); and hitting or kicking others. Nathaniel’s behavior was discussed with him during numerous one-to-one conversations and during his PCP meetings. Additionally, behavior intervention plans were created to help Nathaniel improve his behavior.

Although we did not dismiss Nathaniel because of his behavior, we did ask his parents to hold him out of the program for one year to give him time to decide if the university environment was appropriate for him and conducive to his success as an adult. Nathaniel had often reported to his

peers that he did not wish to be in the program, and we concluded that much of his behavior was a function of that wish. At the end of the year of absence from the program, Nathaniel did not return. In a later communication, Nathaniel's mother acknowledged that perhaps she had pushed him too hard to become a student in the program.

As can be seen from the above cases, Tier 3 interventions may be necessary to assure the safety and security of students in the UP Program (e.g., Joey and Monica), as well as to prevent UP students from causing disruption to the activities of the UP Program or to the broader campus community (e.g., Shirley and Nathaniel). The importance of the former is self-evident. If any UP student makes inappropriate decisions that put them in harm's way, or potentially do so, then their safety and well-being is in jeopardy. On the other hand, if any UP students are disruptive within a college environment, then their behavior infringes on the right to a peaceful environment by other students. While both situations are potentially harmful to individuals, both can also jeopardize the existence of a PSE program on a college campus. No college or university is going to expose itself repeatedly to potential liability. Whether it is a student with ID who is harmed, or it is harm or disruption brought on by a student with ID that adversely affects others on campus, any college or university administrator will take due note and will respond to the situation. Unfortunately, this can mean the PSE program itself may be put in jeopardy.

Conclusion

Because our campus is generally safe and welcomes students with ID in the UP Program (Tier 1), because we proactively plan for students with ID to participate

appropriately and avoid unsafe or precarious situations (Tier 2), and because we are prepared to provide quick, individualized attention when the need arises (Tier 3), we have achieved a record to date of no significant occurrences or threats to safety or security. We do not know how the three tiers have individually affected our record per se, but we feel that holistically, they have been significant in our achieved level of safety and security.

We recognize, however, that there may be certain conditions unique to the WCU campus that make the tiered approach we use feasible, and the extent to which our approach may be generalizable to other campuses and achieve the same results is not known. WCU is a small, regional, rural university that serves a geographical area in which many students have known each other before coming to the university, including many of the students in the UP Program. The university has a relatively small student body of approximately 10,000 and most of the daily lives of students are confined to a campus of approximately 600 acres. We limit the number of students in the UP program to no more than eight at a given time, and all are known personally to the UP staff and communicate with the staff on a daily basis. A large number of traditional students (about 200 per year) volunteer for the program and either know individual UP students very well, or are at least familiar with them, because of the natural supports they provide to them on a daily basis. Importantly, all volunteers undergo initial training that includes knowledge of intellectual disability, strategies for promoting safety, self-determination, advocacy, problem solving, and specific protocols to facilitate appropriate social skills, independence, and good judgment.

Certainly not all colleges or universities share these conditions. Nevertheless, by employing a three-tiered structure to promote safety and security, regardless of the specific campus characteristics, PSE

programs for students with ID will likely do as much as they can to promote safety and security while still allowing their students as much freedom as possible.

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Comparison of Perception of Agency and Skills Related to Retention at Community College by Students Categorized as having a Learning Disability or Autism

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The purpose of this study was to investigate the perceptions of successful community college students diagnosed as either being on the Learning Disability (LD) or autism spectrum (ASD). Based on findings in the literature, we sought to answer questions related to their perception of agency and pathways in attending community college. Twenty community college students, 10 categorized as LD and 10 categorized as ASD, participated in this study. Data was derived from a 29 item questionnaire, 8 items based on the Hope Scale and 21 items based on the modified Hannish Survey. Comparisons between the two groups were made in terms of agency and pathway. Implications for transition services at the community college level are discussed.

The transition to adulthood can be challenging for almost any young person. Many emotional, physical, interpersonal, and educational changes emerge throughout adolescence and continue into early adulthood. Dealing with multiple shifts in societal expectations can be difficult for anyone, but individuals with disabilities often experience elevated challenges during this developmental phase (Carter & Briggs, 2016; Forte et al., 2011; Wei et al., 2015). Without a doubt many articles have been written describing the challenges faced by individuals on the LD or autism spectrum. Attention has often concentrated on documenting and predicting the postsecondary outcomes of these young people in areas such as employment, postsecondary education, and community inclusion focusing on poor achievement

rates relative to typical peers (Haber et al., 2015).

Students with learning disabilities or autism in spite of academic talent, often struggle with certain aspects of higher education such as managing time, organizing material, and engaging in social interactions ((Caruso & Crawford, 2011; Oslund, 2013). Postsecondary enrollment for students with disabilities, nonetheless, is growing. An estimated number of undergraduates identified as having a disability consists of approximately 11% of the student population (Snyder & Dillow, 2012).

In fact, between 1990 and 2005, the postsecondary enrollment of students with disabilities increased from 26% to 46% (Newman, Wagner, Cameto, Knokey, &

Shaver, 2010). Community colleges, not surprisingly, are the postsecondary institution of choice for many students with disabilities (Hoachlander, Sikora, Horn, & Carroll, 2003) and numbers reflect that enrollment for students with disabilities is growing faster at community colleges than at 4-year institutions. Between 1990 and 2005, community college enrollment of students with disabilities increased nearly 19% (from 13.6% to 32.4%), with only a 9% increase at 4-year institutions (from 5.2% to 14.3%) (Newman et al., 2010). Completion rate is higher than for those with disabilities at 4 year colleges and universities (Newman et al., 2011). Between 2007 – 2008, 40.8 % and 32.6% of students with LD and ASD respectively who had been out of high school for up to 8 years were attending community college and of that group, 29.4% and 33% had graduated (Snyder & Dillow, 2012).

Because the mission of the community college is to serve the community, open-door admissions policies have enabled large numbers of at-risk students to enroll in community colleges. Multiple factors that put students at risk, include, but not limited to a lack of readiness for college-level coursework due to deficiencies in reading, writing, and/or mathematics (Provasnik & Planty, 2008). Studies reveal that these students face various difficulties in coping with academic skills as well as in the social and psychological domains (Hadley, 2006, 2007).

Given increasing numbers of students with LD or ASD enrolling in community colleges, the Department of Education has offered grants to post-secondary schools to establish transition programs to meet the needs of such students at the community college. At the community college level transition programming continues under

various names, such as Learning Assistance Centers (LACs) or Disability Resource Service, but all such organizations commonly provide learning assistance to individuals with disabilities. Predictions suggests that the number of such programs will also increase in response to the demand for higher completion rates, but advocates and others say some students with LD or ASD go to college ill-prepared and may not be well served by such centers (Franklin & Blankenberger, 2016; Gregg, 2007; McCabe, 2000; White, 2002). Although the focus of most of these learning centers is on academic survival skills, completion rate has not had the hoped for impact. Many articles continue to emphasize the challenges experienced by many individuals with LD or ASD.

In this study we attempted to describe the extent to which other variables might also influence quality of community college experience. Our rationale is that the personal perceptions of students offer another set of factors to consider. Positive character strengths such as courage, optimism, hope, and empathy have been linked to broad measures of life satisfaction for young adults and may generalize to success in specific living areas such as postsecondary education (Proctor et al., 2011; Shogren et al., 2006). In addition, the capacity for self-determination has been linked to array of positive post-school outcomes for individuals with disabilities (see Wehmeyer & Abery, 2013). Goal directed thinking requires that an individual feels some agency or empowerment as well as the skills needed to attain a particular goal (Heiman & Shemesh, 2012; McAdams, 2015; Sinnott, 2012). These two factors are additive and interact reciprocally. Experiences iterate in the thoughts of individuals when pursuing goals, that is, knowledge builds upon experience and creates predispositions for

new experiences, When experiences, based on agency and pathways of knowledge result in success, then the probability of goal attainment is increased. Conversely when experiences, based on agency and pathways of knowledge result in failure, the likelihood of goal attainment is decreased.

The rationale for this study was to provide information based on an investigation as to why some students with LD or ASD experience success at the post-secondary level in light of agency and pathways of knowledge which could be a preliminary step toward better transition preparation at the secondary as well as postsecondary level, (i.e., increasing their chances for college success). Based on the theoretical underpinning related to goal setting, we chose to investigate the perspective of those students with LD or ASD who had demonstrated, in spite of low odds, success during their first year at a postsecondary institution. Thus the purpose of this study was to investigate the perceptions of successful community college students diagnosed as either being on the LD or ASD spectrum.

Based on findings in the literature, we sought to answer two research questions. First, how do such individuals perceive their agency in attending community college, that is, ongoing goal-directed thinking? We anticipated these ratings would be moderately low reflecting personal traits and connections (i.e., self-determination, strengths, and hope) inferred from the literature which has painted a very bleak description of successful community college experiences for these young people. The second question addressed pathways, that is, the ability to follow prescribed rules and practices for transition-age youth with LD or ASD as provided through transition programs and learning support centers. We

anticipated that both groups would have similar ratings of pathway. We were interested in identifying similarities and differences between the two groups relative to agency (personal traits) and pathways (procedural knowledge). We hypothesized that the spectrum aspect of the conditions would show that young people with LD would have a higher level of goal attainment than those with ASD, but little if any differences would be found in perceptions of procedural knowledge.

Method

Participants

A total of 20 male community college students classified as LD or ASD between the ages of 18 – 26 were placed into groups of 10 consisting of students aggregated by classification of ASD or LD. To be eligible to participate in the study, the learner had to have finished one year of successful community college enrollment (24 hours). Identification of population pools were made possible by community college directors or members of a tutoring clinic designed for individuals with ASD or LD at the postsecondary level.

Procedure

Upon approval of the IRB and permission from the local community college system, an initial letter explaining the purpose of the study was sent to the students indicating that participation in the study was voluntary. No negative consequences would result if the student did not wish to continue with the survey. If the student wished to participate then he could continue with the survey. A follow-up contact with each student, either online or via telephone, was implemented to complete the survey. Once the student had completed this survey he also could indicate if he would be willing to be interviewed at a later date. Students were told that they would be entered into a lottery for a \$50.00

gift certificate for completing the 37 item survey. All students contacted elected to complete the survey and agreed to be interviewed at a later date.

Measures

The two dependent variables were scores taken from the Hope Scale (10 items, Snyder, 1995), a measure designed to offer valid self-report measures of ongoing goal-directed thinking, and the modified Hamish Questionnaire, (21 items, Hamish, 2010) which focuses on self-perception of agency for young adults. The Hope Scale (Snyder, 1995) has two main components: (a) agency and (b) pathways. The scale consists of 10 items on a 5-point Likert-type scale from never agree (1) to always agree (5). Items included, for agency, *I energetically pursue my goals* (Cronbach's alpha of .85) and, for pathways, *There are a lot of ways around my problem* (Cronbach's alpha of .87). The total Cronbach's alpha was .91. Responses were tallied with regard to the individual items. The eight statements on the horizontal axis of Figure 1 are directly from the Hope Scale. Ten items were originally placed on the Hope Scale, two were distractors so were not included in the analysis. Given the small number of participants, the eight items were collapsed without regard for agency (goal-directed perceptions) and pathways (planning to accomplish goals).

The Hamish Questionnaire (Hamish, 2010) consists of 21 items about logistics related to community college, e.g., *I have contacted a counselor at the DRC for assistance* or *I speak to the instructor to discuss any problems or challenges in the classroom*. Participants then rated the responses using the following scale: Not at all (1), Very little (2), When I need to (3), Most of the time (4). Targeted behaviors were adapted from the *Hamish Transition Survey* (Hamish, 2010). This scale is a compilation of

selected skills identified in the literature as being important for successful college completion.

Results

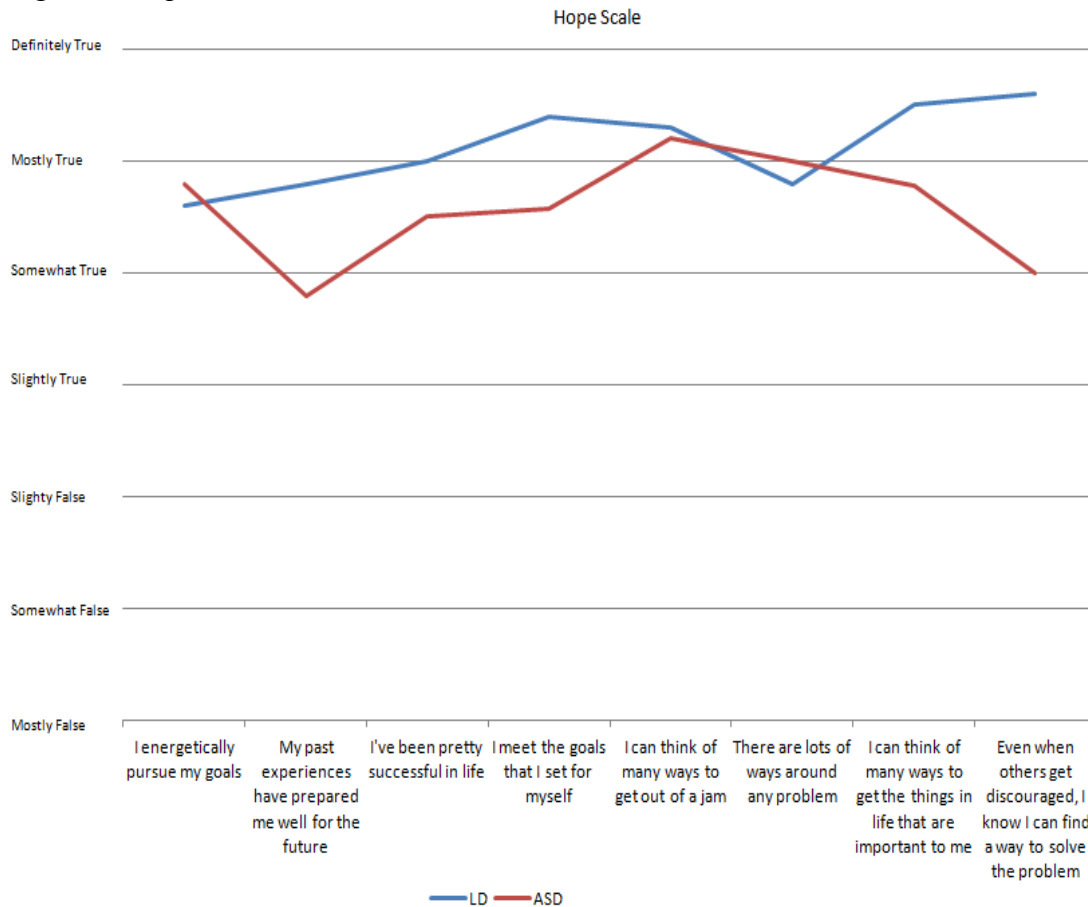
We used descriptive statistics to determine how the students assessed their perceptions of agency and pathways leading to goals for the aggregated sample of our students. We disaggregated the data by categorical type and plotted the responses for Agency using the Hope Scale. See Figure 1 Hope Scale. With regard to the Hamish Questionnaire, we looked for common themes among the questions and then created broader trends based on those common themes. Survey responses, for example, based on verbal and email communication with college instructors was categorized as *Communicate effectively with instructors for academic success*. These broad themes are the categories listed on the horizontal axis line on Figure 2 Hamish Questionnaire.

Discussion

In what ways do individuals with LD or ASD perceive their ongoing goal directed thinking (Agency)?

We were pleased to find that ratings on the Hope Scale to be moderately high reflecting the personal traits of self-determination, strengths, and hope. Regardless of categorical grouping, these successful students all fell within the upper ranges of responses for agency. Both groups were similar in their perception of energetically pursuing goals most of the time. Students with LD were generally optimistic. They felt that past experiences had helped them to be successful and prepared for meeting their goals. For the most part they indicated a sense of control over external events. They felt that they could find alternative solutions to problems which might emerge, and they could think of ways to get what is important to them. The students with LD were quite

Figure 1. *Hope Scale*



sure that they would rise above being discouraged and could problem solve to meet their objectives.

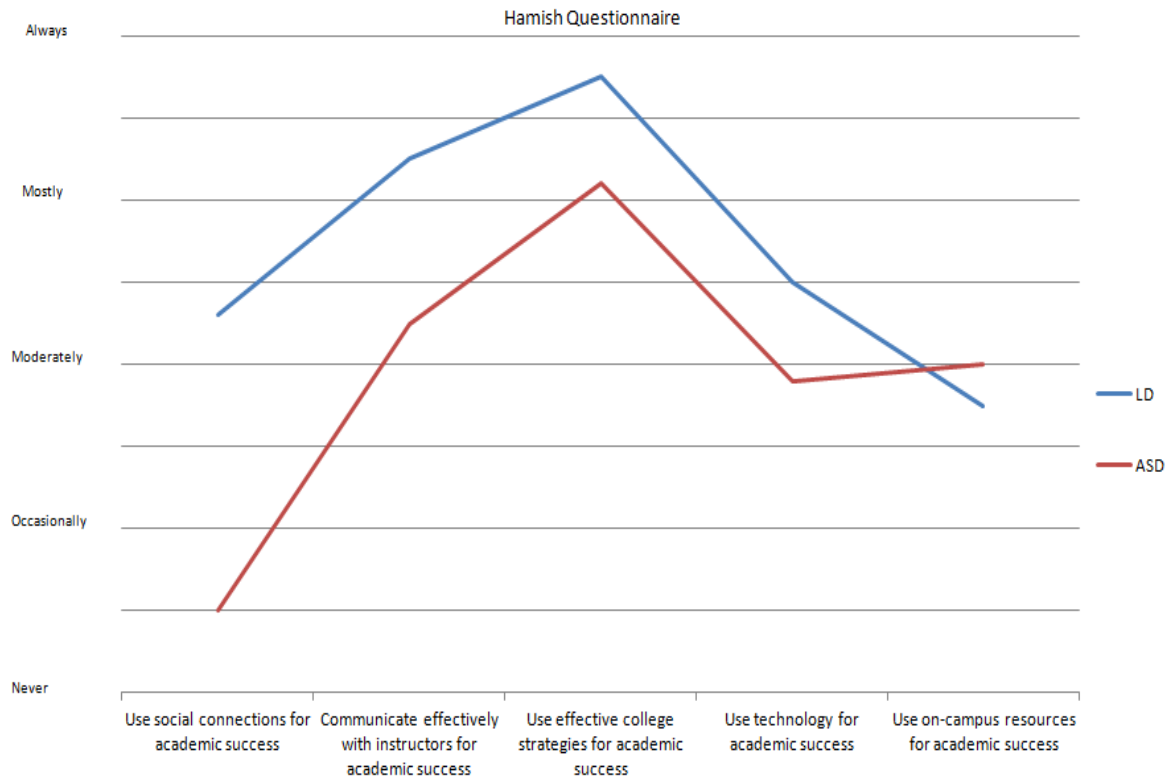
Responses from Individuals with autism produced parallel responses to being successful, meeting goals and finding ways out of difficult situations, but rather than indicating most of the time, the young people with ASD were more tentative than those of students with LD indicating that these actions were somewhat true rather than mostly true. Both groups felt that past experiences had prepared them for future experiences, although the students with LD were more favorable to their past preparation than the students with ASD with responses being mostly true and only

somewhat true, respectively. In contrast to students with LD, the Students with ASD were less confident in problem solving to achieve their goals. They also had less self-assurance in their ability to seek alternate means of goal achievement when discouraged.

In what ways do individuals with LD or ASD differ in their perception ratings of procedural knowledge, (i.e., pathways for negotiating the community college)?

A much larger discrepancy in responses emerged between the perceptions of students with LD and those with ASD relative to pathways for negotiating success in the community college student. As can be seen in Figure 2, neither group felt that using

Figure 2. *Hamish Questionnaire*



social connections was often practiced. The students with LD found social connections only moderately helpful when striving for academic success and those with ASD found social connections midway between never and occasionally useful in making academic progress. Both groups found the greatest value in using college strategies to make academic progress as well as interactions with a course instructor. The students with LD almost always felt positive about using academic strategies and the students with ASD indicated that they used college strategies most often when studying.

Although the second highest ranking dealt with communication with the college instructor, perception varied between the students with LD who indicated mostly and those with ASD who indicated moderately. The categories of using technology and

utilizing on campus resources were met with a response of moderately by both groups suggesting a neutral position in these two resources. Overall the two groups again were parallel in responses, but the responses of students with ASD could be characterized as less engaged than responses from the students with LD.

Implications

Our findings are in contrast to the literature that suggested the young people with LD or ASD were at risk for success at the community college level (Hadley, 2006, 2007), but these results may be a function of the parameters of our participants. Our population is a specific subgroup within the larger all-inclusive categories of LD or ASD, targeting only those students who were successful in their first year of the community college experience. This

distinction again serves to prompt the concept that subcategories exist within the broad classifications of LD and ASD. The examination of the performance and perception of successful subgroups may lead to practices that can improve higher rates of success for others who aspire to a college education.

Both groups of students in this study indicated positive character strengths linked to postsecondary education experiences suggesting generally optimistic outlooks on life (Proctor et al., 2011; Shogren et al., 2006). Discrepancies between the perception of self-determination and problem solving existed between the two groups in this study. Students with LD had an especially strong sense of self-determination and problem solving. In contrast students with ASD in our study perceived themselves less positively indicating feelings of less control over discouragement and the ability to problem solve. The capacity for self-determination has been considered important in creating positive post-school outcomes (see Wehmeyer & Abery, 2013) yet successful students with ASD perceive themselves as somewhat discouraged and lacking in problem solving ability. In contrast, the students with ASD perceived themselves as being goal directed and successful in achieving their goals suggesting that feelings of agency and empowerment relative to known objectives. Successful attainment of goals literate knowledge builds upon experience and creates predispositions for new experiences. (Heiman & Shemesh, 2012; McAdams, 2015; Sinnott, 2012). Building upon successful experiences provides the student with a base of known factors, whereas when faced with a new situation requiring problem solving some individuals with autism, even those successful in many areas, may feel discomfort and discouraged.

Although the findings of our study are preliminary, they raise many questions for future research. Educators may need to reassess thinking related to transitions to postsecondary education in terms of what is important to success and what is not. Social interactions may also play only a moderate role in achievement and technologically is perceived neutrally. Should emphasis in transition programs or learning centers shift from development of social interactions to a greater emphasis on academic strategies and problem solving? Although not surprising, social interactions are lower for ASD than LD, but neither group seems to be socially involved. Perhaps the nature of the community college or perhaps academic success does not depend so much on interactions with other students for successful community college students with ASD or LD. What both groups valued was the use of instructional strategies. This finding suggests that transition programs continue to emphasize proven strategies for learning, including how to interact with instructors. Our students responses are consistent with the literature in that learning centers do not seem to play a vital role in their success (Franklin & Blankenberger, 2016; Gregg, 2007; McCabe, 2000; White, 2002), but perhaps more emphasis on instructional strategies which demonstrate goal attainment would be helpful to struggling students. Community college students with ASD who are successful might benefit from activities which encourage more positive self-perceptions when presented with new situations.

The limitations of this study, (e.g., size, need for replication, qualitative perspectives and so forth) are the springboard for future research. Findings should be considered in light of this particular group with these particular measures as catalysts for future enquiry. This study raises many questions.

Not the least of which is what would happen if the transition programs focused more on meaningful goal-directed behavior. Should our transition programs encourage optimism in goal attainment? Would optimistic students be more likely to pursue goals than pessimistic ones? If our behavior is the total of our experiences, then how soon is too soon to provide our students with the ability to problem solve using proven and established strategies for academic success? We cannot say what the results would be for unsuccessful students, but taking a lesson for those who are successful, maybe less emphasis should be placed on communication and social skill

development, a shift not an elimination, to more instructional techniques that increase probability of academic success.

With the large influx of students with LD or ASD, the community college is challenged to find successful support systems. Postsecondary success builds upon skills the incoming students bring from past experiences. Acknowledging and addressing the influences of agency and pathways can be one important step in increasing the goal of successful community college experiences for individuals with ASD or LD.

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Relationship between Age and Psychopathological Manifestations in School-Age Children with an Intellectual Disability: The Role of Executive Functioning

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The risk of psychopathology among children with an intellectual disability (ID) is 3 to 4 times higher than their typical peers, with prevalence rates ranging from 35 to 40%. Psychopathological manifestations vary according to sex, age, and IQ of children with an ID. The present study explores the mediating role of executive functions, on the one hand, between age and psychopathological manifestations and, on the other hand, between IQ and psychopathological manifestations in school-age children with an ID. Participants were recruited in a rehabilitation center for people with intellectual disabilities (Quebec, Canada). Parents (106 mothers and 83 fathers) assessed their child (54 girls and 68 boys with an ID from 5 to 21 years old) by filling out the Behavior Rating Inventory of Executive Function (BRIEF) and the Developmental Behaviour Checklist – 2nd Edition – Primary Carer Version (DBC-P). Results showed that parents report a higher level of anxiety and more difficulty with emotional control for girls than boys. Moreover, IQ was not significantly correlated with BRIEF's executive functioning subscales and indexes. Therefore, executive functions could not be considered as a mediating variable between IQ and psychopathological manifestations.

The risk of psychopathology among children with an intellectual disability (ID) is 3 to 4 times higher (Tonge, 2007) than their typical peers, with prevalence rates ranging from 35 to 40% (Dekker & Koot, 2003; Emerson, 2003; Emerson & Hatton, 2007; Tonge, 2007). A better understanding of the variables associated with psychopathological manifestations may allow the development of appropriate intervention and prevention strategies for this clientele.

The assessment of psychopathology in people with an ID is complex because the expression of symptoms may differ from that of the typical population (de Ruiter, Dekker, Verhulst, & Koot, 2007; Tonge, 2007). The lack of standardized instruments, communication and expression difficulties typical among

individuals with an ID, and the fact that ID can mask symptoms of psychopathology are factors that can explain this situation. In addition, there is no consensus on the definition of psychopathology in people with an ID (Dekker, Koot, van der Ende, & Verhulst, 2002; Sturmey, 2007).

Psychopathology is the manifestation of a behavioral, psychological, or biological dysfunction in a person, which results in clinically significant behavioral or psychological symptoms (APA, 2013). They can be subdivided in three categories of disorders: internalized (e.g., depression, anxiety), externalized (attention-deficit, hyperactivity, conduct, and other impulse control disorders), and those related to substance use (Achenbach & Edelbrock, 1978; Krueger, 1999).

Studies show that psychopathological manifestations among children with an ID vary according to their sex, age, and IQ. In this regard, Bradley and Isaacs (2006) mention that the sex differences among typically developing children are likely to be found in children with an ID. Among typically developing children, boys exhibit more externalizing disorders and girls internalized ones. These sex distinctions may be explained by differences in sociocultural education related to child's sex, psychological maturity level, developmental curve, and also some biochemical changes (Winstead & Sanchez, 2005). In children with an ID, many studies showed that externalizing disorders as antisocial behavior, conduct disorders, cognitive problems, are more prevalent among boys (Emerson, 2003; Hastings & Mount, 2001; Steinhausen & Metzke, 2004). Compared with the latter, girls with an ID manifest more internalized disorders as depressive symptoms (Lunsky, 2003). However, other studies found no sex differences (Chadwick, Piroth, Walker, Bernard, & Taylor, 2000; Dekker & Koot, 2003) or more manifestations of internalizing behaviors (e.g., self-absorbed behaviors) by boys (Hastings & Mount, 2001). Links between sex and psychopathological manifestations in children with an ID are still sparsely studied. Consequently, little evidence was provided to explain the disparity in the results.

Research also indicates that externalizing behaviors, including hyperactivity symptoms and conduct disorders, decrease with age, while emotional problems increase (Einfeld, Tonge, & Turner, 1999; Tonge & Einfeld, 2000). However, psychopathological manifestations are less likely to decrease over time in children with a severe to profound ID than in those with a mild ID. This could possibly be due to more severe brain abnormalities (Einfeld et al., 2006). Moreover, children with a severe to profound ID presented

more stereotyped behaviors, self-injury, and social withdrawal (Chadwick et al., 2000; Einfeld et al., 2006; Einfeld & Tonge, 1996; Koskentausta, Iivanainen, & Almqvist, 2007), while children with a mild to moderate ID manifest more antisocial and disruptive behavior as well as depressive and anxiety symptoms (Einfeld et al., 2006; Einfeld & Tonge, 1996; Koskentausta et al., 2007). Finally, results from current research are not consistent on this aspect. While some authors report that children with a severe to profound ID are more at risk of psychopathological manifestations (McCarthy, 2008) others mention that the risk is higher in children with a moderate ID (Koskentausta et al., 2007).

The origin of psychopathological manifestations seems multifactorial, but as brain abnormalities and diffuse brain damage is commonly observed, the importance of biological factors should be considered (Lussier & Flessas, 2009). Some authors reported that development of the brain and its functions would differ in people with an ID (White, Chant, Edwards, Townsend, & Waghorn, 2005) as well as report that structures of the frontal lobes and of the prefrontal cortex develop atypically (Anderson, Anderson, Northam, Jacobs, & Catroppa, 2001; Japundza-Milislavljjevic & Macesic, 2008; Lussier & Flessas, 2009). Since the prefrontal cortex is considered the seat of executive functions, it suggests some of these functions could not reach full maturity in the context of ID.

Executive functions control and supervise the organization and management of cognitive activities, as well as emotional responses and behaviors (Isquith, Crawford, Espy, & Gioia, 2005). They interact as an integrated supervisory system (Anderson et al., 2001; Huizinga, Dolan, & Van der Molen, 2006; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). More specifically, they allow the

individual to adapt more effectively and easily to new situations when the learned and automatic action routines are insufficient (Goldstein & Naglieri, 2014). These functions include inhibition, cognitive flexibility, working memory, planning, emotional control, initiation, ability to organize material, and self-assessment (Gioia et al., 2000a; Miyake, Friedman, Emerson et al., 2000).

The development of executive functions begins in childhood and continues into early adulthood (Anderson, 2002; Romine & Reynolds, 2005). Several factors contribute to their development. The first factor relates to the growth and maturity achievement of anterior, posterior, and subcortical brain regions (Anderson, 2002; Romine & Reynolds, 2005). The second factor relates to the refinement of connections within the prefrontal cortex and those between the latter and the motor, sensory, and associative brain regions. Finally, myelination of nerve fibers that occurs during childhood and adolescence may contribute to both the development and specification of connections and optimization of executive functions as information transmission would perform more efficiently (Anderson, 2002). For an optimal and appropriate operation of executive functions, it is important that the entire brain is preserved, despite the importance played by the frontal lobes in their operation (Anderson, 1998). The inhibition ability and working memory, which are considered more primary functions, and are among the first to develop, while planning, problem solving, and flexibility develop later (Epsy, Kaufmann, Glisky, & McDiarmid, 2001; Huizinga et al., 2006). Due to an earlier maturation of prefrontal regions in girls, there may be differences in the developmental trajectory of executive functions related to child's sex (Chevalier, 2010). Some authors found that girls performed better on tasks assessing inhibition abilities during the preschool

period (Carlson & Moses, 2001) while others found no difference between the sexes (Hongwanishkul, Happaney, Lee, & Zelazo, 2005). On this issue, Chevalier (2010) mentioned that girls' executive functioning was slightly more efficient than boys', but that the differences were tenuous.

In several neuropsychological and neuropsychiatric disorders that coexist with an ID, such as conduct disorders, attention-deficit disorder with hyperactivity, autism and Tourette's syndrome, executive dysfunctions were observed, notably concerning inhibition ability and working memory (Barkley, 1997; Pennington & Ozonoff, 1996). Thus, children with an ID and with symptoms of these disorders can have deficits in terms of inhibition capacity, attention, working memory or planning (Oosterlaan, Scheres, & Sergeant, 2005; Pennington & Ozonoff, 1996; Roelofs et al., 2015; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005).

Executive functions in children with ID have not been studied extensively (Willner, Bailey, Parry, & Dymond, 2010). Some studies that focused on specific phenotypes of individuals with an ID identified deficits at different levels. An executive dysfunction is found in people with fragile X syndrome (Van der Molen et al., 2010). Children with velo-cardio-facial syndrome have difficulties in terms of shared attention, cognitive flexibility, and executive control (Bish, Ferrante, McDonald-McGinn, Zackai, & Simon, 2005; Lewandowski, Shashi, Berry, & Kwapil, 2007; Sobin et al., 2004; Woodin et al., 2001), while in adults, these difficulties concern planning and problem solving (Henry et al., 2002). A general executive dysfunction is observed in adolescents and adults with trisomy 21 (Lanfranchi, Jerman, Dal Pont, Alberti, & Vianello, 2010; Rowe, Lavender, & Turk, 2006).

In summary, even if authors mentioned a link between abnormal development of executive functions and some neuropsychiatric conditions, and externalizing disorders in childhood (Barkley, 1997; Oosterlaan et al., 2005; Pennington & Ozonoff, 1996), no identified study examined the link between executive function deficits in children with an ID and the psychopathological manifestations. On the other hand, research suggests that psychopathological manifestations in children with an ID vary notably by sex, age, and IQ (e.g., Bradley & Isaacs, 2006; Einfeld et al., 1999, 2006). Consequently, this study aims to verify if: 1) among children with an ID, girls present more internalized and less externalized psychopathological manifestations than boys, and show a more efficient executive functioning, when age and IQ are taken into account; 2) the executive functioning (inhibition, cognitive flexibility, working memory, planning, emotional control, initiation, ability to organize material, and self-assessment) plays a mediating role between age (independent variable) and psychopathological manifestations (dependent variable) in children with an ID, when sex and IQ are taken into account (controlled variables); and 3) the executive functions play a mediator role between IQ (independent variable) and psychopathological manifestations (dependent variable) in children with an ID, when age and sex are taken into account (controlled variables).

Method

Procedure

This research was conducted in the Saguenay-Lac-Saint-Jean region in the northeast part of Quebec Province in Canada. All the families of this region that have a child, from 5 to 21 years old, with a confirmed diagnosis of ID and who is receiving public services from the rehabilitation center for intellectual disabilities received a letter informing

parents of the main objectives of the study. The letter also stated they would be contacted by a professional from the center to invite parents to participate. In a phone call, the professional presented the study objectives, confidentiality and anonymity measures and obtained the consent of families to send their contact information to the principal investigator. A second phone call was made by a research coordinator to gather information about the child with an ID and the family and arrange an appointment for a home visit. During the visit, a research assistant obtained parents' informed consent. Subsequently, they individually completed a self-reported questionnaire, which included a section on child behaviors.

Participants

Among parents who completed the questionnaires, 106 are mothers and 83 fathers (80 couples). The age of fathers ranged from 31 to 62 years ($M = 44.8$, $SD = 7.5$) and from 27 to 60 years for mothers ($M = 41.7$, $SD = 7.5$). Fathers are significantly older than mothers [Welch's t -test (176) = -2.81, $p < .01$]. The last level of education completed is primary/secondary for nearly 60% of parents and 85% consider their family income sufficient to support family needs.

Data collection among parents was based on 122 children (54 girls and 68 boys) from 5 to 21 years old ($M = 13.5$, $SD = 4.9$) with an ID. Concerning ID level, 18% have a mild disability, 42% have a moderate disability, 27% have a severe disability, and 13% have a profound ID. Moreover, 31% have only a slight deficit on adaptive behaviors. Most children live in a nuclear family (71%) and attend a special class (66%) in school. A psychopathological manifestations questionnaire independently completed by mothers and fathers indicated that 75 children (37%) of the sample can be considered as having psychopathological manifestations. Based on observations

made by parents regarding executive functioning, 68 children (34%) of the sample presented difficulties with no sex differences.

Instruments

The Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000b) is designed to assess executive behaviors in children aged 5 to 18 years. It includes 86 items related to behaviors that may be manifested at home or school for which the parent has to assess whether the behavior is either 0 = never a problem, 1 = sometimes a problem or 2 = often a problem. Items are divided into 8 subscales: Inhibit (10 items), Shift (8 items), Emotional Control (10 items), Initiate (8 items), Working Memory (10 items), Plan/Organize (12 items), Organization of Materials (6 items), Monitor (8 items). These subscales are grouped into two indexes. The Behavioral Regulation Index (BRI) includes the first three subscales, whereas the Metacognition Index (MI) the other 5 subscales. An overall score, the Global Executive Composite (GEC), is also available and a T score above 65 is considered clinically significant. The alpha coefficients of the English version vary from .80 to .98. In this study, the alpha coefficients of the French version ranged from .79 to .97 for the overall score, the 2 indexes, and the 8 subscales. Those scores and indexes were used as mediator variables.

The French version of the Developmental Behavior Checklist – 2nd Edition - Primary Carer version (DBC-P; Einfeld & Tonge, 2002) was used to assess psychopathological manifestations in children with an ID aged 4 to 18 years. Parents rated each of the 96 items (15 to 20 min) using a 3-point Likert scale (0 = not true or does not apply, 1 = somewhat or sometimes true, 2 = very or often true). A principal component analysis revealed five factors (Disruptive/Antisocial, Self-

Absorbed, Communication Disturbance, Anxiety, and Social Relating) explaining 43.7% of the variance (Einfeld & Tonge, 2002). A total score above 45 is considered clinically significant. The alpha and test-retest coefficients (2 weeks interval) vary respectively from .66 to .91 and from .51 to .87. In this study, alpha coefficients of the overall score and of the five subscales range from .67 to .95. Those scores were used as dependent variables.

Results

Correlations and hierarchical multiple regressions were used respectively to test the first hypothesis stating sex differences between children on psychopathological manifestations and executive functioning and the two hypotheses on the mediating role of executive functions. The regression analysis can be used to control confounding variables like sex, age or IQ in respect to hypothesis.

Preliminary analyses showed that no univariate and multivariate outliers were found and that assumptions of normality, homoscedasticity, collinearity, and linearity were met. Matrix correlations between all variables show that child's sex is significantly related to anxiety [$r(199) = -.17, p < .05$] and to emotional control [$r(199) = -.14, p < .05$]. Thus, according to parents, girls are more anxious ($M = 4.74, SD = 3.27$) and show more emotional control problems ($M = 20.25, SD = 5.77$) than boys ($M = 3.70, SD = 2.76; M = 18.68, SD = 5.29$, respectively). No other significant correlations with child's sex were observed. Consequently, the first hypothesis stating that girls present more internalized and less externalized psychopathological manifestations than boys and show a more efficient executive functioning, when age and IQ are taken into account, is partially confirmed.

To test the second hypothesis on the mediating role between age and psychopathological manifestations, a

partial correlations matrix was computed in order to verify Baron and Kenny's (1986) criteria. According to these authors, three conditions are to be met. First, the independent variable (IV) must be significantly correlated with the mediating variable (MV). Secondly, the MV must be significantly correlated to the dependent variable (DV). Finally, the IV must be significantly correlated to the DV. Moreover, when the MV is considered, the correlation coefficient between the IV and DV decreases or becomes nonsignificant (partial or total mediation). Lastly, to determine if the effect of the MV is significant or not, the Sobel test was applied (MacKinnon & Fairchild, 2009).

The correlations between age and BRIEF's subscales were consequently examined while sex and IQ were controlled (see Table 1). The first criterion was met for 3 executive function components (Working Memory, Organization of Materials, and Monitor) of the Metacognition Index and the latter overall index. Indeed, significant correlations were found between age (IV) and Metacognition Index [$r(199) = -.18, p < .01$], Working Memory [$r(199) = -.22, p < .01$], Organization of Materials [$r(199) = -.31, p < .001$], and Monitor [$r(199) = -.15, p < .01$] subscales. The second criterion of Baron and Kenny (1986) was also met since these four variables (MV) were significantly correlated to all of DBC-P subscales as well as its overall score (DV). Lastly, in relation to the last criterion, age is significantly correlated to two subscales of the DBC-P: Self-Absorbed Behaviors [$r(199) = -.35, p <$

$.001$], and Social Relating [$r(199) = .23, p < .001$].

Subsequently, hierarchical multiple regressions were performed on DBC-P subscales and overall score separately. The control variables (sex and IQ) were entered in the first block of regression analysis. The second block included the age (IV) and the MV alternatively (Metacognition Index, Working Memory, Organization of Materials, Monitor). Sobel tests allow confirmation that Metacognition Index (*Sobel z-value* = -2.54, $p < .05$), Working Memory (*Sobel z-value* = -3.03, $p < .01$), Organization of Materials (*Sobel z-value* = -3.71, $p < .001$), and Monitor (*Sobel z-value* = -2.10, $p < .05$) partially mediate the relationship between age and Self-Absorbed Behaviors subscale (see Table 2). Conversely, the different MVs (Metacognition Index, Working Memory, Organization of Materials, Monitor) increased the effect of age on the Social Relating subscale, suggesting a suppression effect. Sobel tests indicated that all these effects were significant (Metacognition Index: *Sobel z-value* = -2.31, $p < .05$; Working Memory: *Sobel z-value* = -2.81, $p < .01$; Organization of Materials: *Sobel z-value* = -3.15, $p < .01$; and Monitor: *Sobel z-value* = -2.04, $p < .05$). In conclusion, the second hypothesis on the mediator role of executive functions between age and psychopathological manifestations is partially confirmed. In fact, only metacognition indicators play a mediating effect between age and the Self-Absorbed Behaviors subscale, but a suppressor role for Social Relating subscale.

Table 1

Partial correlations between age and BRIEF subscales after controlling for sex and IQ

	1	2	3	4	5	6	7	8	9	10	11
1. Age	--										
2. INHIB	-.08	--									
3. SHIFT	.04	.67 ***	--								
4. EMOCTL	-.04	.69 ***	.64 ***	--							
5. INITIA	-.01	.64 ***	.54 ***	.53 ***	--						
6. WMEM	-.22 **	.61 ***	.56 ***	.45 ***	.72 ***	--					
7. PLAN	-.07	.62 ***	.56 ***	.50 ***	.71 ***	.75 ***	--				
8. ORGMAT	-.31 ***	.51 ***	.42 ***	.48 ***	.51 ***	.59 ***	.59 ***	--			
9. MONIT	-.15 *	.77 ***	.61 ***	.59 ***	.69 ***	.71 ***	.75 ***	.61 ***	--		
10. BRI	-.04	.90 ***	.84 ***	.90 ***	.64 ***	.60 ***	.63 ***	.54 ***	.75 ***	--	
11. MI	-.18 **	.73 ***	.63 ***	.59 ***	.86 ***	.90 ***	.88 ***	.77 ***	.87 ***	.73 ***	--
12. GEC	-.13	.87 ***	.77 ***	.78 ***	.82 ***	.82 ***	.82 ***	.71 ***	.87 ***	.92 ***	.95 ***

Note. INHIB=Inhibit. SHIFT=Shift. EMOCTL=Emotional Control. INITIA=Initiate. WMEM=Working Memory. PLAN=Plan/Organize. ORGMAT=Organization of Materials. MONIT=Monitor. BRI=Behavioral Regulation Index. MI=Metacognition Index. GEC=Global Executive Composite of Behavior Rating Inventory of Executive Function (BRIEF).

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

Results of mediation analysis using hierarchical multiple regression

Mediating Variable (MV)	Dependent Variables (DV)	Initial β coefficient for age	β coefficient for age after introduction of the MV	Percentage of explained variance (r^2)
Metacognition Index	Self-Absorbed Behaviors	-.35***	-.25***	45.5
	Social Relating	.23***	.32***	29.7
Working Memory	Self-Absorbed Behaviors	-.35***	-.24***	39.5
	Social Relating	.23***	.34***	26.1
Organization of Materials	Self-Absorbed Behaviors	-.35***	-.22***	31.9
	Social Relating	.23***	.34***	15.3
Monitor	Self-Absorbed Behaviors	-.35***	-.26***	45.8
	Social Relating	.23***	.29***	21.2

Note. The percentage of explained variance includes age and the MV.

*** $p < .001$.

The same procedure was carried out to verify the third hypothesis that stated executive functions perform a mediating role between child's IQ and psychopathological manifestations, taking into account sex and age. A partial correlations matrix (see Table 3) showed there was no significant relationship between children's IQ and any of BRIEF's subscales. Thus, the first criterion of Baron and Kenny (1986) necessary for mediation is not met. Consequently, no further analyses were conducted and the third hypothesis was unconfirmed.

Discussion

The first hypothesis stated that girls with an ID present more internalized and less externalized psychopathological manifestations than boys and show a more efficient executive functioning than boys. Results partially confirm this hypothesis. Indeed, sex is significantly linked to anxiety as assessed by the DBC-P. Girls showed higher scores than boys. This result converges with those reported by other authors (Bradley & Isaacs, 2006; Einfeld, et al., 2006; Winstead & Sanchez, 2005).

Bradley and Isaacs (2006) indicated, among other things, that sex differences observed in the general population in relation to psychopathology may also be found among people with an ID. Thus, in children with typical development, biological, cognitive, and emotional development of girls is faster than boys. This is due to the fact that puberty occurs earlier. The same mechanisms operate for the majority of children with an ID, but puberty may occur at a later chronological age than in typically developing children (Morano, 2001). In addition to these phenomena, boys and girls with an ID are more exposed to negative social experiences such as peer rejection, stigma or intimidation (Reiss & Benson, 1984). The combination of negative social experiences may affect children's perception about themselves (Emerson & Hatton, 2007). As in general population, anxiety appears more prevalent for girls with an ID.

In this sample, anxiety is the only significant sex difference concerning psychopathological manifestations. In other studies, many authors found no sex differences on psychopathological

Table 3

Partial correlations between IQ and BRIEF subscales after controlling for sex and age

	1	2	3	4	5	6	7	8	9	10	11
1. IQ	--										
2. INHIB	-.07	--									
3. SHIFT	-.01	.67 ***	--								
4. EMOCTL	-.04	.69 ***	.64 ***	--							
5. INITIA	-.14	.64 ***	.54 ***	.53 ***	--						
6. WMEM	-.09	.61 ***	.56 ***	.45 ***	.72 ***	--					
7. PLAN	-.11	.62 ***	.56 ***	.50 ***	.71 ***	.75 ***	--				
8. ORGMAT	-.31	.51 ***	.42 ***	.48 ***	.51 ***	.59 ***	.59 ***	--			
9. MONIT	-.05	.77 ***	.61 ***	.59 ***	.69 ***	.71 ***	.75 ***	.61 ***	--		
10. BRI	-.05	.90 ***	.84 ***	.90 ***	.64 ***	.60 ***	.63 ***	.54 ***	.75 ***	--	
11. MI	-.14	.73 ***	.63 ***	.59 ***	.86 ***	.90 ***	.88 ***	.77 ***	.87 ***	.73 ***	--
12. GEC	-.10	.87 ***	.77 ***	.78 ***	.82 ***	.82 ***	.82 ***	.71 ***	.87 ***	.92 ***	.95 ***

Note. INHIB=Inhibit. SHIFT=Shift. EMOCTL=Emotional Control. INITIA=Initiate. WMEM=Working Memory. PLAN=Plan/Organize.

ORGMAT=Organization of Materials. MONIT=Monitor. BRI=Behavioral Regulation Index. MI=Metacognition Index. GEC=Global Executive Composite of Behavior Rating Inventory of Executive Function (BRIEF).

*** $p < .001$.

manifestations among children with an ID (Chadwick et al., 2000; Dekker & Koot, 2003). The complex interactions between age, level of ID, and sex may be explained by the heterogeneity of psychopathological manifestations among children with an ID and differences observed with those typically developing (Einfeld et al., 2006; Witwer & Lecavalier, 2008). Thus, it is difficult to identify the contribution of each factor and the interaction may better reflect the whole. Moreover, Mash and Dozois (2003) found that, in children with typical development, sex differences among preschoolers and elementary school children are tenuous or sometimes nonexistent, but increase with age. Considering the fact that socio-emotional development and brain maturation occur later in children with an ID, it is possible that sex differences may also occur later and accentuate with age. Nevertheless, the relationships between sex and psychopathological manifestations in children with an ID were not studied extensively and so far results diverge. Now that dual diagnosis in ID is recognized, Hodapp and Dykens (2005, 2009) recommend that studies address this topic.

The first hypothesis also postulated executive functions of girls with an ID are more efficient than that of boys, but the only emerging sex difference concerns emotional control. However, it appears that girls experience more difficulties than boys in modulating their emotional responses by showing, for example, emotional lability or overreacting to innocuous events (Gioia et al., 2000b). Some authors suggested that executive functioning of girls with typical development was slightly more efficient than boys (Chevalier, 2010), particularly in terms of inhibition capacities (Carlson & Moses, 2001), due to an earlier maturing of prefrontal brain regions in girls. The fact that brain development of children with an

ID occurs later and with anomalies, in comparison to typically developing children, may explain the few sex differences found between boys and girls (Lussier & Flessas, 2009). In addition, some studies reported no sex differences in executive functioning among children with typical development (Hongwanishkul et al., 2005). On the other hand, the higher level of girls' anxiety observed by parents may contribute to emotional control difficulties. Finally, it is socially expected that girls should be quieter and more reserved than boys (Carter, Silverman, & Jaccard, 2011). Consequently, as behavioral problems exhibited by girls with an ID are more prevalent than in the general population, they can underlie emotional control difficulties.

The second hypothesis stated that executive functions play a mediating role between age and psychopathological manifestations in children with an ID. Results showed that metacognition had a mediating role between age and self-absorbed behaviors and a suppression effect in the relationship between age and social related problems.

Even if authors report children with an ID manifested less self-absorbed behaviors as they get older, few hypotheses were formulated to explain this relationship (Cormack, Brown, & Hastings, 2000; Einfeld & Tonge, 2002; Einfeld et al., 2006). Einfeld et al. (2006) and Witwer and Lecavalier (2008) indicated sex and ID level were related to psychopathological manifestations, but that other variables may also intervene in this relationship. Metacognition could therefore be one of these variables. De Ruiter et al. (2007) suggested age could have a positive or a negative relationship depending on the type of psychopathological manifestations. According to these authors, developmental stages of children with an ID may differ or

occur later than those of typically developing children due to a deficit or a delay concerning communication skills development. Emotions are thus more likely to be expressed through impulsiveness, social withdrawal or behavioral problems such as self-absorbed behaviors. Consequently, the older the child gets, the more likely he should develop communication and social skills, which would reduce behavioral disorders as in young children with typical development. This developmental stage might occur later in children with an ID (de Ruyter et al., 2007). In this sense, Lussier and Flessas (2009) argued that frontal lobes of children with an ID may develop more belatedly and would not reach maturity due to frequent brain abnormalities. The decline of self-absorbed behaviors with age may also be related to acquisition of language skills which are linked to executive functions development (Denckla, 1996; Dodd & Crosbie, 2011). Indeed, authors demonstrated that verbalization of relevant information while solving tasks involving executive functioning promotes children's performance (Fernyhough & Fradley, 2005; Kirkham, Cruess, & Diamond, 2003; Müller, Zelazo, Hood, Leone, & Rohrer, 2004). Children with better language skills also have more efficient executive functioning (Espy, Bull, Martin, & Stroup, 2006). Therefore, just as in children with typical development, language development seems to contribute to an increase in metacognitive capacities in children with an ID. Acquisition of metacognition, which relates to the ability of the child to initiate, plan, organize, and maintain an effective strategy for problem solving in working memory, enables him to self-regulate and reflects his ability to adjust in a current task and also to consider environmental feedback (Gioia et al., 2000b). It allows the child to increase self-awareness and sensitivity to the surrounding world, and also to decrease self-

absorbed behaviors. Development of executive functions, notably metacognition, is linked to adaptive functioning and socio-emotional skills development (Dodd & Crosbie, 2001). Moreover, Einfeld et al. (2006) found children with severe to profound ID have the highest scores concerning self-absorbed behaviors and the latter are negatively correlated with age. Consequently, children with mild to moderate ID exhibit less self-absorbed behaviors, greater language skills and metacognition capacities. Considering a later maturation of the frontal lobes, metacognition capacities are also likely to develop later in children with severe or profound ID.

Contrary to what was expected, results highlighted the suppression role of metacognition in the relationship between age and social related problems. The suppression effect of a variable (metacognition) means that its introduction into the relationship between the independent variable (age) and the dependent variable (social related problems) increases the proportion of variance explained by the independent variable (MacKinnon et al., 2009). The older the child gets, the more likely s/he is to demonstrate skills in terms of metacognition and also become at risk for relationship problems. Einfeld et al. (2006) found relationship problems increase, while other types of psychopathological manifestations tend to decrease with time. They hypothesize that an increase of anxiety symptoms and of relationship disorders in girls might reflect that the social skills of the child are more solicited with age, for example when leaving a protected environment, such as school. Several authors also identified that as children with an ID get older they face more psychosocial stressors than typically developing children

(de Ruiter et al., 2007; Emerson & Hatton, 2007; Wallander, Dekker, & Koot, 2006). These stressors can produce negative consequences on personality development of the child, his/her emotional adjustment, and attachment capacities, which can lead to inappropriate social behavior and eventually to relationship problems (Tonge, 2007). Child's metacognitive development allows him to become more aware of the world around him, of his/her condition, of his/her differences, and the look of others over him, but his skills in terms of problems solving remain nevertheless limited. In this sense, Lussier and Flessas (2009) report that in children with a mild ID, development usually stops at the concrete operational stage. Thus, these children are likely to be less skilled to solve new or unusual problems because they lack metacognitive strategies and have difficulties using them spontaneously. De Ruiter et al. (2007) found the adolescence period confronts the child with an ID with his personal limitations and s/he becomes more at risk to develop internalized disorders that can cause or be expressed by relationship problems. Evans (1998) added these children would have an unrealistic self-concept, which would expose them to multiple failures in their interpersonal relations. This would make children more vulnerable to depression, which can be expressed by social withdrawal and relationship problems. Although results show a reduction of executive problems with age, the executive functioning of these children is not as efficient as that of typically developing children. Thus, an altered or incomplete development of executive functions, and more specifically of metacognition, does not allow the child to acquire sufficient socio-emotional capabilities to adequately adapt to his environment. To this end, Danielsson, Henry, Messer, and Rönnerberg (2012) found the global executive functioning of children

with a mild ID is significantly less efficient than that of children of the same chronological age. Finally, this result may be related to that discussed above, namely that the development of metacognition with age is linked to less self-absorbed behaviors. Consequently, the child, who is more open to others and less centered on him/herself, has more opportunities to interact socially, but this also creates more opportunities to have relationship problems.

As in typically developing children, metacognition development is related to age among children with an ID, but contrary to what was expected, it is not the case for behavioral regulation. Behavioral control is the child's ability to show cognitive flexibility and to modulate emotions and behavior through appropriate inhibitory control. It allows metacognitive processes to develop into an active and effective problem solving system and more generally, to support effective self-regulation. Moreover, Gioia et al. (2000b) indicated behavioral regulation would occur prior to metacognition development. This raises the question whether behavioral regulation skills stop developing earlier in children with an ID than among those typically developing. In the latter, the inhibitory capacity, part of behavioral regulation, starts to develop during preschool years and improvements can be noted up to the age of 21 (Best, Miller, & Jones, 2009; Huizinga et al., 2006; Romine & Reynolds, 2005). Inhibitory capacity is also recognized as playing a fundamental role in other executive functions development (Best et al., 2009). A deficit of inhibitory processes in infancy could then have a negative influence on the development of other executive functions without necessarily nullifying their development because, in the current sample, changes are observed on metacognition.

The last hypothesis stating that executive functions play a mediator role between IQ and psychopathological manifestations in children with an ID is unconfirmed because IQ is not significantly correlated with the various executive functions studied in this research. According to previous authors, the links between IQ and executive functions differ. Thus, some studies with non-clinical populations showed links between performances in so called intelligence tasks and tasks assessing executive functions (Carpenter, Just, & Schell, 1990; Miyake, Friedman, Rettinger, Shah, & Hegarty, 2000; Salthouse, Fristoe, McGuthry, & Hambrick, 1998). More specifically, Luciano et al. (2001) raise the possibility that executive functions and intelligence share a common variance that could be explained by frontal lobe development level. In a sample of adults with an ID of various etiologies, Willner et al. (2010) observed very weak links between IQ and performance on tasks assessing executive functions. However, other authors indicate that it is not all executive functions that have links with intelligence (Friedman et al., 2006). Therefore, Hooper et al. (2008) as Kirk, Mazzocco, and Kover (2005) found that IQ is related to low performance on executive function tasks, particularly concerning inhibition, flexibility, planning, and working memory in children with fragile X syndrome or Turner syndrome. Results of the current study are not in the same direction as those found in previous research (Carpenter et al., 1990; Miyake, Friedman, Rettinger et al., 2000; Salthouse et al., 1998). Those latter focused on homogeneous samples of children for whom the etiology of ID was known (Hooper et al., 2008; Kirk et al., 2005). In the current study, the sample included children with different or unknown origins of ID. This sample heterogeneity may have contributed to the

fact that IQ is not linked to the various executive functions assessed by the BRIEF.

The BRIEF is a questionnaire that allows an ecological assessment of executive functioning based on behaviors observed at home or school. However, different authors observed that BRIEF scores are not or are only slightly correlated to those obtained with tests assessing executive functions, such as inhibition, and working memory (Anderson, Anderson, Northam, Jacobs, & Mikiewicz, 2002; McAuley, Chen, Goos, Schachar, & Crosbie, 2010; Vriezen & Pigott, 2002). According to McAuley et al. (2010), this questionnaire better assesses attention deficits and hyperactivity than executive functioning. The BRIEF's Working Memory subscale is particularly sensitive to these problems and the combination of Working Memory, Inhibit, Shift, and Plan/Organize subscales are good predictors of AD/HD (McAuley et al., 2010). Thus, future studies could include tests to assess executive functioning and compare results with measurements reported by members of the entourage. The factorial structure of the BRIEF is also questioned by various authors. According to some, a factorial structure with three factors: one related to behavioral regulation, another to metacognition and a third to emotional regulation could account for more explained variance (Egeland & Fallmyr, 2010; Peters, Algina, Smith, & Daunic, 2012). In addition, the Monitor subscale should be divided in two in order to account for differences between tasks and behavior management. On the other hand, Keogh and Bernheimer (1998) reported clinicians and researchers insist on behavior problems assessment using various informants to obtain a more accurate portrait of the behavior in different environments. In this study, children's assessment was generally done by their two parents. Even if it was done separately, this

constitutes a limitation since their evaluations are not completely independent as they are from the same family. Moreover, parental assessment of child behavioral problems could be affected by their level of psychological distress. As the latter is more prevalent among parents of children with an ID than in general population (Baker et al., 2003), they may report more child behavioral problems (Renk et al., 2007).

Representativeness of the study's sample may affect external validity. It is composed of parents receiving services from a center for children with an ID. In Quebec it is known that families having a child with a mild ID are less likely to use services available. This may contribute to the lack of variability concerning IQ and the small correlations found between IQ scores and various executive functions or psychopathological manifestations assessed, respectively, by the BRIEF and DBC-P. Consequently, it would be interesting to conduct this study with a sample including more children with a mild ID. As significant links were found in studies on typical populations, it would be useful to understand why correlations were not found in ID.

Conclusion

Until now, few studies investigated executive functions of children with an ID due to characteristics of the population that limit neuropsychological tests choice, but the current study showed that an assessment of executive functioning of these children through informants provides interesting results for clinical purposes. Among reviewed papers, no studies examined the relationship between executive functions and psychopathological manifestations. Furthermore, parental observations showed that girls have a higher level of anxiety and

greater difficulties in terms of emotional control than boys. Future studies should investigate if emotional control difficulties identified by parents are a consequence of girls' higher anxiety level.

The current study also revealed that development of executive functions, mainly metacognition, could explain a decrease of self-absorbed behaviors when the child gets older and an increase of relational difficulties, as the child becomes more aware of his capabilities, limitations, and his environment. Interventions that enable the development of metacognition functioning among children with an ID should be considered as well as their preparation to deal with this awareness. Consequently, metacognition constitutes an element that practitioners in schools and services centers could include in their interventions. Knowing that some children with an ID have metacognition abilities that may develop, it becomes possible to implement interventions that contribute to acquire strategies to palliate or compensate for their executive deficits. Interventions are also needed to prevent increasing relationship problems with age. Development of students' metacognitive skills, including those related to problem solving, could help to improve their social integration. In conclusion, this study showed that metacognitive capacities of children with an ID appear to develop sufficiently to allow them an openness to the world and awareness of their condition and differences, but the level achieved does not seem to allow proper adaptation. Even if improvements in executive functioning are noted as children with an ID get older, metacognition does not develop at the same rate and to the same level than in typically developing children.

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