Education and Training in Autism and Developmental Disabilities

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

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The purposes of this organization shall be to advance the education and welfare of persons with autism and developmental disabilities, research in the education of persons with autism and developmental disabilities, competency of educators in this field, public understanding of autism and developmental disabilities, and legislation needed to help accomplish these goals. The Division shall encourage and promote professional growth, research, and the dissemination and utilization of research findings.
Education and Training in Autism and Developmental Disabilities

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Manuscripts Accepted for Future Publication in Education and Training in Autism and Developmental Disabilities

September 2019

Do illustrations promote reading comprehension in adults with intellectual or developmental disabilities? Meredith Saletta, Erica Kaldenberg, Kiara Rivera, and Audrey Wood, University of Iowa, Dept. of Communication Sciences and Disorders, Wendell Johnson Speech and Hearing Center, 250 Hawkins Dr., Iowa City, IA 52240.

Effectiveness of video modeling presented by tablet PC on teaching job interview skills to individuals with developmental disabilities. Turgut Bahcali and Arzu Ozen, Anadolu Universitesi, Engel-liler Arastirma Enstitusu, Eskisehir, 26470, TURKEY.

Comparing no-no prompt to flexible prompt fading to teach expressive labels to individuals diagnosed with autism spectrum disorder. Justin B. Leaf, Joseph H. Cihon, Julia L. Ferguson, Ronald Leaf, and John McEachin, 200 Marina Drive, Seal Beach, CA 90740.

Promoting social play based on ecological assessment and social play selection conditions of a child with autism spectrum disorder in an inclusive early childhood classroom. Aya Fujiwara and Shigeki Sonoyama, University of Tsukuba, 111 Tennodai, Tsukuba, Ibaraki 3058572, JAPAN.

Impact of video modeling combined with skillstreaming teaching procedures on the social interaction skills of middle school-aged children with ASD. Onur Emre Kocaoz, Mary E. Little, and Jennifer Gallup, Department of Special Education, Aksaray University, Aksaray, 68100, TURKEY.

Effects of a self-monitoring strategy to increase classroom task completion for high school students with moderate intellectual disability. Yi-Fan Li, Hsinyi Chen, Dalun Zhang, and Carly B. Gilson, Department of Educational Psychology, 4225 TAMU, College Station, TX 77843-4225.

Examining use of school personnel in CBT interventions for anxiety in students with ASD. Lisa A. Simpson, Cara S. Maffini, and Rachel K. Schuck, Connie L. Lurie College of Education, One Washington Square, San Jose State University, San Jose, CA 95192-0078.

Effects of constant time delay on route planning using Google maps for young adults with intellectual and developmental disabilities. Chengan Yuan, Kinga Balint-Langel, and Youjia Hua, Arizona State University, Mary Lou Fulton Teachers College, PO Box 871811, Tempe, AZ 85287-1811.

Address is supplied for author in boldface type.
Descriptive Analysis of the Use of Punishment-Based Techniques with Children Diagnosed with Autism Spectrum Disorder

Justin B. Leaf, Donna Townley-Cochran, Joseph H. Cihon, Erin Mitchell, Ronald Leaf, Mitchell Taubman, and John McEachin
Autism Partnership Foundation

Abstract: Punishment is any stimulus change following a response that decreases the probability of that response occurring in similar situations in the future. Punishment-based techniques (i.e., techniques developed based upon the functional definition of punishment) are effective at decreasing undesired behavior. Despite the documented effectiveness, there have been several concerns about the use of punishment techniques (e.g., potential negative side effects such as aggression and problems of generalization). As a result, the use of punishment techniques (e.g., saying “no”) have been avoided within clinical settings for children diagnosed with autism spectrum disorder (ASD). The purpose of this descriptive analysis was to evaluate how punishment techniques were used within a clinical setting for 15 students diagnosed with ASD. The results showed that although punishment techniques (e.g., saying “no” or removal of a token) occurred frequently, the students rarely demonstrated negative reactions commonly ascribed to the use of punishment.

Punishment is defined, functionally, in terms of its effect on behavior. That is, punishment is any stimulus change contingent upon a response that decreases the probability of that response occurring in similar situations in the future (Catania, 1998; Skinner 1953). Positive punishment occurs when aversive stimuli are added to the environment that reduce probability of the preceding behavior (Cooper, Heron, & Heward, 2007). Negative punishment is the removal of a reinforcing stimulus contingent upon a response that reduces the probability of the behavior that preceded the stimulus change (Cooper et al., 2007). Punishment is also used colloquially to describe punishment-based techniques used within the treatment of autism spectrum disorder (ASD). Moreover, the term “punishment” is commonly used to describe corrective procedures such as time out, token removal, contingent removal of a reinforcer, and corrective feedback which rely on the principle of punishment for their effectiveness.

The use of punishment-based techniques have been empirically investigated with individuals diagnosed with ASD, developmental disabilities, and cognitive delays (e.g., Fisher et al., 1993; Lovaas & Simons, 1969; Moore & Bailey, 1973). Researchers have evaluated the effectiveness of these techniques within more socially acceptable procedures such as timeout from reinforcement (e.g., Alberto, Heflin, & Andrews, 2002; Bostow & Bailey, 1969; Foxx & Shapiro, 1978; Yeager & McLaughlin, 1995), redirection (e.g., Cassella, Sidener, Sidener, & Progar, 2011), overcorrection (e.g., Foxx & Azrin, 1973), loss of tokens (e.g., Burchard & Tyler, 1965), and corrective feedback (e.g., Barbetta, Heron, & Heward, 1993; Drevno et al., 1994; Smith, Mruzek, Wheat, & Hughes, 2006). The effectiveness of punishment techniques with less socially acceptable procedures have also been evaluated including, but not limited to, thigh slaps (e.g., Lovaas 1987), electric shock (e.g., Lovaas & Simons, 1969), and water misting (e.g., Amtzen & Werner, 1999). It should, however, be noted that there is also a clear literature base indicating that contingent delivery of shock, slaps, and other
procedures that result in physical pain or discomfort are associated with a significant set or reactive responses (Cooper et al, 2007).

Generally, the results of studies evaluating punishment techniques have demonstrated that these techniques are effective at decreasing the probability of a response when implemented with high fidelity, in controlled settings, and with proper supervision (Lerman & Vorndran, 2002). It is common and recommended that these punishment techniques are only used in the context of a comprehensive program including the use of reinforcement-based techniques. Despite the documented evidence of the effectiveness of punishment-based techniques, their use within the treatment of ASD, and ABA in general, remains controversial. As such, many professionals have advocated for or against the use of punishment-based techniques (e.g., Baer, 1970; Gast, 2011; LaVigna & Donnellan, 1986; McGee, Menolascino, Hobbs, & Menousek, 1987; Risley, 1968). Common rationales to avoid the use of punishment techniques (e.g., saying “no” following an incorrect response) include, but are not limited to, modeling of undesirable behaviors, negatively affecting an individual’s self-esteem, invoking respondent or operant aggression, momentary decreases in probability would not generalize, or that a therapist may become over reliant on punishment techniques (Ferster & DeMeyer, 1962; Gast, 2011; Lerman & Vorndran, 2002; Sulzer-Azaroff & Mayer, 1991). These rationales are provided despite the evidence that aberrant behavior only occurs in a small number of cases involving the use of punishment-based techniques (Matson & Tarras, 1989).

The debate over the use of less socially acceptable forms of punishment techniques (e.g., shock, water misting, taste aversion, loud reprimands) may have contributed to professionals avoiding the use of all types of punishment techniques, even less invasive forms such as verbal feedback, token removal, or loss of a toy/activity. Additionally, this debate may have contributed to the dearth of recent empirical investigations of the use of punishment-based techniques within the field of ASD intervention. Given the documented effectiveness of punishment techniques and the common use thereof in modern life (Skinner, 1953), more investigations are necessary. Therefore, the purpose of this descriptive analysis was to evaluate the clinical implementation of common, less invasive forms of punishment-based techniques (e.g., verbal corrective feedback, loss of a toy/privilege, loss of a token, or denial of request) for 15 individuals diagnosed with ASD. Specifically, we evaluated ten 30 min clinical sessions for each participant to determine: (a) the frequency of punishment-based techniques used by the therapist; (b) the different variables involved in the implementation of these techniques (e.g., the child’s responses that resulted in their use, the therapist’s voice tone); (c) the frequency and type of student responses following the use of a punishment-based technique; and (d) the relationship between type of technique and the type of student response.

Method

Students

The study included 15 students who were independently diagnosed with an ASD. All students were currently receiving behavioral intervention which included, but was not limited to, discrete trial teaching (DTT), group instruction (e.g., Ledford, Gast, & Luscre, 2008), systematic desensitization (e.g., Ellis, Ala’i-Rosales, Glenn, Rosales-Ruiz, & Green spoon, 2006), teaching interaction procedure (TIP; e.g., Dotson, Richman, Abby, Thompson, & Plotner, 2013), cool versus not cool procedure (e.g., Leaf et al., 2016c), and incidental teaching (Hart & Risley, 1975). Each student’s curriculum was individualized, generally the approach to treatment was progressive (for a detailed description see Leaf, Cihon, Leaf, McEachin, & Taubman, 2016a; Leaf et al., 2016b) and utilized several curriculum sources (e.g., Leaf & McEachin, 1999; Taubman, Leaf, & McEachin, 2011). All students had prior experience with procedures that included the punishment-based techniques measured; however, each student’s history with these techniques varied. All students and parents consented to the clinical procedures implemented in this analysis. No student had any form functional analysis for any aberrant behavior as the clinical model endorsed a progressive approach (Leaf et al., 2016a) where functions of behavior were based on in the moment decisions.
To analyze the use of the punishment-based techniques (i.e., techniques developed based upon the functional definition of punishment) from the therapists and the students’ response to those techniques, the students were divided into two groups. The first group (Group A) included seven students all who would be considered “higher functioning” (e.g., Level 1 on DSM V). Students in Group A had full scale IQ scores on the Wechsler Intelligence Scale for Children Version Four or the Wechsler Preschool and Primary Scale of Intelligence Version Three of 80 or above (i.e. low normal or higher). Students in Group A could maintain simple conversations, had deficits in social skills (e.g., difficulty identifying and responding to social cues), and engaged in low rates of potentially dangerous aberrant behavior (e.g., aggression or self-injury). The second group (Group B) included eight students with more skill deficits and challenging behavior (e.g., considered Level 3 on DSM V). Students in Group B had IQ scores that ranged from 79 to untestable (borderline and below), who displayed limited language skills, limited social skills, and engaged in serious and potentially dangerous aberrant behavior. Table 1 displays demographic information for the students in the two groups.

### Therapists

Thirty therapists participated in the study. Each therapist was hired as a full-time employee of an agency that provides behavioral intervention to individuals diagnosed with ASD. Each therapist had a minimum of a bachelor’s degree in psychology, education, or a related field (e.g., communication majors). Each therapist participated in approximately three months of full time (40 hours per week for approximately 480 total hours) initial training which included didactic instruction, role-playing, in-vivo feedback, and hands on training of the principles of applied behavior analysis (ABA) and characteristics of students diagnosed with an ASD. Some of the specific areas of training included foundational skills (e.g., identifying and conditioning reinforcers), communication temptations (e.g., setting up clear opportunities for communicative responses to occur), pacing (e.g., not repeating instructions, clear end and beginning to each trial), prompting (e.g., when and how to fade prompts, when to avoid prompts), shaping, and behavioral management (e.g., responding to aberrant behavior based upon presumed function). It should be noted that these are just some areas and examples and is not an exhaustive list of training targets. Each therapist received ongoing supervision by certified and non-certified behavior analysts with 7–40 years of experience with ABA and ASD intervention. Additionally, two licensed psychologists oversaw the entire program. Therapists had from 2 months (not including initial training) to 19 years of experience within the agency and from 1 week to 3 years of experience with the student with whom they were working.

### Setting

All sessions took place in a clinical office in the western part of the United States that provides behavioral intervention for individuals diagnosed with an ASD. There were a total
of 13 different intervention rooms within the agency and sessions could occur in any room dependent upon the daily schedule. All rooms had adult and child furniture, instructional materials, and reinforcers available at all times.

Observation Periods

The researchers evaluated the therapist and student behaviors (described below) during 30 min observation periods. Each student came to the clinic 1 to 5 days per week with anywhere from one to three sessions per day. Each session lasted between 2 to 3 hr. The researchers randomly determined a 30 min observation period for the students who came for only one session per day. For students who came for more than one session per day, the session and 30 min observation period were randomly determined. Each student was observed for 10 sessions for a total of 300 min of observation (total of 4500 min of observation across all participants).

During each observation period, the student, therapist, researcher, and, at times, a trainee (i.e., a professional that was receiving the initial training) were present. Observation periods only occurred if one of the student’s regular staff was present (i.e., not a substitute therapist), and intervention was going to occur in a one-to-one instructional format. Additionally, in order to ensure that the observed behavior was not mitigated or exaggerated by factors unrelated to the aversive stimulus itself, observations were not conducted if the therapist planned to target frustration tolerance or utilize systemic desensitization or relaxation training. If the therapist indicated s/he was going to implement any of the aforementioned programs, the researcher waited until the therapist was done with those programs to conduct the observation period. Prior to the observation period, the researcher informed the therapist that s/he would be observing the session for 30 min and to proceed with therapy as usual. The researcher sat in a chair or couch, did not provide any other instructions, and did not interact with the therapist or participant. To prevent potential reactivity to the researcher, s/he spent at least one session in the room with the participant prior to an observation period. Furthermore, it was not uncommon for a supervisor, researcher, or other observers to come into sessions throughout the day.

Measures

Several therapist and student measures were collected during observational periods. Table 2 provides detailed operational definitions for student and therapist measures.

Therapist. Therapist measures included the frequency and type of punishment-based techniques, the student’s response, and the therapist’s tone of voice. A Punishment-Based Technique (i.e., techniques developed based upon the functional definition of punishment) was defined as the therapist contingently presenting a potentially aversive stimulus or removing a potentially reinforcing stimulus contingent upon student aberrant behavior. Student responses were divided into two subcategories (i.e., aberrant behaviors and incorrect responses). Three subcategories of punishment-based techniques were defined (i.e., corrective feedback, token loss, or loss of an item or privilege). Furthermore, we made an effort to develop a hierarchy using these three subcategories based upon their presumed invasiveness from an outside observer. If the therapist utilized multiple of these subcategories (e.g., corrective feedback and token loss) both were recorded (to determine frequency); however, the subcategory that was the highest on the hierarchy was used to calculate the percentage of types of corrective events provided. The hierarchy, from the least to most invasive, was corrective feedback, token removal, and a loss of a toy/privilege. We calculated the percentage of each type of punishment-based techniques provided by dividing the frequency of each type by the sum of all three types. It should be noted that no physical punishment techniques (e.g., water mist, shock, slaps, taste aversion) were evaluated in this study or used in the clinical setting. Tone was divided into three subcategories (i.e., mild, moderate, and firm). A mild tone was if the therapist provided feedback in a tone that was similar to how instructions were provided during teaching. A moderate tone of voice was if the therapist provided feedback in a tone that was similar to how instructions were provided during teaching. A firm tone of voice was when the teacher raised their voice tone so that it was louder.
and with an increase pace than how instructions were provided during teaching.

Student. Student measures included how the student responded to the punishment-based technique (i.e., techniques developed based upon the functional definition of punishment). Responses to Punishment Techniques were divided into three domains consisting of 12 subcategories across the domains (contact the first author for a detailed list of operational definitions). Domain 1, positive or no reaction, consisted of desirable behaviors (e.g., deep breathing, counting down) or the absence of aberrant behavior. Domain 2, negative-not dangerous, included aberrant behavior which would not result in harm to the student, to the staff, or to the environment which included: (a) non-compliance; (b) yelling; (c) non-aggressive tantrum; (d) crying/whining; (e) stereotypy; and/or (f) swearing. Domain 3, negative-dangerous reaction domain, consisted of aberrant behaviors which could result in harm to the student, to the staff, or to the environment which included: (a) aggression; (b) self-injurious behavior; (c) property destruction; and (d) elopement. Responses within each domain and across domains could occur simultaneously. In these instances, all responses were recorded. Data on responses to the punishment techniques were collected during the 15 s following therapists’ use of the technique.

The percentage of negative student responses (i.e., Domains 2 and 3) the use of a punishment-based technique and each of the variables (i.e., type of punishment based technique, voice tone) was calculated. To calculate the overall percentage of negative student responses (i.e., Domains 2 and 3), the total number of instances in which the student engaged in a negative response (i.e., Domains 2 and 3) immediately following the use of a punishment technique by the total number of times a punishment based technique was used for that student. To calculate the percentage of negative student responses (i.e., Domains 2 and 3) to each variable, the total number of instances in which the student engaged in a negative response (i.e., Domains 2 and 3) immediately following the use of a punishment technique by the total number of times a punishment based technique with that variable was used for that student. For example, the percentage of negative responses (i.e., Domain 2 and 3) to punishment techniques for when the student was engaging in aberrant behavior and the teacher used a punishment technique was calculated by dividing the total number of instances that the

### TABLE 2

**Dependent Measures**

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Response</td>
<td><strong>Aberrant Behavior</strong>&lt;br&gt;Therapist used a punishment technique contingent upon aberrant behavior (e.g., stereotypic behavior, aggression, non-compliance, elopement, in attention) that occurred during the session</td>
</tr>
<tr>
<td></td>
<td><strong>Incorrect Response</strong>&lt;br&gt;Therapist used a punishment technique contingent upon an incorrect response following a direct instruction</td>
</tr>
<tr>
<td>Type of Punishment Technique</td>
<td><strong>Corrective Feedback</strong>&lt;br&gt;The therapist provided a verbal statement (e.g., “That is not it” or “Stop it”) or a non-verbal statement (e.g., thumbs down or nodding head no)</td>
</tr>
<tr>
<td></td>
<td><strong>Token Removal</strong>&lt;br&gt;The therapist removed a token from the token board or added a token to the board if a diminishing field was in effect</td>
</tr>
<tr>
<td></td>
<td><strong>Loss of Item or Privilege</strong>&lt;br&gt;The therapist prevented access to a tangible item or an activity</td>
</tr>
<tr>
<td>Therapist Voice Tone</td>
<td><strong>Mild</strong>&lt;br&gt;The therapist provided vocal feedback in a tone similar to the instruction</td>
</tr>
<tr>
<td></td>
<td><strong>Moderate</strong>&lt;br&gt;The therapist provided vocal feedback louder than the instruction</td>
</tr>
<tr>
<td></td>
<td><strong>Firm</strong>&lt;br&gt;The therapist provided vocal feedback that would be considered yelling</td>
</tr>
</tbody>
</table>
teacher used a punishment technique when the student was engaging in an aberrant behavior and the student displayed a negative behavior divided by the total number of presentations of punishment techniques used while the student was engaging in an aberrant behavior.

Interobserver Reliability

A second observer collected data during 25% of all sessions. Event recording was used to collect interobserver agreement (IOA) for each measure. Event recording consisted of taking the smaller frequency recorded and dividing it by the larger frequency and multiplying by 100. For punishment techniques (i.e., techniques developed based upon the functional definition of punishment), the mean IOA was 94% (range, 50 to 100% per session). For what the punishment technique was contingent upon (e.g., incorrect responding), the mean IOA was 90% (range, 50 to 100% per session). For the type of punishment technique (e.g., token loss) that was used, the mean IOA was 93.8% (range, 50 to 100% per session). For tone of voice the mean IOA was 88% (range, 50 to 100% per session), and the mean IOA for student response was 91.4% (range, 50 to 100% per session).

Results

Frequency of Punishment Techniques

Figure 1 displays the frequency of punishment techniques used with each student across the 10 observation periods. The gray bars represent students in Group A (high functioning group) and the black bars represent students in Group B (more impacted group). Across all participants in both groups, the frequency of punishment techniques used ranged from 40 (i.e., Sally) to 245 (i.e., Barry).

The overall frequency of punishment techniques used with each group was 658 (average, 94 per student) for Group A and 1471 (average, 183.8 per student) for Group B. Within group A, the frequency of punishment techniques used with each participant ranged from 40 to 174 while in Group B the range was 123 to 245. Using the total frequencies for each group, the average rate of punishment techniques used per minute can be calculated. The rate of punishment techniques per minute for Group A and B was 0.31 and 0.62, respectively.

Responses to Punishment Techniques

The top panel of Figure 2 displays the percentage of times punishment techniques
were used contingent upon aberrant behavior and incorrect responses. Across the students assigned to Group A, 50.6% (range, 32.2 to 88.8%) of punishment techniques were used following aberrant behavior and 49.4% (range, 11.2 to 67.8%) following incorrect responding. Across the students assigned to Group B, 45.8% (range, 20.5 to 59.7%) of punishment techniques were used following aberrant behavior and 54.2% (range, 40.3 to 79.5%) following an incorrect response.

**Types of Punishment Techniques**

The middle panel of Figure 2 displays the percentage of each type of punishment technique used. Across the students assigned to Group A, 92.3% (range, 82.9 to 100%) of punishment techniques consisted of corrective feedback, 2.9% (range, 0 to 4.9%) consisted of removal of a token, 4.8% (range, 0 to 12.7%) consisted of removal of a preferred item or privilege. Across the students assigned to Group B, 89.7% (range, 79.3 to 98.7%) of punishment techniques con-
sisted of corrective feedback, 4% (range, 0 to 11.6%) consisted of removal of a token, 6.3% (range, 1.3 to 19.4%) consisted of removal of a preferred item or privilege.

Voice Tone

The bottom panel of Figure 2 displays the percentage of each type of voice tone the therapist used while implementing punishment-based techniques. Across the students assigned to Group A, the therapist used a mild tone of voice 97% (range, 95.1 to 100%) of the times punishment techniques were used and a moderate tone of voice 3% (range, 0 to 4.9%) of the times corrective feedback was provided. For students in Group A, a firm tone of voice was never used. Across the students assigned to Group B, the therapist used a mild tone of voice 85% (range, 72.2 to 98.4%) of the times corrective feedback was provided, a moderate tone of voice 12% (range, 1.6 to 21.7%) of the times corrective feedback was provided, and a firm tone of voice 3% (range, 0 to 6.1%) of the times corrective feedback was provided.

Student Responses to Punishment Techniques

Figure 3 displays the percentage of negative student responses to punishment-based techniques (i.e., Domains 2 and 3). Across all students and both groups, Jack (in Group B) engaged in the highest percentage of negative responses following the use of punishment techniques (i.e., 19.4% of the time). Two students, Bobby and Sally, never engaged in negative responses following the use of punishment techniques. The mean percentage of negative responses for Group A was 3.4% (range, 0 to 9% across participants) and 9.5% (range, 3.2 to 19.4% across participants) for Group B. Table 3 provides the frequency of negative responses (i.e., Domains 2 or 3) following the use of punishment techniques for each group.

Table 4 displays the percentage of time each participant engaged in a negative response following the use of a punishment technique across each therapist measure. For example, Ben engaged in a negative response 4.1% of the time a punishment technique was used for aberrant behavior and Ty engaged in a negative response 14.2% of the time a punishment technique was used with a moderate tone. There are several instances in which a student may not have come into contact with various therapist measures (e.g., if the therapist never used a firm voice when using a punishment technique), in which case a “N/A” was used.

Generally, participants in Group A were more likely to engage in a negative response
TABLE 3
Child Responses Following a Punishment Technique

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Compliance</td>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>Yelling</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Tantrum</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Aggression</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Self-Injurious Behavior</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Property Destruction</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Crying</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Stereotypic Behavior</td>
<td>3</td>
<td>59</td>
</tr>
<tr>
<td>Elopement</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Swearing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Frustration Tolerance (Positive Response)</td>
<td>19</td>
<td>0</td>
</tr>
</tbody>
</table>

when the therapist used a punishment technique contingent upon an aberrant behavior, when loss of a privilege or item was the punishment technique used, or when a mild tone was used. There are cases in which there were a high percentage of negative responses (e.g., Ty following a loss of a privilege); however, in some cases there was a small sample in which a specific type of punishment technique used (e.g., an item or privilege was only taken away one time throughout all observations). Participants in Group B generally were more likely to engage in a negative response when the therapist used a punishment technique con-

TABLE 4
Percentage of Negative Responses Following the Use of a Punishment Technique Provided Across Each Therapist Measure

<table>
<thead>
<tr>
<th>Participant</th>
<th>Punishment Technique Used Contingent Upon</th>
<th>Type of Punishment Technique</th>
<th>Voice Tone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aberrant Behavior</td>
<td>Incorrect Responding</td>
<td>Corrective Feedback</td>
</tr>
<tr>
<td>Ben</td>
<td>4.1%</td>
<td>4.1%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Bobby</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Henry</td>
<td>1.7%</td>
<td>0%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Matt</td>
<td>10.7%</td>
<td>4.5%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Sally</td>
<td>N/A</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Ty</td>
<td>8%</td>
<td>4.8%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Wayne</td>
<td>14.2%</td>
<td>8.6%</td>
<td>12.7%</td>
</tr>
<tr>
<td>Group A Average</td>
<td>7%</td>
<td>2.8%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Ally</td>
<td>11.4%</td>
<td>17.1%</td>
<td>14.1%</td>
</tr>
<tr>
<td>Barry</td>
<td>17.3%</td>
<td>2.8%</td>
<td>5.0%</td>
</tr>
<tr>
<td>David</td>
<td>14.4%</td>
<td>6.4%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Don</td>
<td>21.6%</td>
<td>3%</td>
<td>10%</td>
</tr>
<tr>
<td>Ivan</td>
<td>6.3%</td>
<td>2.2%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Jeremy</td>
<td>10.4%</td>
<td>1.3%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Jack</td>
<td>26.7%</td>
<td>13.8%</td>
<td>19.1%</td>
</tr>
<tr>
<td>Nate</td>
<td>6.8%</td>
<td>8.4%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Group B Average</td>
<td>14.1%</td>
<td>6.4%</td>
<td>9.7%</td>
</tr>
</tbody>
</table>
tingent upon an aberrant behavior, when loss of a privilege or item was the technique used, and when a mild tone was used.

Discussion

The purpose of this descriptive analysis was to evaluate the clinical implementation of punishment-based techniques for individuals diagnosed with an ASD. In a clinical setting, as part of a comprehensive intervention, punishment techniques were used at high rates (up to .61 per min) across all 15 participants. Despite the frequent use of punishment techniques, none of the students engaged in negative responses following the use of punishment techniques in more than 22% of the times in which they were used, and the average across students was below 10%. Furthermore, when participants engaged in negative responses, they would generally be considered mild (e.g., not harming), as the combination of aggression, self-injury, and property destruction only accounted for less 1% of all negative responses.

The results of this analysis demonstrated that common punishment-based techniques can be used with little to no negative side effects (e.g., aggression). Nonetheless, there are professionals who recommend against the use of any form of punishment techniques even in the context of a comprehensive program including the use of reinforcement-based techniques. For example, one claim against the use of punishment techniques is they may lead to more errors or may not be effective in teaching new skills (Bisconti, 2015; Burk, 2014; Gast, 2011). However, there is research that does not support this position, and has demonstrated that punishment techniques, when combined with reinforcement procedures, have led to rapid skill acquisition (Smith et al., 2006). A second claim against the use of punishment techniques is they may lead to aberrant behavior (Gast, 2011). However, this claim does not align with a review conducted by Matson et al. (1988) or the results of the current analysis. As such, there is no reason that clinicians should unconsciously avoid the use of safe, effective, mild punishment techniques (e.g., corrective feedback).

There are limitations that this descriptive analysis did not address which could set the occasion for future research. First, all of the students had a history with ABA procedures which include the use of punishment-based techniques. Therefore, it remains unknown how students would respond with no previous history and future researchers may wish to conduct further descriptive analyses and empirical evaluations while controlling for this history. Second, this study was done in a controlled clinical setting. Future researchers may wish to evaluate the use of punishment techniques in other settings (e.g., home, school, or community). It is, however, important that the same level of support and supervision be provided wherever punishment techniques are used (BACB, 2016). Third, this study did not evaluate if the implementation of the punishment techniques led to a decrease in the probability of the behavior that occasioned the punishment technique, or an increase in skill acquisition. Therefore, it would be difficult to interpret the results in the context of a functional definition of punishment. However, it would be difficult to measure the effects of the punishment techniques evaluated within this analysis since they were part of a comprehensive program in which other elements may be responsible for change over time. Nonetheless, future researchers should evaluate if students’ rates of acquisition increase and the frequency of aberrant behavior decreases with the same, or lower, levels of negative responses to punishment techniques observed in this analysis.

Finally, we did not measure the frequency of the use of reinforcement-based techniques (e.g., delivering a token, praise). Punishment-based techniques should never be used in isolation and should only be used in conjunction with reinforcement based procedures (BACB, 2016). The researchers did note that, anecdotally, reinforcement techniques were used more frequently than punishment techniques; however, objective data is required to make any further analyses. Additionally, researchers should evaluate the frequency of reinforcement techniques as it relates to the frequency of punishment techniques. Finally, we did not collect any social validity or acceptability measures. It remains unclear if the parents, students, or therapists preferred the use of punishment techniques. It should be noted that all parents of the students in this study
provided consent for the procedures used within the clinic. Nonetheless, future researchers should include measures of social validity when conducting similar analyses. While not the purpose of the current study, another potential future area of research would be to compare immediate responses to putatively punishing and putatively reinforcing base techniques.

Despite these limitations, this descriptive analysis demonstrated that punishment techniques resulted in little to no negative responses for 15 students diagnosed with ASD. Thus, this analysis provides a preliminary analysis of the conditions under which punishment techniques, such as error correction, can be used during intervention for individuals with an ASD. Again, it should be noted that, anecdotally, high rates of reinforcement-based techniques were used during all sessions as recommended by professionals (BACB, 2016; Van Houten, 1988). The implementation of punishment techniques might lead to quicker skill acquisition and may be an important component of a comprehensive treatment package (Lovaas, 1987). Furthermore, punishment is common within the natural environment (Skinner, 1953), and preventing learners from coming into contact with punishment techniques may leave them ill-equipped to navigate the world outside of the therapy room.

References


Foxx, R. M., & Azrin, N. H. (1973). The elimination of autistic self-stimulatory behavior by over-


Using an Individual Work System to Increase Independence for Students with Autism in a Special Education Classroom in China

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Abstract: The purpose of this study was to evaluate the effects of an individual work system on student task engagement, prompts needed for task completion, and the accuracy in task completion for three students with ASD in a special education classroom in China. Three students with ASD (two girls and one boy, ages 8–9) participated in this study. A multiple-probe across participants design was used. The students independently practiced the tasks acquired during pre-experimental training in a 10 to 15-min independent work session each day. The work system was implemented for 18 days during school days until all three students maintained stable performance at a high level in their task engagement. Results indicated that task engagement was improved, teacher prompts required for task completion were reduced, and accuracy in task completion was increased for all three students, as a result of the introduction of the individual work system. Such improvements were maintained at least 1 week following the completion of the intervention.

Due to deficits in social communication and restricted patterns of behavior, individuals affected by autism spectrum disorder (ASD) often have difficulties working independently without adult support. Lacking independent work skills can potentially lead to poor outcomes in adulthood. For example, Chamak and Bonniau (2016) reported that none of the 76 adults with ASD in their study lived independently without parental or caregiver support. Similarly, Steinhausen, Mohr Jensen, and Lauritsen (2016) also found that almost a half of the adults with ASD in their study sample had very poor outcomes in social relationships, employment, and independent living. The poor outcomes with high reliance on external supports for adults with ASD underscore the importance of teaching independent skills to these individuals. Independence is one of the most important educational goals and should be incorporated into school curricula for students with ASD (National Research Council, 2001; Olley, 1999). Therefore, it is necessary to teach independent skills while these individuals are in schools in order for them to become as independent as possible in adulthood. Independence consists of a set of skills and may include several stages before an individual reaches full independence in life. At school, one of the most important independent skills is to independently complete school work without adult support.

In the school setting, independent work may be defined as a student engaging in the completion of tasks without adult assistance (Hume & Odom, 2007). Obstacles to independent work for students with ASD pertain to their limited attention to multiple stimuli in the environment, inability to initiate and follow through task completion, and difficulties in the generalization of acquired skills to non-instructional settings (Carnahan, Hume, Clarke, & Borders, 2009). When learning a new skill,
students with ASD often need one-on-one instruction to provide constant prompts, verbal instruction, and external reinforcement, rendering a trained adult a necessary component of instruction. Continued adult support remains needed to provide cues to start a task, monitor task engagement, and reinforce task completion for students to maintain a newly acquired skill (Smith, 2001). Ongoing instruction of the same skill in different settings is often required for generalization to occur (Pierce & Schreibman, 1994).

Although such highly supported learning is effective for skill acquisition, students may inadvertently learn to rely on an adult for assistance and perform a task only when an adult is present as opposed to complete the tasks on their own (Smith, 2001). Learned prompt dependence and the lack of spontaneity not only hinder opportunities for students with ASD to become more independent learners but also impede their participation in inclusive education. Their constant needs for adult support may interrupt ongoing instruction and social interactions with other students in the general education classroom. Therefore, it is imperative to embed independent work skills as part of instruction to promote independence when designing skill acquisition instruction for students with ASD. Some important independent work skills include organizing tasks for completion, sequencing tasks from start to finish in order, monitoring task completion, and self-delivering reinforcement (Hume, Plavnick, & Odom, 2012). Students with independent work skills are often on task and require few prompts provided by adults.

One strategy that can potentially meet the learning needs while promoting independent skills for students with ASD is the individual work systems (Hume, Loftin, & Lantz, 2009). An individual work system refers to a place organized with the physical structure and visual information for students to practice acquired skills independently and is one of the components in Treatment and Education of Autistic and related Communication-handicapped Children (TEACCH; Schopler, Mesibov, & Hearsey, 1995). In an independent work system, the physical arrangements are constructed to minimize distractions with visual cues to inform students the types and amount of to-do tasks, the pictorial prototypes of the finished products, and the activity following task completion (Hume et al., 2012). It provides an organized environment for students to independently engage in maintenance tasks they have mastered during instruction.

Research indicates that the work systems are effective in increasing accurate task completion (Bennett, Reichow, & Wolery, 2011; Hume et al., 2012), task engagement, task productivity, and independent task completion (Hume & Odom, 2007), and in decreasing problem behavior (Bennett et al., 2011). Through the independent work systems, students also increase their independent academic engagement in the general education setting (Hume et al., 2012) and spontaneous participation in recess activities on the playground (O’Hara & Hall, 2014). Specifically, a left-to-right structure is arranged where the to-do tasks were placed on top-to-down levels of a shelf on the left side, a work desk is next to the shelf for the student to complete the tasks, and a basket labeled with “finished” was on the right side for the student to place the products of completed tasks (Hume & Odom, 2007; Hume et al., 2012). After the required tasks are completed, a pictorial visual cue informs the student of the scheduled activity so the student spontaneously continues to engage in the next activity without adult assistance. In the above two studies, the researchers taught the students to use individual work systems while the classroom teachers/staff only provided prompts for students as necessary and were not trained to use the independent work systems. Given the empirical supports on independent work systems, it may be beneficial to train special education teachers to implement this system in their classrooms to facilitate independent skills for their students.

In China, the estimated prevalence of ASD is 1% of the total population, which is approximately 13 million people (Sun et al., 2013). Recent survey findings indicate that 34% of children with ASD with moderate or severe intellectual disabilities are enrolled in special education schools because their learning needs cannot be met in the general education setting (Ministry of Education of China, 2016). Some children with ASD are even denied by special education schools due to the fact that
many special education teachers are not prepared to meet these children’s complex learning needs (Huang, Jia, & Wheeler, 2013; McCabe, 2013). For those who enter the specialized schools, it is also not uncommon that special education teachers use non-evidence-based instructional practices for their students (McCabe, 2013). It is, therefore, a priority for educational researchers to identify evidence-based practices suitable for the special education system in China and to evaluate its efficacy of implementation. As discussed previously, the individual work systems designed specifically for the unique learning needs of students with ASD have demonstrated its efficacy in facilitating independent task completion without adult assistance for these students across special and general education settings in Western culture. This practice holds a promise to empower special education teachers in China who strive for teaching independent work skills to students with ASD in the classroom (Wong & Hui, 2008). However, no study has been conducted to evaluate the use of the work systems in a Chinese special education classroom. To fill this gap, the purpose of this study was to verify the efficacy of an individual work system implemented by special education teachers in their classroom in China. Specifically, we trained the teachers to establish and implement an independent work system to three students with ASD in the classroom and evaluate the effects on student academic engagement, prompts needed for task completion, and the accuracy in task completion. The following research questions are addressed: a) did the individual work system increase the students’ task engagement? b) did the independent work system decrease prompts needed for task completion? and c) did the independent work system increase the accuracy of task completion for three students with ASD in a special education classroom?

Method

Participants

Three fourth-grade students (one boy and two girls, 8–9 years) diagnosed with ASD served as participants in this study. They attended a full-time special education school for students with special needs. The three students were in the same ASD classroom with the other two students with ASD, two special education teachers, and one teaching assistant. The three students were referred to this study by their teachers for their lack of independence in their daily school activities. All students had individual and group instruction in language, art, mathematics, social studies, science, music, and art in the classroom. Both teachers had a master’s degree in special education with six years of experiences in classroom teaching. The teaching assistant had a bachelor degree in special education. However, they had no knowledge and training in structure teaching or behavior analysis.

Mingming was a 9-year-old boy diagnosed with ASD using the Chinese version of the Childhood Autism Rating Scale (CARS; Lu, Yang, Shu, & Su, 2004; Schopler, Reichler, & Renner, 2002). His CARS score was 48 in the range of severe autism. His IQ score was 69 assessed from the Chinese version of the Wechsler Intelligence Scale for Children-IV (WISC-IV; Wechsler, 2003; Zhang, 2008). Mingming followed simple one-step directions but relied on constant verbal prompts to complete the tasks. He could mand 10 preferred items with echoic prompts and label at least 50 common items when asked, “What is this?” He could match identical pictures, sort items by color and shape, and identify colors and body parts. He also had basic self-help skills, such as dressing up, self-feeding, and getting backpack ready for school. However, he needed constant supervision and reminders from teachers to complete his school work.

Xinxin was a 9-year-old girl with ASD. Her CARS score was 59 in the range of severe autism and her WISC-IV IQ score was 60. She followed one-step directions with gestural and verbal cues. She could mand 15 items with two- or three-word phrases when asked, “What do you want?” She could label more than 50 common objects, sort objects by color and shape, and identify colors and body parts. She also had basic self-help skills, such as dressing up, self-feeding, and getting backpack ready for school. However, she needed adult assistance and supervision when completing school tasks.

Lingling was an 8-year-old girl. Her CARS score was 37 in the range of moderate autism,
and her IQ measured by WISC-IV was 80. She followed one-step instruction but frequently needed physical assistance and verbal prompts to complete the tasks. She responded to simple social questions when verbal cues were provided. She could mand for 20 preferred items without prompts. She could feed and dress and only needed physical assistance with zippers. She also needed constant verbal reminders and supervision to clean up her desk, put things in the backpack, and complete school work.

**Settings and Materials**

This study took place in a fourth-grade classroom in a special education school located in a major city of northeastern China. The classroom was 8m × 6m × 3 m by size, with a teacher’s desk in the upper left corner adjacent to a one-on-one instruction area, a calm-down area in the lower left corner, a group instruction area next to the calm-down area, and an individual work system area in the upper right corner. These areas were divided by partition panels. Each instruction or work area had a small table, individual desks, chairs, and shelves for task materials. The calm-down area contained soft mats, a bean bag, and some stuffed toys.

Table 1 lists the task materials used for each student. The materials for each task were placed in a plastic box or a basket. The materials in the individual work system area included two plastic baskets, the one on the left was labeled as “to do” and another on the right as “finished.” A tripod with a video recorder was set next to the table to record the sessions.

**Experimental Design**

The study employed a multiple probe design across three participants (Gast, Lloyd, & Ledford, 2014) to examine the effects the individual work system on the students’ task engagement, the number of prompts needed, and the accuracy of task completion. The work system was introduced to the first participant after a stable level of baseline performance of task engagement was reached. Once the participant achieved 80% task engagement for at least three consecutive sessions, the second participant was introduced to the work system. The same sequence continued for the third participant. We chose a multiple probe design based on practical concerns that repeated task demands in extended baseline may become aversive, decrease motivation, or increase chances of fatigue for the students. Maintenance data were collected 1 week following the completion of the intervention for each student.

**Dependent Measures and Data Collection**

The dependent variables included the percentage of task engagement behavior, the number of prompts needed per minute, and the percentage of accurate task completion. Task engagement behavior was defined as the child engaged in the assigned tasks by looking at the visual schedule/task analysis, retrieved the materials from the baskets, worked on the materials to complete the tasks, and placed the finished products to the designated baskets. Non-task engagement was defined as the child looked away from the visual schedule/task analysis and work materials, walked away from the work system area, paused working for more than 5 s, or engaged in inappropriate behavior (e.g., repetitive manipulation of an object) or problem behavior. The percentage of task engagement was calculated by dividing the total seconds of task engagement by the total seconds of task completion and multiplying by 100.

Prompts were defined as any teacher prompts delivered to the student to facilitate task completion during work time, including, verbal instruction (e.g., “pick up the red circle”; “get the materials from the basket”), gestural prompts (e.g., pointing to), visual cues (e.g., presenting visual task analysis), and graduated physical guidance (e.g., hand-over-hand). A prompt was delivered when the student did not engage in the tasks for 5 s, regardless of the accuracy of task completion. The number of prompts delivered per minute was calculated by dividing the total number of prompts delivered by the total number of minutes and multiplying by 100.

The percentage of accurate task completion was calculated by dividing the number of steps completed correctly by the total steps in a task.
An accurate completion of one step was defined as the completed step of a task matched the description of that particular step on the task analysis. An inaccurate completion of one step was defined as the completed step of a task did not match the description of that step on the task analysis. The steps of task analysis ranged from 3 to 14.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Task</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mingming</td>
<td>Bottle opening</td>
<td>Three kinds of different bottles</td>
</tr>
<tr>
<td></td>
<td>Button up</td>
<td>Five buttons with different size</td>
</tr>
<tr>
<td></td>
<td>Puzzles</td>
<td>Nine-piece puzzles</td>
</tr>
<tr>
<td></td>
<td>Number 1–10</td>
<td>Trains with ten carriages</td>
</tr>
<tr>
<td></td>
<td>Facial features</td>
<td>Pictures of eyes, a mouth, and a nose. Each type has three different pictures.</td>
</tr>
<tr>
<td></td>
<td>Money Recognition</td>
<td>Pictures of 1-dollar, 5-dollar, and 10-dollar bills. Each type has three pictures.</td>
</tr>
<tr>
<td></td>
<td>Shapes</td>
<td>Pictures of the triangle, circle, and square. Each type has three different pictures.</td>
</tr>
<tr>
<td></td>
<td>Color Classification</td>
<td>Pictures of yellow, red and green. Each type has three different pictures.</td>
</tr>
<tr>
<td></td>
<td>Size Classification</td>
<td>Pictures of bags, cups, balls, watermelons in big and small sizes.</td>
</tr>
<tr>
<td></td>
<td>Fruit and Vegetable Classification</td>
<td>Pictures of “apples, pears, peaches, oranges…” Pictures of “tomatoes, cabbages, eggplants, celeries…”</td>
</tr>
<tr>
<td></td>
<td>Binding</td>
<td>Three paper clips, six pieces of paper.</td>
</tr>
<tr>
<td></td>
<td>Tying shoe</td>
<td>Two wooden boards. Each board has two rows of three holes. Two shoelaces.</td>
</tr>
<tr>
<td></td>
<td>Emotion recognition</td>
<td>Pictures of happiness and sadness. Each type has four pictures.</td>
</tr>
<tr>
<td>Xinxin</td>
<td>Word-to-picture matching</td>
<td>Words and pictures in fruit and vegetables, including “apple, strawberry, orange, eggplant, and green pepper.”</td>
</tr>
<tr>
<td></td>
<td>Character tracing</td>
<td>30 Chinese characters. Three characters provided each time.</td>
</tr>
<tr>
<td></td>
<td>Height Classification</td>
<td>Pictures of trees, giraffes, toys, bottles.</td>
</tr>
<tr>
<td></td>
<td>Additions which sum up to 5</td>
<td>Five items of additions</td>
</tr>
<tr>
<td></td>
<td>Shopping</td>
<td>Coins, items with price tags</td>
</tr>
<tr>
<td></td>
<td>Reading</td>
<td>One picture book</td>
</tr>
<tr>
<td></td>
<td>Coloring</td>
<td>Ten pieces of coloring paper</td>
</tr>
<tr>
<td></td>
<td>Gluing</td>
<td>Colorful tapes and white papers</td>
</tr>
<tr>
<td></td>
<td>Binding</td>
<td>Dovetail clamp in different sizes, white papers</td>
</tr>
<tr>
<td></td>
<td>Packing</td>
<td>Two stationary bags, eight stationary items</td>
</tr>
<tr>
<td></td>
<td>Tying shoes</td>
<td>One sports shoe</td>
</tr>
<tr>
<td></td>
<td>Size Classification</td>
<td>Pictures of bags, cups, balls, watermelons in big and small sizes.</td>
</tr>
<tr>
<td>Lingling</td>
<td>Height Classification</td>
<td>Pictures of trees, giraffe, toys, bottles.</td>
</tr>
<tr>
<td></td>
<td>Blocking</td>
<td>6 pieces of blocks</td>
</tr>
<tr>
<td></td>
<td>Money recognition</td>
<td>Pictures of 1-dollar, 5-dollar, and 10-dollar bills. Each type has three pictures.</td>
</tr>
<tr>
<td></td>
<td>Number 1–5</td>
<td>Five groups of sticks. Each group has different numbers of sticks.</td>
</tr>
<tr>
<td></td>
<td>Word-to-picture matching</td>
<td>Words and pictures in fruit and vegetables, including apple, strawberry, orange, eggplant, and green pepper.</td>
</tr>
</tbody>
</table>
steps. An example of task analysis is presented in Table 2.

The data were collected using the pencil-and-paper format via the observations of the video recordings. Two graduate students were trained to observe the video recordings and code the dependent variables.

**Procedure**

**Preference assessment.** Prior to baseline, we conducted a preference assessment to determine preferred items for each student. We first surveyed the teachers and parents to list a pool of preferred items/activities for each student. We then conducted the multiple stimulus without replacement preference assessment (Leon & Iwata, 1996) to identify the top 10 preferred items/activities to be used as potential reinforcers for each student. The students were allowed to engage in one of their preferred activities after task completion for each work session.

**Pre-experimental teacher training.** Prior to the beginning of the study, the two special education teachers who implemented the work system procedure in this study participated in the TEACCH three-day training workshop held by Dr. Laura Klinger in Beijing in 2016. After the workshop, we provided an additional 60-min hands-on training for these two teachers specifically for this study. The training content included a) a brief general introduction of the nature of the study, b) the individual work system, its components and implementation, c) task analysis for each task for the students, d) different types of prompts and their implementations. The training was completed when each teacher implemented the individual work system to a student with ASD (not included in this study) with 100% accuracy in a total of five different tasks.

**Pre-experimental student training.** We first asked the students' teacher to provide a list of skills based on each student's current individualized educational plan and conducted an assessment. We then selected skills that the students had not yet acquired and provided one-on-one training on these skills. The tasks trained during pre-experimental training and used in the intervention for each student are listed in Table 1.

Each student had an individual visual schedule containing the selected tasks to direct task completion during training. One of the teachers randomly selected three tasks and provided 10 to 15 min training on each task during each training session. The teacher sat next to the student and used various prompts with a 5-s time delay to teach each skill selected for the students. Depending on each task, the prompts involved picture prompts, verbal directions, gestural prompts, modeling, partial physical prompts, and full physical prompts. The prompts were also used when the student

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**TABLE 2**

**Task Analysis for Tying Shoes**

<table>
<thead>
<tr>
<th>Step</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Take one lace in each hand (laces in corresponding hands).</td>
</tr>
<tr>
<td>2</td>
<td>Cross laces to form an X with the left lace over the right one (lace tops point left and right).</td>
</tr>
<tr>
<td>3</td>
<td>Pull the right lace under left, and bring back to the same position with lace tops pointing left and right.</td>
</tr>
<tr>
<td>4</td>
<td>Hold left and right lace tops in corresponding hands and pull lace tops away from each other until the lace is tight on foot.</td>
</tr>
<tr>
<td>5</td>
<td>Continuing holding laces in corresponding hands.</td>
</tr>
<tr>
<td>6</td>
<td>Make a large loop with the left lace using the left hand; the loop should have a &quot;stem&quot; at the bottom.</td>
</tr>
<tr>
<td>7</td>
<td>Pinch the loop tight using the thumb and the index finger.</td>
</tr>
<tr>
<td>8</td>
<td>Bring the right loop toward you and around the thumb, the index finger, and the loop, keeping the lace tight around the index finger and forming a small hole at the bottom of the loop.</td>
</tr>
<tr>
<td>9</td>
<td>Leaving the left thumb as is, reach through hole with the index finger of the left hand while pushing part of right lace closest to loop into but not through the hole.</td>
</tr>
<tr>
<td>10</td>
<td>Hold lace in the hole with the left thumb and the index finger and reach up and grasp the loop with the right thumb and the index finger.</td>
</tr>
<tr>
<td>11</td>
<td>Holding lace in the hole with the left thumb and finger and holding the loop with the right thumb and finger, pull loops away from each other.</td>
</tr>
</tbody>
</table>
did not follow the visual schedule to retrieve materials for the next task. The pre-experimental training for each task was completed when the student achieved at least 80% accuracy of the total steps in that task.

The teacher provided praises for correct responses defined by each step on the task analysis and provided necessary prompts if the student had incorrect or no response after 5 s. The student was asked to complete each task one at a time and move onto the next task based on the visual schedule. The total pre-experimental training sessions were 25 for Mingming, 34 for Xinxin, and 39 for Lingling. The students were allowed to access their preferred items at the end of each training session for their participation.

**Baseline.** Baseline sessions were conducted by the two teachers in the one-on-one instruction area of the classroom. The teacher provided a verbal direction, “It’s work time. You may start working!” The student then followed a visual schedule to independently complete three of the tasks acquired in the pre-experimental training. The teacher observed the student complete the tasks and did not provide any assistance or directions for the student to complete the tasks. The teacher only provided a general praise for the student’s participation at the end of each session (e.g., “Thank you for your work.”) without any comments on task engagement or accuracy. The student also had an opportunity to engage in a preferred activity after each session.

**Intervention.** During the intervention, the student independently practiced tasks acquired during pre-experimental training in a 10 to 15-min independent work session each day. Each individual work session contained three tasks selected based on the order in a student’s task list to ensure the student practiced each task with the same frequency. The students were required to complete these tasks based on their visual schedules provided. We established an individual work system for each student participated in this study.

The work system in this study was developed based on Hume et al. (2012) to provide visual information for the students to independently complete the required tasks, including the tasks listed on a visual schedule containing tasks to be completed, the pictures of completed tasks to show the student finished products, and instructions to move onto the next task. Specifically, each work system was arranged from left to right: three to-do baskets with materials for each task were placed on a three-layered shelf on the left of the work system, a pictorial task analysis for each task was adhered on the outside of each basket, a visual activity schedule was displayed on the left side of the table, and a picture of the finished task was attached to its finished basket on the right side of the table. The student retrieved one task at a time from a do-do basket in the order of the top, middle, and bottom layer of the shelf, completed the work independently, and then placed the completed work in the finished basket on the right. When a task was completed, the student followed the visual schedule to retrieve the next task placed in the next layer. When all three tasks were completed, the student followed the visual schedule to engage in a preferred activity for about 3 to 5 min.

One teacher stood next to the student engaging in independent task completion. The teacher observed the student’s work session. If the student was observed to cease working for 5 s, the teacher provided a prompt for the student to return to work. A verbal direction was typically used as a prompt to direct the student back to work (e.g., “Name, finish your work.”). If the student did not follow the verbal direction, the teacher provided a gestural prompt (e.g., pointing to the task itself or its picture on the visual schedule). If the student remained no response, the teacher provided a partial physical prompt by gently touching the student’s elbow. A full physical prompt was used only when the student did not respond to the above prompt sequence. In this study, the student responded with verbal direction and sometimes with gestural prompts. No physical prompts were used in this study. The work system was implemented for 18 days during school days (except Xinxin was absent for 2 days) when all three students maintained stable performance at a high level in their task engagement.

**Maintenance.** Maintenance sessions were conducted 1 week after the intervention was completed for all students. We also obtained maintenance data 2 weeks after the intervention for Xinxin and 3 weeks after the intervention for Mingming. The individual work sys-
tem remained in the designated area in the classroom after the intervention was completed. The work system procedure conducted during maintenance was identical to the intervention, except that the implementer was the teaching assistant but not the teacher.

Social Validity

Social validity was measured by conducting individual interviews with open-ended questions to the two teachers who implemented the procedure and the parents of participating students. Interview questions for the teachers and parents are as follows. a) Did you observe any change in the student’s independence in task completion? If so, in what ways? If not, why not? b) Do you think the individual work system is helpful to improve the student’s independence in work completion? If so, in what ways? If not, why not? c) Would you use the individual work system in your classroom/home? If so, how would you use it? If not, why not? d) Is there anything in the work system needing improvements? If yes, in what ways? e) Are you satisfied with the intervention? and f) any suggestions or comments.

Interobserver Agreement and Procedural Fidelity

To assess interobserver agreement (IOA) and procedural fidelity, a second observer (a graduate student) who was naive to the purpose of the study was trained to collect data by watching the video recordings independently and separately from the experimenter. IOA data were collected for 50% of training sessions and 50% of the probe sessions randomly selected from each condition for each student. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The agreement of task engagement averaged 94.2% with a range of 90.1% to 94.8%, the number of teacher prompts averaged 93% with a range from 92.3% to 94.4%, and the accuracy of task completion averaged 94% with a range from 85% to 100%.

Procedural fidelity was assessed by one supervising researcher from the university, who conducted evaluations either on-site or via video recordings for 30% of all training and 30% of the probe sessions in each condition across participants. A checklist containing eight steps of implementation during the intervention was used to evaluate the accuracy of implementation for each step. The steps included accurate arrangements of furniture, accurate selections of target tasks, accurate placements of baskets on the self, accurate materials for each task in its corresponding basket, accurate arrangements of the visual schedule, accurate placements of finished baskets, accurate presentations of prompts necessary when the student was off-task for 5 s, accurate feedback provided to the student on task completion. The percentage of procedural fidelity was calculated by dividing the number of correct steps by the total steps and multiplying by 100. The data on procedural fidelity ranged from 97% to 100% with an average of 98% across all teachers for all sessions observed.

Results

Figure 1 depicts the percentage of task engagement (left Y-axis), the number of prompts needed per minutes (right Y-axis) and the percentage of accurate task completion (left Y-axis) across conditions for the three students. All three students engaged in independent task completion at a relatively high level during intervention and maintenance, compared to the baseline. Mingming had an average of 63% (range: 62–65%) task engagement during baseline but increased to an average of 84.2% (range: 80–89%) during the intervention and an average of 80% (range: 79–81%) during maintenance. Similarly, the average task engagement was 64.8% (range: 64–68%) for Xinxin and 69% (range: 64–76%) for Lingling during baseline. Xinxin’s task engagement increased to an average of 93.2% (range: 88–93%) and maintained at 86.4% (range: 85–88%) during maintenance, and Lingling also had an average of 92% (range: 84–94%) task engagement during intervention and maintained at 85.6% (range: 84–86%) during maintenance.

All three students also displayed the same pattern on the number of prompts needed across conditions. During baseline, the number of prompts delivered per minute for each 5-s work cessation was stable at a high level for all three children (M = 4.4; range: 4.2–4.8 for Mingming, M = 4.3; range: 4.1–4.3 for Xinxin, and M = 3.8; range: 4.0–4.2 for Lin-
As the individual work system was introduced, the number of prompts needed during work time decreased immediately to a low level and remained steady at a low level until the completion of the intervention for all three students ($M = 1.7$; range: 1.5–1.8 for Mingming, $M = 0.6$; range: 0.6–0.8 for Xinxin, and $M = 0.9$; range: 0.7–1.1 for Lingling). All three students maintained a steady low level of prompts needed per minute during maintenance ($M = 1.8$; range: 1.82–1.84 for Mingming, $M = 1.2$, range: 1.0–1.2 for Xinxin, and $M = 1.4$; range: 1.32–1.45 for Lingling).

Data on the accuracy of task completion indicated that Mingming completed required...
tasks with a low level of accuracy during baseline \((M = 24.2\%);\) range: 18.9–29.6%). His accuracy in task completion began to increase as the intervention was introduced and rapidly increased to a high level and remained at a high level until the end of the intervention \((M = 81.7\%);\) range: 41.2–87.9%). He maintained the accurate task completion at a high level during maintenance \((M = 85.3\%);\) range: 85–88.3%).

Xinxin completed the required tasks accurately at a mid-level during baseline \((M = 61.6\%);\) range: 55.6–67.2%) but gradually increased to a relatively high level and maintained at a high level under the intervention condition \((M = 87.6\%);\) range: 73.7–91.1%) and the maintenance condition \((M = 87.6\%);\) range: 86.7–89.4%). Lingling also displayed a similar pattern as Xinxin. The percentage of accurate task completion was at a mid-level during baseline \((M = 63.8\%);\) range: 62.9–63.9%) but gradually increased to a relatively high level and remained stable at a high level in the intervention \((M = 86.8\%);\) range: 75.8–88%) and the maintenance condition \((M = 86.2\%);\) range: 85.2–87.8%). Overall data indicated that the percentage of accurate task completion was increased as a result of the introduction of the work system and such improvements were maintained during maintenance sessions for all three students.

Teachers and parents provided positive responses to the interview questions. Both teachers reported that the students’ independent task completion was noticeable. One teacher elaborated Mingming’s progress, “He is more independent in completing these tasks than before. In the past, he would stand there, staring at me and waiting for my direction. Now he walks to the work area and completes the tasks by himself.” Both teachers who implemented the procedure also clearly indicated that the work system was very helpful and they would like to continue the work system as a routine in their classroom. The teachers were very satisfied with the results of the intervention. They did not have further suggestions to improve the work system.

All three parents were also very satisfied with the results of the intervention and supported the continuation of the intervention in the classroom. They all expressed their willingness to establish a work system at home. Xinxin’s parent reported, “We have already established the work system at home and are very satisfied with Xinxin’s independent homework completion without constant reminders and monitoring from us.” As for the suggested improvements, all parents recommended that the teachers provided them pictures of tasks used in school ahead of time, so they could use them to set up a work system at home.

**Discussion**

The purpose of this study was to promote independent work skills for three students with ASD in a special education classroom in China. Results indicated that the task engagement was improved, teacher prompts required for task completion were reduced, and the accuracy in task completion was increased for all three students as a result of the introduction of the individual work system. Such improvements maintained at least 1 week for all three students after the intervention was completed. This study extended the literature by demonstrating that the individual work system effectively increased independent work completion for three elementary students with ASD in a special education classroom in China. Results of social validity also supported the feasibility, acceptability, and satisfaction of the individual work system intervention in Chinese culture.

Consistent with previous research (Bennett et al., 2011; Hume & Odom, 2007; Hume et al., 2012; O’Hara & Hall, 2014), results of this study suggested that the individual work system improved students’ task engagement, decreased teacher prompts, and increased the accuracy in task completion. All three students increased their task engagement and thus decreased teacher prompts to remain on task when the work system was in effect, suggesting the work system reliably increased student independence in task completion in a classroom setting.

The success of the individual work system used in this study may be attributed to several reasons. First, the work system structured the work environment with visual supports, which were recommended as one of the established evidence-based practices for children with ASD (National Autism Center, 2015). The vi-
ual supports included a left-to-right arrange-
ment, a visual schedule, visual task analyses,
and visual signs. The left-to-right arrangement
provided an orderly structure so the student
was able to follow the same direction consist-
tently across tasks. The visual schedule and
task analysis directed the student to complete
several activities without adult prompts in the
classroom (Heflin & Alaimo, 2007; National
Autism Center, 2015). The visual signs also
ensured that the student obtained accurate
materials required for each task. These visual
supports not only provided visual information
but also functioned as prompts for the stu-
dent. Secondly, the work system shifted stu-
dent’s attention from adult-delivered prompts
to the visual information and the related task
materials. As discussed previously, many stu-
dents with ASD develop prompt dependency
in the acquisition process involving prompts
provided by an adult and are in need of con-
tinued adult support even when the skills are
acquired (Smith, 2001). The work system used
in this study provided the student opportuni-
ties to practice acquired skills while eliminat-
ing the need for an adult to provide prompts
for the student to engage in acquired tasks.
Thirdly, the work system contained a built-in
consequence component by including a pre-
ferred item or activity in the visual schedule.
Therefore, the student knew what s/he worked
for in the beginning of a work session without
relying on an adult to deliver reinforcement.

Besides increased task engagement, the re-
result indicated that tasks were completed with
a high level of accuracy, suggesting that the
quality of task completion also improved
along with the quantitative engagement. This
result was consistent with the findings re-
ported by Hume et al. (2012), that the work
system effectively increased students’ accuracy
in independent task completion for recently
acquired skills. It is possible that the work
system provides an independent practice op-
portunity for students to maintain acquired
skills at the mastery level of performance.

Previous research on the individual work
systems did not involve teacher-implemented
procedure or teacher training. Different from
previous studies, the two teachers who imple-
mented the work system procedure in this
study received training on providing struc-
tured teaching and the work system prior to
the beginning of the study. The classroom was
converted to a structured environment from a
traditional classroom arranged for group in-
struction. Thus, the teaching format was
brand new for the teachers and students in
the classroom. Results of our interviews indi-
cated that the teachers and parents were satis-
fied with the intervention results, the new
teaching format, and the structured arrange-
ment in the classroom. This indicated that the
work system was applicable for special educa-
tion classrooms in China, as it also created a
learning environment suitable for Chinese
students with ASD.

Data on maintenance also supported the
continued use of the work system for the stu-
dents with ASD to practice and maintain their
acquired skills in the classroom. In this study,
the maintenance was implemented by a teach-
ing assistant who did not receive any training
in structured teaching or the work system. We
simply provided general instruction requiring
the teaching assistant to monitor student task
completion and to provide prompts when a 5-s
work cessation was observed. Results of main-
tenance suggested that the teacher may assign
a teaching assistant to monitor student task
completion once a work system was estab-
lished and the student was taught to use the
work system.

Limitations of this study included the lack
of clearly defined prompt hierarchy in the
intervention, a small number of participants,
no within-participant comparison of the inter-
vention effect, the lack of generalization to
other settings, the failure to remove adult
prompts during maintenance sessions, and
the lack of evaluations of long-term mainte-
nance. Because the teachers who imple-
mented the procedure in this study were not
accustomed to the new teaching format and
the classroom arrangement, we offered in-
struction on suggested prompt hierarchy and
required them to deliver a prompt upon a 5-s
work cessation, but did not ask them to pro-
vide consistent prompts based on the hierar-
chy. It is necessary to incorporate systematic
prompt hierarchy into teacher training prior
to the beginning of the study. Although
teacher training is beyond the scope of this
study, future researchers may consider train-
ing special education teachers in China to
implement the work system and examining
the effects on teachers’ teaching skills and student independent work skills in the classroom. The experimental design of multiple probe across participants did not allow the comparison of the experimental effects within each participant. Researchers may construct other types of designs that allow within-participant analyses, such as a withdrawal or a multiple probe across settings design.

Due to the fact that the students participated in our study were enrolled in a specialized school, we were unable to evaluate the generalization effect in an inclusive classroom as in the study by Hume et al. (2012) and make placement recommendations for inclusion based on research results. As reported, school-aged children with high functioning ASD are enrolled in general education public schools while those with a relatively low level of functioning are either in special education schools or private agencies (Huang et al., 2013). This posits a practical difficulty for researchers to test generalization in an inclusive setting for students enrolled in special education schools in China. Before evaluating the generalization effect in an inclusive setting, however, it is possible to evaluate generalization effects in other settings in the school (e.g., gym class, recess time, lunch time) or at home (e.g., independent homework completion), as previous research clearly indicated that the participants’ independent work skills acquired through the individual work systems were applicable during school recess time on the playground (O’Hara & Hall, 2014) and in the employment setting (Hume & Odom, 2007). Additionally, it is necessary to include more participants and long-term maintenance in future studies.

Despite the limitations, the results of this study have important implications for promoting independence in task completion for elementary-aged students with ASD enrolled in special education schools in China. The work system is highly applicable and potentially sustainable as a regular instructional practice to increase independent work skills for students with ASD in special education schools in China. Special education teachers can be trained to implement the work system procedure accurately and reliably in the classroom. After the work system is implemented as a regular instructional practice in the classroom, the intensity and the frequency of prompts provided is reduced during independent work sessions with minimal adult supervision. It is imperative to conduct more research in China to guide special education teachers in providing evidence-based instructional practices for students with ASD.

References


Hume, K., Plavnick, J., & Odom, S. L. (2012). Promoting task accuracy and independence in students with autism across educational setting
Effectiveness of Teaching Social Skills to Individuals with Autism Spectrum Disorders Using Cool versus Not Cool

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Abstract: One of the interventions, of which effectiveness in the teaching of social skills has been examined in autism literature in recent years, is teaching with cool versus not cool. In this study, it was aimed to examine the effectiveness of teaching with cool versus not cool in the teaching of social skill (“Coping with inappropriate requests from familiar peers or adults”) to participants with autism spectrum disorder (ASD). A multiple probe design across participants was used to investigate the effectiveness of teaching social skills with cool versus not cool. In the study, follow-up data after 1, 4 and 10 weeks, and across-settings generalization data were collected from participants with ASD. Furthermore, social validity data were collected from participants with ASD. The findings of the study showed that all participants acquired and preserved social skills. In the study, it was observed that the first and second participants generalized the skills they acquired to different environments. No generalization data were collected for the third participant. The social validity findings collected with the subjective evaluation approach revealed that the participants’ opinions about the target skill, the teaching process and post-teaching performance were positive. It was observed that the findings of the study were in parallel with other research findings related to the subject, and suggestions for the intervention and further studies were made.

Autism spectrum disorder is a neurological disorder that occurs and courses with inadequacies in social interaction and communication, limited and repetitive behaviors, and limited areas of interest. In this definition, which identifies ASD from a medical perspective, an inadequacy in two areas is mentioned in the definition of ASD, being social-communicative and limited, repetitive behaviors and areas of interest (American Psychiatric Association [APA], 2013). From the behavioral-educational perspective, ASD is defined as a disorder that courses with biological-based behaviors and social inadequacies and extremisms, but these inadequacies and extremisms can be improved by structuring the physical and social environment (Green, 2001). It is emphasized that individuals with ASD from both perspectives experience social-communicative limitations. Social-communicative inadequacies are grouped into three categories: social and emotional inadequacies, non-verbal communication inadequacies, and inadequacies in establishing and maintaining relationships (APA, 2013). It is emphasized in the study focusing on the social and communication characteristics of individuals with ASD that social skill deficiencies are one of the most important symptoms of ASD, leading to an increase in the number of studies aiming at improving the social-communicative characteristics of individuals with ASD (Leaf, Dotson, Oppeneheim, Sheldon, & Sherman, 2010).

Social skill deficiencies are difficulties in acquiring social skills or in exhibiting the acquired social skills (Gresham, 1986). Eliminating social skill deficiencies requires the social skills teaching process which is designed in a direct and planned way and results in a posi-
tive social competence approval by peers and adults (Sugai & Lewis, 1996). The social skills teaching includes some aspects such as introducing positive behaviors and strategies, being a model for some behaviors and strategies, providing an opportunity to try positive behaviors and strategies in vivo or in vitro, and teaching students the self-direction skills (observation, evaluation, and reinforcement) in various environments (Rutherford, Chipman, Digangi, & Anderson, 1992). As in every teaching process, in the social skills teaching, which principles based on which approach will be adopted and which social skills teaching methods will be used are decided according to the characteristics and development levels of the individual or individuals to be taught social skills. Different teaching methods based on different approaches are used in the social skills teaching. It is observed that methods such as peer-mediated practices (e.g. Kamps, Potucek, Lopez, Kravis, & Kemmerer, 1997; Laushey & Heffin, 2000), direct teaching (e.g. Taras, Matson, & Leary, 1988), modeling (e.g. Charlop-Christy, Le, & Freeman, 2000; Schrandt, Townsend, & Poulson, 2009), video modeling (e.g. Charlop, Dennis, Carpenter, & Greenberg, 2010; Nikopoulos & Keenan, 2004), social stories (e.g. Delano & Snell, 2006; Sansosti & Powell-Smith, 2006), natural teaching (e.g. Hancock & Kaiser, 2002; Kohler, Anthony, Steighner, & Hoyson, 2001), and the social skills teaching package in which techniques such as giving clues, reinforcement, and role-playing are used (e.g. Koenig et al., 2010; Laugeson, Frankel, Mogil, & Dillon, 2009) have been used in introducing the target social skills to individuals with ASD in the literature.

In recent years, one of the interventions that have started to draw attention to social skills teaching in the autism literature is teaching with the cool versus not cool procedure. Practices such as modeling, role-playing, reinforcement, feedback, and prompting are presented together in teaching with cool versus not cool (Leaf, Taubman et al., 2016). Teaching with cool versus not cool is similar to other social skills teaching practices because it includes interventions such as modeling, role-playing, reinforcement, presenting feedback, prompting, and social decision-making. The point at which teaching with cool versus not cool distinguishes from other teaching practices is that when both appropriate and inappropriate behaviors are modeled, it is ensured that the individual chooses the appropriate behavior and displays this behavior (Leaf, Taubman et al., 2016). In other words, it takes into account the social decision-making. There is a limited number of studies examining the effectiveness of teaching social skills to individuals with ASD with cool versus not cool (Au et al., 2016; Leaf et al., 2012; Leaf et al., 2015; Leaf, Mitchell et al., 2016).

In one of these studies, Leaf et al. (2012) investigated the effectiveness of teaching with cool versus not cool in the teaching of the skills of participating in a dialogue appropriately, changing a game, greeting appropriately, directing the attention, changing a dialogue, preventing abduction, and establishing an eye contact to children with ASD between 4–9 years of age, and in another one, Au et al. (2016) investigated the effectiveness of teaching with cool versus not cool in the teaching of the skills of initiating a game with peers, commenting on a toy or item showed by a peer, and drawing the attention of the peer to participants with ASD between 3–6 years of age. In both studies, the role-playing practices, which were the last step of the intervention at the beginning, were not included; however, the role-playing practices were only included for participants who could not reach the scale for 10 sessions. Following the role-playing practices, it was observed that the participants acquired the target social skills. In the study, in which all the steps of teaching with cool versus not cool were used, Leaf et al. (2015) investigated the effectiveness of teaching with
cool versus not cool in the teaching of the skills of coming to an agreement with a peer on which game to play, sharing, and defending themselves when a peer take their belongings without a permission to three participants with ASD between 3–7 years of age; Leaf, Taubman et al. (2016) investigated the effectiveness of teaching with cool versus not cool in the teaching of the skills of social interaction; and Leaf, Leaf et al. (2016) investigated the effectiveness of teaching with cool versus not cool in the teaching of the skills of playing games. Leaf, Leaf et al. (2016) conducted the practice with a group regulation in their study. The findings obtained from these studies have shown that teaching with cool versus not cool is effective in teaching the target social skills.

Leaf, Mitchell et al. (2016), differently from other studies, compared the effectiveness of teaching with cool versus not cool and social stories in teaching of the skills of responding appropriately to being defeated in a game, participating in a dialogue appropriately, empathizing, ending a dialogue, changing the game when others are bored, and acting gentlemanly in sportive activities to a child with ASD at the age 7. The findings of the study using the adapted alternating treatment design show that the participant has acquired all of the target social skills by teaching with cool versus not cool and the results of teaching with social stories show that the participant has made little progress in the target social skills.

All of the studies mentioned were carried out by Leaf et al. in the USA, and it was found out in these studies that teaching with cool versus not cool is effective in teaching social skills to individuals with ASD. It is an important criterion to observe whether this kind of research by different researchers gives similar results in different geographical regions (Horner et al., 2005; Kratochwill et al., 2013). The studies have shown that young children with ASD are studied, communication skills and play skills are included in teaching, role-playing practices are included additionally for participants who cannot meet the criterion.

The literature review has shown that it is required (a) to determine the methods that can be used effectively in the teaching of social skills to individuals with ASD, (b) to carry out studies examining the effectiveness of teaching with cool versus not cool on individuals with ASD, (c) to examine the effectiveness of teaching with cool versus not cool by different researchers in different geographical regions, (d) to determine the effectiveness of teaching different social skills with cool versus not cool on individuals with ASD studying at primary school and secondary school, (e) to demonstrate the effectiveness of using the role-playing practices as one of the steps in teaching with cool versus not cool in teaching the target social skills. This study was planned to produce solutions for the problems in the fields listed in accordance with all these limitations encountered as a result of the literature review concerning the teaching with cool versus not cool.

The aim of the study is to examine the effectiveness of teaching with cool versus not cool in the social skills teaching to individuals with ASD studying at primary school and secondary school. Starting from this aim, answers will be sought to the following questions in the study:

1. Is teaching with cool versus not cool effective in the teaching of the target social skill (Coping with inappropriate requests from familiar peers or adults) to individuals with ASD studying at primary school and secondary school?
2. If the target social skill can be taught using teaching with cool versus not cool to individuals with ASD, can individuals with ASD be able to maintain these skills after one, four, and ten weeks and generalize them to different environments?
3. What are the opinions of the individuals with ASD about social skill, cool versus not cool procedure, and the research findings?

Method

Participants

The participants consisted of learner participants, peers and adults, practitioners and observers.

Learner participants. The learner participants of the study consist of three male students with ASD between 9–12 years of age who have been benefiting from the inclusion at an elementary and secondary school in An-
kara province, Turkey. Approval was obtained from the Ethics Committee of Anadolu University before the process of determining the participants was started. Afterwards, special education and rehabilitation centers in Ankara province were interviewed, and the participants with ASD studying at a primary school or secondary school were determined. At this stage, students’ Health Board and Educational Assessment reports were used as a base. Individual interviews were held with the families of the students having these characteristics and the students themselves, and explanations were made about the aims, importance, the contributions it would provide, and the steps of the study and what would be done in this process. Then, the students who were allowed to participate in the study by their family and volunteered were assessed in terms of the prerequisite properties. Written permissions were received from the participants themselves with the prerequisite properties and their families regarding this information.

The participants were expected to meet five prerequisite properties, being (a) directing their attention to visual and auditory stimuli for at least five minutes, (b) mimicking non-verbal skills, (c) mimicking expressions of two or more words, (d) following directions with at least one object and an action, (e) distinguishing between an appropriate and inappropriate behavior and (f) having the verbal language to explain why the behavior was appropriate or inappropriate. Whether the participants had the prerequisite skills in items a, b, c, and d, whether they directed their attention to the story read or the video played for at least five minutes, whether they mimicked the behaviors exhibited by the practitioner such as pulling out a chair and sitting on it, having an angry face, etc., whether they mimicked the expressions of the practitioner such as “Your toy is very beautiful, should we play together?”, etc., whether they followed the instructions such as “Take the pen and put it on the table, ask for an eraser from the next class”, etc. were observed and assessed. A session was held during the assessment of the prerequisite skills listed, five opportunities were given to the participant in each session, and it was decided that the participant had these skills after 100% correct response. In order to assess the prerequisite of distinguishing between an appropriate and inappropriate behavior and having the verbal language to explain why the behavior was appropriate or inappropriate, five stories with appropriate and inappropriate behaviors were read and questions related to the behaviors of the characters in these stories such as “Which behavior of the character in the story is appropriate/inappropriate? Why is the character’s .........................behavior appropriate/inappropriate?” were asked. A session was held during the assessment of these prerequisite skills, and it was decided that the participants had this skill when they answered all the questions about the stories correctly.

The Wechsler Intelligence Scale for Children (WISC-R) was used to determine the intelligence level of the participants, the Gilliam Autism Rating Scale-2-Turkish Version (GARS-2-TV) was used to determine the autistic disorder index, and the Social Skills Checklist developed by the researchers was used to determine the social skills-related performance. The participants of the study were Okan, Orkun, and Emre. The demographic characteristics and the WISC-R and GARS-2-TV scores of the participants are presented in Table 1. Okan, Orkun, and Emre have the

<table>
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<th>Participant</th>
<th>Age</th>
<th>Class</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>WISC-R Score</th>
<th>GARS-2-TV Autistic Disorder Index</th>
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<tr>
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<td>Male</td>
<td>ASD*</td>
<td>80</td>
<td>90</td>
</tr>
</tbody>
</table>

*The participants were diagnosed with ASD by general hospitals.
social skills of starting a communication, continuing and terminating the communication, participating in group activities, cooperating, using context-appropriate social expressions (Please, I apologize, Thank you, I am sorry, etc.), understanding the body language of the person in question, and acting appropriately. The participants’ skills of accepting the answer “No” as an appropriate answer when they receive it, saying “No” when necessary, coping with dirty jokes or mocking of their friends, responding appropriately to the pressure of friends and adults, and staying calm in stressed, oppressed, or in controversial environments show limitations. Furthermore, Okan and Orkun have inappropriate behaviors such as hitting and cursing their friends, and these behaviors arise mostly as a result of the peer pressure. Emre has quite intense vocal stereotypes.

Peers and adults. During the collection, probe, follow-up, and generalization sessions, familiar peers and adults, who would create an opportunity to achieve the target social skills, were included in the study. It was ensured that the peers and adults participated in the practice throughout the practice at most three times in the same week and not on the consecutive days. The prerequisites of the ability to follow the directives, having non-verbal skills, mimicking the oral language skills, and being maximum 4 years older than the participants were sought in the peers, and a written consent was received from the families of the peers with these prerequisites. Since the peers were asked to make an inappropriate request for the study, a contract was signed with them to ensure that they would not exhibit this behavior outside the study. Furthermore, two specialist psychologists were consulted for inappropriate request scenarios determined for the peers, and scenarios related to the activities and dialogues they make when they are with friends were created. For example, while waiting for the practitioner, asking “Should we go and get ourselves ice-cream?” or while reading a story on the computer, asking “Should we play...... game for 2 minutes?”, etc.

Peer and adult education was included to explain how peers and adults should behave and what they need to tell in the study process. In the education, which was provided for peers and adults to exhibit the most appropriate performance, the stages of (a) explaining the aim of the study and the role of the peer/adult, (b) introducing the target skill, (c) being a model for how to behave and what to tell, (d) role-playing were included. Particular attention was paid to the naturalness of the peers and adults in the education process, and the education continued until the peers and adults reacted 100% correctly. The characteristics of the peers and adults are presented in Table 2. Among the identified peers and adults, the participants’ mothers and siblings were also included. The study was conducted with a total of 51 peer and adult participants.

The study also included a peer with whom the practitioner had rehearsed the steps to be followed in teaching with cool versus not cool before starting the experimental process. This peer is a 10-year-old student who continues the fifth grade and shows a typically development. Written consent was obtained from her family for the study to be conducted with this peer.

Practitioner and observer. The intervention was conducted by the first author of the study. This person has a doctoral degree in the field of special education. She has worked in special education and rehabilitation centers,
where students with special needs receive education, for approximately 10 years and she is still continuing these studies. The reliability data of the dependent and independent variables in the study were collected by a special education teacher. The observer was informed about the dependent and independent variables of the study, the intervention period of the study, the data collection techniques to be used in the study, and how data would be collected.

Setting

The study was carried out in an assessment unit of a university. The teaching session of the study was held in a 15 m² classroom of the assessment unit. There are a table, two chairs, and a bookshelf in the class. The baseline, probe and follow-up sessions were held in different environments that are appropriate for exhibiting the social skills determined, such as in the offices of the unit, computer lab, university cafeteria, etc. The generalization sessions were held at the general education schools where the participants continued their education.

Tools and Materials

Depending on the scenarios in the study, tools and materials were used such as brain games cards with the answers behind, attention-building games (e.g. asking the participant to look behind the card), foods (e.g. asking the participant to take someone else’s food unauthorized or secretly), tablet pc (e.g., asking the participant to play a game he is not allowed to play), computer (e.g. asking the participant to go online unauthorized when performing an activity given to him on the computer), calculator (e.g. asking the participant to perform the mathematical operations given to him using the calculator when he is not allowed to do so), mobile phone (e.g. asking the participant to bring someone else’s phone or use it unauthorized). At all stages of the study, a video camera was provided for video recording.

In order to assess the effect of the teaching with cool versus not cool on the social skill of the participants with ASD, a “multiple probe design across participants” among the single-case research models was used. In this study, the fact that the participants, who were provided with the experimental control education, acquired the target skill and there was no change in the performances of the participants whose education did not start yet was ensured by providing the education and by the participants’ acquiring the target skills in sequence.

Dependent variable. The dependent variable of the study was the participants’ level of learning the skill of “coping with inappropriate requests from familiar peers or adults.” During the determination of the target social skills, the counselors of the participants at the primary school or secondary school were asked to complete the Social Skills Checklist developed by the researchers. The checklist consists of a total of 64 items under the headings of self-direction, self-expression, cooperation, responsibility, and problem-solving. The counselors were asked to assess whether the students have these skills and how much they are important for the students. The skills that the counselors said were not found in their students and were very important were identified. Moreover, the social skills in the Pervasive Developmental Disabilities Support Education Program (a program which is used for individuals with ASD in Turkey) social skills module and in individualized education programs (IEP) of students were examined. Afterwards, interviews were held with the participants’ mothers about the skills in the forefront of these assessments. As a result of the interviews held with the mothers, the skill of “coping with inappropriate requests from familiar peers or adults”, which is also important for the safety of the participants, was identified to be the target skill. In the interviews, mothers stated that their children could refuse the requests from strangers, but they accepted the requests from their friends, siblings, cousins, and other adults around them, whether or not the request was appropriate. In the interview conducted, Okan’s mother stated why she wanted this skill with
the expressions: “One day, I left Okan to his grandmother. There was also the son of my sister, and he is much older than Okan. My sister’s son first made Okan draw circles on the wall from small to large, then asked him to hit the circles with eggs. The result was a disaster. I cleaned the house for a week. So it is very important for us that Okan learns this skill.”

Skill steps for the skill of “coping with inappropriate requests from familiar peers or adults” were determined to be as saying “No, this is not a correct/appropriate behavior,” and taking a deep breath and moving away from there if the peer or adult continues to make an inappropriate request. In the determination of the skill steps, expert opinions were consulted, and opinions were received from a special education teacher and two counselors.

Independent variable. The independent variable of this study is teaching with cool versus not cool. In this study, teaching with the cool versus not cool procedure was conducted in nine steps, being (a) drawing the student’s attention to the target skill (“Sometimes, individuals around us make inappropriate requests from us. When we accept these requests, we may exhibit an inappropriate behavior. We need to learn how to cope with these requests. Let’s start if you are ready!”), (b) reinforcing the responses of the participants showing that they are ready, (c) explaining a situation in the scenario pool (“...is an inappropriate request.”), (d) being a model to appropriate and inappropriate behaviors twice (“We can act in two ways against this request. I will exhibit both of the behaviors. Watch me carefully.”), (e) asking the participant after each display whether the behavior is appropriate (“Is this an appropriate or inappropriate behavior?”), (f) asking the participant why the behavior exhibited is appropriate or inappropriate (“Why do you think this behavior is appropriate/inappropriate?”), (g) showing the correct response to the performance of the participant in the process of being a model (reinforcing the correct responses and correcting the incorrect responses), (h) including role-playing practices until the participant’s responses are 100% correct (“Now let’s portray the appropriate behavior for this situation. Do you want to be ... or ...?”), and (i) giving correct responses in relation to the performance of the participant in role-playing practices (reinforcing the correct responses and presenting corrective feedback the incorrect responses).

General Process

In the study, a scenario pool was created to provide opportunities for the target skill in the probe, teaching, follow-up, and generalization sessions. The scenarios related to the appropriate and inappropriate requests that the participants may encounter are included in this scenario pool. The scenario pool created was shared with the participants’ teachers at the primary school and secondary school they attended and with their families, respectively. The scenario took its final form after the additions and regulations made by them. Since the researchers would apply teaching with cool versus not cool for the first time, rehearsals were performed concerning how the steps of teaching with the cool versus not cool procedure should be with a student of 10 years of age with a typically development before the experimental process was initiated. During the rehearsals, the scenario samples, steps used in teaching with cool versus not cool, expressions used in these steps, and suitability of the definition of the dependent variable were evaluated. This process was recorded on video. The rehearsals continued until it was decided that the practitioner displayed teaching with cool versus not cool at 100%. For this purpose, four trials were conducted throughout a day.

In the experimental period of the study, the probe sessions, the teaching with cool versus not cool sessions, follow-up sessions, and generalization sessions were included. All sessions were held by individualized teaching regulations. In all stages of the study, two types of responses are defined: (a) the correct response and (b) the incorrect response. The correct responses are defined as the participant’s responding to inappropriate requests from a peer or adult within 5 seconds by exhibiting the skill steps listed above. The incorrect responses are defined as the participant’s responding to inappropriate requests from a peer or adult within 5 seconds by not exhibiting the skill steps listed above (hitting and swearing the individual), accepting the re-
quest, or not making any responses. How each stage is realized is explained in the following stages.

**Probe sessions.** In the study, two types of probe sessions were organized, being full probe sessions and daily probe sessions. The first full probe session was held in order to collect the baseline data, and the other full probe sessions were held simultaneously with all participants, immediately before the start of teaching with a participant, and immediately after meeting the criterion in the teaching practices. Full probe sessions were continued until at least three consecutive data points were obtained and a full probe session was held each day. Daily probe sessions were held in the same way as the full probe sessions. In the study, the criterion was compared with the data obtained from the daily probe sessions, and daily probe sessions were continued until the participants responded 100% correctly in three consecutive sessions. In all of these sessions, the principle of organization of the controlled baseline phase was adopted. As a result of the principle of organization of the controlled baseline phase, the criterion to be able to form a dependent variable, on which data are wanted to be collected, in the study was created by the practitioner, and four different opportunities were created in each session. Three of these opportunities are inappropriate requests from a peer or adult, and one of them is an appropriate request. The aim here is to see whether the participants can distinguish inappropriate from appropriate requests. The presentation order of the four opportunities presented was determined randomly.

During the probe sessions, the practitioner organizes the environment and places the calculator on the desk in such a way that the participant and the peer can see it. The participant and the peer are given a paper with additions and are asked to do the operations. The practitioner says that if they finish the operations in 10 minutes, they will be allowed to play a game they want. Then, he/she leaves the room saying, “I have a thing to do”. The peer says “It is not possible to finish these operations in 10 minutes. I really want to play games. I have a super idea,” and picks up the calculator on the desk and says, “Let’s do the operations with this. You are better at this than me. I tell you the numbers, you do the operations.” If the participant accepts the request, the peer puts the calculator on the desk saying “I think someone is coming” and puts the calculator on the desk and the practitioner goes in. If the participant refuses the request, the peer uses expressions such as, “Come on! Do you not want to play games? Be a little brave,” and insists on the inappropriate request. If the participant rejects the inappropriate request by exhibiting the skill steps, the peer says, “Yes, you are right. This is an incorrect behavior. Thank you for showing me the right way”. Immediately after the trial, the practitioner watches the video footage and notes the response of the participant.

**Intervention sessions.** In the study, teaching with cool versus not cool was used in the teaching of the skill of “coping with inappropriate requests from familiar peers or adults”. The intervention sessions were held following the daily probe sessions. The correct responses of the participants were reinforced in all intervention sessions and correction was made in the cases of incorrect responses. A situation was selected from the scenario pool to be used in the intervention sessions. In these sessions, the practitioner exhibited the teaching with cool versus not cool as described in the heading of the independent variable.

During intervention sessions, the practitioner arranges the environment according to the situation in the scenario selected from the pool. He/she gives a clue that draws attention by saying, “Sometimes, individuals around us make inappropriate requests from us. When we accept these requests, we may exhibit an inappropriate behavior. We need to learn how to cope with these requests. Let’s start if you are ready!” When the participant states that he is ready, the practitioner says, “You are great. I’m starting then.” After explaining the situation by saying, “Sometimes our teacher gives us mathematical operations that we should do without using a calculator. When we do the operations, our friends may propose us to use the calculator. It is unfavorable for us to do operations with the calculator, secretly from our teacher”, the practitioner becomes a model of the appropriate and inappropriate behavior by saying, “We can act in two ways against this request. I will exhibit both of the
behaviors. Watch me carefully.” Which one to exhibit first is determined in an unbiased way. After exhibiting the behavior, the practitioner asks, “Is this behavior appropriate or inappropriate?” While reinforcing the correct answers of the participant (“You are great. This is an appropriate/inappropriate behavior.”), he/she makes a correction for the incorrect answers (This is an appropriate/inappropriate behavior. You will find the correct answer next time.). Then, the practitioner asks, “Why is this behavior appropriate/inappropriate?” While reinforcing the correct answers of the participant, he/she makes a correction for the incorrect answers. After the practitioner exhibits the appropriate and inappropriate behavior twice, the step of role-playing is passed to. The situation in the scenario is created in the role-playing step. The practitioner takes on the role of a peer or adult who makes an inappropriate request. The role-playing practices are continued when the participant exhibits the target skill with 100% accuracy twice. While the correct responses of the participant are reinforced during role-playing practices (e.g. “You are the best. You have rejected the request by saying no,” or “It’s great that you have breathed deeply to calm down”, etc.), correction is made for the incorrect responses (e.g. “It is more accurate to move away from here rather than yelling. Move away from the environment next time when I insist in the trial”, etc.). Sessions were held twice a day, five days a week with Okan and Orkun. Due to Emre’s school schedule, two sessions were held twice a day, three days a week (Monday, Wednesday, and Thursday) with Emre.

Follow-up sessions. Follow-up sessions were held to assess whether the participants were able to maintain their skills they acquired 1, 4, and 10 weeks after the last probe session. The follow-up sessions were held as probe sessions.

Generalization sessions. The participation of different peers and adults in the research process contributed to the fact that the participants generalized the skills they acquired to different individuals, the inclusion of different situations in the prepared scenarios contributed to the fact that the participants generalized them to different situations, and holding sessions in different environments contributed to the fact that the participants generalized them to different environments. Furthermore, whether the participants continued to exhibit the skills they learned at the primary school and secondary schools they attended was assessed with pre-test and post-test measurements, and the generalization data were collected. The generalization pre-test sessions were performed before the participants started the practice and in a similar way to the probe sessions. The post-test sessions were performed after the intervention sessions ended and in a similar way to the probe sessions. No generalization data were collected for Emre because the necessary permissions could not be obtained from his school.

Social Validity

In the study, the social validity data were collected from the participants with ASD by the subjective evaluation approach. The social validity data were collected in two stages by using the questionnaire developed by the researchers. In the first stage performed after the end of teaching, four questions were included to receive the opinions of the participants on the target skill and teaching method. In the second stage performed one month after the end of teaching, three questions were included to receive the opinions of the participants on whether they encountered inappropriate requests in their everyday lives, whether they used the skills they acquired, and how they felt when they exhibited that skill.

Reliability

Two types of reliability data were collected in the study: (a) interobserver reliability and (b) treatment reliability. The interobserver reliability and treatment reliability were collected from 33% of the follow-up and generalization sessions and from all daily sessions and intervention sessions. The interobserver reliability was calculated using the formula \[
\text{Interobserver Reliability} = \frac{\text{Number of agreements}}{\text{Number of agreements} + \text{disagreements}} \times 100
\] (Cooper, Heron, & Heward, 2007). The collected treatment reliability data as to whether the teaching with cool versus not cool was applied reliably were analyzed using the formula \[\text{Observed practitioner behavior/Planned practitioner beh-} \]
behavior × 100] (Cooper et al., 2007). In the study, the interobserver reliability was found to be 100% for Okan and Orkun and 94.64% (range 75–100%) for Emre. The treatment reliability for all sessions was found to be 100%.

Results

Effectiveness

The performances of the participants in the full probe, teaching, follow-up, and generalization sessions were analyzed, and findings of the effectiveness of teaching with cool versus not cool were obtained and findings of the full probe, teaching, and follow-up sessions are presented in Figure 1. Furthermore, the performance of the participants for the requests from peers and adults and whether they distinguished the appropriate requests and gave correct responses were analyzed.

Okan exhibited the skill of “coping with inappropriate requests from familiar peers or adults” at a level of 0% at the baseline sessions. Okan achieved 100% performance in the eighth teaching session, but teaching continued until he gave a correct response at 100% in three consecutive sessions.

Figure 1. Participants’ learning level of targeted social skill.

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When the requests from the peer and adult, to which Okan gave an incorrect response, were examined, it was observed that he gave incorrect responses only to inappropriate requests from adults. Moreover, like all participants, three inappropriate requests and one appropriate request were directed to Okan in each probe session, and it was observed that Okan responded appropriately to the appropriate and inappropriate requests, but refused only one appropriate request from a peer. It was observed that Okan gave correct responses at 100% in all of the second, third, and fourth full probe sessions. In the follow-up sessions held 1, 4, and 10 weeks later, Okan was observed to maintain his skill at 100%, and while he exhibited the target skill in the pre-test generalization session at an average of 0%, he reached 100% correct response percentage in the post-test session. While Orkun exhibited the skill of “coping with inappropriate requests from familiar peers or adults” at a level of 0% at the baseline sessions, he reached the 100% level in the sixth teaching session and the teaching was ended after the eighth teaching session when he gave correct responses at 100% in three consecutive sessions.

When the requests from the peer and adult, to which Orkun gave an incorrect response, were examined, it was observed that Orkun gave a wrong response to inappropriate requests from both his peers and adults. It was also observed that Orkun responded to three of the inappropriate requests from his peers and adults by saying, “No, this is not correct,” and exhibited violence-related behaviors as a result of the insistence by the peer or adult, and these responses were recorded as incorrect responses. Orkun responded appropriately to all of the appropriate requests from the peer or adult during the intervention. Orkun was observed to respond appropriately at an average of 8.3% in the second full probe session and at 100% in the third and fourth full probe sessions and follow-up sessions. The follow-up data show that Orkun maintained the skill he acquired at 100% after 1, 4, and 10 weeks, and the generalization data show that he exhibited the target skill at 0% in the pre-test session and at 100% in the post-test session.

At the baseline sessions, Emre exhibited the skill of “coping with inappropriate requests from familiar peers or adults” at an average of 0%. A total of 14 sessions were held with Emre. Emre reached the criterion of 100% in the fourth and ninth sessions, but the teaching continued until he responded at 100% in three consecutive sessions. When the requests from the peer and adult, to which Emre gave an incorrect response, were examined, it was observed that Emre gave incorrect responses to inappropriate requests from both his peers and adults, gave correct responses to all of the appropriate requests from the peer or adult during the intervention. It was observed that Emre gave a correct response at an average of 0% in the first, second, and third full probe sessions and at 100% in the last full probe session. It was observed that Emre maintained the skill he acquired at 100% in the follow-up sessions held 1, 4, and 10 weeks later.

In the study, the percentage of non-overlapping data (PND) technique was used to calculate the effect size of the intervention. The percentage of non-overlapping data of the baseline and intervention phases was found to be 100%, high effect size, in all participants. In all participants, an immediate effect was observed with the start of the intervention.

Social Validity

The social validity data collected from the participants through the subjective assessment approach in two stages were analyzed descriptively. In the first stage, the participants were asked questions related to which skills they learned during the study, the importance of these skills, and favorable and unfavorable properties of the method used to teach the skills. Two of the participants stated that they learned not to accept the inappropriate request they encountered and one stated that he learned to say “No”. All of the participants stated that the skills they learned were important, thus preventing something bad from happening. The participants’ opinions about the positive and negative properties of the teaching method used showed that all participants liked and enjoyed the role-playing practice involved in the teaching. Orkun listed the favorable aspects of the method by saying, “It was very funny. Sometimes you became a mother or a teacher, and sometimes I did. It is very enjoyable to play.” The participants stated...
that there were not any unfavorable properties of the method. In the second stage, the participants were asked questions about whether they encountered inappropriate requests in their daily lives, whether they used the skill they acquired, and how they felt when they exhibited this skill. The participants listed inappropriate requests from familiar individuals in their daily lives. Okan stated that his sister wanted him to do housework that she needed to do, Orkun stated that his friends wanted him to play music on his teacher’s computer and to hit people, and Emre stated that his brother wanted him to take the tablet pc from his father’s shop secretly. All of the participants stated that they did not fulfill the inappropriate requests from others. Emre answered this question by saying “My brother asks me to take the tablet pc from our father, but I say ‘No, this is not appropriate. You should get permission from our father.’ If he keeps talking, I go to my mother. He cannot come.” All of the participants stated that they felt good and happy when they said “No” to inappropriate requests from others because they were saved from doing bad things.

Discussion

In this study, it was aimed to investigate the effectiveness of teaching with cool versus not cool in the teaching of the skill of coping with inappropriate requests from familiar peers and adults to individuals with ASD attending primary school and secondary school. Furthermore, the subjective assessment approach was used in the study, and social validity data were collected from direct participants with the semi-structured interviews. The research findings showed that the participants with ASD acquired the target skill with cool versus not cool and that they continued to maintain the skill they acquired and generalized it to different environments after 1, 4, and 10 weeks after the end of the study. The social validity findings collected by the subjective assessment approach revealed that the participants’ opinions about the target skill, the teaching process, and their post-teaching performances were positive.

Some of the studies examining the effectiveness of teaching with cool versus not cool included the role-playing practices as a part of the teaching process, and some included them for participants who were unable to meet the criterion after the modeling practices. In this study, the effectiveness of teaching with cool versus not cool, in which role-playing practices were used as a part of teaching, was investigated and the obtained findings were found to be similar to the findings of the study, in which role-playing practices were addressed as a part of the teaching process (Leaf, Leaf et al., 2016; Leaf et al., 2015; Leaf, Mitchell et al., 2016; Leaf, Taubman et al., 2016). When the participants’ performances in acquiring the target social skill were examined, it was observed that Okan acquired the social skill in 10 sessions, Orkun in eight sessions, and Emre in 14 sessions. Emre gave a correct response at 100% in sessions four and nine, but teaching continued because he could not sustain his performance in three consecutive sessions. This variability in Emre’s performance is thought to be due to the fact that Emre has a lower intelligence score and that he has intense vocal stereotypes. It is emphasized in the literature that one of the points that affect the effectiveness of teaching with cool versus not cool may be the level of intelligence (Leaf, Leaf et al., 2016). The findings of this study support this opinion. Furthermore, the findings of the study showed that the participants’ verbal responses to the appropriate requests offered to them varied in the implementation process. During the study, the participants were taught to use the expression “No. It is not an appropriate/correct behavior,” and it was observed that the participants used different expressions such as, “This request is incorrect. Come on, you know this is not appropriate,” in the probe, follow-up, and generalization sessions in addition to this statement.

In the studies examining the effectiveness of teaching with cool versus not cool, it has been shown that early childhood participants aged between 3–7 years have been studied, and in this study, participants aged between 9–12 years who are benefiting from the inclusion at an elementary and secondary school have been studied. While other studies have examined the effectiveness of teaching with cool versus not cool in the teaching of social skills such as playing games, giving an appropriate response to be defeated, participating in a dialogue appropriately, empathizing, changing games when others are bored, be-
having gentlemanly in sports activities, sharing, and starting games, in this study, the skill of coping with inappropriate requests, which is included in the social skills from one aspect and in the safety skills from another aspect, has been addressed. It is thought that the study will contribute to the literature in terms of the characteristics of the participants and the skill examined.

In the study, the follow-up data were collected 1, 4, and 10 weeks after the end of teaching. The follow-up data revealed that all participants continued to maintain the target skill they acquired after the end of teaching. The findings of other studies examining the effectiveness of teaching with cool versus not cool also revealed that participants continued to maintain the social skill they acquired after the end of teaching (Au et al., 2016; Leaf et al., 2012). The follow-up findings obtained in this respect support the findings of the literature. Measurements were taken to maintain the permanence by performing the intervention in the presence of familiar peers and adults in the natural environment in which the participants are intensively found, by using the stimuli that emerged naturally during the intervention, and by continuing the teaching until the participants exhibited the target skill at 100% in three consecutive sessions.

Unlike other studies examining the effectiveness of teaching with cool versus not cool, the generalization data were collected from the pre-test and post-test sessions for two participants, and it was observed that the participants generalized the skills they acquired to different environments. In the study, the pre-test and post-test data related to whether Emre generalized the skills he acquired to different environments could not be collected since the necessary permission could not be obtained from the primary school Emre attended. In the process of conducting the study, arrangements that would contribute to the generalization between environments, individuals, and situations were included by working in different environments, holding probe sessions in which different peers and adults were included, and using different scenarios. The performances of the participants in the intervention process are also an indication that the generalization is ensured. Due to the characteristics of the study related to generalization, it is considered to contribute to the literature on teaching with the cool versus not cool procedure.

The skill aimed to be taught in the study, teaching with cool versus not cool, and the effect obtained as a result of this teaching were assessed by the participants, and the social validity data were collected. The social validity data were collected in two stages. The social validity data collected in the first stage revealed that the participants were aware of the target skills that were being taught, they found this skill important, they liked the method used to teach the skill, and they found it fun, and there was no property of the method that they did not like. The social validity data collected in the second stage revealed that the participants encountered inappropriate requests in their daily lives, they used the expressions, “No. This is not appropriate,” when they encountered these requests, when an individual persisted they moved away from the environment or did not listen to the individual, and that they felt good and happy when they coped with inappropriate requests they encountered. Since the social validity data were not collected in other studies examining the effectiveness of teaching with cool versus not cool, it is thought that the participants’ opinions, especially about the method, will contribute to the literature and planning of different interventions.

By taking into account both this study and the previous studies, it can be said that teaching with the cool versus not cool procedure can be effectively used in the teaching of target social skills to primary and secondary school children with ASD, and by taking into account the positive opinions of the participants about the role-playing step of the method, it can be said that the inclusion of the role-playing step in the intervention increases effectiveness. There were some difficulties and limitations in the process of conducting the study. There were difficulties in preparing the scenarios, creating the opportunities related to the scenarios, arranging the environment where the opportunities would be presented, reaching the people who would create the opportunities, determining the suitable hours for these people, and training of these people during the probe sessions. In this sense, it can be said that the arrangement of the probe
sessions is challenging and time-consuming. The most important limitation of the study is not being able to collect the generalization data for Emre.

Based on the findings obtained from the study and observations during the study, suggestions can be made for the intervention and further research. For the intervention, family members, domain experts, and teachers can be suggested to include the teaching with cool versus not cool in the teaching of different social skills and safety skills. In further studies, it may be suggested to investigate the effectiveness of teaching with cool versus not cool in the teaching of different skills in different environments (e.g. in the home environment), by different individuals (e.g. teacher, peer), and investigate the effectiveness of intervention, in which appropriate and inappropriate behaviors are presented in videos during the intervention. It is possible to carry out studies comparing the effectiveness and efficiency of teaching with cool versus not cool and social skills teaching methods such as social story and video model, of which effectiveness has been revealed in the studies.

References


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Using Content Area Literacy Strategies during Shared Reading to Increase Comprehension of High School Students with Moderate Intellectual Disability on Adapted Science Text

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Abstract: Students with intellectual disability (ID) often have limited access to general education science content. The current study evaluated the effects of a content area literacy intervention designed to improve the comprehension of high school students with moderate intellectual disability on adapted expository science text. The multicomponent intervention included explicit instruction in comprehension strategies before, during, and after reading an adapted text in a shared reading lesson. Using a multiple-baseline across participants, results showed that students improved their ability to answer both multiple choice and open-ended comprehension questions about the text. In addition, students and classroom staff expressed positive feedback regarding the intervention procedures, goals, and outcomes.

Federal law mandates that students with disabilities, including students with moderate to severe intellectual disability (ID), multiple disabilities, and developmental disabilities such as autism spectrum disorder (ASD; Individuals with Disabilities Education Improvement Act [IDEIA], 2004), have access to the general education curriculum. Access to the general education curriculum can improve academic and functional achievement during students’ younger and adult lives and can improve social skills, self-competence, engagement, reading and math achievement, and post-secondary transition (Cosier, Causton-Theoharis, & Theoharis, 2013; Ryndak, Ward, Alper, Storch, & Montgomery, 2010). Research on access to the general curriculum and academic instruction for students with ID has grown steadily the past several years (Hudson, Browder, & Wood, 2013b; Spooner, Knight, Browder, & Smith, 2012). Despite this, many students with significant disabilities receive instruction that remains largely disconnected from the general education curriculum (Timberlake, 2014).

Comprehension of Content Area Texts

Reading a range of texts in the content areas (e.g., science, history, social studies, mathematics) is part of the Common Core State Standards (CCSS) English Language Arts (ELA) standards for science and other technical subjects and is considered part of the general curriculum (CCSS, 2010). For high school students, these standards include being able to accurately summarize or paraphrase the central ideas or conclusions of an expository text (CCSS.ELA-Literacy.RST.11-12.2) and understand the domain-specific vocabulary words and phrases used in a scientific or technical text (i.e., CCSS.ELA-Literacy.RST.11-12.4). Science is one content area where students work towards these standards. Science, in particular, requires

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extensive vocabulary knowledge and comprehension of abstract concepts (Mason & Hedin, 2011; Scruggs, Mastropieri, & Okolo, 2008). Science texts can be difficult for students with limited reading skills, including students with ID who often have limited language abilities and may struggle processing auditory information (Mason & Hedin, 2011; McDuffie, Yoder, & Stone, 2005; Solis, El Zein, Vaughn, Mc Coolley, & Falcomata, 2016). Without explicit instruction focused on comprehension, students with ID may struggle to gain meaning from science text.

While there has been limited research on comprehension instruction for students with ID, the research on less skilled readers more broadly, including students with learning disabilities, provides evidence to suggest that they benefit from explicit instruction in comprehension strategies (Edmonds et al., 2009; Roberts, Torgesen, Boardman, & Scammaca, 2008; Vaughn et al., 2015). Effective comprehension instruction includes explicit instruction of strategies that teachers can teach students to monitor comprehension before, during, and after reading (Block & Parris, 2008). Elements of effective comprehension instruction for students who struggle with reading, including students with learning disabilities, include (a) activating prior knowledge, (b) enhancing the text to make it more accessible, (c) engaging in strategy instruction (e.g., graphic organizers, questioning, paraphrasing, summarizing); (d) and incorporating multiple components into an intervention package (Mason & Hedin, 2011). Specific comprehension strategies that have been deemed effective include graphic organizers, mnemonic instruction, question generating and answering, vocabulary instruction, summarization, and activating prior knowledge (Block & Duffy, 2008; Mason & Hedin, 2011).

**Comprehension instruction for students with ID.**

Several specific strategies have been shown to improve comprehension for students with significant disabilities including: (a) explicit vocabulary instruction, (b) questioning throughout reading, (c) graphic organizers, and (d) shared story reading. These strategies have been used to demonstrate that students with ID can learn to answer literal recall questions and increase academic engagement when provided with systematic and explicit reading instruction (Afacan, Wilkerson, & Ruppar, 2017; Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006).

**Explicit vocabulary instruction.** Several studies have used systematic and explicit instruction to teach key vocabulary words to students with significant disabilities. Constant-time delay (CTD) has been identified as an evidence-based practice for teaching general education vocabulary as well as functional vocabulary words to students with ID and ASD (e.g., Browder, Trela, & Jimenez, 2007; Jimenez, Browder, Spooner, & DiBiase, 2012; Knight, Smith, Spooner, & Browder, 2012; Knight, Spooner, Browder, Smith, & Wood, 2013). In this body of research explicit instructional procedures (e.g., time delay, prompting, error correction) are used to teach the meanings of key words to students before engaging in an academic activity or reading a text.

**Questioning.** Posing and answering questions during reading is another approach to engaging readers in explicit comprehension monitoring (Mason & Hedin, 2011). Although used less frequently than explicit vocabulary instruction for students with significant disabilities, questioning has been used to promote comprehension. Browder, Lee, and Mims (2011) used questioning throughout a story to engage students with severe disabilities in a shared reading activity. The authors found that students leveraged multiple response modes to respond to comprehension questions throughout the story to increase engagement and learning. Similarly, Browder et al. (2007) trained teachers to implement a lesson plan that prompted students with moderate and severe disabilities to answer questions throughout a shared story reading. In both studies the comprehension questions were embedded within a task analytic lesson plan.

**Graphic organizers.** Although there is research to suggest that students with high-incidence disabilities benefit from explicit instruction around the use of graphic organizers to improve comprehension (Kim, Vaughn, Wan zek, & Wei, 2004), there is less research on the use of graphic organizers to promote the reading comprehension of students with significant disabilities. Knight et al. (2013) used graphic organizers paired with systematic instruction to teach science vocabulary to students with autism spectrum disorder (ASD) and ID. Mims, Hudson, and Browder (2012)
used graphic organizers in a peer-supported reading intervention to help students answer “Wh” questions. Both studies situated the use of graphic organizers within a task analytic lesson plan that leveraged systematic and explicit instruction.

Shared story reading. An evidence-based approach to improving comprehension of students with significant disabilities has been to situate instruction within the context of a shared reading activity using an adapted text, sometimes called story-based lessons. Shared reading can improve the comprehension of students with significant disabilities on narrative (texts that tell what happened; e.g., stories) and expository (texts that explain or inform; e.g., textbooks) text (Hudson & Test, 2011). Shared reading interventions involve adapting grade level text and reading the story with students, embedding opportunities for students to engage with the text and the content throughout the experience (Hudson & Test, 2011). Shared reading interventions can be adapted for varying content areas and age groups and have been used in literature (e.g., Browder et al., 2007), science (e.g., Hudson, Browder, & Jimenez, 2014), and social studies (e.g., Mims et al., 2012). Typically instruction is delivered using a task analytic lesson plan that can be implemented by the research team, teacher (e.g., Browder et al., 2007), paraprofessional (e.g., Spooner, Rivera, Browder, Baker, & Salas, 2009), or peer (e.g., Hudson et al., 2014). The supports in a shared story vary depending on the needs of the K-12 learners (Hudson & Test, 2011). As the literature base for this strategy has grown, a variety of support strategies have been implemented in the context of a shared story intervention including: (a) attention-getting activities at the beginning of a text; (b) picture symbols above key vocabulary, (c) repeated story lines; (d) comprehension questions; and (e) graphic organizers.

Comprehension outcomes. Despite the growing research base focused on comprehension instruction for students with ID, the majority of measured outcomes in this area focus on literal recall comprehension questions as opposed to inferential comprehension questions (Ruppar, 2015). Open ended, inferential questions require critical thinking to construct meaning without explicit connections in the text and also provide students with opportunities to make personal connections to what they are reading (Perfetti & Adolf, 2012). Unfortunately, the literature base on reading instruction for students with significant disabilities suggests that isolated, sight-word vocabulary instruction is emphasized most frequently with limited emphasis on additional elements of comprehension (Browder et al., 2006). Vocabulary instruction alone may not facilitate content specific comprehension (Perfetti & Adolf, 2012), especially for students with complex learning needs who need systematic and explicit instruction to make progress in academic content (Hudson et al., 2013b).

One way to address these higher-level comprehension skills would be through the use of multicomponent interventions. Multicomponent interventions, which include instruction in more than one component of reading as defined by the National Reading Panel (NRP, 2000) and leverage multiple evidence-based practices, have been found to improve outcomes for students with ID (Afacan et al., 2017; Allor, Mathes, Roberts, Champlin, & Cheatham, 2010; Browder, Alghirm-Delzell, Flowers, & Baker, 2012). Future research should evaluate systematic arrangements of multicomponent reading instruction that include multiple evidence-based literacy practices and promote active comprehension monitoring before, during, and after reading. This will help determine if multicomponent interventions may be effective at improving the comprehension of students with ID on academic concepts needed to access the general curriculum.

Purpose
Science was chosen as the target content area because it has the potential to improve students’ understanding of and participation in the natural world around them by teaching them to ask questions about their environment, make connections between science concepts and their lives, and engage in critical thinking to answer those questions (National Research Council, 2000; Spooner, Knight, Browder, Jimenez, & DiBiase, 2011). It is also one area where students with ID disproportionately lack access (Spoonier et al., 2011). Despite a growing emphasis on STEM (i.e., science, technology, engineering, and mathematics) education, and research demonstrat-
ing that students with ID can learn complex science concepts, students with ID typically receive limited access to science content (Courtade, Browder, Spooner, & DiBiase, 2010; Jimenez et al., 2012; Knight et al., 2013; Spooner et al., 2011). Science learning often requires accessing complex, expository text (Mason & Hedein, 2011), which may be difficult for students with disabilities who may not have the required background knowledge (Wahlberg & Magliano, 2004) or comprehension monitoring skills (O’Connor & Klein, 2004) to comprehend necessary concepts. Students with ID need content area instruction that addresses these skills.

Thus, the purpose of this study was to evaluate the impact of a multicomponent content area literacy intervention situated within the context of a shared reading activity on the comprehension of students with moderate ID on an adapted science text. The research question was: (1) What is the impact of a multicomponent shared reading intervention on students’ ability to answer both literal recall and open-ended comprehension questions related to an adapted science text?

Method

Participants

Students. Three high school students with moderate ID took part in this study. The research team did not have access to student files or test scores so the special education teacher at the participating high school was asked to identify students who met the following inclusion criteria: (a) have an IQ that falls within the moderate to severe ID range (<55 IQ); (b) require extensive support in both academic and functional skills; (c) qualify for the alternate assessment designed for students with significant disabilities; (d) have IEP goals related to reading comprehension; and (e) have the ability to attend to a task for at least 10 minutes without exhibiting challenging behavior. Destiny, Matt, and Sarah, three students from the same self-contained special education classroom, were identified and were recruited into the study.

Destiny was a 17-year-old, white female with moderate ID. Destiny received speech and language services and a specially designed curriculum focused on life skills. Throughout the school day she received supports for transitioning to and from her general education classes, developing life and social skills, and self-monitoring behavior. Matt was a 19-year-old white male with ASD and moderate ID. Matt also received speech and language services and a specially designed curriculum focused on life skills. Throughout the day Matt received supports designed to help him self-regulate his behavior and social interactions. Sarah was a 17-year-old, white female with moderate ID. She received speech and language services, occupational therapy and a specially designed curriculum focused on life skills. She had a one-on-one paraeducator who helped her with adaptive skills throughout the school day. All three students were verbal and used speech to communicate. Based on recent curriculum based measures, all participants had independent reading levels at approximately the third or fourth grade.

Special education teacher. One special education teacher participated in the study. The teacher was certified in special education with categorical licensure in both high and low-incidence disabilities (K-12) and had six years of experience teaching special education, all of it in the current setting. She collaborated with the research team on nominating students for participation, selecting the science standards and materials, communicating with families regarding the study, and facilitating parental consent.

Setting

This study took place in the self-contained special education classroom within a suburban high school in the Midwest. The classroom had one special education teacher and five paraeducators, two of whom were one-on-one supports for specific students. Students received all core academic instruction and instruction on IEP goals in the self-contained classroom (e.g., English Language Arts [ELA], mathematics, communication, functional skills). Destiny and Sarah attended one to two general education classes a day (e.g., art, horticulture). Matt did not attend any general education classes. Sessions for all conditions were conducted two to three times a week (Monday to

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Friday) and lasted between 15 to 30 minutes per participant. The first author, a previous special education teacher, was the interventionist and delivered the intervention one-on-one to each student at a table inside the special education classroom.

Materials

Adapted text. Three science books were selected and adapted for use in the study based on their alignment with (1) secondary science standards and (2) student interests and daily activities. The standard that focused on the structures and functions of living systems was selected as the focal standard because it aligned with the general education biology class and alternate assessment. The first author and special education teacher reviewed several expository texts aligned with the focal science standard and selected three books, one for each student, to use during both baseline and intervention phases. The first book, *Recycling*, is all about the recycling process and how to increase recycling practices in everyday life and is related to the biology concept of interdependence. It was selected for Destiny because she was involved in the high school recycling program. The second book, *Ocean Food Chains*, is about organisms in the ocean and relates to matter cycles and energy transfer. It was selected for Matt because he was particularly interested in living creatures. The third book, *Body Fuel*, is about nutrition and practicing healthy habits and aligns with biology concepts related to matter and energy transformations. Sarah’s family was concerned about her eating habits and thus the teacher thought it would be appropriate for her.

Baseline text. For the baseline phase, all three books were adapted using the procedures for adapting text for independent readers as outlined by Hudson, Browder, and Wakeman (2013a). This included dividing each book into 20 to 30 sections and rewriting each section to include between 100 and 200 words written at an accessible Lexile (a measure of text complexity, MetaMetrics, 2017) depending on the student’s reading level. Prior to beginning baseline sessions each student was assessed by the first author to determine their instructional reading level. To do this, the first author had each participant read text at various Lexile levels (http://lexile.com; MetaMetrics, 2017) until they were able to read with between 90% and 96% accuracy (Armbruster, Lehr, & Osborn, 2001). The results of this assessment determined that Destiny’s estimated instructional reading level was 750 Lexile, Matt’s was 750 Lexile, and Sarah’s was 650 Lexile. Per the recommendations from MetaMetrics (2017), each section of the adapted text was then rewritten to be within 100 points below and 50 points above participants’ estimated Lexile. For consistency, comprehension questions across all phases were written between 400 and 500 Lexile. This ensured that readability of the questions did not impact comprehension.

Intervention text. For the intervention phase, two additional modifications were made to the adapted text that align with the recommendations by Hudson et al. (2013a). First, one target vocabulary was selected per each section of the text. Vocabulary words were selected based on three rules: (1) they were considered tier two words that would be encountered in other texts, were crucial to the main idea, and were unlikely to be learned independently through observational learning due to their limited conversational use and content specific nature (Beck, McKeown, & Kucan, 2002); (2) they occurred more than once in the target section; and (3) they occurred in at least two other sections of the text. The researchers added the definition of the target vocabulary along with an example, non-example, and picture symbol to the beginning of the section to improve student comprehension. Picture symbols were only included on the introductory vocabulary page and not in the remainder of the section. Second, each section was divided into a predictable structure that included four paragraphs, and ‘STOP’ signs were inserted at the end of each paragraph to cue students to stop reading and think about what they had read.

Shared reading lessons. The lesson procedures for the baseline and intervention phases were written into two separate task analytic lesson plans. Task analytic lesson plans are a format of lesson planning where multiple, chained tasks are broken down into a series of consecutive, discrete tasks (Courtade et al., 2010). They are used frequently in shared story research and can help increase interven-
tion fidelity and data collection because they provide the interventionist with a step-by-step checklist to monitor delivery of each lesson component (e.g., Browder et al., 2007; Courtade et al., 2010; Hudson & Test, 2011; Mims et al., 2012). Task analytic lesson plans include directions and procedures for how to (a) present content, sometimes with specific teacher scripting; (b) engage students through questioning and other opportunities to respond (e.g., point to, touch); and (c) prompt students and provide error correction (Carnine, Silbert, Kame’enui, & Tarver, 2010). The baseline task analytic lesson plan had six steps and included procedures for the opening, shared reading, and 10 comprehension questions. No comprehension strategies were embedded into the lesson. The intervention task analytic lesson plan had 20 steps and included procedures for the opening, pre-teaching vocabulary, during reading activities (i.e., stopping to complete graphic organizer), after reading activities (i.e., review the graphic organizer, summary statement), and 10 comprehension questions.

Dependent Variables and Data Collection Procedures

Dependent variable. The dependent variable for this study was ten comprehension questions of each section of the adapted text. Eight questions were literal recall multiple-choice and two questions were open ended. Literal questions are “facts, vocabulary, dates, times, and locations explicitly stated in the text” (Bursuck & Damer, 2015, p. 290). Answers to the eight literal recall questions in each session were explicitly answered in the text read during the session. Per recommendations by Hudson et al. (2013a), the literal recall questions were written using who, what, when, where, why, and how stems as appropriate for the section. Responses were presented in a multiple-choice format where students selected the correct answer from a field of four options. To promote higher level comprehension, two open-ended, inferential questions were included. Inferential questions do not have the answers explicitly stated in the text (Bursuck & Damer, 2015). They include main idea questions and questions that require students to connect their own experiences and knowledge to the text to formulate an answer (Bursuck & Damer, 2015). The two questions remained consistent and asked students to identify (a) one thing they learned from the section, and (b) the main idea of the section. These questions were selected because they focus on overall comprehension of the text, which was the goal of the study.

At the end of each session, after reading the section of the adapted text, students were verbally prompted to read and answer the 10 comprehension questions. Beyond the initial verbal prompt to read and answer the comprehension questions, only unprompted and correct responses (marked “+”) were counted as correct. The interventionist used the system of least to most prompting (e.g., verbal, gesture, physical) after a 5 second time delay if the student did not respond after the initial verbal prompt. Questions requiring additional prompting were scored as incorrect (marked “−”). The dependent variable was calculated as the percentage of correct independent responses on the 10 comprehension questions with a maximum of 100% correct.

Inter-observer agreement. Inter-observer agreement (IOA) data for the dependent variable was collected at 100% of the baseline and intervention sessions. Three graduate students in special education received training regarding the dependent variable and the measurement prior to beginning baseline data collection. They took turns attending sessions as a second data collector while the main author conducted the intervention. IOA was calculated by comparing the second observer’s scores for comprehension with the interventionist’s scores. Questions that both observers scored the same were considered in agreement (e.g., both giving a “+” or “−”). IOA was calculated by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100 (Kennedy, 2005).

Social validity. At the conclusion of intervention, the special education teacher and the student participants participated in a social validity survey and interview. The researcher developed a student questionnaire with a 3-point Like scale (i.e., 3=yes, 2=I don’t know, 1=no) paired with accompanying happy (3), neutral (2), and sad faces (1). The 14 question survey asked students questions...
about intervention goals, procedures, and outcomes with statements like, “I feel like my reading got better from this project” and “I felt comfortable working on this project each day.” For the teacher, the researcher developed a 20 question survey with a 5-point Likert scale (i.e., 1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree). The survey asked the teacher to rate statements like, “I believe that this intervention produced permanent improvements in my students’ literacy skills” and “I would be willing to carry out the intervention in my classroom at the conclusion of the study.” Participants also completed a semi-structured interview focused on their perceptions of the study.

**Experimental Design**

A single-subject, concurrent, multiple baseline design across participants (Kennedy, 2005) was used to examine the effects of a shared reading intervention on the reading comprehension of three students with moderate ID. This design allowed for intervention to begin with the first participant while the other two participants were still in baseline. The intervention was designed to adhere to quality design standards of the field for single-case design, which includes having at least six phases (i.e., three baseline and three intervention) and having a minimum of five data points per phase (Kratochwill et al., 2013). The study lasted approximately 16 weeks, with students participating two days a week.

**Intervention Procedures**

**Baseline.** During baseline the students engaged in a shared reading of the adapted science text without the content area literacy enhancements. Students were instructed to begin reading the adapted text aloud and a systematic error correction procedure was used for oral reading errors. The error correction procedure involved the interventionist pointing to the missed word and saying, “Stop, this word is ______. What word? (wait for student response). Read that sentence again.” Once students finished reading the section they were prompted to answer 10 comprehension questions. A system of least to most prompts was used if students did not answer the question after an initial 5-second time delay (e.g., verbal, verbal + gesture). Baseline sessions lasted approximately 15 minutes per student.

**Intervention.** During intervention, four content area literacy strategy text enhancements designed to improve students’ comprehension were added to the reading procedures before, during, and after reading the target section: (a) pre-teaching target vocabulary before reading, (b) embedding stop signs within each section to encourage students to pause as they read and think about what they just read (during reading), (c) completing a graphic organizer as they read (during reading), and (d) summarizing the main idea of the section after reading. Graphic organizers and explicit vocabulary instruction were selected based on their success in previous research with students with significant disabilities (Jimenez et al., 2012; Knight et al., 2013). Although main idea summarization has not been used with students with ID, it is an effective comprehension strategy for students with high-incidence disabilities (Gersten, Fuchs, Williams, & Baker, 2001). Multiple strategies were combined because there is evidence to suggest that multicomponent literacy instruction is more effective for students with ID than reading instruction that uses a single strategy (Afacan et al., 2017). All of the strategies were delivered using systematic instruction in the context of a shared reading lesson, both of which are evidence-based practices for students with significant disabilities (Hudson & Test, 2011; Spooner et al., 2011). Intervention sessions lasted approximately 30 minutes per student.

**Before reading.** Before reading the text, the interventionist taught the specific vocabulary word for the section using an explicit definition, a picture symbol, and showing an example and non-example to reiterate the meaning of the word. Direct instruction was used to get the student to repeat and state the definition and a systematic error correction procedure was used if the student responded incorrectly.

**During reading.** Next, the interventionist began during reading activities. These activities included engaging in shared reading, stopping at each stop sign to prompt the student to complete the graphic organizer to
track the main idea and three facts from the section. The graphic organizer was a web, with a circle in the middle labeled “main idea”, and three boxes surrounding it labeled one, two, and three. Four stop signs were embedded at strategic points in the section to indicate that the student should stop reading to reflect on what they had just read. At each stop sign the interventionist asked the student, “What is something we learned in that section?” and prompted the student to write their answer in one of the boxes on the graphic organizer. At the final stop sign, the interventionist prompted the student to re-read the facts in the graphic organizer and then come up with the main idea of the section, which was defined as “The most important part about what we read.” The student was then prompted to write the main idea of the section in the middle circle of the graphic organizer and then come up with the main idea of the section, which was defined as “The most important part about what we read.” The student was then prompted to write the main idea of the section in the middle circle of the graphic organizer. If students could not come up with a response, a systematic prompting procedure was used to direct them to (a) try to remember what they just read about; (b) look at their graphic organizer and think about what their three facts were about; (c) read the section again and think about the most important part.

After reading. After the student had read and completed the graphic organizer, they were prompted to write a main idea statement using a sentence frame with a stem that read as follows: “The main idea of this section is ______.” Paragraph and sentence frames have been used in writing interventions for students with ID (Lee, Browder, Hawley, Flowers, & Wakeman, 2016) and have been shown to increase students’ writing production. Using a series of task analytic steps, students were (a) reminded what a main idea is; (b) prompted to re-read each response on the graphic organizer starting with what they learned first, second, third, and then what they wrote in the center circle; (c) prompted to complete the sentence stem by looking at their completed graphic organizer; and (d) prompted to read the completed main idea sentence aloud.

Measurement. After the main idea sentence was completed and read aloud, the students were prompted to read and answer the comprehension questions. The baseline time delay and prompting procedures were used in intervention if students did not begin answering the questions after an initial 5-second time delay. Only independent, correct responses were counted as correct.

Intervention fidelity. Treatment fidelity was obtained across 100% of the baseline and intervention sessions for each participant. The secondary observers used the task analytic lesson plans to document whether each step of the baseline and intervention conditions were present (i.e., “+” if yes, “−” if no) and treatment fidelity was calculated by dividing the number of implemented steps by the total number of possible steps and multiplying by 100 (Kennedy, 2005).

Results

Intervention Fidelity and Interobserver Agreement

Intervention fidelity was monitored during 100% of sessions by calculating the number of steps completed by the interventionist during baseline and intervention phases. Intervention fidelity for the sessions was 100%. Interobserver agreement (IOA) data was taken at 100% of the baseline and intervention sessions on intervention fidelity and the dependent variable. IOA for intervention fidelity was 100% for all sessions. IOA for the dependent variable, percentage of student independent correct comprehension responses, was 100% (range of 99–100%).

Student Results

For literal recall questions, the effect was immediate for all students with minimal overlap in scores between phases (see Figure 1). The median percentage of non-overlapping data (PND) across all three participants was 77%, which can be interpreted as an effective intervention per interpretation guidelines by Scruggs and Mastropieri (1998). All students also improved in their ability to answer the two open-ended comprehension questions (questions 9 and 10), going from an average of 5% answered correctly during baseline to 75% answered correctly during intervention.

Destiny. Destiny’s baseline data was stable after six sessions with a mean score of 38% (range 13–50%). Upon introduction of the intervention her score increased immediately to 88% and her mean score during intervention was 83% (range=28–100%).
Destiny’s PND between baseline and intervention conditions was 90%, indicating that this was an effective intervention for Destiny (Scruggs & Mastropieri, 1998). Destiny also improved in her ability to answer the two open-ended comprehension questions, going from an average of responding correct 9% of the time during baseline to 83% during intervention.

**Matt.** Matt had more variability in his data, but still showed a strong response to the intervention. In baseline, his scores ranged from 25% to 63% (mean 44%). His mean score during intervention was 83% (range 50–90%). His PND was 77%, indicating that this was an effective intervention for Matt (Scruggs & Mastropieri, 1998). Matt also improved in answering the two open-ended comprehension questions going from answering correctly 5% of the time during baseline to 46% of the time during intervention.

**Sarah.** Sarah was the last to receive intervention. Her baseline score was 28% (range 0–50%). During intervention her score did not fall below 75% (mean 87%, range 75–100%). PND for Sarah’s data was 100% indicating no
overlap between baseline and intervention condition and a highly effective intervention (Scruggs & Mastropieri, 1998). Sarah also improved in answering the two open-ended questions, going from 0% correctly to 95% correct.

**Summative Evaluation**

The research team returned to the classroom three weeks after the intervention concluded to complete a single summative evaluation to determine if the participants maintained their comprehension of the science concepts beyond the intervention period. During this 15-minute session students did not receive intervention and instead completed the summative evaluation, which included 30 multiple choice questions and three open-ended questions. The multiple-choice questions were randomly selected from the bank of previously used intervention questions. The three open-ended questions included: (1) What was the name of the book you read? (2) What are three things you learned from that book? And (3) What was the main idea of the book? All three students scored higher on the summative evaluation than their average baseline scores on the literal recall questions (Destiny = 66%, Matt = 66%, Sarah = 94%). Of the open-ended questions, Destiny got 100% correct, Matt got 80% correct, and Sarah got 100% correct.

**Social Validity**

All students had an average score of 3.0 (out of 3) on the 14-question survey, indicating positive perceptions of the intervention. During the exit interview, all students stated that they enjoyed participating in the intervention and working with the research team. When asked what they would change, one student said to shorten the readings and another cited difficulty in pronouncing some vocabulary words. The teacher had an average score of 4.73 (out of 5) on the survey indicating a positive view of the intervention. She stated that she noted improvements in the students’ reading practices during in-class reading. She also noted that the intervention procedures were feasible and could be easily implemented in her classroom.

**Discussion**

This intervention evaluated the effects of a multicomponent intervention package that combined evidence based practices in comprehension instruction with evidence-based practices in shared reading research. Participants with ID demonstrated improved comprehension of science text when the reading included comprehension strategies before, during, and after reading the adapted text.

**Implications for Research and Practice**

The Common Core State Standards (CCSS, 2010) require that all students read and comprehend complex texts from a variety of content areas. The content specific vocabulary, density of multisyllabic words, and text structure of expository text make reading in the content areas challenging for a variety of students, including students with disabilities (Gajria, Jitendra, Sood, & Sacks, 2007). For students with ID, who often have literacy skills below their grade level, the issues can be exacerbated. Explicit instruction in content area literacy skills before, during, and after reading can facilitate the comprehension of expository text for students with and without disabilities. Although explicit reading instruction is more common in elementary school (Shahan & Shanahan, 2012), many students may need explicit instruction in content area literacy strategies throughout secondary school (Edmonds et al., 2009). The results of this study suggest that with support all students can access and gain meaning from content area text.

While access to the general curriculum is mandated for all students, many students with significant disabilities are excluded from accessing grade level content and curriculum (Timberlake, 2014). Previous research has found that the majority of academic instruction for students with moderate and severe ID focuses on learning isolated, receptive vocabulary words through constant time delay procedures (Hudson et al., 2013b; Ruppar, 2015). While vocabulary is an important part of comprehension, more research is needed on how to facilitate student comprehension of complex content area topics. The strategies applied before, during, and after reading text in this study
illustrate that students with ID can answer inferential comprehension questions about a text when provided with support. Williamson, Carnahan, Birri, and Swoboda (2015) had similar results when they applied comprehension strategies before, during, and after reading narrative text with secondary students with ASD. These results, paired with results from Williamson et al. (2015), suggest that additional research in this area is warranted.

This study also provided students with opportunities to use expressive language skills to engage with others and demonstrate comprehension. Unfortunately, students with ID are rarely asked to generate open ended answers based on an academic task (Lee et al., 2016; Ruppar, 2015). Ruppar’s (2015) study examining the literacy experiences of secondary students found that expressive communication is underemphasized in instruction for students with significant disabilities. This is concerning considering that authentic communication requires both receptive and expressive skills (Ruppar, 2015). Instruction should reflect these natural communication exchanges and include tasks where students use both receptive and expressive language skills.

Although an outside researcher implemented instruction in this study, similar interventions have been implemented by classroom staff suggesting that the practices are feasible and efficient. Whalon and Hanline (2008) taught peers how to use reciprocal questioning to support the comprehension of students with ASD, Heinrich, Collins, Knight, and Spriggs (2015) taught paraprofessionals and peer tutors to deliver simultaneous prompting in inclusive science classrooms, and Hudson et al. (2014) taught peers how to facilitate science read alouds with peers with moderate ID. These strategies can be combined in multicomponent intervention packages to support students’ comprehension before, during, and after reading text. Interventions with a single strategy may not be effective enough to facilitate meaningful access and learning in the general curriculum.

Quality programs for students with ID require multiple, intensive supports that use systematic instruction (Pennington, Courtade, Ault, & Delano, 2016).

Despite the increase in research on academic instruction for students with significant disabilities in the last 10 years, instructional practices in schools do not reflect the growing evidence base (Ruppar, 2015; Timberlake, 2014). This limits opportunities for improving the communication, social opportunities, academic learning, and engagement of students with ID. These issues may be exacerbated for students at the secondary level, when pressure to prepare students with the functional skills needed for post-secondary independence increases (Ruppar, 2015). Research on supporting schools in instructional transformation is necessary to ensure that students with ID are provided with high quality, evidence-based instruction.

Most importantly, this study demonstrates how to support students with ID in accessing and engaging with general education science content. As Spooner et al. (2011) note, students with ID deserve access to science learning because it is part of the “full educational opportunity of their schools” (p. 62) and their schools are accountable for their learning in this area. Beyond issues of accountability, science content has the ability to uniquely increase student engagement with and participation in the world around them. Science teaches students to notice and ask questions about the phenomenon in their lives, use evidence and data to make predictions about what they think might happen in their future, and connect with others around these shared experiences. Furthermore, it teaches and encourages the cycle of inquiry which can promote curiosity, a sense of wonder, and lifelong learning.

**Limitations and Areas for Future Research**

Several limitations should be considered in using the findings to influence research and practice. This study took place in a self-contained special education classroom for high school students with significant disabilities, which is where the majority of the academic intervention research for students with significant disabilities takes place (Spooner et al., 2012). This is concerning considering that the rate of inclusive placements for students with significant disabilities have not improved in recent years (Kurth, Morningstar, & Kozleski, 2014). Without research demonstrating that students with significant disabilities can learn
academic content alongside their peers, it will be difficult to improve policies around inclusion in K-12 schools. The intervention was also delivered in a one-on-one format, which may not be realistic for special education teachers and classroom staff. Future research should evaluate the effects of similar procedures when used with small groups of students, or consider how similar strategies can be applied in general education classrooms to differentiate to larger groups of learners with varying abilities. Due to the participant and research team schedule, generalization measures were not taken. Thus, it is difficult to determine how and if the participants continued to use these strategies across classes or materials, which is a goal of content area literacy skills. Future research should attempt to collect this type of generalization data. Also important to note, is that the participants were not pre-tested on the key vocabulary for each section so there is a chance that they were more familiar with the vocabulary words in some sections than others, which would impact their overall comprehension. Future research should attempt to control for prior vocabulary knowledge. Finally, we did not analyze the complexity of students’ open-ended responses, which was beyond the scope of this intervention but would be an insightful next step.

Conclusion

Students with disabilities do not perform well in STEM areas when compared to their peers without disabilities (AccessSTEM, 2007). STEM content has the ability to facilitate students’ interaction and engagement with the world around them. The lack of access to science content is particularly troubling for students with moderate intellectual disability considering that they are consistently segregated from the rest of their school communities (Kurth et al., 2014). Content area classes provide rich opportunities for students to engage with and learn about concepts that can facilitate increased social interactions, communication, and critical thinking. Explicit and systematic, multicomponent comprehension instruction may be one way to improve students’ access to the general curriculum in a meaningful way that will generalize to greater understanding of and engagement with the world around them.

References

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Teaching Algebra with a Functional Application to Students with Moderate Intellectual Disability

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Abstract: A multiple probe across participants design was used to examine the effectiveness of a treatment package to teach students with moderate intellectual disability how to solve simple linear equations. The investigator read realistic scenarios of a problem, used actual items as manipulatives, presented a visual aid of the equation, and used a system of least prompts procedure to teach the students to solve the problems. The results revealed the treatment package was effective in teaching students with moderate intellectual disabilities to solve linear equations. Participants generalized the ability to solve algebraic equations to problems in the natural environment.

Systematic instruction is a core characteristic of programming for students with moderate intellectual disability (MID; Collins, 2012; Wolery, Ault, & Doyle, 1992). Three systematic instructional strategies for teaching skills to students with MID supported in the special education literature include the system of least prompts (SLP; Manley, Collins, Stenhoff, & Kleinert, 2008), time delay (Riesen, McDonnell, Johnson, Polychronis, & Jameson, 2003), and simultaneous prompting (Pennington, Collins, Stenhoff, Turner, & Gusselman, 2014; Seward, Schuster, Ault, Collins, & Hall, 2014). Researchers have used these strategies to teach a variety of functional and vocational skills, including opening a locker (Fetko, Schuster, Harley, & Collins, 1999), cooking (Graves, Collins, Schuster, & Kleinert, 2005; Mechling, Gast, & Fields, 2008), constructing shipping boxes (Maciag, Schuster, Collins, & Cooper, 2000), using a telephone (Manley et al., 2008), and shopping for groceries (Morse & Schuster, 2000).

One specific systematic strategy is SLP, a type of response prompting strategy that transfers stimulus control from a prompt to a discriminative stimulus alone. The instructor defines a prompt hierarchy and then delivers those prompts ordered from the least to the most amount of assistance that is required to evoke the desired behavior. In a typical sequence, the instructor presents the discriminative stimulus and waits a specified amount of time (e.g., 3–5 s) for the student to respond independently. If the student does not respond or responds incorrectly, the teacher delivers the first prompt in the hierarchy and provides the student more assistance. This sequence continues until the student responds correctly or the instructor delivers all of the prompts specified in the prompt hierarchy, providing the student more assistance. This sequence continues until the student responds correctly or the instructor delivers all of the prompts specified in the prompt hierarchy. The instructor reinforces the correct response and records the independent response. The instructor delivers the next prompt in the hierarchy, resulting in the correct response (Ault & Griffen, 2013; Collins, 2012; Wolery et al., 1992).

Task analytic instruction also is a component of systematic instruction that is well-researched and effective for individuals with
MID that involves breaking content into a sequence of smaller teaching steps (Collins, 2012; Wolery et al., 1992). Spooner, Knight, Browder, Jimenez, and DiBiase (2011) conducted a review of the literature and found that task analytic instruction, as a component of systematic instruction, was an evidence-based practice in teaching science skills.

The SLP and task analytic instruction has a strong research base and a history of success in teaching individuals with disabilities an assortment of skills (Doyle, Wolery, Ault, & Gast, 1988; Shepley, Lane, & Ault, 2018; Wolery et al, 1992). Traditionally, SLP and task analysis have been used to teach functional skills to students with disabilities, such as cleaning tasks to teenagers (Yakubova & Taberdoughty, 2013), using pretend play to preschoolers (Barton & Wolery, 2010), using the telephone to elementary students (Manley et al., 2008), transitioning between activities to elementary-aged students (Cihak, Fahrenkrog, Ayres, & Smith, 2010), and self-prompting of cooking to young adults (Mechling et al., 2008).

More recently, an emphasis has been placed on the importance of teaching grade-appropriate academic skills to all students with disabilities, and federal law mandates that individualized education program (IEP) goals are aligned to state academic content standards (Browder & Spooner, 2014; Yudin & Musgrove, 2015). Researchers have taught academics using SLP and task analytic instruction. Examples of academic instruction from the literature that have incorporated the system of least prompts as a component of the independent variable include teaching comprehension of passages of text to middle schoolers with MID (Browder, Hudson, & Wood, 2013), and asking questions to comprehend expository text to middle schoolers with MID (Wood, Browder, & Flynn, 2015). Task analytic instruction as a component of the independent variable has been used to teach elementary and middle school students with MID to solve math word problems (Browder et al., 2018), and middle school students with autism and intellectual disability to complete a science task analysis (Knight, Spooner, Browder, Smith, & Wood, 2013).

Although SLP and other systematic instructional strategies have been used to teach a variety of academic skills, previous studies aimed at teaching mathematics to persons with MID have focused primarily on numbers and operations and on concepts related to measurement (Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, 2008). Most often they focused on functional academic skills, such as money management, telling time, and basic number identification rather than on the skills necessary for solving problems in the general curriculum (Jimenez, Browder, & Courtade, 2008).

Much of the MID literature has focused on teaching acquisition of either academic or functional skills, but fewer have provided an emphasis on embedding a functional component within academic content instruction (Collins, Hager, & Galloway, 2011; Collins, Karl, Riggs, Galloway, & Hager 2010; Karl, Collins, Hager, & Ault, 2013). The few studies that have tested the effects of combining functional and academic content have yielded positive results. In one such study, Collins et al. (2011) studied the effects of adding functional content during language arts, science, and math classes in teaching high school students with MID. The study used constant time delay to teach functional skills such as cooking, appropriate dressing, reading the news, and computing sales tax as well as academic content of vocabulary, properties of elements in the periodic table, and mathematical computation. The results indicated that students could learn, maintain, and generalize both types of content presented within the same lesson. To add a functional context to mathematics instruction, Saunders, Bethune, Spooner, and Browder (2013) recommend teaching grade-aligned math standards using real-life activities and stories within lessons on grade-aligned standards.

The purpose of this study was to extend the findings of Jimenez et al. (2008) in which the researchers used SLP in combination with a concrete representation to teach students with MID to solve for x in an algebraic equation. Participants ranging in age from 15–17 years were taught to solve linear equations using a multi-component intervention that included a concrete representation of solving a simple linear equation, task analytic instruction on the steps to solve the equation, multiple trials for learning, and SLP to promote errorless learning. Results of the study indicated the
participants learned to use the concrete representation of the equations they were asked to solve and generalized the skill to the general education setting and with a peer.

The current study replicated the findings of Jimenez et al. (2008) by using a concrete representation of the algebraic math problem, task analytic instruction, and systematic prompting and fading. The current study extended the Jimenez investigation by testing the effects of adding real-life functional scenarios, as recommended by Saunders et al. (2013), and concrete manipulatives related to the scenarios to the multi-component intervention. The current study also assessed to what extent the participants could generalize the academic skill to functional tasks. The research questions were:

1. What is the effect of a treatment package including (a) real-life scenarios, (b) a visual aid of the equation, (c) SLP prompting, and (d) concrete representations related to the scenarios, on the number of independent responses of a task analysis for solving linear equations in high school students with MID?

2. Following instruction using the treatment package, will students generalize the skill of solving linear equations when performing job tasks within a school setting?

Method

Participants

Students. Three males, ages 14 and 15, met the inclusion criteria for participating in the study. Inclusion criteria included high school age students with MID who participated in the state’s alternate assessment with the ability to (a) rote count to nine, (b) expressively identify numbers up to nine in numerical print form, (c) demonstrate one-to-one correspondence, (d) follow one-step verbal directions, (e) follow gesture, model, and physical prompts, and (f) write numbers one to nine in numerical form with a writing utensil. Table 1 shows additional student information. All students were served in a self-contained classroom for individuals with MID for the majority of the school day. They all communicated using oral speech consisting of full sentences and phrases and could maintain conversations with both peers and adults. All students had at least one academic IEP goal in reading (e.g., comprehension and fluency) and mathematics (e.g., addition and subtraction). The students who participated in this study were concurrently receiving modified instruction in mathematics aligned to the ninth grade math curriculum. They had not received instruction on solving linear equations prior to the study.

Adults. The primary investigator was the data collector who implemented all sessions. She was a graduate student in a special education master’s program and a certified teacher with 3 years teaching experience with students with MID. The students’ classroom teacher collected data for reliability purposes. She had 17 years of experience in teaching students with MID and had previous experience in data collection.

Dependent Variable

The dependent variable was the number of task analyzed steps completed independently for solving linear equations. The specific instructional objective was stated as: Given scenarios read aloud to students, a visual aid containing a simple linear equation (e.g., \( \frac{3}{x} = 5 \)), and concrete manipulatives, the student will solve \( x \), correctly and independently completing the steps of the task analysis for three consecutive sessions. We replicated the task analysis and procedures used in the Jimenez et al. (2008) study. These steps included the student (1) pointing to the sum on

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age in Years.months</th>
<th>Diagnosis</th>
<th>IQ</th>
<th>Adaptive Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dylan</td>
<td>14.10</td>
<td>ASD; ID; Epilepsy</td>
<td>40</td>
<td>58</td>
</tr>
<tr>
<td>Isaac</td>
<td>15.9</td>
<td>ID</td>
<td>52</td>
<td>55</td>
</tr>
<tr>
<td>Gabe</td>
<td>14.0</td>
<td>ID</td>
<td>44</td>
<td>61</td>
</tr>
</tbody>
</table>

TABLE 2
Materials, Teacher and Student Behaviors for Linear Equation Task

<table>
<thead>
<tr>
<th>Materials Given</th>
<th>Teacher Behavior</th>
<th>Student Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Reads real-life scenario of problem requiring a linear equation to solve.</td>
<td></td>
</tr>
<tr>
<td>2. Small poster with equation written on it (e.g., 3 + x = 5).</td>
<td>Asks student: “How many objects do you need?”</td>
<td>Student points to sum on the equation (e.g., 5).</td>
</tr>
<tr>
<td>3. Red marker to mark sum on chart.</td>
<td>Asks student: “How many objects do you already have?”</td>
<td>Student moves red marker to sum on poster.</td>
</tr>
<tr>
<td>4. Known number of objects in a container.</td>
<td>Asks student: “How many more objects will you need to get?”</td>
<td>Student counts number of items in the container.</td>
</tr>
<tr>
<td>5. Green marker to mark number of known objects on chart.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Additional objects to get to the total number of objects needed.</td>
<td>Asks student: “How many more objects will you need to get?”</td>
<td>Student moves green marker to number of known objects on chart (e.g., 3).</td>
</tr>
<tr>
<td>7. Number line with removable numbers.</td>
<td></td>
<td>Student counts on to the sum with additional materials.</td>
</tr>
<tr>
<td>8. Empty container to put additional objects in.</td>
<td></td>
<td>Student selects the number of additional objects they counted to get to the total number.</td>
</tr>
<tr>
<td>9. Dry erase marker to write solution to equation.</td>
<td></td>
<td>Student puts this number on top of the x in the equation.</td>
</tr>
</tbody>
</table>

a visual aid of the equation when asked, “How many (objects) do you need?” (2) moving a red marker to the sum on the equation, (3) counting the number of items in a container and finding this known number on the equation when asked, “How many (objects) do you already have?,” (4) moving a green marker to the known number on the number line, (5) counting to the sum with materials when asked, “How many more (objects) will you need to get?,” (6) selecting the number counted, (7) putting the correct number for x on the equation, (8) putting the correct number of objects needed in a container, and (9) solving for x by writing the number. A breakdown of the materials presented, the teacher behaviors, and task analysis of student behaviors for the current study is shown in Table 2.

Setting and Instructional Arrangement
The study was implemented at a rural public high school in a self-contained resource room for students with MID. The classroom included a restroom, one table with chairs, and six student desks. The dimensions of the room were 8.5 m by 7.6 m. Additionally, the classroom contained two desktop computers, a dry-erase board, a Smart Board, a projector, and a document camera. All sessions were conducted at a kidney-shaped table in a one-to-one format, with the students’ backs to the rest of the class. The investigator and the student sat facing each other on opposite sides of the table. During all sessions, the other students in the classroom were working on their own math assignments while monitored by the classroom teacher and a paraprofessional. Generalization sessions were conducted at two
locations in the school including the cafeteria and library.

Materials

The materials included both investigator-made and readily available materials. Investigator-made materials included written scenarios of real-life problems, an algebra expression strip, a small (22 cm × 28 cm) laminated poster printed with an algebraic equation without numbers (i.e., ___ + x = _____), a laminated number strip with numbers one to nine affixed with Velcro for easy removal, and data collection sheets. Other materials included a green and red plastic disc the size of a nickel used as place markers when solving the equation, dry erase markers, objects to use for counting that were related to the real-life scenarios (i.e., newspapers, bags of chips, plates, bottled beverages, spoons), and containers in which to place objects to count.

Experimental Design

A multiple probe across participants research design was used to evaluate the effectiveness of the treatment package for teaching students with MID to solve algebraic equations (Gast, Lloyd, & Ledford, 2018). Using this design, experimental control is demonstrated when, only upon introduction of the independent variable for each participant, there is a change in level and trend of the dependent variable. Specific to this study, experimental control was demonstrated when the participants demonstrated an increase in independent completion of the task analysis for solving linear equations after introduction of the multi-component intervention.

General Procedure

A treatment package was used as the independent variable that included real-life scenarios, a visual aid of solving a simple linear equation, total task analytic sequence of instruction, concrete manipulatives, and SLP. The generalization pre-test was conducted first, followed by initial probe sessions conducted for all students. Once the first participant achieved a stable initial probe level, he entered the intervention phase and the remaining participants in subsequent tiers received intermittent probe sessions on a weekly basis. Immediately before entering intervention, participants received at least two consecutive probe sessions. When the first participant performed five steps of the task analysis independently or improved his performance at least 50% over initial probe levels, the second participant received consecutive probe sessions and then entered the intervention phase. When the second participant demonstrated the ability to perform five steps of the task analysis independently or improved 50% over initial probe levels, participant three received consecutive probe sessions prior to beginning intervention. These procedures continued until all participants received the intervention. After each participant reached criterion, he entered the maintenance phase. Following maintenance sessions, the generalization post-test was conducted.

Screening Procedure

Before conducting formal probe sessions, the instructor conducted screening sessions to determine if the participants could perform the task of solving a linear equation. The investigator began by providing a general attentional cue to secure the participant’s attention (e.g., “Get ready to work on math”). The investigator waited for an attentional response from the participant (e.g., joining the investigator at the table). During the screening phase of this study, each participant was presented a poster with an algebraic expression, a number line, manipulatives for counting, a green and red plastic marker, and a dry erase marker, and was asked to solve for x. The participants were not provided prompts or feedback for their performance. Screening sessions were conducted using a single opportunity probe in which the first incorrect response or no response from the participant ended the session and all subsequent steps were scored as incorrect. If a participant initiated the first step correctly, but not the subsequent steps, the first step was scored as correct and the remaining steps were scored as incorrect. Correct responses were defined as the participant initiating a step of the task analysis within 5 s of the task direction, or of completing the previous step, and completing the step correctly within
5 s of the initiation. Incorrect responses were defined as the participant initiating a step within 5 s of the task direction and completing the step in a different topography than defined in the task analysis, out of sequence, or not completing the step within 5 s of the initiation. No responses were defined as the participant failing to initiate any type of response within 5 s of the task direction or completion of the previous step. Regardless of performance, the investigator provided praise (e.g., “Thank you for working hard,”) at the conclusion of each screening session.

**Generalization Pre/Post-Test Procedure**

The investigator conducted a generalization pre-test prior to collecting initial probe data and a generalization post-test following maintenance probes. Each participant was directed to complete a vocational task including stocking the snack cart in the cafeteria, setting the table for a pre-determined number of people, or gathering a number of newspapers to distribute to teachers in the school. The participant was presented with an algebraic expression, a number line, items for counting, a green marker, a red marker, and a dry erase marker, and was asked to solve for $x$. The presented problems were similar to vocational tasks that could be completed as a part of a job (i.e., stocking a shelf at a store, setting a table at a restaurant, or gathering a specified number of items to distribute) and used with corresponding manipulatives (i.e., chips, bottled beverages, plates, spoons, and newspapers). For example, the investigator stated, “I need you to stock this shelf. There are three bags of chips on the shelf already, but I need 10 bags total on the shelf. How many more bags of chips do you need? Solve for $x$ and put the correct number of bags on the shelf.” The participant was not provided prompts or feedback for his performance. The first generalization pre-test was conducted using a multiple opportunity probe, and remaining generalization pre-test sessions used a single opportunity probe. During the multiple opportunity probe, incorrect responses or no responses from the participant resulted in the investigator completing the step of the task analysis out of the participant’s view and then allowing the participant the opportunity to complete the remainder of the steps. This was repeated for each incorrect or no response until the task analysis was complete. Single opportunity probes were conducted identical to screening procedures. Regardless of performance, participants received verbal praise for attending to the task (e.g., “Thank you for working hard,”) at the completion of each generalization pre- and post-test.

**Probe Procedure**

Probe sessions were conducted using the same sequence as was described in the generalization section, but rather than being directed to complete an actual task, the investigator verbally presented a brief scenario. The scenario described a hypothetical person completing a realistic task that consisted of gathering a specified number of materials (e.g., bags of chips, spoons, newspapers). An example scenario used was: Mike delivers newspapers. He has to deliver newspapers to seven people. He has three newspapers in his bag. Mike needs to figure out how many more newspapers he needs to put in his bag before setting out to deliver them. The investigator used three different real-life scenarios that were randomly selected prior to each probe session. A multiple opportunity probe was implemented for the first probe session and a single opportunity probe was implemented for the remainder of the probe sessions. A multiple opportunity probe was used first to determine if the participants could complete the steps of solving the algebraic equation. If the participant could not complete any of the steps for solving the equation, the subsequent probes were single opportunity probes and the session was terminated following the first error in the sequence. This was done to protect against potential testing threats associated with multiple opportunity probes (Alexander, Ayres, Shepley, Smith, & Ledford, 2017; Alexander, Smith, Mataras, Shepley, & Ayres, 2014). Three types of student responses were possible during probe sessions and were identical to the definitions used in screening sessions. The investigator gave no specific feedback following student responses during probe sessions. Regardless of performance, participants received verbal praise for attending (e.g., “Thank you for working hard,”) at the completion of each probe session. The
number of correct steps for solving the equation was recorded on a data sheet and graphed.

**Intervention Procedure**

During intervention sessions, the investigator provided a general attentional cue to secure the participant’s attention (e.g., “Get ready to work on math”), and then waited for an attentional response from the participant (e.g., joining the investigator at the table) before proceeding. The investigator verbally presented a real-life scenario. The investigator then presented the participants with materials for solving the equation (i.e., algebraic equation strip, a number line, manipulatives for counting, a green marker, objects related to the story, containers for the objects, a red marker, and a dry erase marker) and gave the task direction, “Solve for $x$.” Manipulatives for solving the equations corresponded to the materials used in the story. For example, if the student in the story was asked to gather a certain number of newspapers, the participant solving the equation also used newspapers as manipulatives for solving the equation.

A SLP procedure was used to teach the algebra skill. The prompt hierarchy included an independent level, a verbal prompt, a gesture plus verbal prompt, and a model plus verbal prompt. The verbal prompt included a verbal description of the task analytic step (e.g., “Point to the sum on the equation.”). The gesture plus verbal prompt included the investigator pointing to the materials needed or portion of the equation related to the task step while also verbally describing the step (e.g., index finger pointed toward the equation strip while saying “Point to the sum of the equation”). The model plus verbal prompt included the investigator modeling the step for the participant using the materials while also verbally describing what the step, followed by the direction for the participant to do the step (e.g., “Point to the sum like this” while index finger points to sum on equation strip. “Now you do it”). The model plus verbal prompt was the most intrusive prompt used and served as a controlling prompt for all participants. For each step of the task analysis, the investigator waited 5 s before beginning the prompt hierarchy to provide an opportunity for the participant to respond independently. The investigator also provided a 5 s response interval following delivery of each prompt unless the participant began to engage in an error, in which case the investigator interrupted the participant’s response and delivered the next more intrusive prompt in the hierarchy. At any time in the prompt sequence that a participant performed a correct response, the investigator delivered descriptive verbal praise (e.g. “Great job using the green marker”). Once the participant had nine out of nine independent responses for one session, descriptive verbal praise thinned to a variable reinforcement on the average of every third correct response schedule (VR-3). When a participant had nine out of nine independent responses for one session on a VR-3 schedule, praise was thinned to a fixed reinforcement for nine correct responses schedule (FR-9). During intervention sessions, the instructor recorded the prompt level required for the student to complete each step of the task analysis on the data sheet. Data were collected according to the prompt level that resulted in correct participant responding. Only independent responses were graphed and counted toward criterion. Each participant continued in the intervention condition until he reached the terminal criterion level of nine out of nine independent correct responses for three consecutive sessions.

**Maintenance Procedure**

Maintenance sessions were conducted weekly for 3 weeks following each participant reaching criterion levels during the intervention phase. Sessions were conducted identically to probe sessions, with the first session consisting of a multiple opportunity probe followed by two single opportunity probe sessions. The number of correct responses for solving the equation were graphed.

**Social Validity**

The investigator collected social validity data at the conclusion of the study using a 5-point Likert scale survey. The classroom teacher completed a survey and ranked five statements as either strongly agree, agree, undecided, disagree, or strongly disagree that included: (1) The skills
addressed in this study are valuable for my students to learn; (2) The skills addressed in this study are skills that will help my students with future job tasks; (3) The skills addressed in this study are part of the academic curriculum my students are required to learn; (4) The intervention used to teach the skills was effective; and (5) I will use this intervention in the future when teaching similar skills. The student participants completed a survey that consisted of ranking four statements including: (1) The skill I learned in this study was important; (2) Learning how to solve these problems will help me in the future when I get a job; (3) The way the teacher taught me this skill was easy to learn; and (4) I will use this method to solve problems in the future. The instructor read the survey questions and answer choices aloud to each student and each student recorded their own responses.

Reliability

The classroom teacher collected reliability data for inter-observer agreement (IOA) and procedural fidelity. The investigator trained the classroom teacher on intervention procedures and student response definitions. The classroom teacher was given an opportunity to practice collecting reliability data through role play using the data sheet before collecting data on the instructor conducting sessions. The classroom teacher was required to have 100% IOA and procedural fidelity before beginning data collection during probe or intervention sessions.

Reliability data were collected on 38% of all probe sessions, 22% of all intervention sessions, and 11% of maintenance and generalization sessions.

Interobserver agreement. IOA was calculated using the point-by-point agreement formula in which the number of agreements was divided by the number of agreements plus disagreements and multiplied by 100 (Ledford, Lane, & Gast, 2018). IOA was 100% for all probe, intervention, maintenance, and generalization sessions.

Procedural fidelity. Procedural fidelity during probe sessions was assessed by scoring the occurrence of the following investigator behaviors: securing student attention, introducing the context of the task, providing materials necessary for completing the task, delivering the task direction, stopping the session following incorrect student responses (single opportunity sessions), correcting student errors out of student’s sight (multiple opportunity sessions), and providing verbal praise at the conclusion of the session. Procedural fidelity during intervention sessions was assessed by scoring the observance of the following investigator behaviors: securing student attention, introducing the context of the task, providing materials necessary for completing task, giving the task direction, correctly providing prompts following incorrect student responses, providing reinforcement following correct responses. Procedural fidelity data were figured as a percentage by calculating the number of investigator behaviors observed divided by the number of planned behaviors and multiplying by 100 (Barton, Meadan-Kaplansky, & Ledford, 2018). During observed probe sessions, procedural fidelity data ranged from 92% to 100% with a mean of 97.6%. For observed intervention sessions, procedural fidelity data ranged from 92% to 100% with a mean of 97.3%. Procedural fidelity data were 100% during generalization sessions and a mean of 96% for maintenance sessions.

Results

Figure 1 shows the participant responding data in, probe, intervention, maintenance, and generalization conditions. The results indicated that the treatment package was effective in increasing the level and trend of correct independent completion of a task analysis for solving linear equations in high school students with MID. Responding during initial probe sessions for all three students was at zero levels of independent completion of the task analysis. During the intervention condition, levels of independent completion of the task analysis showed increasing trends with each student reaching criterion levels of responding. Dylan performed all steps of the task analysis independently after 12 intervention sessions. He reached the terminal criterion within 18 sessions. Isaac performed all steps of the task analysis independently after 7 intervention sessions and reached the terminal criterion in 10 sessions. Gabe performed
all steps of the task analysis independently after 14 intervention sessions and reached the terminal criterion in 17 sessions.

In maintenance sessions, Dylan maintained the skill 1, 2, and 3 weeks after reaching criterion. Isaac demonstrated a decrease in steps of the task analysis completed independently during his 1 week maintenance session but was able to complete all steps independently during subsequent 2 and 3 week maintenance
sessions. Gabe only performed five steps of the task analysis independently during the 1 week maintenance session but performed eight steps independently during the 2 week maintenance sessions and all steps correctly during the final 3 week maintenance session.

Generalization pre-test data were collected for three sessions prior to the initial probe condition for all participants and in the three sessions immediately following each participant meeting criterion. In pre-test sessions, no participants were able to complete any of the steps of the task analysis independently. In post-test sessions, all participants were successful in generalizing the skill to job tasks with untrained materials and settings in the school. Each participant completed all steps of the task analysis independently when they were asked to solve an equation as a part of a job task.

**Social Validity**

The classroom teacher completed a survey using a 5-point Likert scale on the intervention and behaviors targeted by the study. The classroom teacher strongly agreed that the skills taught in this study were valuable for her students to learn. She agreed that the skills the students learned as a result of the study would help them with future job tasks, were a part of the academic curriculum they are required to learn, and that the intervention used to teach the skills was effective. She was undecided on whether she would use this intervention in the future to teach similar skills.

The participants also completed a survey using a 5-point Likert scale on the intervention and behaviors targeted in the study. Dylan and Gabe strongly agreed that the skill they learned from the study was important. Isaac agreed that the skill he learned was important. All three students agreed that the skill they learned will help them in the future with job tasks. Dylan and Isaac agreed that the way the instructor taught the skill was easy to learn, while Gabe was undecided. Gabe and Isaac agreed that they would use this method in the future to solve problems and Dylan was undecided.

**Discussion**

The purpose of this study was to replicate the effectiveness of a treatment package used by Jimenez et al. (2008) to teach high school students with MID to solve simple linear equations, to extend the literature by using real-life scenarios and materials, and to assess the generalization of the strategy to actual job tasks in the school. Results from the study indicated that a functional relation was established between the treatment package and criterion responding on the number of steps of a task analysis that participants could independently complete to solve linear equations. The results also provided an additional demonstration to the literature that adding a functional component (i.e., inclusion of a real-life scenario and actual materials) to an academic task may have aided the participants in generalizing the skill to job tasks although the pre/post design did not allow for a functional relation (Collins et al, 2010; Karl et al., 2013). This study provides additional evidence that individuals with MID can learn grade-appropriate math content and generalize it to a functional task.

The multi-component intervention used in this study incorporated best practices for teaching math content to individuals with MID. For example, the intervention included the use of systematic prompting and feedback, both identified as evidence-based practices when teaching math to individuals with intellectual disability (Browder et al., 2008). The procedures also incorporated the use of a meaningful context of the problem, through the use of the real-life scenarios, and instructional supports through the use of concrete manipulatives as recommended by Saunders et al. (2013). It may be that inclusion of a functional real-life scenario presented prior to a math problem may lead to better generalization and maintenance of the targeted math content, although this study did not experimentally analyze this (Collins et al., 2011).

Because we used multiple components in the intervention, we were unable to identify which component may or may not have attributed to the effectiveness of the intervention and future research should complete component analyses to determine which components are needed for students to be successful.
Practical Implications

When working to teach math standards to individuals with MID, several implications arise from this study. First, teachers should use systematic instruction with fidelity and have this teaching behavior in their repertoire. They also should teach math problems by providing meaningful contexts for students and measure generalization of the math content to functional contexts. This could be done by embedding math problem solving when students are involved in functional or vocational tasks in their daily schedule, or teachers could incorporate stories or present videos showing individuals involved in motivating, meaningful problems that need to be solved as described in the enhanced anchored instruction literature (Bottge, Heinrichs, Chan, & Serlin, 2001).

Teachers should be aware that although students were able to learn the skill, instruction was delivered within a self-contained setting and the dosage of instruction needed for students to learn to solve the linear equation was at a higher level than they would receive within a general education classroom. Therefore, as teachers work within general classroom settings, consideration will need to be given as to how this additional dosage will be delivered to students with MID.

Limitations and Future Research

One limitation to this study was the limited diversity of the participants. All of the participants in the study were male and were in the same grade. The participants were also similar in their strengths, weaknesses, and cultural backgrounds, which limits external validity. Future research including a more diverse pool of participants is needed to determine if the intervention is effective when used with students of varying academic strengths, ages, grades, and cultural backgrounds.

A second limitation was that the skill was taught by an investigator in a special education setting and generalized to a job task within the school. Although the classroom teacher confirmed the value of the skills being taught, she was unsure of using this effective intervention in the future. It would be beneficial if, in future replications of this study, the classroom teacher was trained to deliver instruction rather than an outside investigator, thereby enhancing social validity by demonstrating that typical intervention agents could successfully deliver the intervention. Having the teacher deliver the intervention would be especially important given the teacher from the current study valued the skills that were taught but was unsure if she would use a similar intervention in the future.

Third, generalization to other settings, such as actual vocational settings in the community, was not examined. Examination of academic skill instruction with functional applications that would generalize to community settings would be important areas of future research. The generalization of the skill to other settings, such as the general education setting, should also be considered in future research in order to determine if students can learn to do linear equations found in a textbook format typical of general education when given task analytic instruction with systematic prompting. Future research is needed not only to determine if the skills taught in this study could be generalized to more settings, but also to determine if utilizing the method in this study could be effective in teaching other advanced level mathematics skills. For example, although this study demonstrated that individuals with MID could be taught how to solve an algebraic equation using the treatment package, it did not teach the participants when to select this strategy for solving a math problem or why a particular method would be used to solve a particular problem. Future research should teach individuals with MID decision-making rules for determining how to identify particular methods for solving particular problems in order to be a truer demonstration of problem solving. Recently Root and Browder (2017) taught three middle school students with intellectual disability and autism spectrum disorder to solve problems using modified schema-based instruction and a visual aid. They presented students with word problems and taught them to identify the type of problem that needed to be solved and to select the appropriate method to solve it using visual aids. This area of research will lead to more authentic math problem solving skills.

A fourth limitation involved the use of de-
scriptive praise for correct responding in the intervention condition and not in probe sessions. Although no participants responded correctly in probe sessions, this is still an additional change in implementation from the probe to the intervention conditions. Future replications should plan to provide praise contingent on correct responding in all conditions so as to ensure the independent variable was the causal agent responsible for therapeutic behavior change.

A fifth limitation was the use of three data points in the initial probe conditions. Although, What Works Clearinghouse (WWC) single-case guidelines call for at least five data points per phase in time-lagged designs (Kratochwill et al., 2013), we used only three data points. Three data points was used because all participants were responding at zero levels of responding, we wanted to minimize testing effects, and the likelihood of increased responding during probe sessions was low. In addition, three data points in the initial probe condition still results in a study that Meets Standards with Reservations based on the WWC guidelines (Kratochwill et al., 2013).

A final limitation was the percentage of sessions in which reliability data were collected. Although the recommended 20% of sessions for reliability data collection (Kratochwill et al., 2013) was met for probe and intervention sessions, it was only collected during 11% of the maintenance and generalization sessions.

**Conclusion**

In summary, this study is one of few that has taught algebra skills to students with MID and provided an additional demonstration that students with MID can learn to solve algebraic equations. The students who participated in this study were successful in learning to solve an algebraic equation through the use of systematic instruction with a concrete representation of the problems being solved. The students all showed mastery, with generalization across materials and settings. This study contributes to the literature in that it addressed access to grade-level standards in mathematics for high school students with MID. It extends the literature through the use of a functional application and the use of contextual stories prior to delivering instruction, a method that is recommended when teaching grade-aligned content to individuals with MID (Saunders et al., 2013). However, continued research is still necessary to help students gain access to grade-level standards while completing daily living and vocational activities and moving toward higher level problem solving.

**References**


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Teachers’ Perception of Use and Actual Use of a Data-Based Decision-Making Process

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Abstract: This study evaluated whether or not teachers of students with severe disabilities reported implementing specific data-based decision guidelines to make instructional decisions (Browder, Liberty, Heller, & D’Huyvetters, 1986; Browder, Demchak, Heller, & King, 1989) following completion of their teacher preparation program. A cross-sectional survey regarding reported accuracy was followed by examination of teacher-submitted student performance data sheets to determine actual accuracy. A majority of respondents reported currently using the decision guidelines or using the guidelines in the past. Survey results indicated teacher perception of accurate use was high, while data sheet evaluation indicated actual accuracy was questionable and generally low. Teachers reported having lower confidence and accuracy in their actions related to data analysis than data collection. The actual data sheets supported their reports; steps and actions of the decision guidelines with the lowest accuracy of use were related to data analysis and instructional decisions. We discuss implications and suggestions for increasing accurate use of the data-based decision-making guidelines.

Collection of student performance data and evaluation of that data to improve instruction and favorably impact student outcomes are important elements of classroom teaching. During this time of school accountability, it is important that teachers of students with severe disabilities know not only how to collect meaningful student data, but how to use that data to make instructional decisions. In the 1980s and 1990s various researchers studied data-based decision guidelines for use by teachers of students with severe disabilities (Browder, Demchak, Heller, & King, 1989; Farlow & Snell; 1989; Grigg, Snell, & Lloyd, 1989). Although this research is from a number of years ago, texts in the area of severe disabilities continue to recommend data collection and evaluation of that data for improvement of instruction and enhanced student outcomes (e.g., Snell & Brown, 2011; Westling, Fox, & Carter, 2015). Not only are textbook recommendations evident, but recent recommendations regarding quality indicators for programs for students with significant disabilities also support the need for collecting, reviewing, and evaluating student performance data (e.g., Pennington, Courtade, Ault, & Delano, 2016).

The purpose of using data-based decisions is to shape teacher response to student performance data in a way that increases student learning. Early research on instructional decision-making focused on teacher analysis of students’ data trends (Utley, Zigmond, & Strain, 1987), use of specific decision rules (e.g., Browder, Liberty, Heller, & D’Huyvetters, 1986; Browder et al., 1989), frequency of data collection (Munger, Snell, & Loyd, 1989), and accuracy of data analysis (Munger et al., 1989). Following guidelines improved teachers’ ability to use student performance data appropriately and effectively; teachers who followed guidelines to use data saw greater student success (Stecker & Fuchs, 2000). Browder et al. (1986) found that when teachers made decisions based on decision guidelines, they were more likely to improve student performance. Fuchs and Fuchs (1986) similarly found that the effect sizes on student achievement were higher when decision guidelines were used. Empirical evidence supports the use of guidelines to improve decisions (Holvoet, O’Neil, Chazdon, Carr, & Warner, 1983; Utley et al., 1987).
The data-based decision-making process developed by Browder et al. (1986, 1989) includes a system for data collection, graphical display, data review and analysis, and application of instructional decision rules (see Table 1). The data sheet allows for collection of response-by-response data and equal interval graphing on the same form. Each instructional session should include between eight and 20 discrete trials, or steps in a chained skill, and data should be collected at least six times in a 2-week period to ensure there are sufficient responses in each session, and sufficient data points in a review period. Performance data are reviewed every 2–3 weeks through calculation of the mean level and drawing trend lines. Specific rules related to instructional decision-making based on mastery, no progress, adequate progress, inadequate progress, and motivational patterns are prescribed.

More recently, Jimenez, Mims, and Browder (2012), focusing specifically on the data-based decision-making process developed by Browder et al. (1986; 1989), conducted a study to evaluate mastery of data-based decision guidelines through online professional development. Jimenez et al. (2012) effectively delivered professional development through a 90-minute online model. After the training, the teachers could correctly identify more data patterns and make more appropriate decisions based on the data than before they knew the guidelines. The positive results of the online professional development are promising and could make professional development accessible to many more teachers that did not previously have access, a major challenge to the implementation of data-based decision-making (Buzhardt et al., 2010).

However, Jimenez et al. (2012) commented on the need for further research pertaining to evidence of implementation of these guidelines in various settings. The present study addresses this gap and provides evidence pertaining to the effectiveness of a teacher preparation program in aiding teachers to acquire, maintain, and generalize use of these data-based decisions guidelines.

The current study evaluated whether or not teachers of students with severe disabilities who were taught the Browder et al. (1986; 1989) data-based decision-making process and guidelines during their graduate teacher preparation program implemented the process upon completion of the program. Specific research questions were:

1. Do teachers report implementing data-based decision guidelines following com-

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**TABLE 1**

<table>
<thead>
<tr>
<th>Criteria Met</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Yes</td>
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<td>Yes</td>
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<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
pletion of their teacher preparation program? If no, why not? What are teacher perceptions about accuracy of their use of the guidelines?

2. What is the actual use of data-based decision guidelines by teachers? Do teachers accurately implement the process and guidelines after completion of their teacher preparation program?

Method

Participants

Completers of a graduate teacher education program in severe intellectual disability (ID) over a 20-year period from the early 1990s to 2015 were recruited by email. All graduates from this program of a western United States university during this time period, for whom current email addresses could be found, were sent a link to an anonymous online survey about their use of data-based decision guidelines. The survey was sent to 79 potential respondents with a return rate of 71%. At the time of survey completion, graduates had an age range of 25–70 years and were predominately female (87%). Of the 56 respondents, 37 reported that they were currently teaching, 14 were not currently teaching (five of these respondents were working in education in another role, such as administrator or mentor), and five did not specify current employment at the time of the survey. Respondents worked in a variety of settings and programs, including self-contained special education classrooms, general education classrooms, and “inclusion classrooms.” They served students in preschool through transition programs who qualified for special education services under a range of disability categories, including intellectual disability, multiple impairment, autism, vision impairment, specific learning disability, and emotional and behavioral disturbance.

Research Design and Analysis

The research design was a cross-sectional survey followed by an examination of teacher-submitted data sheets showing how teachers collected student performance data and made instructional decisions. Descriptive statistics were used to analyze responses to close-ended questions, while narrative responses to open-ended questions were analyzed for themes and used to corroborate teacher self-report regarding the use of the decision-making system. On completion of the survey, respondents were asked if they would be willing to submit actual data sheets showing how they documented student performance data, their review of that data, and what instructional decisions were made. A total of 48 unique data sheets from six participants were reviewed. A checklist reflecting the criteria of the Browder et al. (1986; 1989) data system was created and used to evaluate the submitted data sheets (see Table 1). Occurrence or non-occurrence of each criterion was recorded for individual data sheets.

Survey Design

A study-specific survey was developed asking a series of questions in a branched format: (1) not currently collecting data, but formerly used the system taught in the teacher preparation program (i.e., Browder et al., 1986; 1989); (2) formerly collected data, never used the Browder et al. system, and not currently collecting data; (3) currently collecting data, but not using the Browder et al. system; and (4) currently collecting data and using the Browder et al. system (see Figure 1). Each branch was comprised of both close-ended and open-ended questions. Closed-ended questions focused on whether respondents were using, or had ever used, a data-based decision-making process for making instructional decisions and on participant use of the specific elements of the decision-making system developed by Browder et al. (1986; 1989). Respondents were asked to respond “yes” or “no” to questions about their use of the system and its required actions and criteria. Respondents were also asked to rate their confidence in their correct performance of steps in the data-based decision-making process on a 5 point Likert-type scale, ranging from strongly agree to strongly disagree with an additional option to respond “unsure.” Other questions asked respondents if they would like further training in data-based decisions and if they would like technology or software to assist in the process of data collection and decision-making. Open-ended ques-
tions focused on different areas depending upon the branch of the survey. For example, those who reported using a decision-making system other than the Browder et al. (1986; 1989) system were asked about their methods for data collection and the decision-making process they used. Those who reported using the Browder et al. (1986; 1989) system were asked about how they performed the steps in the process, particularly if their close-ended responses indicated that they did not follow the specific actions and criteria of the system. Open-ended questions also allowed for clarification and more description of a respondent’s use of instructional decision-making.

**Inter-rater Reliability**

The researchers independently coded submitted data sheets for accurate implementation according to the specific criteria for the system developed by Browder et al. (1986; 1989). The second author analyzed and coded all data sheets and the first author independently analyzed a minimum of 25% of data sheets submitted by each respondent. A point-by-point analysis was conducted and yielded an inter-scorer mean agreement of 91% (range 82–100%). Percent agreement was calculated by dividing the number of total agreements by total agreements plus total disagreements and multiplying by 100. Any discrepancies between raters were reviewed and resolved to achieve 100% agreement.

**Results**

Survey results are grouped by respondents’ self-reported use of the Browder et al. (1986; 1989) data collection system (formerly or currently) in accordance with the branching described above and reflected in Figure 1. Following those re-
sults, the analysis of the submitted data sheets is presented.

Analysis of Survey Responses

Not currently collecting data but formerly used the system taught in the teacher preparation program. Twenty-five percent of the respondents reportedly used the data-collection system previously and provided the following reasons for no longer using the system (number of respondents for each reason in parentheses): (a) retired (7); (b) stay-at-home mother (1); (c) no longer in the field of education (1); (d) currently a district mentor for teachers and not directly with students (1); (e) teaching in an online high school (1); (f) teaching but with a different population of students (1); (g) formerly used the system when teaching at middle school, but never started when moved to teaching at high school (1); and (h) “the student I was using it with moved on” (1).

Responses. Comments from these respondents indicated that at least some teachers found the Browder et al. (1986; 1989) system to be beneficial. One retired teacher stated, “When I was teaching I was happy to have some way to analyze the data and make changes when necessary.” While another retired teacher specified, “Although collecting data can be time consuming and difficult at times, it was worth it for making appropriate decisions.” Another respondent commented, “I am no longer in the field of special education. If I were to return to teaching, I would likely use this method for decision making, as I found it effective and easy to use.”

Unfortunately, other responses indicated that those who reportedly used the system may not have been doing so accurately. For example, one respondent indicated, “I used the data driven method to do evaluations every time a progress report was to be completed. That was the only way I could tell if a student was making progress.” However, progress reports are typically completed quarterly and so this comment indicates data were not reviewed as often as they should have been (i.e., every 2–3 weeks). If this guideline was not followed, it is possible that other aspects of the system were also not implemented correctly.

Not currently collecting data but previously used a different system not taught in the teacher preparation program. Two respondents, both teaching students with ID (transition age and high school age), reported they were not currently using a data-based decision-making process, but they had used one previously, although not the one taught in the program.

Responses. One teacher stated “I admittedly have a challenge in the area of collecting data. Being in a community based program and not have (sic) an actual classroom it has proven very challenging to develop a system to collect data other than observations and collections sheets. I am constantly reminded of the necessity of doing so and desperately want to find a solution.” This teacher reported wanting additional training in data-based decisions and thought that technology or computer software would be helpful in supporting use of data-based decision-making guidelines. The second respondent said, “I use a P+, P−, +, − process for helping me use data to mark progress.” Another comment from this teacher about the decision-making system was, “I use it, but not in the way it was intended to be used.” This teacher reported not wanting additional training, but thought software would be helpful.

Currently using a data-driven decision-making process, but not the one taught. Twelve respondents (21%) reported that they are currently using a data-driven decision-making process, but not the one taught in the program. Two of these respondents were working in roles outside the classroom, one as a dean and one as an administrator. The other 10 were current teachers in special education programs.

Responses. Some responses provided very little information – a current dean of students said that grades are used while another current administrator indicated that a process is followed, but provided no details. A current teacher stated that data are collected with instructional decisions made every 2–3 weeks, but did not provide any details. Another current teacher indicated that “a yes/no format plotted by an ABA specialist” is used and that “we do a trial run for 2 weeks and if it doesn’t work, we reevaluate and amend lesson.” However, no specifics were provided regarding how data are evaluated to make those modifications. Two teachers indicated that they use the STAR program with one specifying that it
was a district mandate with which she did not agree: “unfortunately it is my district’s expectation that I use the STAR Program. I’d prefer to use what I was taught as I believe it provides me more in-depth information.” The other teacher who used the STAR program indicated that she used STAR plus the data sheet taught, but had “no time with seven active students and other demands to figure the means and percentages” and that instructional decisions were made “once a quarter, except for STAR or academic work; then movement when work is mastered.” Two other teachers used Excel to aid their decision-making with one teacher stating “Every month the data from the sheets are inputted into an excel spreadsheet and for some, graphs are made and others (because the data is easily read) are not. From this changes to programs for students are made.” Two other teachers used software programs provided by their districts: EasyIEPTM and Goal Tracker; however, it was not clear how EasyIEPTM was used given that individual student performance tracking does not appear to be part of that program. The teacher using Goal Tracker reported generating reports only once a grading period for progress monitoring. Another teacher also reported using a software program, but did not provide any details only stating that she used an “Internet based data collection system that focuses on a growth model.” The final teacher who reported currently using a data-driven method of instructional decision-making, but not that taught in the teacher preparation program, reported using “DRA, teacher-made pre/post assessments for math units, IEP goal pages by a binder with monthly assessment of specific skills from objectives” without specific details on how decisions were actually made.

Currently using the data-driven decision-making process that was taught. Twenty-four of the respondents (three males, 20 females, one not reported; age range 29–64 years) reported using the Browder et al. (1986; 1989) data-based decision-making process taught in the program. The vast majority of the respondents indicated using the system in their positions as teachers in a variety of types of classrooms (e.g., classes for those identified with intellectual disability or autism, resource room settings) while one respondent used the system in her capacity as a guardian of an individual with severe disabilities.

Responses. Of teachers reportedly using the Browder et al. (1986; 1989) system at the time of the survey, 88% indicated that they ensure they have sufficient data points prior to making an instructional decision, 8% do not ensure sufficient data points, and 4% were unsure (see Table 2). Although the large majority of respondents indicated they ensured having sufficient data points for an instructional decision, subsequent comments actually reflect some inaccuracy in adhering to this criterion. Examples of comments indicating correctly adhering to gathering a sufficient number of data points included “10 data points,” “2 weeks’ worth or an equivalent number of days in a row,” “6–10,” “at least 6 data points (preferably consecutive),” and “in most cases at least 8.” One teacher said, “6 if the data/trend is consistent, but prefer 8 to show solid trend. Sometimes timelines and opportunities limit to 6.” Another comment in accordance with this criterion of the system was,
“... I calculate trends and means after 6–8 teaching days.” Other teachers incorrectly identified the amount of data that is sufficient as 1–2 weeks of data, 15 data points, 3, 7 minimum, 5–8, 4–6 or stable data, at least 10 or a 2-week period, and about 4 or 5. One teacher said, “We usually do about 2–3 data points.” Another teacher incorrectly said, “Depending upon the task the student is working on, three consecutive +’s demonstrating independence, would automatically move the student on; otherwise, if the data reflects growth over time, I would decide to increase the expectation...” Some of these same teachers made comments that reflected how often they reviewed the data was acceptable, including 10 days or 2 weeks, bimonthly, every 2–3 weeks, and bi-weekly. One teacher said, “I try to review about every 2 weeks, unless I notice that the criteria has been met during my instructional/data collection (then I may review at that time).” Another said, “After at least 6 days of instruction over 2 weeks I calculate trend and mean to see how the student is progressing and what I need to change next or continue with instruction.” One stated, “Every 2 weeks if data is taken on a daily basis. Sometimes the time period varies depending on the generalization/maintenance of the skill being learned.” Many teachers' comments suggested they did not know how often they should review data, as evidenced by answers describing data review as occurring more or less frequently than necessary, such as every 1–2 weeks, daily, every week, and quarterly. One teacher said, “We review monthly or more depending on what the data is showing.” Another commented, “Data is taken often during the week by aides, and once weekly by myself. If I’m noticing fluctuations in the data, I make my determinations while I’m working with the student on ‘their day’ of the week.” A further comment was, “I evaluate data daily as I take it then review for weekly planning each Friday as to plan for the following week.”

Table 2 presents reported implementation and confidence in implementation of key actions of the Browder et al. (1986, 1989) data-based decisions process. The first key component, after collecting sufficient data, is to calculate mean performance for review period; 83% of respondents using this system reported calculating means for student performance for each review period, 13% reported not calculating means, and one participant (4%) said she was unsure what means are. However, these respondents were not necessarily highly confident in their calculations with only 37% strongly agreed that they were confident in correct calculation of means, 42% agreed that they were confident in correct calculations, one participant (4%) disagreed that she was confident, and 17% did not respond. After calculating the mean, the second key action is to draw a trend line for student performance for the same review period; 83% of respondents indicated drawing trend lines and 17% stated that they did not. As with calculating means, even though the respondents indicated drawing trend lines they were not necessarily all highly confident in how they drew them. Fifty-four percent indicated strong agreement and 29% indicated only that they agreed being confident in drawing trend lines correctly. The remaining 17% did not indicate their level of confidence in drawing trend lines.

All respondents in this group reported that they followed, or attempted to follow, the decision rules that they were taught. As with the earlier responses, the respondents were not all equally confident in their accuracy in following the rules with 42% strongly agreeing and 58% only agreeing that they were confident that they correctly followed the decision rules. However, perhaps most importantly, these results (strongly agree and agree) indicate that all respondents perceived that they were accurately following the decision rules.

Finally, participants were asked about potential supports for their use of the data-based decision-making process. Forty-two percent of respondents who reported using the system indicated they wanted additional training in the process. A large majority of respondents (92%) believed it would be helpful to have software or technology to support their use of a data-based decision-making process with only 8% disagreeing.

Analysis of Sample Data Sheets

A total of 48 data sheets from six respondents were included in the analysis. Data sheets submitted in culminating portfolios, with personally identifiable information redacted, by
four graduates of the teacher preparation program were included, along with data sheets submitted by two additional respondents (and similarly redacted). The percentages of data sheets meeting each action and criterion for the data-based decision-making system are listed in Table 3. Analysis of actual data sheets indicates overall low accuracy and fidelity of implementation. The most common errors were columns not labeled with a date for each school day, incorrectly calculated means, trend lines not drawn or drawn incorrectly, direction of trends not identified, and instructional decisions not based on guidelines. With the exception of the absence of dates and notations in columns without data, all of the other criteria were related to data analysis and use of data to inform instructional changes. These actions, arguably the most important components of the data-based decisions system, met criteria least often (range 6–33%). No submitted data sheet met all criteria.

Discussion

It is evident from these data that, although teachers reported finding data-based decision-making systems valuable and reported using them in the instruction of individuals with disabilities, their perceptions of their accuracy and fidelity of implementation varied considerably from their actual practice. A possible explanation is that teachers trained in the use of decision-making guidelines believed they were following the guidelines accurately, but had forgotten how to apply some elements of the system over time. Another possible explanation is that the self-reported teacher use of the guidelines was not reliable, or were not accurately reported by the teachers. That is, the respondents may have been responding in a way that they thought the researchers wanted. It might also be that the training in the teacher preparation program may have been insufficient to bring about change in teachers’ classroom behaviors. As Belfiore and Browder (1982) note, teachers trained in the use of data-based decision-making are still inconsistent in their review of data. More recently, Jimenez, Mims, and Baker (2016) similarly found that teachers did not generalize skills in data-based decisions to their own students’ data. Teachers may need additional or ongoing training and support to increase accurate use of decision-making guidelines. Changes to teacher preparation programs may be required to increase the fluency with which teachers systematically collect, analyze, and use data to ensure fidelity of use of the deci-

<table>
<thead>
<tr>
<th>Actions and Criteria</th>
<th>Met</th>
<th>Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are at least 8 and no more than 20 behaviors listed in first column (either for a chained skill or stacked for a discrete skill)?</td>
<td>90%</td>
<td>10%</td>
</tr>
<tr>
<td>Was a column labeled with each date during the school week?</td>
<td>27%</td>
<td>73%</td>
</tr>
<tr>
<td>If data are not collected on a school day (e.g., school assembly occurred), is that column blank with a notation?</td>
<td>27%</td>
<td>73%</td>
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<tr>
<td>Are there at least six data points during each 2–3-week review period?</td>
<td>46%</td>
<td>54%</td>
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<tr>
<td>Was an appropriate response prompting method and prompting hierarchy specified on the data sheet for teaching the skill?</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Were data reviewed every 2–3 weeks?</td>
<td>48%</td>
<td>52%</td>
</tr>
<tr>
<td>Were percentages correctly calculated for each instructional session?</td>
<td>54%</td>
<td>46%</td>
</tr>
<tr>
<td>Were means correctly calculated for each review period?</td>
<td>33%</td>
<td>67%</td>
</tr>
<tr>
<td>Were trend lines correctly graphed for each review period?</td>
<td>17%</td>
<td>83%</td>
</tr>
<tr>
<td>Were trends in student performance correctly identified?</td>
<td>21%</td>
<td>79%</td>
</tr>
<tr>
<td>Was an appropriate instructional decision made based on the guidelines?</td>
<td>6%</td>
<td>94%</td>
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sion-making process. The key place for such changes to occur might be in supervised field experiences when teachers are expected to implement skills targeted in their preparation program in the classroom. It is most typically during a field experience when a teacher is expected to implement targeted practices for an entire caseload. Expecting teachers to demonstrate competence only for isolated course projects targeting a small number of students, or perhaps only one student, is likely insufficient for teachers to maintain and generalize behavior.

Another possibility for strengthening teacher skills is the use of behavioral skills training (BST; Parson, Rollyson, & Reid, 2012) while teachers are learning the data-based decision-making process. BST is a training sequence that includes describing a target skill, providing a succinct, written description of the behavior, demonstrating the behavior or skill, requiring practice, providing feedback to the learner during practice, and then repeating these steps until mastery of the skill or behavior is achieved (Parson et al., 2012). Maffei-Almodovar, Feliciano, Fienup, & Sturmey (2017) demonstrated that the use of BST can be beneficial in teaching graph analysis to teachers in a home-based, special education setting. However, their study is limited in that it did not occur in a school setting, targeted a small number of graphs, and did not evaluate whether changes in teacher behavior lead to changes in student performance. Even though further research is needed regarding the use of BST, there is preliminary evidence that it might be beneficial as a means of providing data-based decision-making training to teachers.

Finally, the use of self-monitoring strategies by teachers to increase implementation fidelity is a potentially cost-effective method that has shown some positive results (Belfiore & Browder, 1992; Browder et al., 1986). These methods include self-evaluation to decide if behavior (data analysis and decision-making) has met a predetermined criterion, and self-recording to document behavior as related to meeting criteria with the use of a tool, such as a checklist.

The system developed by Browder et al. (1986; 1989) is prescribed in setting up data sheets, number of data points needed to make a decision, drawing trend lines, calculating means, and using this information to make instructional decisions. Future research could focus on the necessity of such a prescribed method, or in the necessity of individual components of the decision-making process as developed by Browder et al. (1986; 1989) for equal interval graphs. For example, is it necessary for the data sheets to be set up with a column for each school day or can data columns be used with no blanks as long as there is a minimum of six days within a 2-week period? An evaluation of teacher skill in visual analysis of an easily identifiable trend in lieu of drawing a trend line might also be warranted. Would a mentoring program or ongoing support at the onset of teaching increase the likelihood that teachers will implement the decision-making process as well as increase their accuracy?

During their teacher preparation program, each of the respondents in this study demonstrated proficiency in this decision-making system, as required. The reduced accuracy of their implementation of the system after graduation indicates that the practice was not supported by the school environment. It is possible that correct use of the system was not reinforced, or that incorrect use of the system was inadvertently reinforced by school staff and administration. Anecdotally, teachers shared that they were being commended for their use of data, even when they also related that they recognized that their use of the data-based decision process was not accurate. Contingent reinforcement of accurate teacher use of the decision-making system by colleagues and administrators is key to high levels of accuracy and fidelity of implementation of educational practices. Further, the use of data-based decision-making processes are important because educational institutions value student learning. Redefining teacher performance expectations to reflect educational values in the form of specific criteria (Binder, 2016), such as making and documenting instructional decisions directly based on student performance data, might also decrease the gap between teacher knowledge and teacher performance.

Nearly one-half of the teacher respondents reported not currently using the data-based decision-making system taught in their teacher preparation program. Because they were not using the system, they likely did not
have access to student data sheets and therefore, could not submit data sheets for analysis. Open-ended responses to survey questions indicated two themes among these respondents. One theme was that teachers who changed positions, such as leaving the classroom, or teaching students without moderate to severe disabilities, quit using the system at the time of their changes in positions. The second theme was that teachers who reported using systems other than the one taught in their teacher preparation program described data collection and recording systems, but did not mention data analysis or how data were used to make instructional decisions in response to any survey question. This omission leads one to question how the data collected were used, and if data were used to make modifications to instructional plans.

It is noteworthy that data sheets from only six teachers were available for analysis, a small proportion of the original 56 participants; the discrepancy between reported use and actual use of the decision-making system evident in this study may not accurately reflect the use of the system by all teachers. As noted, many of the respondents were not using the Browder et al. (1986; 1989) system at the time of the study, so they did not have data sheets to submit. The remaining participants may have chosen not to submit data sheets for a number of reasons. Some participants indicated they would be willing to submit data sheets, but did not send them, suggesting a practical limitation, such as the additional time and effort related to copying, deidentifying, and mailing, prevented them from submitting. It is also possible that participants who did not submit data sheets were concerned about having their practice evaluated because they suspected they were not implementing the decision-making system with accuracy and fidelity, although instructions for anonymous submission were provided.

A number of respondents indicated that they would be more likely to use the data-based decision-making process if a software program was available. Future research could focus both on whether or not such a software program would enhance the likelihood that teachers would implement data-based decisions and whether or not they would do so accurately. A software program or technology has the potential to decrease teacher errors through programmed completion of calculations and graphing trend lines. It could increase timely review of student performance data and instructional modifications by prompting teachers to review data and make instructional decisions. Further, time required by teachers to use the system could be reduced with the assistance of technology.

Summary

Although many teachers reported using the data-based decision-making process taught in their graduate teacher preparation program in severe disabilities, other teachers did not use any particular method of collecting student performance data or evaluating that data. For those teachers who used the method emphasized in their program, their perception of correct use was high. Unfortunately, their actual accuracy was questionable. However, given the research base for use of data-based decisions, it is essential to find effective methods to enhance the likelihood that teachers of students with significant disabilities will generalize and maintain data-based decision-making behaviors with their own students in applied settings.

References


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Socio-sexuality instruction represents a widely acknowledged need for individuals with developmental disabilities (DD). However, with relatively few socio-sexuality education curricula developed for individuals with DD and few evaluations of these curricula, many professionals lack knowledge about how to present socio-sexuality content. Without knowledge of how to teach, individuals with DD may not learn socio-sexuality content effectively and efficiently. This review sought to identify the instructional strategies/methods used in commercially published socio-sexuality curricula for students with DD. Results indicated that very few instructional strategies were being used to teach socio-sexuality content to individuals with DD, with visual strategies and social problem solving being employed most frequently. The importance of using evidence-based instructional methods when teaching socio-sexuality content to individuals with DD and future directions are discussed.

Central to any curriculum are strategies for instruction. In order to improve student learning, attention should focus on instruction itself (Charalambous & Hill, 2012; Hiebert & Grouws, 2007; Raudenbush, 2008). Empirically based instructional strategies have been identified for teaching academic skills to individuals with autism spectrum disorders (ASD) and developmental disorders (DD); Spooner, Knight, Browder, & Smith, (2012). However, few studies exist that clearly identify strategies that are empirically based for teaching socio-sexuality information (Sullivan & Caterino, 2008; Travers, Tincini, Whitby, & Boutot, 2014).

The National Autism Center’s National Standards Project (NAC; 2015) and the National Professional Development Center (NPDC; 2014) provide extensive evidence related to instructional strategies/treatments for individuals having ASD. Other evidence-based instructional strategies for individuals with ASD/DD that have been identified in the literature include discrete trial training (Downs, Downs, Fossum, & Rau, 2008; Odom, Collet-Klingenber, Rogers, & Hatton, 2010; Wong et al., 2015); modeling (Odom et al., 2010; Wong et al., 2015); video modeling (Bellini & Akullian, 2007; Reichow & Volkmar, 2010); story-based intervention (Wong et al., 2015); scripting (Wong et al., 2015); direct/explicit instruction (Spooner et al., 2012); role-play (Muccigrosso, 1991; Rogers, 2000); systematic prompting and fading (Browder & Cooper-Duffy, 2003; Browder & Spooner, 2011); task analysis instruction (Brown & Snell, 2006); use of visual supports (Copeeland & Hughes, 2000; Odom et al., 2010; Wong et al., 2015); and strategies for promoting generalization such as training in natural settings, programming common stimuli, and use of multiple exemplars (Stokes & Baer, 1977). Although a variety of
evidence-based instructional strategies are recommended for use in academic subjects (Spooner et al., 2012), most socio-sexuality education curricula present few strategies to teach the content nor provide sufficient detail to determine what or how methods are used (Schaafsma et al., 2015; Travers et al., 2014).

In a review of 12 curricula for individuals with severe disabilities, Blanchett and Wolfe (2002) found that strategies used most predominately in socio-sexuality education included discussion, role-play, lectures, and questions and answers (Q & A). In their review of self-determination and socio-sexuality education, Travers, Tincani, Whitby and Boutot (2014) found that the socio-sexuality education programs primarily used strategies such as lecture, role-play, guided practice, and discussion but overall strategies were generally ill-defined. Schaafsma et al. (2015) conducted a systematic review of socio-sexuality education programs for individuals with DD (20 studies) and found the following instructional strategies were being used to teach socio-sexuality information: (corrective) feedback, role-play, practice skills or guided practice, modeling, rehearsal, reinforcement, imagery or images, and discussion. Like Travers and colleagues (2014), these authors also state that most articles lacked detail in describing instructional strategies or any parameters for their use.

Socio-sexuality curriculum content is important in conveying information to students. However, in order for optimal learning to occur, it is equally essential to identify the instructional strategies used to convey the curriculum content. Without knowledge of how to teach, individuals with DD may not learn socio-sexuality content effectively and efficiently. This study forms part of a larger project examining socio-sexuality education curriculum for individuals with DD including the content and curricular features used in published curricula (see Wolfe, Wertalik, Domire, & Gardner, 2017a; Wolfe, Wertalik, Domire, Gardner, & Ruiz, 2017b). The purpose of the current review was to identify what instructional strategies/methods were used in commercially published socio-sexuality curricula for students with DD.

Method

Materials

The Sexuality Information and Education Council of the United States (SIECUS, 2004) maintains an extensive socio-sexuality education library. One activity of the Council has been the development of standards for comprehensive sexuality education. Based on the listing in the SIECUS library, curricula included in the present review were identified by SIECUS staff/resources as the most frequently used materials to teach socio-sexuality information to individuals with DD and were available either commercially for purchase or in the public domain (on the internet without associated costs) (personal communication, nd). Individuals with DD included those identified as having cognitive disabilities, intellectual disabilities, multiple disabilities, and/or ASD. Eleven curricula were identified. Two of the curricula recommended by SIECUS were excluded as they centered on specialized content (e.g., Circles and Date Smart because they focused on relationships). See Wolfe et al. (2017b) for an overview of each curriculum.

Procedure and Coding

Materials were requested from publishers and/or located from the Internet. Materials included manuals, and if applicable, videos/CDs and training materials (all elements that would be included for purchase or were downloadable). Coding forms were used that first, defined each variable to be evaluated and second, detailed a scoring rubric. Twelve instructional strategies were used identified as best practice strategies based on review of the literature (e.g., Odom et al., 2010; NRC, 2001; NPDC, 2014; NAC, 2015; Spooner et al., 2012; Wong et al., 2015). Two individuals served as coders; one individual coded each curriculum, and one served as an inter-rater for reliability. Both coders (doctoral students) were trained on the use of the coding sheet and rubric on a socio-sexuality education curriculum not included in the review. Training consisted of review of instructional strategy definitions (Table 1) and the application of a predetermined rubric until consensus was reached as well as the criterion for rating.
Coders were instructed to rate each strategy as “present” or “absent.” A predetermined criterion of five instances was used to indicate the presence or absence of each instructional strategy. The authors selected this criterion because it was thought that not every instructional strategy would be used equally during instruction. Therefore, to represent presence or absence, five instances was thought to fairly demonstrate the usage of the strategy across the full curriculum. The use of presence or absence of instructional strategies was believed to provide evidence of the use but not the effectiveness of the strategy. The first coder reviewed each of the nine curricula by reading each chapter/section and reviewing accompanying materials (i.e., videos, handouts) in order to identify instances where each instructional strategy was utilized. Once five instances of an instructional strategy were identified, the strategy was deemed “present.” For instructional strategies rated as “absent,” the entire curriculum was reviewed to determine that less than five instances were used within the curriculum.

**Inter-rater Reliability**

To calculate inter-rater reliability of instructional strategies, a second rater was trained in use of the rubric described above. Following training, the second rater independently reviewed and rated 44% of the nine curricula (N = 4) using the above pre-determined criterion. The obtained inter-rater reliability was 90%. Given disagreements, the first and second rater discussed the discrepancies until they came to consensus and agreement on all

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**TABLE 1**

**Instructional Strategy Definitions**

<table>
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<tr>
<th>Instructional Strategy</th>
<th>Definition</th>
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<tr>
<td>Discrete Trial Training</td>
<td>A highly structured teaching technique in which skills are taught through discrete teaching trials that consist of the teacher’s instruction/presentation, the child’s response, and a consequence that rewards a correct response or marks an incorrect response</td>
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<td>Modeling</td>
<td>Demonstration of a desired target behavior that results in imitation of the behavior by the learner</td>
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<td>Video Modeling</td>
<td>A visual model of the targeted behavior or skill, provided via video recording and display equipment to assist learning a desired behavior or skill</td>
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<td>Story-Based Interventions</td>
<td>A written description of the situations under which specific behaviors are expected to occur</td>
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<td>Visual Strategies</td>
<td>Any visual display that supports the learner engaging in a desired behavior or skills independent of prompts</td>
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<td>Task Analysis</td>
<td>The process of breaking a complex skill or series of behaviors into smaller, manageable teachable steps in order to assess and teach the skill</td>
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<td>Systematic Prompting</td>
<td>A systematic method of using supplemental stimuli to increase the likelihood that a student will engage in the correct response</td>
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<tr>
<td>Social Problem Solving</td>
<td>Problem solving where individuals identify and generate potential solutions to the social dilemma</td>
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<tr>
<td>Direct/Explicit Instruction</td>
<td>A systematic method of teaching with an emphasis on progressing in small steps, checking for student understanding, and attaining active participation by all students</td>
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<td>Scripting</td>
<td>A verbal and/or written description about a specific skill or situation that serves as a model for the learner</td>
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<td>Role-play</td>
<td>A strategy used to work through a scenario or problem by taking on roles and practicing what to say and do</td>
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<tr>
<td>Generalization</td>
<td>Strategies that will increase the likelihood that a behavior will occur across time, across settings, across people and across stimuli</td>
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ratings (Hong et al., 2015; Ninci et al., 2015). If the raters were unable to come to a consensus, a third rater (first author) evaluated the disagreement. A final decision on the disagreement was then made by two of the three raters.

Results

Table 2 delineates the results for the instructional strategies found within each curriculum. The presence of the instructional strategy within the curricula (out of 9), ranked from the lowest rating to highest rating are as follows: discrete trial training (0/9); video modeling (0/9); task analysis (0/9); systematic prompting (0/9); scripting (0/9); direct/explicit instruction (0/9); strategies for generalization (0/9); modeling (1/9); story-based intervention (2/9); role-playing (7/9); visual strategies (9/9); social problem solving (9/9).

Discussion

Types of instructional strategies. The current research revealed that very few instructional strategies were being used to teach socio-sexuality content to individuals with DD. Instructional techniques employed most frequently were visual strategies and social problem solving (9/9); next in usage was role play (7/9). The only other techniques included in the curricula were story-based interventions (2/9) and modeling (1/9). Just as in other content areas, a variety of techniques are needed to teach socio-sexuality information. Some authors (e.g., Sullivan & Caterino, 2008; Spooner et al., 2011) suggest that approaches/strategies found to have empirical bases in other subject areas be used to teach social skills and socio-sexuality skills. The current research indicates that curriculum developers (and perhaps teachers) are not employing the full breath of instructional strategies that have an empirical basis. As identified by NAC (2015) and NPCD (2014), many of the instructional strategies identified as effective for individuals with ASD are founded in applied behavior analysis (ABA; Matson et al., 2012) and are equally applicable to instruction of individuals with DD (Neidert, Dozier, Iwata, & Hafen, 2010; Spooner et al., 2012). ABA based strategies can be applied to socio-sexuality content (Wolfe, Condo, & Hardaway, 2009). By not using a variety of methods to convey content, educators may not be effectively matching the objectives or the nature of the content with the most appropriate strategy. Just as in other subject matter, instruction should be tailored to the learner’s needs and what information is conveyed (e.g., Stover, Sparrow, & Sievert, 2017). Some individuals may benefit from learning factual content using discrete trial training (e.g., private body parts) and others learning chained events via a task analysis (e.g., how to use proper hygiene during a menstrual cycle).

Instructional strategies involving perspective-taking. It is interesting that the two-of-the-three most frequently used instructional strategies (social problem solving and role-playing) were strategies that center on the ability of individuals to take the perspective of another. Perspective taking is a skill widely acknowledged to be an area of difficulty for individuals with DD, particularly those with ASD (Gould, Tarbox, O’Hara, Noone, & Bergstrom, 2010; Pearson, Roper, & Hamilton, 2013; Southall & Campbell, 2015; Williams, 2010). In fact, deficits in the ability to take the perspective of another is a diagnostic criterion cited in the DSM-V for individuals with ASD (e.g., reduced sharing of interests, emotions, or affect; American Psychiatric Association, 2013). Activities that display perspective taking include deception, empathy, self-consciousness, self-reflection, persuasion, and pretense (Howlin, Baron-Cohen, & Hadwin, 1999). Typically developing children show signs of perspective taking in early infancy, and by approximately 5 years old can understand how others feel (Howlin et al., 1999). However, throughout life, individuals with ASD and DD show severe deficits in perspective taking (Baron-Cohen, 2000).

There are a number of cognitive theories related to deficits in perspective-taking including Theory of Mind (Baron-Cohen, Leslie, & Frith, 1985), Executive Functioning (Ozonoff, Pennington, & Rogers, 1991), and Weak Central Coherence (Frith & Happé, 1994). Behavioral theories such as Relational frame theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001) also are used to explain perspective taking. The RFT theory suggests that perspective taking skills are generalized operant behaviors, and perspective taking behaviors can be
### TABLE 2
Instructional Strategies Found within Socio-Sexuality Education Curricula

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taught through multiple-exemplar training (DeBernardis, Hayes, & Fryling, 2014). A central criticism related to perspective taking interventions regardless of the theoretical basis are that they are overly simplistic (e.g., say “hello” to a peer) and do not adequately prepare individuals for complex interactions that they will likely face (e.g., how to break up with someone in a romantic relationship; Reed, Hyman, & Hirst, 2011). Given that socio-sexuality curricula often contains objectives related to emotions, communication, feelings, and awareness of others, individuals with DD will likely need to learn content via instructional techniques that do not rely solely on perspective taking.

Meaningful assessment of perspective taking used in social problem solving and/or role-playing also is an issue as there are few assessment strategies to evaluate students’ progress in these activities. In a review of twelve studies related to social perspective taking interventions for students with “high functioning ASD,” Southall and Campbell (2015) found that perspective taking could be taught using systematic instruction, group interventions, and technology. The authors also found, however, that generalization into natural environments was inconsistent and some outcomes were not deemed socially valid (Southall & Campbell, 2015). In several studies related to assertiveness in requesting a partner put on a condom (Mercer Koller et al., 2016; Somlia, 1998), role-play with confederates was used. Scenarios were created to elicit specific skills that had been taught in training sessions. The skills of interest were either grouped as content type (confidence, eye contact, validation of partners’ perspective, among others) or categories rated on a 4-point scale (acknowledging the position of the partner, explicit refusal, provision of health benefits, overall appropriate level of assertiveness). The sessions were either video or audio taped to see if the skills were used.

Jensen and Steiner (2017) assessed parenting skills using role-play with neuro typical mothers. The authors used a curriculum to select skills to target for instruction. A specific script was used that allowed the skills to be demonstrated. These authors created a “task analysis”, similar to a checklist, that was used to assess the role-play. The role-plays were video recorded and coded at a later time to determine student progress. Although the intervention was deemed successful (reliability of 80%), the authors found that the strategies did not generalize to natural settings (mothers playing with their own child; 59%). These studies suggest that role-play can be effective but that specific methods are needed to better assure success and accurate measurement. For example, specific scripts that illustrate the concept or skill would be useful as well as careful identification of skills that correspond with the scripts. Moreover, audio or video taping role-play sessions may assist in more reliable assessment. In addition to well-structured role-play scenarios, instructors should build generalization strategies into the lessons (multiple people, settings, materials).

Instructional strategies for concepts and facts/skills. Curriculum content in socio-sexuality programs is varied and often contains content that may be difficult to teach. Over time, comprehensive curricula have begun to focus on important but challenging topics related to values, relationships, and culture. Some topics may be taught effectively as “facts” or “skills” that easily lend themselves to a variety of instructional strategies (e.g., kinds of contraceptives, how to put on a condom, types of abuse, or routines for proper hygiene). However, some of the topics may represent concepts that are not easily taught. Like factual information, educators should consider an array of instructional techniques to teach concepts. Concepts are abstract ideas representing the fundamental characteristics of what it represents (Prater, 1993; Tiemann & Markle, 1990). Related to socio-sexuality education, concepts might include safe sex, abuse, dating, or romance. Researchers have suggested that when teaching concepts, instructors should define the instructional objective; analyze the task used to demonstrate knowledge, provide a definition and label; select examples and non-examples; outline the defining attributes; and provide feedback (Birkin, 2012; Jonassen, 2006; Prater, 1993). Critical when teaching concepts, are sufficient examples and non-examples followed by practice in classifying new instances (Tullis & Zangrillo, 2013). The majority of the strategies included in the review should be considered for either concept
or factual instruction, and used to provide varied and effective instruction.

Strategies for promoting generalization. Another interesting finding of the current review was the lack of strategies geared toward promoting generalization of skills. The inability to generalize skills is a widely acknowledged area of concern for individuals with DD and ASD (Neidert et al., 2010; Wong, Kasari, Freeman, & Paparella, 2007). Generalization often is thought of as the most important phase of learning as the ability to generalize skills across settings, people, materials, and time reflects one’s ability to use the skills in everyday life. (Haring, 1988). Traditionally, a “train and hope” approach (i.e., train the child and hope that the new behavior generalizes to other environments) has been used (Schutte, 2010; Stokes & Baer, 1977). However, for individuals with DD and ASD, generalization does not always occur without specific planning and careful selection of instructional procedures and materials (Mechling, Ayres, Foster, & Bryant, 2015). For instance, an individual with ASD may learn how to ask someone on a date within the classroom environment but may not generalize these skills when presented with a natural opportunity. Researchers have suggested that intervention programs for individuals with ASD and DD should include strategies geared toward promoting skill generalization (Neely et al., 2015; NRC, 2001). As posited by Stokes and Baer (1977), instructional methods have included training in natural settings, programming common stimuli, use of multiple exemplars, and use of a rigorous performance criterion. Just as with other academic subject matter, socio-sexuality curricula should have clear strategies for generalization throughout lessons to better assure that generalization will occur.

Limitations

As noted in Wolfe et al. (2017b), there are a number of limitations of the review. First, only curricula nominated by SIECUS and available online or for preview were included in the review. Second, because there were only nine curricula they might not adequately represent all curricula that are published. Also, although the instructional techniques selected were guided by reviews of the literature, not all strategies may have been identified. Finally, the pre-set criteria of five instances of each instructional strategy may not adequately reflect the presence or absence of each technique. The use of the criteria of five instances was a decision by the researchers to demonstrate that the instructional strategy was being used more than one time within the curriculum, and to provide a means of representation that would fairly demonstrate a range of instructional strategies that may be applied to socio-sexuality curricula.

Implications and Future Research

The current study reveals that there is work to be done related to instructional strategies used to teach socio-sexuality content. Although future research may be seen to apply only to curricular developers, the review can serve to enhance the instruction of teachers who present socio-sexuality curriculum through examination of how to present material. The review clearly noted that curricula did not suggest the breadth of evidence-based instructional strategies available to them to individualize instruction and match the content with the type of instruction. Future research should focus on the effectiveness of specific instructional strategies with both concepts and facts that are frequently included in socio-sexuality curriculum. Although concepts may be deemed more difficult to teach, a variety of strategies can be used. Those teaching concepts should use the guidelines related to defining the instructional universe, and developing sufficient exemplars and non-exemplars. Research related to the parameters of concepts and exemplars/non-exemplars could begin to help educators teach challenging concepts often included in socio-sexuality curriculum.

Developers and educators should also avoid reliance on instructional strategies that rely heavily on perspective taking skills, a known area of difficulty for many individuals with DD. Further, future research should address how to accurately assess role play and social problem solving if these strategies are implemented. It is critical that assessment data be collected when using any instructional strategy; data collection should be taken and accu-
rately denote progress for perspective taking strategies as well. Furthermore, generalization should be considered when developing or implementing socio-sexuality curriculum. Considering individuals with DD and ASD often have difficulty incidentally generalizing skills, developers and educators should strive to incorporate strategies that promote generalization within socio-sexuality curriculum and instructional practices. Future research should also seek to investigate the use of different methods to promote generalization when teaching socio-sexuality education.

Conclusion

The present review indicated that very few instructional strategies were used in socio-sexuality curriculum for individuals with DD. It is important that educators consider the use of evidence-based instructional methods when adopting socio-sexuality curricula. Without use of evidence-based instructional methods, individuals with DD may not learn socio-sexuality content effectively and efficiently. Socio-sexuality education for individuals with DD is of utmost importance; curriculum developers as well as educators need to employ the full breath of instructional strategies that have an empirical basis.

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Implementing a Peer-Mediated Intervention in a Work-Based Learning Setting for Students with Autism Spectrum Disorders

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Abstract: Many youths with autism spectrum disorders (ASD) lack the skills necessary to secure and maintain post-high school employment. One intervention that may improve vocational skills and social interactions for individuals with ASD in the workplace is peer-mediated interventions. Peer-mediated interventions (PMI) have consistently documented improvements in academic and social skills for students with ASD in both school-based and community settings. However, PMI have not been implemented in work-based learning (WBL) settings for transition-aged students with ASD and their general education peers. A multiple baseline across participants’ design evaluated the impact of a PMI on three transition-age youth with ASD in a WBL setting in high school. Results demonstrated an increase in independent engagement in vocational skills and social interactions for all three students with ASD. Furthermore, improvements were observed in the quality of social interactions between the students with ASD and their general education peers across all dyads. Implications for practice, future research, and limitations are discussed.

Youth with autism spectrum disorder (ASD) who secure meaningful employment are more likely to have a high quality of life with increased personal autonomy (Levinson & Palmer, 2005; Schalock, 2000). Thus, post-secondary integrated employment should be an attainable goal for youth with ASD. According to Shattuck et al. (2012) within the first two years of graduating from high school, over 50% of young adults with ASD fail to participate in post-school employment and experience the lowest rate of employment compared to other disabilities. In addition, only 58% of young adults with ASD work outside of the home sometime between high school and their early 20s, and these jobs are primarily part-time, low-wage positions (Roux, Shattuck, Rast, Rava, & Anderson, 2015). Since 1990, the Individuals with Disabilities Education Act (IDEA) has mandated transition planning and preparation for students with disabilities to begin in high school. Yet, only 58% of youth with ASD have begun transition planning in school by the age of 14 (Roux et al., 2015) and just over 40% of students with disabilities have measurable post-secondary goals in their individual education plan (Landmark & Zhang, 2013). Nevertheless, national policies such as the Workforce Innovation and Opportunity Act (2014) are only now beginning to focus on bridging the school-to-work gap for youth with disabilities to improve post-school employment outcomes. Guy, Sitlington, Larsen, and Frank (2009) have surmised that one reason for the dismal post-school employment outcomes of youth with disabilities is the lack of access to transition services including vocational education and training in high school. Without access to transition services, including career and technical education programs, youth with ASD may experience lower wages or be precluded from competitive employment (Benz, Yovanoff, & Doren, 1997; Newman, Wagner, Cameto, & Knokey, 2009). Yet, research continues to support that developing vocational skills during high school results in positive transition outcomes for students with ASD (Guy et al., 2009; Test et al., 2009). A few
critical vocational skills that are required in most employment settings include using a computer, being able to alphabetize, answering telephone calls, using a copy machine, or following multi-step directions. Students with ASD may encounter difficulty acquiring these vocational skills in high school due to the lack of vocational education or career and technical education classes, transition focused services, and staff that could teach and practice these hard skills (Benz, Lindstrom, & Yovanoff, 2000; Guy et al., 2009). By not targeting vocational skills in school, youth with ASD may be directly impacted because employers are reticent to hire people who do not possess the proper vocational and social skills for employment (Suarez-Balcazar et al., 2013).

In addition to vocational skills, the knowledge and appropriate use of social skills in the workplace is critical for people with ASD to be successful in post-school employment (Agran, Hughes, Thoma, & Scott, 2016). Social skills are described as the ability to communicate verbally and non-verbally with others, to understand environmental information, to build and maintain social connections, to interpret body language, and to respond appropriately (Bellini, Peters, Benner, & Hopf, 2007). In the workplace, employers note that social skills such as seeking clarification, interacting well with colleagues or customers, following through with tasks immediately, and notifying the supervisor for assistance are essential for maintaining employment (Carter & Hughes, 2005). Therefore, to thrive in an employment setting, youth with ASD must learn to discern and apply numerous social skills when engaging with customers, colleagues, and supervisors at work.

Students with ASD can learn vocational and social skills and how to apply these skills in integrated environments with explicit training (Carter & Hughes, 2005; Hughes et al., 2012). High school programs that provide students with ASD the authentic vocational and social skills training as well as afford them opportunities to practice these skills with their peers without disabilities may help the youth with ASD develop a foundational base of employment-ready vocational skills (Agran et al., 2016; Rowe et al., 2015). Research has also shown that when youth with ASD have the chance to apply and practice vocational and social skills in integrated work-based learning (WBL) settings (i.e., job shadowing, paid and unpaid work experiences, internships, school-based work activities situated either in the school or in a community work place), post-secondary employment outcomes improve (Kittelman, Bromley, & Mazzotti, 2016; Test et al., 2009; Versnel, Hutchinson, Munby, & Chin, 2008). Consequently, it is imperative that students with ASD are granted opportunities to learn and practice vocational and social skills in integrated WBL settings during high school (Bobroff & Sax, 2010; Carter, Sisco, Melekoglu, & Kurkowski, 2007).

A promising strategy to teach vocational and social skills to students with ASD in integrated WBL or employment settings involve peer-mediated interventions (PMI). For students with ASD, PMI may provide a chance to learn and interact in a more natural manner with their same-age peers instead of relying on an adult to teach and assist in the interaction (Gianguero, Halvorsen, Doyle, & Broer, 2004). In peer-mediated interventions, peers without disabilities are provided training to deliver individually tailored academic and social support to students with ASD under the guidance of an adult (Carter, Cushing, & Kennedy, 2008). The majority of PMI research has been conducted in school learning environments (e.g., academic and non-academic classrooms) and has demonstrated positive social and academic outcomes for students with ASD and their peers without disabilities in general education classrooms such as English, biology, ceramics, and health (Carter et al., 2007; Cushing & Kennedy, 1997).

Moreover, several studies have shown how PMI can support learning vocational skills in school settings (Agran, Fodor-Davis, Moore, & Martella, 1992), community-based environments (White & Weiner, 2004), and social skills in employment settings outside of school (Storey & Garff, 1999). Agran et al. (1992) examined the impact of PMI on the work performance of students with moderate to severe disabilities in a food preparation activity in the school cafeteria when partnered with peers with mild intellectual disabilities. Findings demonstrated that the PMI was effective in teaching a complicated work task (i.e., making lunches) for two of the three participants.
In 2004, White and Weiner conducted a correlational study identifying high school variables (i.e., integrated classrooms, community-based training) that were associated with successful integrated post-school employment outcomes. They found that the greatest predictors for post-school employment success encompassed working in integrated environments with peers without disabilities and more time spent in community-based training activities. Finally, a study by Storey and Garff (1999) evaluated the effects of a PMI on the vocational social skills of young adults with disabilities in an integrated employment setting in the community. Coworkers learned instructional strategies to utilize when teaching the young adults with disabilities a new job task. Findings showed an increase in social interactions between the youths with disabilities and the coworkers when engaged in learning new job tasks. While these studies demonstrate that implementing PMI can improve vocational and social skills in the context of work, to date, no studies have directly examined the effectiveness of a PMI on vocational and social skills for students with ASD in an integrated WBL setting in high school. While PMI has been shown to be effective in academic and nonacademic school settings, the effects of PMI have yet to be demonstrated in integrated WBL settings. As Guy et al. (2009) concluded, vocational education and training options in high school are decreasing; therefore, students with ASD are less likely to be provided with the opportunities to learn vital vocational and social skills required for post-school employment. Implementing PMI in WBL settings can offer integrated opportunities to build these skills alongside same age peers in a setting that mimics real-life post-school employment. Additionally, creating integrated WBL settings in high school provides opportunities for students to build vocational and social skills who may not have access to an extensive vocational training program.

The purpose of this study was to assess the impact of a PMI on the vocational skills and social interactions between students with ASD and their peers in an integrated WBL setting in high school. This study extends the current research base in the following two ways: (a) the intervention is implemented in an innovative setting (i.e., integrated high school WBL setting), and (b) the impact of PMI on both social interactions and vocational skills for students with ASD is evaluated. Specifically, the following research questions were addressed:

1. To what extent does a peer-mediated intervention affect the percentage of independent vocational skills for students with ASD in an integrated work-based learning activity?
2. To what extent does a peer-mediated intervention affect the percentage and quality of social interactions between students ASD and their peers in an integrated work-based learning activity?

Method

Setting and Participants

This study took place at two suburban high schools in a midwestern metropolitan school district. A total of 4800 students attended both schools and student ethnicity was primarily Caucasian students (70%). The percentage of students identified eligible for reduced/free lunch averaged 16% (range 8.1% to 21.6%). The district supported the integration of students with and without ASD through the use of a peer-mentoring program. The program was designed by the district special education teachers at the beginning of the school year to provide students without disabilities the experience to work with students with ASD in academic and WBL settings.

Participants were comprised of three students with ASD and three peers without disabilities. Selection of students with ASD were based on the following criteria: (a) educational diagnosis of autism (b) participation in state alternative assessments, and (c) between the ages of 14 – 18 years. Included participants with ASD received their education in self-contained, low-incidence classrooms located in the high school. Criteria used to select peers without disabilities included: (a) not having an IEP, (b) registered for the peer-mentoring program, and (c) between the ages of 14–18 years. All peers were female and 15–17 years old, and they all volunteered to be part of this study. Peers were matched with students with ASD based on interests, age, personality characteristics, and class schedule. The three peers
had not previously interacted with any of the participants with ASD.

John & Kenna. John was a 14-year-old freshman with a diagnosis of ASD. His most recent evaluation demonstrated a standard score of 72 on the Receptive One-Word Picture Vocabulary Test (ROWPVT; Brownell, 2001), a standard score of 86 on the Expressive One-Word Picture Vocabulary Test-Revised (EOWPVT-R; Gardner, 1990), and a standard score of 59 in Broad Independence on the Scales of Independent Behavior – Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996). He communicated in full sentences, followed one- and two-step verbal directions, and answered basic “wh” questions during conversations. He preferred to socialize with school staff and rarely socialized with peers. When socializing with peers, John often resorted to echolalia, used brief responses with a neutral affect, or remained unresponsive to peer interactions. John read at a third-grade level, enjoyed alphabetizing, and was a strong speller. His special education teacher, Ms. Arnold, placed him in a school mail delivery job. John had been working in the mail delivery job for approximately four months but remained prompt dependent on the paraprofessional when initiating and following through with vocational tasks and socializing with his peers. John was paired with Kenna, a 15-year-old female who had no experience working or socializing with students with ASD.

Jerry & Aubryn. Jerry was a 17-year-old senior with a diagnosis of ASD. His most recent evaluation indicated a full-scale IQ score of 33 on the Leiter International Performance Scale-Revised (Leiter-R; Roid & Miller, 1997) and a standard score of <1 in Broad Independence (SIB-R). He used an iPad to communicate and could use one to three-word verbal utterances if needed. Although Jerry enjoyed working with adults and peers, he struggled to socially interact with his peers. He would regularly not respond to his peers’ verbal directions or direct questions when working or socializing together. He read at a kindergarten level and followed one- to two-step verbal directions. His special education teacher, Ms. Lebak, reported that Jerry experienced difficulty staying on task during academic and vocational activities and was prompt dependent. Jerry was also working several times a week at a local pharmacy stocking shelves. Ms. Lebak reported that Jerry had worked at the coffee cart job for the past four months but continued to struggle with initiating work tasks and socializing with his peers without adult prompting. Jerry’s peer was Aubryn, a 14-year-old female. This was Aubryn’s second semester as a peer mentor and she had previous experience as a peer mentor in middle school.

Alex & Briana. Alex was an 18-year-old senior with a diagnosis of ASD. His most recent evaluation demonstrated a full-scale IQ score of 73 (Leiter-R) and a standard score of 55 on the Vineland Adaptive Behavior Scales, 2nd Edition (Vineland-II; Sparrow, Cicchetti, & Balla 2005). Alex verbally communicated using phrases and sentences but would resort to echolalia when confused or frustrated. Alex rarely initiated social interactions which may have been due, in part to the fact that he had difficulty producing an appropriate volume or affect when responding to his peers. He read at a fifth-grade level and could compute math problems at the junior high level. According to his special education teacher, Ms. Kersh, Alex enjoyed socializing with peers, demonstrated annual improvements in academics, actively participated in classroom activities, and navigated the school without assistance. However, during the current school year, Ms. Kersh had observed decreases in his academic skills and social interactions with peers and school staff. Additionally, he required one or two paraprofessionals to keep him on task and address aggressive behaviors. Alex’s school job for the past four months was working at the coffee cart and he continued to require ongoing prompts to engage in work tasks and socialize with peers. Alex was paired with Briana, a 16-year-old female who had no prior experience with working with students with ASD.

Measurement

Dependent variables. Three dependent variables were identified to assess the overall impact of the PMI on the vocational skills and social interactions of the student dyads. The first dependent variable was independent engagement in a vocational task and was defined as the lack of assistance during the vocational task from the peer to the student with ASD. For example, the student with ASD might be
sorting the mail into different folders while the peer was organizing completed folders and talking about her day. If the student with ASD was engaged in the vocational task without help from the peer during the recording interval, it was recorded as a “+.”

Next, social interactions were defined as verbal (e.g., verbal communication, the use of a low or high-tech communication device to speak) and nonverbal (e.g., gestures with hands, eye contact, smiling, facial expressions) exchanges between the student with ASD and the peer. While the student with ASD and/or peer may have interacted with other adults and peers in the environment, data were not collected on those interactions. Examples of social interactions might include asking questions about hobbies at home, restating or clarifying directions about the work activity, smiling at each other while making eye contact, and giving high fives in response to completing a vocational task. If a social interaction occurred between the youth with ASD and the peer during the recording interval, it was recorded as a “+.”

Finally, the quality of the social interactions between the student with ASD and the peer was coded. This variable was assessed using a 5-point Likert-type scale developed by Carter, Cushing, Clark, & Kennedy (2005). According to this scale, the quality of the social interactions could range from a “1”, which was defined as a negative or poor quality social interaction, up to a “5”, which was defined as at least two reciprocal social interactions between dyad members with a positive effect. Table 1 provides examples for each of the five mutually exclusive points identified in the rating scale.

Data collection. Observations of dependent variables were conducted using a 1-minute momentary time sampling procedure (Cushing & Kennedy, 1997), whereby, at the end of each 1-minute interval, data collectors (i.e., the first author, two doctoral students) recorded all dependent variables that were observed during a 5-second data collection period for the entire work session. Baseline work time averaged 49 minutes (range, 31–60 minutes) and intervention work time averaged 45 minutes (range, 22–60 minutes) across participants. Positive responses were divided by the total number of minutes in the work session and multiplied by 100 to report a percentage of engagement in vocational skills or social interactions.

Experimental Design

A multiple-baseline across participants’ design (Gast & Ledford, 2014) was used to evaluate the impact of a PMI on vocational skills and social interactions for students with and without ASD in an integrated WBL setting. This study included a baseline phase and an intervention phase across three participants.

Procedure

Work-based learning settings. Student dyads (i.e., one student with ASD and his peer) were assigned activities in WBL settings within the high school. John and Kenna worked on delivering mail in the school building. They collected and sorted staff mail from a central mail office and organized the mail into folders on a pushcart. Once the mail was sorted, the dyad traveled to five academic offices located around the school. At each office, the dyad greeted staff and delivered the mail into the appropriate teachers’ mailboxes. As soon as the mail was distributed, the dyad returned to the special education classroom to drop off the pushcart.

Jerry and Aubryn and Alex and Briana were assigned to work the coffee cart on different days of the week. Each dyad was expected to travel from the special education classroom to different academic offices located throughout the high school building to solicit orders from teachers and staff. Once the orders were collected, the dyads returned to the special education classroom to prepare the drinks. Afterwards, the dyads delivered the beverages to the teachers and staff and collected payment. Finally, the dyad returned to the special education classroom to clean the coffee machine, count money, and inventory supplies.

Baseline phase. During the baseline phase, dyads were observed working together in their assigned WBL settings without explicit instruction on how to encourage independence or socializations. The peers were trained by the special educator to complete the work activity using a task analysis. The peers had not participated in the work activities prior to the
study. However, the students with ASD had been assigned to their specific WBL setting for at least four months. No peer support strategies were shared with the peers during baseline.

**Peer-mediated intervention.** When the first dyad demonstrated a stable or decelerating independent work baseline, the PMI was implemented. Peers were taught several intervention strategies to use when working with their partner with ASD. First, peers were taught the research-based strategies of modeling (i.e., demonstrating how to do the task, ask questions, and make comments), prompting (i.e., giving a verbal, gestural, or hand guidance to finish the task or engage in social interactions), and scaffolding (i.e., giving temporary support to reach independence) to use while implementing peer support (Carter, Cushing, & Kennedy, 2009) as well as the individualized strategies that the special education teacher used to support the student with ASD (see Figure 1). Once the first session was completed, the researcher (i.e., first author) spent the next two sessions modeling the strategies while working alongside the student with ASD and his peer in the WBL setting. During the modeling sessions, the peer would observe the researcher, ask questions, and practice implementing the different strategies with researcher feedback. Procedural fidelity was collected on the following items to ensure the peers’ accurate implementation of PMI: (a) supported part-

<table>
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<tr>
<th>Rating</th>
<th>Definition</th>
<th>Examples</th>
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<tbody>
<tr>
<td>1</td>
<td>Interaction is of poor quality (negative or unreciprocated).</td>
<td>Reprimands, teasing, bullying, providing behavioral consequences to another student, telling another student “no” or to “stop” inappropriately.</td>
</tr>
<tr>
<td>2</td>
<td>Interactions are infrequent, brief and are neutral in affect.</td>
<td>Short brief greetings, “Hi”, asking for help, or brief support (physical, verbal, or gestural). The tone or affect remains neutral.</td>
</tr>
<tr>
<td>3</td>
<td>Interactions are fair in quality.</td>
<td>A peer is providing support by pointing to what the student is supposed to be doing. After pointing out what the student needs to do, the peer goes back to his/her task or stands back to watch the student. The student responds to the direction by following through with the task but does not respond with any social interaction. Both partners affect remains neutral.</td>
</tr>
<tr>
<td>4</td>
<td>Interactions have a positive affect and are sustained.</td>
<td>Consistent or sustained positive involvement between partners (smiling and giggling). Peer may be guiding the student with the task but the student responds socially (makes a comment, joke, asks a question). Partners are working together and in a sustained manner and seem to enjoy each other’s company (smiling, giggling). Partners may be involved in a conversation unrelated to the work with a positive affect.</td>
</tr>
<tr>
<td>5</td>
<td>Interactions are of high quality. There is a sustained interaction or exchange that maintains a positive effect. More intense than “4”.</td>
<td>Partners are clearly expressing positive emotions in a sustained exchange. (Laughing). Partners are getting silly and laughing. Partners may be involved in an activity that is highly motivating and exciting for each other. They show this by their intense involvement and smiling or laughing. Partners are engaging in a reciprocal communication exchange.</td>
</tr>
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</table>
ner on work tasks, (b) provided partner with correct materials, (c) restated directions verbally or with a gesture if needed, (d) asked questions/made comments about work tasks, (e) asked questions/made comments about social interests, (f) made sure the work was done in a timely manner, and (g) provided partner with verbal and nonverbal praise. Each of these items could be addressed using any of the strategies discussed in the training (i.e., modeling, prompting, scaffolding). Once the peer attained 100% procedural fidelity over two consecutive training sessions on the items, the dyad proceeded to the intervention phase.

**Intervention phase.** During the intervention phase, the peers applied the peer support strategies while working with their partner in the WBL setting. No prompts, support, or feedback was provided to the peer or student with ASD during the intervention phase sessions. Data were collected for each dyad one to two times per week over 16 weeks.

**Interobserver agreement.** Two doctoral students in special education were trained by the researcher on data collection procedures and served as coders. Coders were each trained over three in-situ sessions and an average of 91.1% accuracy (range, 84.4–95.1%) across coders was obtained. Interobserver agreement (IOA) was collected for each baseline and intervention phase across participants and was obtained by dividing the number of agreements between the primary data collector and the secondary data collector by the total number of agreements plus disagreements, and then multiplied by 100. For John, IOA was 98.8% for 17% of baseline sessions ($n = 1$) and 99% reliability (range, 98.9–99.6%) was obtained across 25% of intervention sessions ($n = 3$). Baseline IOA for Jerry averaged 97.6% (range, 96.7–98.9%) over 50% of sessions ($n = 4$) and IOA during the intervention phase averaged 98.4% (range, 97.7–99.1%) across 40% of sessions ($n = 2$). For Alex, IOA averaged 98% (range, 97.2–98.6%) for 38% of baseline sessions ($n = 3$) and 97.5% over 25% of his intervention sessions ($n = 1$).

**Treatment fidelity.** Treatment fidelity data were collected to monitor the peers’ ability to correctly implement the strategies during the intervention phase on the same items as procedural fidelity. Treatment fidelity was calculated by dividing the number of items correctly implemented by the peer as observed by the researcher and self-reported by the peer by the total number of items and multiplied by 100. For all peers, treatment fidelity was collected across all sessions averaging 95.2% (range, 85.7–100%) for Kenna, 100% for Aubryn, and 92.9% (range, 71.4–100%) for Briana.

**Results**

The percentage of independent vocational tasks per work session and the percentage of
social interactions per work session are displayed in Figures 2 and Figure 3, respectively. The baseline trends for vocational tasks and social interactions remained relatively stable for all students and the immediacy of effect was observed within the first three intervention sessions for both independent vocational tasks and social interactions across all three students with ASD.

**John and Kenna**

John’s baseline data for independent vocational skills remained stable with minimal ac-
Acceleration in the last three data points across the phase. Moreover, data during this phase were slightly variable, ranging between 0 to 15.8% (mean = 7.5%). Upon implementation of the PMI, the data demonstrated an increase in level change between the baseline and intervention phase. The mean percentage of independent vocational tasks during the intervention phase was 56.8%, (range, 37.1–66.7%). Although the data during the intervention phase were variable, the trend line steadily increased.

The social interaction data during baseline remained stable with minimal variability and acceleration. Baseline data for engagement in social interactions averaged 20.4% (range,
14.6–32.4%) of the time. During intervention, the mean percentage of social interactions increased to 36.8% (range, 17.5–46.9%). The percentage of non-overlapping data (PND) for engagement in independent vocational skills and social interactions were 100% and 83.3% respectively, indicating that PMI was a moderately to highly effective intervention for John and Kenna.

Jerry and Aubryn

Data during baseline were stable with no variability or acceleration. The mean percentage of vocational tasks completed independently by Jerry was 3.5%, ranging from 0–8%. A level change increase was established between baseline and intervention conditions. The mean percentage of vocational tasks completed independently during the intervention phase increased to 29.3% (range 20–40%). Additionally, the data were minimally variable during the intervention phase and the trend line remained stable.

Baseline data for social interaction data were stable with minimal variability. The average percentage of social interactions during baseline was at 25.6% of the time and ranged from 15 to 33.3%. A discernable change in level was observed when intervention began with the trend line accelerating. The average percentage of social interactions during the intervention phase was 43.4% (range, 38.1–51.8%). These data illustrate higher levels of independent vocational tasks and social interactions during intervention. Though the differences between conditions were slight, the PND for both vocational tasks and social interactions was at 100%. Peer-mediated interventions appeared to be a highly effective intervention for Jerry and Aubryn.

Alex and Briana

Independent vocational tasks remained low and stable with minimal variability during the baseline phase for Alex. Although an acceleration in the last three data points was observed, data during baseline remained relatively low averaging 4.4% engagement in independent vocational tasks (range, 0 to 9.8%). Data demonstrated a level increase between the baseline and intervention phases upon implementation of peer support strategies. The mean percentage of independent vocational tasks increased to 28.7%, with a range of 18.3–36.4%. Moreover, intervention data minimally varied and the trend line increased as the phase continued.

For social interactions, initial baseline data began high but decreased and remained low and stable with little variability. The average percentage of social interactions in baseline was 21.6% (range, 17–33%). Conversely, there was a level increase in social interactions after the introduction of the intervention. Data revealed an increased average percentage for social interactions during intervention to 54% with a range of 43.3–60%. As the intervention phase continued, the trend line steadily increased. These data demonstrated that the PMI positively impacted the independent vocational tasks and social interactions for Alex and Briana. The percentage of non-overlapping data was at 100% for both vocational skills and social interactions confirming that the PMI was a highly effective intervention for Alex and Briana.

When analyzing Jerry’s and Alex’s graphs, it appears the dyads made the move into the intervention phase at the same time which they did not. Jerry had entered into the intervention phase two weeks before Alex, yet, due to the limited amount of times a week data could be collected, it appeared they started the intervention phase simultaneously.

Quality of Social Interactions

The quality of social interactions between dyads is displayed in Figure 4. The mean baseline data between students averaged 2.77 on the 5-point Likert-type scale (range, 2.42 – 3.14). Once the intervention was implemented, an increase to 3.32 (range, 3–3.92) was observed in the average quality of social interactions across dyads. For John and Kenna, the quality of social interactions increased from a baseline average of 2.88 to 3.33 during intervention. Additionally, quality of interactions for Jerry and Aubryn increased from a 2.69 at baseline to 3.14 during intervention. However, the largest increase was observed with Alex and Briana. Their mean baseline score increased from 2.78 to 3.55 during intervention.
Discussion

The purpose of this study was to investigate the impact of a PMI on the engagement in independent vocational tasks and social interactions of transition-aged students with ASD and their peers in integrated WBL settings. The findings indicate that the implementation of the PMI increased independent vocational tasks, social interactions, and improved the quality of social interactions for all three dyads. However, it should be noted that only the targeted independent vocational tasks were evaluated. Independence in other vocational tasks were not assessed, therefore, the ability of the students with ASD to generalize independence to new tasks could not be determined. Due to the lack of a staggering baseline in the third dyad, a functional relation between the PMI and the outcome variables cannot be fully substantiated. However, given the improvements displayed by the dyads, PMI appear to be an effective intervention to improve independent vocational and social skills in a WBL setting for transition-aged youth with ASD.

There remains a paucity of research on the effectiveness of PMI in integrated WBL and employment settings for transition-aged students with ASD. Although Agran et al. (1992) conducted a similar study assessing PMI in a WBL setting for students with moderate to severe disabilities, the peers were diagnosed with mild intellectual disabilities. This study is the first to examine the impact of a PMI in a WBL setting for students with ASD and their peers without disabilities. Findings showed that teaching peers without disabilities how to use research-based strategies to support engagement in independent vocational skills and social interactions between students with and without ASD in an integrated WBL setting was effective. These results support the current literature of how PMI can impact academics (Carter et al., 2007), social interactions (Storey & Garff, 1999), and vocational skills (White & Weiner, 2004) in integrated school, employment, and community settings as well as demonstrating positive skill outcomes for both students with and without ASD. Using peers to support students with ASD in WBL settings at the high school level is an authentic strategy that enables school personnel to teach vocational training skills that could be applicable to the work place (e.g., working with coworkers without disabilities) and potentially allow youth with ASD to easily transfer skills to post-school employment settings. In addition, peers may gain valuable knowledge on strategies to utilize when working with youth with ASD in the future. Thus, additional research is warranted to explore how vocational programming can integrate opportunities into high school curriculum for both students with and without disabilities to address vocational and social skills.

Engagement in quality social interactions while at the job may increase the possibility of maintaining employment for youth with ASD (Agran et al., 2016). The current study demonstrates that students with ASD increased their percentage of social interactions during the work session after the PMI was imple-

Figure 4. Average quality of social interactions per phase for each participant with ASD based on 5-point Likert Scale developed by Carter et al. (2005).
mented. All three dyads engaged in more social interactions during the intervention phase than in baseline. These results are consistent with findings from Storey and Garff (1999) that exhibited increases in social interactions between young adults with disabilities and their coworkers in an integrated work setting. However, the quality of the social interactions between dyads improved only slightly in the current study. This minor improvement could be attributed to the fact that the dyads were primarily focused on the work tasks as opposed to social interactions. This suggests that future PMI may need to include training on improving the quality of social interactions when working with students with ASD.

During adolescence, peers remain a primary source of social interactions and emotional support (Carter et al., 2014). For students with ASD, opportunities to engage socially with peers without disabilities in school may be limited. Lack of access to peers without disabilities to create natural, long-lasting relationships may be attributed to the overuse of adult support such as paraprofessionals (Giangreco et al., 2004). Unfortunately, this over-reliance on paraprofessionals has evolved, in part, due to the increased opportunities for students with ASD to access general education classes (Giangreco et al., 2004). Students with ASD have reported that paraprofessionals hinder their ability to socially interact and develop less authentic relationships with their peers without disabilities when a paraprofessional is around (Rossetti, 2011; Tews & Lupart, 2008). Results from the current study are consistent with research findings that demonstrate improvements in the quality and frequency of social interactions between students with and without ASD.

In summary, results from this study support using a PMI in a WBL setting for students with ASD and their peers to learn valuable vocational and social skills. These skills and similar integrated experiences have been linked to improvements in post-school employment outcomes (Test et al., 2009; White & Weiner, 2004). Therefore, providing opportunities for students with ASD to practice vocational and social skills with their peers in a familiar environment may increase the likelihood for post-school employment success (Agran et al., 2016).

Limitations

Several limitations to this study were identified. First, the lack of a staggered baseline between Jerry and Alex inhibits any conclusions that a functional relation exists between PMI and the improvements in vocational and social skills. In future replications, adhering to the quality standards of multiple-baseline design, including implementing a staggering baseline, should be emphasized. Even though the design is flawed, each dyad witnessed an increase in independent vocational tasks, and the number and quality of social interactions. Second, while the WBL settings were part of the peer-mentoring program, the specific jobs (i.e., mail delivery, coffee cart) had been created for the students with ASD to work with peers without disabilities. Although the work activities were in an integrated environment, they were not accessible by all students without disabilities. To assess the effects of PMI in an inclusive setting, WBL settings should be available to any student in the building regardless of abilities. Third, paraprofessionals or special educators were only marginally involved in the intervention (i.e., pairing the students, assigning the WBL setting). With this limited involvement, it remains unclear whether the school staff sustained PMI once the study was complete. In order for PMI to be sustainable in educational settings, school personnel will need to be instructed on how to implement PMI as well as monitor and evaluate the intervention. As a matter of fact, the high treatment fidelity across peers in this study (averaged 96%) indicates that the presentation and modeling of research-based strategies taught in PMI were feasible and applied by the peers with ease. Therefore, school personnel can be confident when utilizing peers to work with students with ASD and that PMI will be implemented with fidelity. Lastly, the study lacked a maintenance phase. A maintenance phase had been planned but was not completed due to the end of the school
year. It is unknown if the effects of PMI were maintained in the same setting or generalized to a novel setting by the participants. Therefore, future replications of this study should include maintenance phases and generalization probes in order to demonstrate the potential continuation and application of the vocational and social skills learned.

**Implications for Practice and Future Research**

The effectiveness of PMI in WBL settings for students with ASD is in the early stages of research. The vocational skills addressed in this study were specific to the tasks required for each WBL setting. Future research is necessary to evaluate whether students with ASD can generalize the vocational skills they learn to novel employment settings both in school and the community (e.g., school or community coffee shops, mail delivery in an office building). Also, assessing the effectiveness of PMI for different vocational tasks in various WBL settings (e.g., organizing and filing in the library, cleaning in the cafeteria) would add to the limited extant literature on PMI in integrated WBL settings. The results from this research could assist school personnel in developing peer-mediated programs within integrated WBL settings into school environments for a more natural and authentic work experience.

Finally, the improvement on social interactions is consistent with findings from Storey and Garff (1999). The current study noted that PMI increased social interactions in integrated employment settings but only minimally improved the quality of the social interactions. Future research needs to examine what types of social interactions (i.e., work interactions or non-work interactions) are displayed by both students with and without ASD and how these types may affect the frequency and quality of social interactions while working in a WBL setting. This research could assist special educators foster employability skills for students with ASD that are required for successful employment as identified by employers (Agran et al., 2016).

**Conclusion**

Students with ASD continue to require authentic interventions to address vocational and social skills that can be easily applied in integrated school settings. These interventions are vital for students with ASD to secure and maintain post-school employment. While school personnel may be responsible for the progress and learning of vocational skills and providing opportunities to practice social interactions of students with ASD, peers are a natural part of the school setting and can assist with developing these skills. This study extends past the research on PMI by evaluating vocational skills and social interactions in high school WBL settings for transition-aged youth with ASD. In summary, utilizing a peer-mediated intervention may be an effective strategy for students with ASD to learn skills required for post-school employment success.

**References**


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