A SYSTEMATIC REPLICATION OF THE EFFECTIVENESS
OF GROUP DISCRETE TRIAL TEACHING FOR STUDENTS
WITH AUTISM

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by

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Students with autism have varied profiles with deficits across many domains such as communication and social interactions. Education for students with autism requires highly trained teachers in autism spectrum disorders and in evidence-based practices (EBP). Researchers are working to identify treatments that meet standards for EBP and have offered guidelines for assessing and developing current and future research. Replicating research is one important aspect in identifying EBP.

The purpose of this study was to contribute to the list of EBP for students with autism by replicating the findings of Taubman et al. (2001). Specifically, the researcher sought to determine the effectiveness of group discrete trial teaching when implemented with a group of five students with disabilities, including autism. The study also investigated the teacher’s ability to deliver instruction with integrity while collecting data. Additionally, the researcher sought to determine generalization effects of the instructional method. Group discrete trial teaching consists of a series of instructional trials delivered systematically to a small group of students. The procedure leads to an increase in the number of times each student responds during group instruction (Taubman et al., 2001). By offering multiple opportunities to respond during group instruction, the teacher gains information regarding each student’s level of performance. Group discrete
trial teaching offers a consistent format for students with autism to acquire skills in an inclusion setting.

The effects of group discrete trial teaching on skill acquisition were evaluated within a multiple baseline across skills design. The teacher delivered discrete trials sequentially and chorally to the group of students each day. Sequential trials consisted of paced trials delivered to each student one at a time and choral trials consisted of the teacher delivering an instruction to the group with the group responding in unison. Results indicated that group discrete trial teaching was effective in skill acquisition for all five students and that the teacher was able to deliver the instruction with integrity while collecting data. Additionally, the study demonstrated that observational learning was possible during instruction. The findings offer a promising strategy for teachers to instruct students with autism in a group instructional setting.
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CHAPTER I
INTRODUCTION AND REVIEW OF LITERATURE

School districts are mandated to provide all students with free and appropriate education in the least restrictive environment (Individuals with Disabilities Education Act [IDEA] of 2004, 2004). For individuals with autism the least restrictive environments can be difficult to define. Students with autism can make remarkable progress when taught using individualized instruction but have learning challenges associated with the disorder that make learning in group settings challenging (Loveland & Landry, 1986; Spence, Sharifi, & Wiznitzer, 2004). Though individualized instruction is beneficial, teaching all students with autism in one-to-one settings prevents them from being integrated with peers in group instructional settings. Furthermore, individualized instruction is not realistic for most school districts to maintain (e.g., not enough staff to provide each student with a private teacher; Reid & Favell, 1984). Therefore, it is necessary to determine effective instruction for students with autism in inclusion settings (e.g., instruction that occurs with other students).

The purpose of this paper was to explore the benefits of using a component of intensive behavioral intervention (i.e., a comprehensive evidence-based program for teaching students with autism), discrete trial teaching, with students with autism in a group instructional setting. Specifically, the researcher sought to demonstrate the effectiveness of group discrete trial teaching for students with autism and the feasibility of teachers using the procedure in a classroom setting. The first section of this paper
discusses the characteristics of autism, increases in prevalence, and associated learning challenges for learners with autism. The next section addresses applied behavior analysis and how the science has contributed to the identification of effective treatments for students with autism. The third section provides a description of intensive behavioral intervention, a well-researched comprehensive program for educating students with autism based on the principles of applied behavior analysis. Specific details related to the implementation of intensive behavioral intervention based on literature reviews is provided. The final section provides a description of how small group instruction may include the use of discrete trial teaching with students with autism so that learning can occur more readily in different education settings for these students.

**Autism**

Autistic disorder, referred to here as autism, is a complex developmental disorder that severely limits social and communicative skills (United States Department of Health and Human Services, 1999). Specifically, individuals with autism lack play skills, experience problems with verbal and nonverbal forms of communication, and have a restricted range of interests (Kanner, 1943; Spence et al., 2004). Deficits in these areas limit individuals’ ability to develop relationships, build skills, and communicate their wants and needs. Typically, children with autism display multiple symptoms associated with the disorder at an early age (e.g., lack of eye contact, repetitive movements such as hand flapping; National Institute of Neurological Disorders and Stroke, 2009). Usually present before age three, autism is a lifelong disability which affects boys approximately four times more often than girls (Autism and Developmental Disabilities Monitoring
Parents first suspect autism when toddlers fail to meet developmental milestones (e.g., not looking when called, failing to develop functional language, lacking appropriate play skills; National Institute of Neurological Disorder and Stroke, 2009; Shapiro, Menon, & Accardo, 2008). However, diagnosis can be difficult, as a number of the symptoms may be overlooked or attributed to the developmental age of the child. For example, delayed speech, problems playing with other children, and difficulty regulating emotions are common concerns in typically developing children (Attwood, 2008; Frith, 1989).

**Autism Spectrum Disorders**

Autistic disorder is a specific syndrome that falls along a continuum of disorders called Autism Spectrum Disorders or pervasive developmental disorders (American Psychiatric Association, 2000). All disorders that fall along the Autism Spectrum are developmental disabilities that affect infants and toddlers before the age of three. An individual with an Autism Spectrum Disorder could be diagnosed with: (a) autistic disorder (autism), (b) Asperger’s syndrome, (c) Rett syndrome, (d) childhood disintegrative disorder, or (e) pervasive developmental disorder not otherwise specified. Each diagnosis presents with a unique set of characteristics that are associated with learning challenges (see Table 1). Though each of the disorders have a set of defining characteristics, the characteristics overlap and each disorder is distinguished by the number of criteria it meets as defined in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 2000). For example, to receive a diagnosis of Asperger’s syndrome a child would not have a significant delay in
Table 1

*Autism Spectrum Disorders*

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Characteristics</th>
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</thead>
</table>
| Asperger’s Syndrome            | Language and cognition generally better than in autism  
Socially isolated and often viewed as odd or eccentric  
Clumsiness  
Repetitive patterns of behavior, interests, and activities  
Atypical sensory responses (e.g., sensitivity to noises, scents or tastes, or textures)  
Pragmatic deficits |
| Autistic Disorder              | Impaired social interaction and communication  
Repetitive stereotyped behavior  
Some degree of intellectual disability in many cases  
Severe regression of language and sociability occurring between 18 and 24 months in about 25% of cases |
| Childhood Disintegrative Disorder | After two years of normal growth, marked regression in at least two of the following:  
- Social skills  
- Language  
- Bladder and bowel control  
- Motor skills  
Eventually may become more severe than is typical in autism  
Other behaviors that may mimic autism or childhood schizophrenia |
| Pervasive Developmental Disorder—Not otherwise specified (PDD-NOS) | Does not meet criteria for any of other subtypes yet includes a wide range of cognitive and behavioral problems and impairment in social interactions  
Less severe than autism |
| Rett Syndrome                  | Affects development after initial six-month period of normal development  
Deceleration of head growth  
Severe intellectual disability  
Impaired social interaction  
Loss of speech and purposeful use of hands (results in hand-wringing stereotypy)  
Seizures  
Autistic features  
Ataxia  
Affects almost exclusively girls (caused by mutation in MECP2 gene on Xq28) |

communication and therefore, should be able to converse by age three; whereas, a child diagnosed with autistic disorder would have significant impairments in language and communication. Additionally, to qualify for a diagnosis of Asperger’s syndrome an individual would not meet specific criteria for any other Autism Spectrum Disorder (e.g., Pervasive Developmental Disorder-nototherwise-specified, childhood disintegrative disorder). Likewise, to receive a diagnosis of Pervasive Developmental Disorder not-otherwise-specified a child would have traits that meet some criteria consistent with disorders on the Autism Spectrum but would not meet all the qualifications for any one disorder (American Psychiatric Association, 2000). For the purpose of this paper, the term autism is used to identify all disorders on the autism spectrum. This designation follows current diagnostic practice for educational services (discussed more fully in subsequent sections) and also allows for systematic review of the research base. That is, because earlier research studies did not distinguish among different disorders within the spectrum (i.e., most research referred to autism or autistic-like behaviors to identify participants), it is not possible to retrofit current criteria to delineate treatments for individuals with disorders along the spectrum and attempting to identify participants with the more precise diagnoses available today has the potential to introduce error in my synthesis of past research. Therefore, the term autism is used in a broad sense.

**Prevalence of Autism**

Over the past several decades, autism treatment has become a matter of concern as the prevalence of autism continues to rise. Autism prevalence has increased from an average of one in 2,273 births reported between 1966 and 1991, to one in 787 births
reported in the 1990s. By 2007, prevalence reports had increased to one in 150 births (Autism and Developmental Disabilities Monitoring Network, 2007). The most recent estimates of prevalence of autism show that Autism Spectrum Disorders affect one in 91 children ages 3- to 17-years-old, based on a survey conducted by the Department of Health and Human Services National Survey of Children’s Health in 2007 (Kogan et al., 2009; see Table 2).

Table 2

Prevalence of Autism

<table>
<thead>
<tr>
<th>Date</th>
<th>Age</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966-1991</td>
<td>Births</td>
<td>4.4 in 10,000 (1 in 2273)</td>
</tr>
<tr>
<td>1990s</td>
<td>Births</td>
<td>12.7 in 10,000 (1 in 787)</td>
</tr>
<tr>
<td>2004</td>
<td>8 year-olds</td>
<td>80 in 10,000 (1 in 125)</td>
</tr>
<tr>
<td>2006</td>
<td>8 year-olds</td>
<td>91 in 10,000 (1 in 110)</td>
</tr>
<tr>
<td>2007</td>
<td>Births</td>
<td>66.6 in 10,000 (1 in 150)</td>
</tr>
<tr>
<td>2009</td>
<td>3 year- to 17 year-olds</td>
<td>110 in 10,000 (1 in 91)</td>
</tr>
</tbody>
</table>

Note. Prevalence 1966 through 2007 reported by the Center for Disease Control (Autism and Developmental Disabilities Monitoring Network, 2007) and prevalence 2009 reported by The Department of Health and Human Services National Survey of Children’s Health in 2007 (Kogan et al., 2009).
Not only has the national prevalence rate increased, but the number of children identified under the autism classification in public special education through the definitional requirements of the Individuals with Disabilities Educational Act (IDEA) has also increased over time from 53,644 in 1998 to 256,863 in 2007 (Office of Special Education Programs, 2007a; see Table 3). However, it should be noted that other factors, such as the addition of autism spectrum disorder as a classification in public special education in the 1990s through IDEA, may contribute to the increase in prevalence (Center for Disease Control, 2009). Regardless of the time frame for including autism as an educational diagnosis, it is important to acknowledge that schools are now facing unprecedented numbers of children and youth diagnosed with autism for educational purposes, as illustrated in Table 3.

**Historical Context**

The historical context of autism is most commonly traced to child psychiatrist Leo Kanner in the 1940s. While working at John Hopkins Hospital in Baltimore more than 65 years ago, Kanner observed a subset of patients who were distinctly different from his patients labeled as schizophrenic, idiot, or feebleminded. Kanner (1943) identified characteristics shared among his 11 patients (i.e., eight boys and three girls) that were inconsistent with the other mentioned disorders he had previously observed. These patients presented with a delay in development that resulted in deficits in social interactions, atypical language patterns, and uneven skill profiles. Specifically, through in-depth descriptions of his patients, Kanner included the following characteristics as distinguishable from other diagnoses:
Table 3

*Children Ages 6-21 Diagnosed With Autism Served Under IDEA Part B, in the United States as Reported by OSEP Through the Data Accountability Center*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number Served</th>
<th>Prevalence</th>
</tr>
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<tr>
<td>1998</td>
<td>53,644</td>
<td>0.08</td>
</tr>
<tr>
<td>1999</td>
<td>65,617</td>
<td>0.10</td>
</tr>
<tr>
<td>2000</td>
<td>79,085</td>
<td>0.12</td>
</tr>
<tr>
<td>2001</td>
<td>98,032</td>
<td>0.15</td>
</tr>
<tr>
<td>2002</td>
<td>118,269</td>
<td>0.18</td>
</tr>
<tr>
<td>2003</td>
<td>140,398</td>
<td>0.21</td>
</tr>
<tr>
<td>2004</td>
<td>165,619</td>
<td>0.25</td>
</tr>
<tr>
<td>2005</td>
<td>192,764</td>
<td>0.29</td>
</tr>
<tr>
<td>2006</td>
<td>223,395</td>
<td>0.34</td>
</tr>
<tr>
<td>2007</td>
<td>256,863</td>
<td>0.39</td>
</tr>
</tbody>
</table>

- Autistic aloneness—an inability to relate to others beginning at birth. Aloneness is different from those diagnosed with schizophrenia who withdraw from relationships that have already been established.

- Desire for sameness—a tendency that impedes spontaneous actions throughout daily routines.

- Islets of ability—an “excellent rote memory” but unable to use communication skills in a functional way (Kanner, 1943).
Kanner established that a disconnect with other people was the distinguishing characteristic of this group of individuals, a characteristic that was different from how other individuals in the groups presented (e.g., those classified with schizophrenia). Kanner stated that individuals who presented with the characteristics he described “are all unquestionably endowed with good cognitive potentialities” (p. 247). It was at that time that Kanner formally labeled the disorder *early infantile autism*.

**Current Diagnostic Criteria**

Many of the characteristics noted by Kanner (1943) are still used in contemporary definitions of autism. The *DSM-IV-TR* (American Psychiatric Association, 2000) presents the criteria for autism, which include qualitative social and communication impairments, along with behavior impairments. The diagnostic criteria also require that the child must present with delays in one of the following areas before age three: (a) social interaction, (b) language as used in social communication, and (c) symbolic or imaginative play. Each area is described in the following paragraphs.

**Social interaction.** A delay in social interaction is a major feature of autism. To qualify for a diagnosis of autism, a child must present with at least two of the following concerns in relation to social interaction: (a) impairments in nonverbal behavior such as eye contact and gestures, (b) lack of age-appropriate relationship development, (c) lack of joint attention, or (d) a lack of ability to reciprocate social or emotional responses (American Psychiatric Association, 2000). A child lacking play and social skills tends to engage in isolated activities, engage toys or materials inappropriately (e.g., throw toys, flick puzzle pieces), engage in self-stimulatory behaviors (e.g., flap hands, spin wheels,
hum, repeat words), and have difficulty building relationships (e.g., lack ability to initiate or sustain play, lack common interests; Krantz & McClannahan, 1998). Additional play skills, such as taking on the role of a figurine or character, which requires children to identify with others and to use novel objects in imaginative ways while engaging with peers, are also missing for most children with autism (Stahmer, 1995).

**Communication.** In addition to displaying deficits in social interactions, a child must present with impairment in communication in one of the following areas to receive a diagnosis of autism: (a) deficient in speech while also lacking an alternative mode of communication, or for those with language; (b) an inability to initiate or sustain communication with others, (c) atypical language patterns such as repeating words or phrases, or (d) deficits in age-appropriate pretend play (American Psychiatric Association, 2000). Communication skills absent in children with autism include the ability to ask for help when needed and the capacity to convey their wants and needs (Durand & Merges, 2001).

**Behavior.** Children with autism have difficulties with behavior, as well as difficulties with social and communication skills (Durand & Merges, 2001). Specifically, a child must present with one of the following behavioral patterns to qualify for a diagnosis of autism: (a) an interest that is irregular in intensity or focus; (b) difficulty with variance from schedules or routines; (c) repetitive body-movements, such as hand flapping or spinning in circles; or (d) perseveration of parts of objects, such as wheels on a toy car (American Psychiatric Association, 2000). Children with autism who engage in atypical behaviors may often display aggression toward others, may engage in self-
injurious behaviors, and may lack an awareness of dangerous situations (e.g., running into traffic, approaching strangers). Additionally, children with autism may engage in self-stimulatory behaviors that may impede learning (e.g., humming, repeating words or phrases) and impede social interactions (e.g., watching the wheel of a toy car spin instead of driving the car down a ramp with a peer; Attwood, 2008).

Learning Challenges Associated With Autism

Given their difficulties with social interactions, communication, and symbolic or imaginative play, it is not surprising that students with autism have difficulty learning from their environment (Smith, 2001) and require intensive instruction to learn fundamental skills (Lovaas, 1987), such as joint attention. Joint attention, which refers to an individual’s ability to shift attention from an object to a person, is an essential component of successful communication (Eikeseth, 2008) and of observational learning (Delgado & Greer, 2009).

**Typical development of joint attention.** When considering typical development, infants and toddlers learn much through observation. Children learn to interact with their environment through social activities and relationship development (Spence et al., 2004). Skills, such as language, are learned through imitation and practice (Nelson, 1973). To briefly illustrate the joint attention aspect of a learning event, consider, for example, the following scenario. A mother and child are looking at a fish tank, the toddler points at the fish and the mother says, “*fish.*” The child uses joint attention by pointing and looking at the mother expectantly and the mother provides a model of the word. The toddler in turn produces a vocal approximation of the word *fish*
based on the mother’s example. Imitation is an efficient means for the toddler in the example to acquire vocabulary. Typically developing children use imitation prerequisite to observational learning, to learn language and other skills from their environment (Attwood, 2008; Browder, Schoen, & Lentz, 2001). Reciprocal interactions, such as those between the mother and child in the previous example, lead to the production of vocabulary as a child learns to imitate sounds and words (Loveland & Landry, 1986). The acquisition of vocabulary is further maintained and generalized by interactions in the natural environment. For example, while looking at books or playing at a pond the mother may point out other fish indirectly providing occasional opportunities to practice approximating the word until mastery. The acquisition of vocabulary, then, happens naturally and without explicit teaching (Warren & Warren, 1985).

**Deficits in joint attention.** Because toddlers with autism typically do not focus on others and lack interest in playing, they miss out on important learning opportunities, and then miss out on subsequent practice of the skills (Baer, Peterson, & Sherman, 1967; Kanner, 1943). Certainly, a lack of joint attention, observation, and imitation skills limits the ability of a student with autism to acquire information in the same way as their peers (Baer et al., 1967; Browder et al., 2001). Referring to the mother and toddler in the previous example to teach the label *fish*, a child with autism would likely need to be taught the word repetitively using direct, systematic instruction, with many trials over a series of days (National Research Council [NRC], 2001). Teaching one word systematically in a direct format sounds like a simple endeavor, and teaching one discrete skill in this fashion probably is straightforward; however, it is important to know that
unlike children who are learning naturally from their environment, it is likely that a child with autism would need most skills he or she uses to be taught in this fashion. Considering the potential list of skills used in everyday interactions, the seemingly straightforward task of teaching becomes rather daunting. Given that children with autism learn differently from other children, integrating skills into natural learning settings requires careful planning with a focus on teaching joint attention skills (i.e., teaching students how to learn from the environment and how to relate to others—skills that are perhaps more intuitive for other learners; Browder et al., 2001).

Lack of joint attention presents students with autism learning challenges in typical settings. Specifically, because students with autism have difficulty with observational learning (Handleman & Harris, 1983), they often have difficulty acquiring information during large group instruction, such as a lecture format in which a teacher talks and students listen (Leaf & Mountjoy, 2008). Instead, a student with autism requires direct instruction that focuses on skills that are broken down into small parts (e.g., to teach object labels first teach two distinctly different words on index cards until mastery, then teach more similar words until all are mastered, then teach the same words in sentences and in books) and taught systematically (e.g., teach the word fish without distraction of the fish tank, limited conversation about characteristics of fish, direct feedback on accuracy of responses). Although autism is considered a lifelong disability, individuals can learn critical skills such as joint attention, including learning through imitation and observation (Loveland & Landry, 1986). However, to reach their full potential students with autism require instruction that is direct, intense, and systematic (NRC, 2001).
Effective teaching approaches for students with autism utilize the principles of applied behavior analysis because they incorporate instructional components that can systematically address skills such as joint attention. The principles of ABA and intensive behavioral intervention, a specific instructional program based on the principles of ABA developed for teaching students with autism and popularized by Ivar Lovaas (Lovaas, 1987; Lovaas, Koegel, Simmons, & Long, 1973) are discussed in the following sections.

**Applied Behavior Analysis**

Applied behavior analysis (ABA) is a field of study that relies on scientific evidence to increase socially significant behaviors (Baer, Wolf, & Risley, 1968). Research based on the principles of ABA has been extremely instrumental in the identification of treatments for students with disabilities, including students with autism. Over the past 40 years, the *Journal of Applied Behavior Analysis* alone has documented thousands of studies demonstrating positive effects for individuals through the use of ABA principles (e.g., Jones, Carr, & Feeley, 2006; Lovaas et al., 1973; Reid & Favell, 1984; Zanolli & Daggett, 1998). In 1968, the first year of publication for the *Journal of Applied Behavior Analysis*, Baer, Wolf, and Risley described applied behavior analysis in their seminal article entitled *Some Current Dimensions of Applied Behavior Analysis*. Importantly, Baer et al. (1968) specified that research be conducted that focuses on significant behaviors in need of change (e.g., not behaviors which are merely convenient to manipulate and observe) and should be conducted in natural settings rather than in laboratories. Additionally, the authors proposed seven dimensions of ABA that have
become the foundation for current research: (a) applied, (b) behavioral, (c) analytic, (d) technological, (e) conceptually systematic, (e) effective, and (f) generality.

- **Applied.** Applied refers to the extent to which society views the importance of the behavior to be studied. Equally, the individual of study is not chosen based on convenience but is determined based on the need for a behavior change of importance (Baer et al., 1968).

- **Behavioral.** A behavioral study must specifically address the behavior in need of change with the behavior being a physical event that can be quantified and measured (Baer et al., 1968). Also, the study must demonstrate experimental control by manipulating the specific behavior. Researchers in ABA are not concerned with research about the behavior; rather they are concerned with research of the behavior (Cooper, Heron, & Heward, 2007).

- **Analytic.** A study is considered analytic when the researcher has demonstrated control over the behavior.

- **Technological.** For a study to qualify as technological it must include a thorough description of the methods and intervention procedures. Enough information must be provided to allow other researchers to effectively replicate the procedures.

- **Conceptually systematic.** When developing a study, the researcher should refer to the basic principles of behavior. Building on behavior principles supports a strong foundation while allowing the science to be replicated and studied. Systematic procedures also allow studies to be grouped based on
principles which provide packages of treatments instead of “bags of tricks” (Baer et al., 1968).

- **Effective.** Research should demonstrate a degree of effectiveness over a socially significant behavior. This means that the change in behavior is large enough to be useful to the individual.

- **Generality.** The skill attained must be durable enough to maintain over time and should be demonstrated in various locations with various stimuli.

Research studies that rely on ABA embody the seven dimensions of behavior and have been experimentally verified for obtaining positive outcomes related to readiness skills, academics, interpersonal interactions, self-regulatory behavior, and vocational skills, to name a few domains (Bachmeyer et al., 2009; Coleman-Martin & Heller, 2004; Himle, Woods, & Bunaciu, 2008; Kelley, Piazza, Fisher, & Oberdorff, 2003). Likewise, behavior analysts have demonstrated positive outcomes across diverse populations (Farb & Throne, 1978; O’Brien & Azrin, 1972; Petscher & Bailey, 2006), including individuals with autism (Kamps, Walker, & Rotholz, 1992; Stahmer, 1995). When implemented with students with autism, interventions based on ABA are designed to meet a variety of objectives (e.g., to build skills, maintain mastered skills, generalize behaviors across environments and stimuli, decrease distractions, and reduce behaviors which may impede learning; Steege, Mace, Perry, & Longnecker, 2007). The interventions developed from the principles of ABA provide a systematic method for demonstrating experimental control. Through the use of experimental and quasi-experimental group designs and single-subject research designs, ABA has made significant contributions to evidence-
based practice. Specifically, treatment packages demonstrating these principles have been developed to address the specific needs of various populations such as Autism Spectrum Disorders. One specific intervention that embodies these objectives is intensive behavioral intervention.

**Intensive Behavioral Intervention**

Intensive behavioral intervention (IBI) programming incorporates the principles of ABA (i.e., that observable and measurable socially significant behaviors for instruction are identified and then taught through systematic approaches) in a format that has proven to be effective for teaching young students with autism (Cohen, Amerine-Dickens, & Smith, 2006; Lovaas, 1987). Systematic teaching, careful skill selection with continual assessment of progress, and consistency of implementation are essential elements of an IBI program (Ghezzi, 2007). Though IBI programs can be developed in the classroom and implemented by teachers with assistance from an individual who is knowledgeable of behavioral interventions (Leaf, Taubman, & McEachin, 2008), the following sections describe IBI formats used in on home-based programs because that is the environment in which IBI programs are most often initiated (Cohen et al., 2006; Lovaas, 1987; Smith, Groen, & Wynn, 2000).

**Structure of an IBI Program**

Often, IBI programs are organized and individualized for children with autism by behavior consultants (e.g., board certified behavior analysts [BCBA]) who oversee a team of tutors (e.g., three to four individuals trained by the behavior consultant in ABA procedures specific to the target student with autism) who implement instruction in the
child’s home (Shook & Favell, 1996). Intensive behavioral intervention is conducted by one tutor at a time in sessions (e.g., one tutor from the team works with the student for two to three hours each morning and another tutor works with the student for two to three hours each afternoon) in a distraction-free work area. During this time, the student transitions between direct instruction, typically conducted at a table, and play. The tutor structures the student’s time throughout the entire session and teaches the student in a direct and systematic format (S. T. Anderson, Taras, & O’Malley Cannon, 1996).

A critical component of an IBI program is systematic teaching, which employs active rather than passive learning. That is, during each session students are required to demonstrate acquisition of skills by actively responding to instruction (e.g., touching or verbalizing the correct response). Each skill is taught using a highly structured systematic teaching method known as discrete trial teaching (Leaf et al., 2008; Lovaas, 1987; Smith, 2001). Discrete trial teaching, described in detail later in this chapter, provides the student with frequent opportunities to respond, frequent corrective feedback, and positive consequences to increase skill acquisition.

As mentioned previously, when implementing a home-based IBI program, a tutor implements instruction by alternating between skills addressed at a table, on the floor, or in rooms around the house while providing the student with reinforcers for producing target skills. The session is designed to address each goal or skill repetitively with approximately 5 to 10 trials of each skill delivered in rapid pace succession, to provide intense practice for the student to acquire the skill (S. T. Anderson et al., 1996). The tutor works on multiple skills each session (e.g., delivers 5 to 10 trials while working on
action labels, 5 to 10 trials while working on identifying colors, and 5 to 10 trials while working on classifying objects). Data are collected daily and changes (e.g., continuing with the protocol as established, introducing new skills, suspending teaching and introducing a prerequisite skill) are made based on the student’s data. Sessions are conducted regularly to maximize the intensity of instruction and to simulate the amount of time typical children learn each day from their natural environment (Butter, Mulick, & Metz, 2006; Lovaas, 2008; NRC, 2001).

Intensive behavioral intervention involves a comprehensive structure with many areas requiring careful consideration to coordinate a program that is consistent with evidence-based practice. As such, the behavioral consultant organizes the program to ensure consistency. Consistency across tutors is an important aspect of discrete trial teaching in an IBI program because of the number of hours (e.g., 20–40 hours per week) necessary combined with and the number of individuals involved in implementation of the services. Typically, the behavioral consultant conducts consultation meetings with the team of tutors, as well as a student’s parents bi-weekly to assess progress, make changes based on progress, and evaluate team members’ ability to implement the IBI program. The consultation meeting is also used to provide continuing feedback and training to the tutors. One tutor is typically assigned to be the lead or senior tutor based on his or her ability to demonstrate skills the behavior consultant has taught. The role of the lead tutor is to monitor the data and assist the team in making changes based on student performance throughout the week, to assist in managing materials, and to update the behavioral consultant during consultation meetings.
In addition to consultation meetings, the behavior consultant prepares a task analysis for each complex skill along with the language and response requirement that will be used during systematic teaching. The behavior consultant also gathers specific materials to meet each goal with corresponding data sheets and specific stimuli for which the student has shown a preference in the past (S. T. Anderson et al., 1996). Organization and preparation of response requirements, materials, and data sheets ensures consistency among the individuals conducting IBI sessions with the student with autism. Indeed the comprehensive structure of an IBI program requires many necessary components for teaching students with autism. The following section provides a discussion of the components.

**Components of Intensive Behavioral Intervention**

Implementing an IBI program requires the behavioral consultant teach the principles of behavior (Shook & Favell, 1996) to the student’s parents and team of tutors, as they are described in the literature (e.g., Lovaas, 1987; Smith, Eikeseth, & Klevstrand, 2003) and to interpret recommendations for effectiveness for the student with autism (e.g., intense, comprehensive, collaborative; NRC, 2001). Because students with autism can be highly distractible (Lewy & Dawson, 1992), designing an effective learning environment is critical to the success of an IBI program. The behavioral consultant arranges the environment (e.g., limits distractions, selects meaningful materials) and designs a program which employs systematic teaching to foster the development and maintenance of skills for students with autism (Lovaas, 2008). A home-based IBI program is comprised of the following components which are discussed in the following
sections: (a) environmental accommodations, (b) material selection, and (c) systematic teaching.

**Environmental accommodations.** Intensive behavioral intervention sessions are initially conducted in a quiet setting with minimal distractions (e.g., low noise level, minimal visual distractions, few toys) to acquire early skills (e.g., sitting, attending, following simple instructions; S. T. Anderson et al., 1996). Because students with autism have difficulty learning from their environment and tend to be prone to over-stimulation, the environment for instruction is critical to a student’s successful acquisition of skills. The environment must be able to support learning, meaning it should be rich with motivating stimuli (Lovaas, 2008); however, the type and amount of stimuli present should be determined based on the student’s ability to remain engaged when being taught or practicing skills in those environments (e.g., study cubicle, classroom; S. T. Anderson et al., 1996). For example, a home-based, early learning setting may be limited to a table and chairs, a shelf with a few toys that are organized for easy selection, and a cabinet to store materials (S. T. Anderson et al., 1996); later the environment may include shelves full of toys.

As a student gains basic skills such as attending, waiting, following simple instructions, and turn-taking with preferred items (Leaf et al., 2008), the setting is modified to mirror a natural setting (S. T. Anderson et al., 1996). Transforming the learning environment so that it systematically approximates the natural settings is important for building skills that will transfer to other environments (i.e., generalization; Cowan & Allen, 2007). For example, if the goal is to transition a student to preschool,
the IBI setting should include stimuli and physical arrangements similar to that found in a preschool (e.g., a circle time area, a calendar on the wall, shelves with toys, and distractions such as music or other noises). The environment in which students with autism are taught sets the stage for success. Eliminating extraneous distractions enhances the probability that students with autism can gain fundamental skills that will prepare them for learning in natural environments (e.g., waiting, attention, responding to instructions).

**Materials.** Like the learning environment, the selection and organization of materials is an important aspect of an IBI program. When developing an IBI program, the behavior consultant uses materials that will meet the student’s individualized needs and enhance learning. To maximize the time the tutors spend engaging with the student, the behavior consultant identifies, acquires, and organizes materials, data sheets, and reinforcers for easy access. Typically, materials for each targeted skill are housed in a separate bin or bag and labeled according to their use and data sheets are kept in a binder or on a clipboard for easy access and daily record keeping (S. T. Anderson et al., 1996).

Initially, materials are simple with minimal distractions (e.g., basic shapes on cards as opposed to finding shaped objects within books). For example, each picture card in a set of cards used to teach labels of objects would have one object per card and all of the cards would have similar background (e.g., all of the cards would have white backgrounds). Simple materials decrease the likelihood students with autism will attend to insignificant features (Koegel & Lovaas, 1978). For example, if some cards had blue backgrounds and others had red backgrounds the student may learn to respond to the
colored background instead of the object depicted, thereby getting the correct or incorrect answer for the wrong reason (Smith, 2001). Along with simplicity of materials, special consideration is taken when selecting targets to be taught within each program based on the materials. For example, when teaching the first few sight words, the words *car* and *telephone* (words that differ on several graphical dimensions) would be taught before teaching the words *car* and *can* (because of their similarity in size and letter shapes). It is important to select materials that optimally differ yet include similar presentation stimuli (e.g., each card is printed on a card that is the same size, shape, and color), to minimize the level of discrimination necessary for the student to identify the correct response and reduce the likelihood the student will focus on irrelevant stimuli (Koegel & Lovaas, 1978).

**Consideration for generalization of materials.** As students acquire skills, materials are modified to include more complex stimuli (e.g., an addition flashcard compared to an addition worksheet). Additionally, implementation of materials is modified from presentation in a discrete isolated fashion to embedded in natural settings (e.g., instead of reading sight words printed on cards the student is asked to read words posted around the room or written in books; Tate, Thompson, & McKerchar, 2005). Because students with autism have difficulty generalizing skills, modifying the materials is an important part of programming for generalization (Chiara, Schuster, Bell, & Wolery, 1995; Wolery & Schuster, 1997). When developing the materials to teach a skill, multiple examples of teaching materials are used to ensure the student can perform targeted skills when presented with any form of the item (Cooper et al., 2007; Ghezzi,
2007; Leaf, McEachin, & Harsh, 1999). For example, when teaching the label for *lamp*, various pictures and items depicting lamps would be presented (e.g., lamps with a shade sitting on a desk, lamps with an arching arm, lamps of different colors and sizes, halogen lamps that stand upright on the floor). Later programming should include identifying objects in natural settings such as in the classroom or on the playground. Meaningful selection of materials paired with a systematically arranged learning environment offer ideal conditions for systematic teaching. The way in which materials are utilized in an IBI program is essential to a student’s success.

**Systematic teaching.** As mentioned previously, a critical component of an IBI program is the method in which the students are taught. Intensive behavioral intervention incorporates discrete trial teaching in conjunction with other ABA strategies, such as reinforcement, prompting, and task analysis to systematically teach each skill (Leaf et al., 1999; Maurice, Green, & Luce, 1996). During teaching, progress is measured continually through data collection and specific criteria are established for acquisition, maintenance, and generalization (S. T. Anderson et al., 1996; Leblanc, Ricciardi, & Luizelli, 2005). Each of these components associated with systematic teaching are described in the following sections.

**Task analysis.** To develop goals based on the comprehensive needs of students with autism to be addressed during an IBI program, a behavioral consultant assesses a student to determine present levels of performance across all domains (e.g., language, adaptive, visual spatial). Each goal is specifically defined and criteria for mastery are established (S. T. Anderson et al., 1996). After selecting skills to be taught, a task
analysis is used to break skills down into small teachable parts that are more manageable for a student with autism to acquire. A task analysis is created to determine the subcomponents necessary for the student to learn a skill. The subcomponents identified in the sequence, which lead to the goal behavior, are referred to as a behavior chain (Cooper et al., 2007; Steege et al., 2007). The number of steps in a behavior chain depends on the student’s repertoire of pre-requisite skills necessary to attain a complex skill. A targeted behavior, such as hand washing, can include 5 steps or as many as 30 steps depending on the student’s need. For instance, a task analysis for a student who does not know how to turn on a faucet would require many more steps than a student who could independently turn the faucet on and off.

The task analysis process involves writing down each step necessary to complete the task (e.g., identifying the cold water faucet, placing hand on the faucet, turning the faucet, identifying the soap). Complex skills, such as hand washing, are often taught using backward or forward chaining procedures, in which sub-component skills are systematically taught in order (Cooper et al., 2007; Spooner, 1984). Once the steps required to perform the targeted behavior are identified, each skill can be taught one at a time and then chained together. Consider the hand washing example. To backward chain the task, the tutor would prompt the student through each step of the sequence until the student could perform the last step in the sequence independently. The tutor would continue to practice the task with the student until prompts were faded for the second to last step, third to last step, and so on. Each time the student practices the steps he would receive reinforcement for completing the steps independently. Breaking down complex
skills into components allows the student to receive frequent reinforcement for mastery of individual skills as opposed to allowing for frustration by withholding reinforcement until completion of the complex skill. Like backward chaining, forward chaining also requires that the skills are taught to the student one at a time and systematically chained into a complex skill; however, instead of beginning with the last step and working backwards the chain is taught starting with the first step. Both chaining procedures are used systematically to address the components listed in the task analysis for a skill to teach a student a complex behavior.

**Prompts.** Another component of systematic teaching and an effective IBI program is prompting. Prompting strategies are additional supports employed during teaching to ensure successful performance and are then gradually faded to build independence (Leaf et al., 2008; Soluaga, Leaf, Taubman, McEachin, & Leaf, 2008). During acquisition, prompts are provided to ensure success, to avoid incorrect learning, and to minimize frustration (Smith, 2001). Prompts are delivered immediately following the instruction. Specifically, during discrete trial teaching, the instruction is delivered and the student is given an opportunity to respond. If the student does not respond or responds incorrectly, the trial is ended and another instruction is delivered, this time paired with a prompt (Taubman, Brierley, Wishner, McEachin, & Leaf, 2001). The prompt is delivered with the intention of increasing the probability that the student will respond correctly. Prompts vary in intensity and can progress in a sequence from least to most (e.g., pointing, gesturing, modeling, and then hand-over-hand assistance) to produce
the correct response (Leaf et al., 2008; West & Billingsley, 2005). Prompts are chosen based on prior knowledge of the student’s skill attainment (Soluaga et al., 2008).

Prompt fading. To avoid a student becoming dependent on prompts and to foster independence, prompting strategies are faded quickly. Decisions to fade the prompts are made based on data that are collected on the type (e.g., gesture, verbal, modeling) and number of prompts used to teach each skill. For example, after hand-over-hand prompting a student through a hand washing routine, the next step might be to verbally guide the student through the steps involving the sink, towel, and soap; then the prompts are faded to a less intensive prompt, such as only pointing to specific items used in the hand-washing routine, and finally prompts are faded to only include gestures (Soluaga et al., 2008). Prompts used in conjunction with corrective feedback and reinforcement are essential to successful discrete trial teaching.

Reinforcement. Reinforcement, a critical component of discrete trial teaching as well as an IBI program, is a well-researched behavioral principle (Cooper et al., 2007; Kelley et al., 2003). A reinforcer is an item, activity, or event that follows a targeted behavior and increases the likelihood of that behavior occurring in the future (Cooper et al., 2007; Hall, Panyan, Rabon, & Broden, 1968). To be considered a reinforcer, a stimuli (i.e., an item, activity, or event) must be desired by the student to the degree to which the student will be motivated to attain the stimuli. If, in fact, the student’s behavior increases upon consistently receiving the stimuli, then the stimuli can be labeled a reinforcer (Cooper et al., 2007). Systematic reinforcement procedures are part of discrete trial teaching of target behaviors (Baer et al., 1967). When teaching a new skill
using discrete trial teaching each correct response to an instruction is immediately and consistently followed by a reinforcer (Leaf et al., 1999; Leaf et al., 2008). Providing a reinforcer contingent upon the correct response increases the likelihood that the student will respond with the same correct response in the future. Consistent with methods for implementing the other elements of discrete trial teaching, the method for delivering reinforcers is meaningful and systematic.

Establishing reinforcers. To determine the desirability of a stimuli and, thus, its reinforcer potential, a preference assessment is conducted to determine items that the student desires (Cooper et al., 2007; Wolery & Schuster, 1997). Preference assessments are conducted regularly to ensure the stimuli remain reinforcers which are valued by the student. Because students with autism are not typically motivated by naturalistic items and activities (e.g., praise, games, stickers), strategies for increasing the reinforcing qualities of naturalistic items and activities are implemented (e.g., pairing preferred items with naturalistic items; Longano & Greer, 2006). To increase the value of naturalistic reinforcers (e.g., praise), they are paired with access to highly preferred reinforcers such as toys or edible items. Establishing reinforcers that increase the likelihood of behaviors is essential to discrete trial teaching.

Schedules of reinforcement. Delivery of reinforcement is modified based on a student’s performance. When teaching new skills, continuous reinforcement is used to reward each occurrence of the target response (Ghezzi, 2007). Reinforcement is delivered immediately and consistently (Leaf et al., 2008) contingent upon correct responding. Continual delivery teaches a student that reinforcement is available for
correct responses but not available through other means (e.g., incorrect responding, grabbing, crying), increasing the likelihood of correct responses (Cooper et al., 2007). It is imperative that criteria for receiving reinforcement are set at a level that the student is able to achieve and then criteria are gradually increased as performance is enhanced (Cooper et al., 2007). As the student learns target behaviors the continuous reinforcement schedule is thinned. That is, once the student has learned the targeted behavior, delivery of reinforcement shifts from a continuous to an intermittent schedule (e.g., reinforcement is delivered every second or third time the student engages in the behavior). The variable schedule strengthens the behavior because the student cannot predict when reinforcement will be delivered resulting in the student continuously engaging in the target behavior (Cooper et al., 2007). Delivery of reinforcement shifts based on the student’s level of responding. For example, a teacher, after two weeks of delivering reinforcement each time a student puts his book away after math class, may shift to reinforcing the student every two times he puts his book away. If the student’s expected behavior decreases the teacher would adjust the reinforcement back to every time he put the book away. Adjusting the schedule of reinforcement based on the student’s performance is an effective method for increasing target behaviors (Neidert, Iwata, & Dozier, 2005).

Reinforcement system. In addition to manipulating the schedule of reinforcement as the student’s performance improves, other reinforcement procedures, such as token economies can be introduced (Boniecki & Moore, 2003; Cooper et al., 2007; Wrobel & Resnick, 1970). When using a token economy with a student, tokens (e.g., a sticker,
smile face), also known as generalized reinforcers, act as time holders as the student waits for the backup reinforcer (i.e., the stimuli for which the tokens can be exchanged). Each time a student engages in the target behavior a token is provided. The student gains access to the backup reinforcer, once he or she has earned the pre-determined number of tokens needed to acquire that reinforcer (Boniecki & Moore, 2003; Gongola & Sweeney, 2007; Wrobel & Resnick, 1970). Tokens are delivered continuously at first and then the schedule for token delivery is thinned, similar to beginning with continuous reinforcement and then transitioning to an intermittent schedule. Reinforcement procedures, such as token economies, used in conjunction with behavioral interventions have demonstrated effectiveness for students with autism (Matson & Boisjoli, 2009). To increase the student’s opportunity to receive reinforcement, prompts are used to facilitate correct responding and are discussed in the following section (Zanolli & Daggett, 1998).

**Discrete trials.** A discrete trial is part of systematic teaching method that is made up of three parts: (a) discriminative stimulus ($S^D$) or instruction, (b) a student response, (c) a reinforcing stimulus ($S^R$) or consequence (Ghezzi, 2007; Leaf et al., 1999). The discrete trial provides consistent learning opportunities that teach a student that when an instruction is presented, reinforcement is available (Ghezzi, 2007). Therefore, a student learns that responding to an instruction will provide access to reinforcement and failing to respond or incorrect responding will not result in reinforcement but will result in corrective feedback.

- **Discriminative Stimulus ($S^D$)**—each discrete trial includes a clear concise instruction. The $S^D$ provides the student with the information required to
respond. The statement should be brief, concise and specific (e.g., “Touch,” “Give me,” “Say”). When teaching a skill, the same SD is used for the same desired response. During generalization, the $S^D$ is modified to include language the student will hear in the natural environment.

- **Response**—the response is what the student does after the $S^D$. The response should occur within three to four seconds of the $S^D$ and should be specifically defined to include all dimensions of the behavior.

- **Reinforcing Stimulus ($S^R$)**—the $S^R$ is the feedback that is given to the student following either a positive or negative response. Feedback is provided after each response or lack of response (e.g., the student does not respond to the $S^D$ within three seconds) to complete the three-part discrete trial. Providing reinforcement for a correct response will increase the likelihood the student will respond correctly in the future. Providing an informational no or try again for an incorrect response or lack of a response informs the student the trial is over and the response needs to change.

- **Inter-trial Interval.** The inter-trial interval is the length of time between discrete trials. The short interval provides the student with the information that one task has been completed and the next task is about to begin. In most IBI programs, the inter-trial interval is approximately three seconds (Smith, 2001).

**Discrete trial teaching.** When delivering discrete trials in succession, each discrete-trial is followed by a three to five second inter-trial interval (Ghezzi, 2007).
Discrete trials are delivered in a rapid repetitive fashion, which builds momentum and allows for intense instruction in a short amount of time (Smith, 2001). For students with autism the consistent structure of each discrete trial and active response requirement foster successful acquisition of skills. To illustrate the teaching trial, the learning process usually begins with teaching rote skills (e.g., simple facts, item names, shape identification) in a one-to-one, teacher-to-student fashion (S. T. Anderson et al., 1996; Butter et al., 2006). Initially, the teacher presents the instruction clearly, concisely, and slightly louder and more authoritatively than a typical speaking voice (Leaf et al., 2008). Minimal words are used in the presentation of the instruction (e.g., “come here,” “touch ball”) to eliminate distraction and to assist the student in attending to the essential elements of the instruction. The response required from the student is simple and well defined to ensure agreement on performance expectations among all tutors, and to reinforce the same response with consistency. Moreover, a well-defined behavioral response reduces frustration for a student and assists with accurate data collection across tutors. The tutor ends each trial by giving the student a consequence (e.g., informational “no” for incorrect responses, praise for correct responses) on a continuous schedule.

While instructing the student, the tutor works on one task at a time by delivering discrete trials in a mass sequence separated by a three to five second inter-trial interval for approximately 5 to 10 trials (Leaf et al., 1999). The rapid succession of trials reduces the probability the student will engage in off-task behaviors (e.g., reaching for items, getting out of the chair; Ghezzi, 2007). Similar to athletes practicing for a big game or students repetitively writing spelling words before a spelling test, discrete trials offer students with
autism multiple opportunities to become fluent in a controlled learning situation, prior to demonstrating the skill in a natural environment (Smith, 2001). Skills are practiced repeatedly until mastery criteria are met under one set of conditions. For example, a student may be taught a set of object labels using one set of picture cards until mastery (i.e., 80% correct responding across two consecutive sessions).

**Generalizing skills.** As a student begins to respond to the contingencies of discrete trial teaching, more complex skills can be introduced (e.g., answering questions, matching emotions to images, following multi-step directions) and discrete trials can become more complex (e.g., “Where do you live?” “Touch house,” “Go get the big green ball”). Once the student has reached mastery criteria with one set of materials (e.g., a card with a picture of an apple) he may be taught the same objects in natural situations (e.g., an apple located in a refrigerator in the kitchen). To further promote maintenance and generalization of skills, the three parts of the discrete-trial are modified as the student learns (i.e., instruction and response requirements become more complex, reinforcement schedules move from continuous to variable). First the instruction can be generalized to include variations in language in more natural contexts. For example, when first teaching a student to identify his teacher by name, the initial instruction may be, “What is your teacher’s name?” Later the same response would be expected when asked, (a) “Who is your teacher?” (b) “Which teacher do you have?” or (d) “Whose class are you in?” The same response would also be practiced in more natural settings (e.g., settings which include distractions, about various instructors, asked by peers). For example, one-to-one teaching might be moved to natural settings which include distractions (e.g., gym,
lunchroom, hallway), then changed to include a peer in the teaching trial, and eventually transitioned to small and large group instruction. Each modification to the instructional environment would be introduced systematically based on the student’s performance.

Indeed, building appropriate skills for a student with autism requires preparation, consistency, and intensity. It is important to include systematic planning for generalization and maintenance of skills. Because children with autism experience deficits in generalizing skills, specific strategies are employed to teach them behaviors in one environment under one set of conditions, and then they are assessed, and trained as necessary for generalization and maintenance across natural situations (M. A. Anderson et al., 2006; Leaf et al., 2008; Soluaga et al., 2008). As described earlier, as students begin to successfully respond in a one-to-one setting, skills can be generalized to other environments. Additionally, each component of the discrete trial, instruction, response, and consequence, can be varied to assess whether the student has generalized the skill. While continuing to use discrete trial teaching, the skill can be practiced in small group situations, response requirements can be increased or changed (e.g., one word response, response in a sentence format), and the person delivering the question can be varied. It is important that details for transferring new skills to various settings, to different people, and to natural contexts to ensure generalization are given as much consideration and planning as the initial teaching procedures (Cooper et al., 2007; NRC, 2001).

**Maintaining skills.** Moreover, once skills have been generalized, it is of equal importance that specific methods are employed to ensure skills are maintained. Considering the time and effort invested in teaching skills, programming for maintenance
of skills is critical. Lack of programming for maintenance can result in loss of skills as well as loss of critical instructional time. In fact, many students with autism require continuous programming (e.g., extended school year services) to ensure skills are maintained (Handleman & Harris, 1984; NRC, 2001; Zanolli & Daggett, 1998). To program for maintenance, skills are systematically reviewed over time and as mentioned previously the schedule of reinforcement is adjusted to an intermittent schedule. The behavior consultant ensures that skills remain at mastery criteria across time (e.g., when assessed one time per week, one time per month). If a student with autism begins to respond incorrectly to a mastered skill (e.g., percentage of correct responding drops below 80% across two maintenance checks) the skill is readdressed on a more intense schedule (e.g., one time per day with increased reinforcement; S. T. Anderson et al., 1996). Maintenance and generalization of skills requires the same systematic programming as skill acquisition (S. T. Anderson et al., 1996).

The characteristics of discrete trial teaching yield positive results when utilized with students with autism (Smith, 2001). The direct instruction approach, within the framework of an IBI program, provides a student with autism structured learning trials that are predictable. Because children with autism have difficulty with joint attention (Loveland & Landry, 1986), the rapid paced delivery of the discrete trial paired with reinforcement is an ideal solution for maintaining attention (Ghezzi, 2007; Wolery & Schuster, 1997). Furthermore, clear concise instructions, consistent expectations for responding, and explicit direct feedback are essential components for teaching students with autism.
Discrete trial teaching offers advantages over traditional teaching styles for students with autism. As mentioned previously, discrete trials require active responding as opposed to passive learning, they can be adapted and individualized to all types of lessons, and the short instructional trials promote rapid skill acquisition (Downs, Downs, Johansen, & Fossum, 2007). For students with autism, discrete trial teaching takes information that is present in the natural environment and transforms it into manageable bits of information.

**Intensive Behavioral Intervention Research**

Studies evaluating behavioral strategies for students with autism date back to 1962, when Ferster and DeMeyer began to explore autism treatments by experimenting with reinforcement control. The researchers demonstrated that children with autism could learn skills (i.e., pulling levers) when reinforcement was available. In 1973, Dr. Ivar Lovaas and colleagues built on the idea that students could learn skills through the systematic use of behavioral interventions and conducted a study among children with autism in an institutional setting using a combination of behavioral interventions. The participants in the study demonstrated increases in IQ scores, social quotient scores, and appropriate verbalizations, social nonverbal behaviors, and some appropriate play. The seminal article, published in the *Journal of Applied Behavior Analysis*, verified that children with autism could make significant gains in meaningful, behavior-specific skills. These results became the springboard for future research and development in the field of ABA. Dr. Lovaas used the principles of ABA to package a comprehensive treatment for children with autism, with many researchers since contributing to his findings and
refining his procedures (Cohen et al., 2006; McEachin, Smith, & Lovaas, 1993; Sallows & Graupner, 2005; Smith et al., 2000).

**Initial findings in IBI.** After demonstrating that students with autism could make substantial gains (Lovaas et al., 1973), Lovaas (1987) sought to test the variables that made the treatment effective. After studying the development of typically developing children, Lovaas reported that most children acquire information from their environments during all of their waking hours (i.e., 16 hours per day; Lovaas, 2008). Lovaas hypothesized that matching the intensity of learning of typically developing children would mean treatment for children with autism should be intense (e.g., 20-40 hours per week). Additionally, treatment should: (a) be conducted at a young age, (b) be comprehensive across all skills, and (c) include a parent component. The study conducted by Lovaas in 1987 demonstrated that applying these intervention characteristics to a treatment program could result in significant improvements in participant outcomes (Lovaas, 1987). The study consisted of an experimental group ($n = 19$) and one control group ($n = 19$) who received varying levels of IBI (i.e., the experimental group received 40 hours of one-to-one intervention per week and the control group received 10 hours or less of one-to-one intervention per week). An additional control group (i.e., 21 students with autism who were diagnosed by the same agency as the majority of the other students enrolled in the study and who were receiving general community services, such as special education classes) was evaluated to offset the potential that students who were included in the study were included based on selective criteria. The treatment program, which combined the mentioned components
(i.e., early, intense, comprehensive, parent involvement), was conducted by a team of therapists who conducted treatment at home, school, and in the community, and included the parents as part of the instructional team. Behavioral principles (e.g., reinforcement, shaping, planned ignoring) were used in combination with systematic teaching (i.e., discrete trial teaching) to teach skills. Results demonstrated that 9 out of 19 participants in the experimental group reached what Lovaas (1987) defined as best outcome status, designated by the child’s ability to be included into a general education classroom and to demonstrate social behaviors that were indiscriminable from typically developing peers. Additionally, participants in the experimental group gained a mean 30 IQ points over participants in control group one. The mean IQ of participants in both control groups did not change between intake and treatment. Results indicated that the experimental group differed considerably from the combined results of the two control groups, in which only 1 out of 40 participants reached best outcome status (Lovaas, 1987). Since Lovaas’ initial studies, many authors have obtained similar positive results (e.g., inclusion in regular education, skill attainment, increases in IQ; Cohen et al., 2006; Sallows & Graupner, 2005; Smith et al., 2000).

**Comparison of IBI to other treatments.** In relation to general effectiveness of the IBI approach, Eikeseth, Smith, Jahr, and Eldevik (2002) conducted a group study that compared the outcomes of two instructional strategies delivered to two different groups of students with autism. The first group consisted of 13 participants, between the ages of four and seven, who received treatment based on the instructional strategies outlined in the manual entitled *Teaching Developmentally Disabled Children: The ME Book,*
published by Lovaas and colleagues (Lovaas et al., 1981). Each child received an average of 28 hours of treatment (i.e., intensive one-to-one systematic instruction) per week in conjunction with weekly team meetings of the trainers and parent participation. In contrast, the second group consisted of 12 participants who received one-to-one instruction utilizing eclectic instructional methods, including blended treatment of ABA procedures along with other interventions recommended by the multidisciplinary school team (e.g., picture schedules, speech therapy, occupational therapy). Weekly, each child received an average of 29 hours of treatment while the therapists received two hours of consultation. At intake, both groups ranked similarly in relation to intake variables (i.e., chronological age, IQ, performance IQ, language comprehension, expressive language, adaptive behavior scales, adaptive behavior scales: comprehension, daily living, socialization, composite scores). However, the eclectic group had slightly better scores (but not statistically significantly different from the IBI group). The outcome of the study demonstrated positive results for IBI programming. At follow-up, the IBI group achieved greater gains in average scores than the eclectic group on all measures, from IQ (IBI gain of 17.15—eclectic gain of 4.33), language comprehension (IBI gain of 27.0—eclectic loss of 0.7), language expressive (IBI gain of 22.57—eclectic loss of 2.23), and adaptive behavior (IBI gain of 11.23—eclectic gain of 0.17). There was no statistical difference between groups on the Vineland Socialization Scale, although scores on the Vineland Maladaptive Behavior Scale indicated that children in the IBI group had fewer disruptive behaviors than children in the eclectic group at the end of the study.
Like Eikeseth et al. (2002), Howard, Sparkman, Cohen, Green, and Stanislaw (2005) conducted a group study, which also compared IBI to two eclectic treatments and found similar results. The participants ($n = 61$) were all diagnosed with autism or PDD-NOS and were 48 months of age or younger at the onset of the study. The participants were categorized into three groups referred to as intensive behavioral analytic treatment (IBT group), autism educational placement (AP group), or generic educational programming (GP group). The IBT group, consisting of 29 children, received 25 to 30 hours per week of intervention if they were less than three years old and 35 to 40 hours if they were over three years old. Intervention was conducted in multiple settings with strong parental involvement (e.g., parents received training on treatment procedures, collected data regarding maintenance of skills, implemented treatment). The AP group included 16 children who received treatment in special education classrooms designed for children with autism. All the children received 25 to 30 hours per week of intervention by school staff, with seven of the children receiving additional small group speech therapy. AP intervention included ABA discrete trial teaching, structured communication training using visuals, and picture schedules. The GP group consisted of 16 children enrolled in local community special education classrooms serving children with a variety of disabilities. The students received 15 hours per week of intervention with an emphasis on language exposure, play activities, and sensory experiences. Thirteen of the 16 children in the GP group received individual or small group speech therapy. Consistent with the Eikeseth et al. (2002) study, the results demonstrated by Howard et al. (2005) showed that although all three groups were statistically similar at intake, at follow-up,
results demonstrated that the IBT group achieved higher mean scores in all domains when compared to the AP and GP groups. Moreover, there was no statistical significant difference between the AP group and the GP group.

**Intensity of IBI.** To further establish the strength of IBI, Smith, Eikeseth, Klevstrand, and Lovaas (1997) investigated the relationship between intensity of treatment (e.g., number of hours of treatment) and student outcomes. The participants were children diagnosed with mental retardation and pervasive developmental disorder who were 46 months or younger with an IQ of less than 35. The experimental group consisted of 11 boys and the comparison group consisted of 10 boys and two girls. Both groups received similar treatment, which was also based on the manual *Teaching Developmentally Disabled Children: The ME Book* (Lovaas et al., 1981). Children in the experimental group received 30 hours per week of instruction and the comparison group received 10 hours per week of instruction. The results indicated that the children in both groups made gains; however, children in the experimental group who received more hours of treatment had greater gains in IQ (i.e., experimental group increased from mean 28 to mean 36 and the control group decreased from mean 27 to mean 24) and speech acquisition than the children who received fewer hours of treatment. The significant outcomes in this study provide support for using 30 or more clock hours of IBI per week to teach students with autism.

**IBI summary.** Research has found that students with autism can make gains across all areas of functioning (Ferster & DeMeyer, 1962; Ledford, Gast, Luscre, & Ayres, 2008; Lovaas, 1987; Rincover & Koegel, 1977; Taylor & Hock, 2008).
Specifically, the IBI model has been shown to be successful with students with autism (Cohen et al., 2006; Lovaas, 1987; Sallows & Graupner, 2005; Smith et al., 2000); however, students with autism have fewer gains when taught using more traditional methods (Eikeseth et al., 2002; Howard et al., 2005). The IBI program is designed to address the individualized and comprehensive needs of each student (S. T. Anderson et al., 1996). The intense one-to-one format, which is characteristic of the initial stages of an IBI program, provides a student with frequent opportunities to demonstrate skills resulting in positive educational outcomes (Cohen et al., 2006; Lovaas, 1987; Sallows & Graupner, 2005) and increased rates of acquisition (Eikeseth et al., 2002). For example, Eikeseth and colleagues found that when IBI was implemented with students with autism 48% of students who participated in their study demonstrated “rapid learning.” In addition to increased opportunities to respond, characteristics of students with autism that make learning difficult (e.g., low attention, lack of motivation, interfering behavior) can be addressed through IBI, by systematically teaching students skills such as attending, responding, and imitating, to name a few (Taylor & Hoch, 2008). The detailed development of an IBI program from environment to precise delivery of discrete trials makes it an intervention that meets the educational needs of a student with autism.

Though researchers have recognized the need for students with autism to be educated in the regular classroom by conducting studies focused on school-based programs (Eikeseth et al., 2002; Howard et al., 2005; Taubman et al., 2001), research studies using IBI have been conducted most often within programs that are initially home-based (Cohen et al., 2006; Lovaas, 1987; Sallows & Graupner, 2005; Smith et al.,
1997). With the increase in prevalence of children with autism (Kogan et al., 2009) it is difficult, if not impossible, for school districts to maintain a one-to-one teaching scenario that is present in the home-based program for every student with autism (Reid & Favell, 1984). Identifying effective, evidence-based instructional methods that are systematic and explicit is critical to educating students with autism. The following sections describe the process for identifying evidence-based practices.

**Evidence-Based Practice**

Although ABA research dates back to at least 1968 with the first publication of the *Journal of Applied Behavior Analysis*, an established standardized criteria for identifying evidence-based practices (EBPs; e.g., practices which have demonstrated effectiveness in the literature) has not been identified. As mentioned previously, Baer et al. (1968) offered criteria for behavior analysis that guides researchers to include important aspects while investigating treatment procedures. However, the criteria in this seminal article, while important, lack specificity in which to guide researchers in developing rigorous research. The following sections outline the progress which has been made in identifying EBPs for students with autism.

**What Works Clearinghouse.** Though a standardized method for identifying EBP has not been formally adopted, The U.S. Department of Education’s Institute of Education Sciences developed The What Works Clearinghouse (WWC) in 2002 to rate educational strategies to assist policy makers and educators in choosing quality educational programs. The process for identifying practices as evidence-based includes a multi-step system of first evaluating, individual studies and then the entire collection of
studies regarding a specific practice that meet scientific rigor to determine whether the practice can be deemed evidence-based. The WWC determines if the practice: (a) meets evidence, (b) meets evidence with reservations, or (c) does not meet evidence.

To determine the quality of the research base, individual research reports presented in peer-review journals are then screened for the following components: (a) intervention fidelity; (b) outcome measures; (c) the extent to which relevant people, settings, and measure timings are included in the study; (d) the extent to which the study allowed for testing of the intervention's effect within subgroups; (e) statistical analysis; and (f) statistical reporting. After evaluating each study regarding a practice, the WWC rates the group of articles based on quality with the following ratings: (a) Positive Effects: strong evidence of a positive effect with no overriding contrary evidence; (b) Potentially Positive Effects: evidence of a positive effect with no overriding contrary evidence; (c) Mixed Effects: evidence of inconsistent effects; (d) No Discernible Effects: no affirmative evidence of effects; (e) Potentially Negative Effects: evidence of a negative effect with no overriding contrary evidence; and (f) Negative Effects: strong evidence of a negative effect with no overriding contrary evidence. All research that has been reviewed is documented and listed on the WWC website (http://ies.ed.gov/ncee/wwc).

**Exclusion of autism.** Though the WWC provides a process for accessing EBPs, a large proportion of research for children with autism is excluded for review by not including single-subject designs—the most frequent types of research designs used in autism research—in the review process (Simpson, 2005). Single-subject research designs
are those in which results of an active intervention are measured over time after a period of establishing baseline levels of performance through frequently measured dependent variables. The individual (or groups of individuals treated as one subject) serve as his or her own control (Kazdin, 1982). As of December 2009 the WWC review committee did recognize single-subject research designs as appropriate designs for determining effective strategies (along with randomized controlled trials, quasi-experimental, and regression discontinuity). However, the committee was still in the process of developing a protocol for reviewing quality indicators or quality standards for studies that used single-subject research methods (What Works Clearinghouse, 2008). Identifying EBP for students with autism requires an evaluative method for reviewing single-subject design research.

Along with planning for an increased number of students with autism attending schools because of the increase in educational prevalence, schools have to adhere to national policy, which calls for the use of EBPs to teach all children (Yell, Drasgow, & Lowrey, 2005). Identifying and adopting EBPs has been challenging for school districts (NRC, 2001; Simpson, 2005) and general education teachers are expected to teach students with autism (see Table 4) but have little to no training in how to do so (NRC, 2001; Office of Special Education Programs, 2007b). Though numerous research studies have been conducted that provide evidence that behavioral treatments for children with autism are valid, procedures for identifying those treatments as evidence-based are still being established.

**National Research Council.** Another national organization, the National Research Council (NRC; 2001), has also made impressive strides toward identifying
Table 4

*Students Ages 6 Through 21 Who Are Served Under IDEA Part B, by Educational Environment in the United States as Reported by OSEP Through the Data Accountability Center*

<table>
<thead>
<tr>
<th>Placement</th>
<th>2004</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;80% in regular education</td>
<td>3,130,759</td>
<td>3,343,859</td>
</tr>
<tr>
<td>21 to 60% in regular education</td>
<td>1,599,356</td>
<td>1,318,042</td>
</tr>
<tr>
<td>&lt;20% in regular education</td>
<td>1,061,943</td>
<td>905,464</td>
</tr>
</tbody>
</table>

methods for categorizing the effectiveness of practices for students with autism (i.e., by reviewing literature, assessing the quality of research, determining whether sufficient, quality research points to effectiveness of particular practices). The NRC formed the Committee on Educational Interventions for Children with Autism in an effort to integrate literature on policy, theory, and science (NRC, 2001). The committee sought to identify effective preschool and school intervention programs for children with autism from birth to age eight along with specific conditions for delivering the interventions.

During their process, the NRC (2001) conducted a literature search of current treatments reported for children with autism in an effort to obtain an exemplar sample of program options. The committee reviewed journals such as *Infants and Young Children, School Psychology Review*, and *The Journal of the Association for Persons with Severe Handicaps* and took a frequency count for the intervention models. The search identified and invited model programs and requested information from each program director.
Program descriptions and, provided peer-reviewed outcome studies were presented for the committee to review. At least 7 of the 10 reviewed models demonstrated the use of behavioral approaches or were based on strategies of ABA.

After reviewing interventions, the committee found a general pattern of criteria to make recommendations for effective programming. The pattern included a strong recommendation for early treatment and direct instruction with active participation and intensive programming for five days per week, with systematic teaching opportunities (NRC, 2001). Individualized goals should be addressed through one-to-one teaching, or teaching in very small groups. The committee further recommended children with autism begin services as soon as they are diagnosed. Services should include year-round programming for a minimum of 25 hours per week spent working on objectives in a systematically planned, developmentally appropriate program. Specifically, children with autism should receive a sufficient amount of instruction to meet individualized objectives. Objectives should highlight areas of functional and spontaneous communication, instructions delivered across settings, development in cognitive and play skills, and approaches that intervene with behavior using proactive interventions (NRC, 2001).

**Council for Exceptional Children contributions to evidence-based practice.**

Inherently, studies conducted on behavioral interventions using single-subject designs provide a systematic method for demonstrating experimental control. Even though the What Works Clearinghouse has not determined quality indicators or evidence criteria for studies that use single-subject designs, the special education professional organization,
the Council for Exceptional Children (CEC), has recently developed specific criteria for developing and producing outcome studies that meet rigorous research standards (Horner et al., 2005) and recognizes single-subject research designs as valid methods for determining practice effectiveness.

**Standards for single-subject design research.** To further assist the establishment of criteria for EBPs, several researchers have proposed quality indicators for evaluating single-subject design research studies that will contribute to the establishment of EBPs (Chard, Ketterlin-Geller, Baker, Doabler, & Apichatabutra, 2009; Horner et al., 2005). Because identifying EBPs requires replication of findings that generalize to other participants and because single-subject designs are commonly used to assess the effectiveness of interventions for students with autism, it is important that researchers adhere to the proposed standards to allow for systematic replication.

**Replication of single-subject research.** To continue to advance the field of ABA, specifically IBI treatments for students with autism, it is important to replicate research. Generalizing the findings across studies strengthens the validity of the treatment. As described earlier, the process for identifying evidence-based practices involves reviewing a collection of studies conducted on one specific method (What Works Clearinghouse, 2008). To effectively produce collections of studies, Horner et al. (2005) proposed that single-subject research design studies must include specific features described in detail to allow for replication. The authors identified seven quality indicators necessary to be included in a single-subject research design study: (a) description of participant and setting, (b) description of dependent variable, (c)
description of the independent variable, (d) description of the baseline conditions, (e) demonstration of experimental control, (f) demonstration of external validity, and (g) measures of social validity. The purpose of replication is to establish generalized findings across studies. Each indicator must be described with enough detail that another research could replicate the procedures. Because single-subject designs evaluate within subject outcomes as opposed to comparison data from control groups (e.g., designs that have large comparison groups in which the findings can be generalized to the population), it is important that researchers report on the design of the study with enough detail that allows for replication (see Table 5).

Horner and colleagues further recommended that the collective body of research studies must include (a) a minimum of five single-subject studies that meet minimally acceptable methodological criteria and document experimental control published in peer-reviewed journals, (b) being conducted by at least three different researchers in at least three different geographical locations, and (c) collectively a total of at least 20 participants (Horner et al., 2005). Researchers have contributed to the literature by applying the quality indicators to current literature in an attempt to determine first the quality of published studies and to assess the practicality of the quality indicators as measures of EBP (Chard et al., 2009; Tankersley, Cook, & Cook, 2008). Because a large majority of research that addresses interventions for students with autism use single-subject designs, it is important that future researchers consider the quality indicators when developing, conducting, and replicating research. The current study sought to
Table 5

*Single-Subject Research Quality Indicators*

<table>
<thead>
<tr>
<th>Participants and Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorough description of participant (e.g., age, diagnosis, present skill levels)</td>
</tr>
<tr>
<td>Selection process</td>
</tr>
<tr>
<td>Precise descriptions of the setting (e.g., classroom features)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operationally defined behaviors</td>
</tr>
<tr>
<td>Description of measurement procedures that are quantifiable</td>
</tr>
<tr>
<td>Frequent measures of behavior</td>
</tr>
<tr>
<td>Interobserver agreement measures which meet minimal standards—IOA=80%; Kappa=60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedures are described with enough information to allow for replication</td>
</tr>
<tr>
<td>Variable are systematically manipulated</td>
</tr>
<tr>
<td>Treatment fidelity is measured</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeated measures of the dependent variables</td>
</tr>
<tr>
<td>Thorough description of baseline procedures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Experimental Control/Internal Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration of at least three functional relationships</td>
</tr>
<tr>
<td>Description of techniques used to reduce threats to internal validity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effects are replicated</td>
</tr>
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<table>
<thead>
<tr>
<th>Social Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish the significance of the dependent variable</td>
</tr>
<tr>
<td>Establish practicality and cost-effectiveness</td>
</tr>
<tr>
<td>Determine if the independent variable will maintain under natural circumstances</td>
</tr>
</tbody>
</table>

*Note.* Adapted and modified from Horner et al. (2005)
contribute to EBP by systematically replicating the findings by Taubman et al. (2001) and to describe the procedures in such detail to allow others to replicate the findings.

**Small Group Instruction**

Although numerous investigations have demonstrated the effectiveness of discrete trial teaching in one-to-one settings (e.g., Lovaas, 1987; McEachin et al., 1993), there is a growing body of research that supports the inclusion of students with autism in group instructional settings (Kamps et al., 1992; Ledford et al., 2008; Rincover & Koegel, 1977; Taubman et al., 2001; Wolery & Gast, 1990). Small group instruction typically consists of at least two and no more than 10 students who are arranged in close proximity (Collins, Gast, Ault, & Wolery, 1990). Including students with autism in group instructional settings has been shown to provide opportunities for learning skills that are not available in one-to-one settings (e.g., observational learning, incidental learning; Collins et al., 1990; Ledford et al., 2008; Taubman et al., 2001). Furthermore, research supports that working in multiple instructional settings can be beneficial for students with autism as it promotes generalization.

Yet, teachers do not have to choose group instruction at the expense of individualized time. Both individual and group instruction can be accommodated in the classroom. For example, the day can be structured to include time for students to practice skills in group instructional settings that were learned in one-to-one instructional settings (Rincover & Koegel, 1977); conversely, students can practice skills they struggle with in group, during one-to-one instructional settings (Collins et al., 1990). A procedure that supports using both formats is referred to as tandem instruction, a practice in which the
teacher begins teaching in a one-to-one setting and systematically increases the number of students present during instruction (Collins et al., 1990). Regardless of the number of students included in the instructional format (e.g., one-to-one small group), numerous studies have been conducted testing variations on systematic instruction within those configurations (e.g., discrete trials, constant time delay, prompt fading, and variations in student response procedures; e.g., Handleman & Harris, 1983; Soluaga et al., 2008; Taubman et al., 2001).

Given the need to identify instructional methods for students with autism taught in inclusive educational settings, and given the effectiveness with which discrete trial instruction through IBI training have been shown, it seems possible that group discrete trial teaching has the potential to be a useful format for instructing students with autism. Because of the importance of replication, the following section describes the process of reviewing the literature for group discrete trial teaching, followed by an overview of specific studies that used this instructional format.

**Descriptions found in the literature.** For the current study, the researcher was interested in determining whether the effective use of group discrete trials had been systematically replicated in the literature. A review of extant literature was undertaken to determine what literature existed related to use of discrete trial training provided in a group setting for students with autism and only one study was found (Taubman et al., 2001). The search was broadened to include research that made use of one or more components associated with these three criteria (i.e., autism, discrete trials, group instruction). Information was available on small group instruction which used discrete
trial procedures; however, the purpose of the studies and the descriptions in the procedures sections focused on time delay procedures (Chiara et al., 1995; Ledford et al., 2008; McDonnell et al., 2006). Additional studies were found that used keywords to describe the instruction such as *small-group massed-trial, individually-distributed-trial instruction* (Chiara et al., 1995), *small group instruction* (McDonnell et al., 2006), *couplet instruction* (Handleman & Harris, 1983), and *individualized instruction to a group* (Rincover & Koegel, 1977). Those studies which included discrete instruction, defined response requirements, and explicit feedback with students with autism are reviewed below.

**Group Discrete Trial Teaching**

In general students with autism seem to demonstrate optimal skill acquisition when group instructional time is structured and consistent (Quill, Gurry, & Larkin, 1989), and the students have the opportunity to actively respond to instruction and receive feedback based on the responding (Collins et al., 1990; Taubman et al., 2001). Group discrete trial teaching embodies these features (Leaf et al., 2008; Taubman et al., 2001).

**Structured lessons.** Although group discrete trial teaching is usually structured and consistent, the teacher does have some flexibility in the way the lesson is presented. The teacher can choose the order of presentation, such as a predictable manner in which the students are asked the questions in the same order each session, or a random order in which the students are unaware of when they will need to respond (Collins et al., 1990). The teacher also has the option to vary the method of delivering instruction (i.e., choral, sequential—individual, overlapping; see Taubman et al., 2001). Multiple modes for
delivery allow the teacher flexibility to implement evidence-based instruction based on the students’ needs.

**Modes of delivery.** Teachers can use different modes of delivering instruction through discrete trial teaching. First, in sequential instruction, each student responds before the teacher delivers the instruction to the next student. While the teacher is directly teaching one student all of the other students are waiting (Collins et al., 1990; Taubman et al., 2001). Second, in choral responding the teacher delivers instruction with the expectation that all the students will respond in unison (Collins et al., 1990; Taubman et al., 2001). Choral responding increases the number of opportunities to respond for all the students, while sequential allows for individual testing for acquisition (Collins et al., 1990). Third, overlapping responding is described as a fluid process that can be modified to meet the particular needs of the group. In general, the teacher begins instruction with one student and as the student is in the process of responding, the teacher begins a trial with a second student before closing the trial with the initial student (Taubman et al., 2001). Some research suggests students with autism may stop responding or exhibit off task behaviors during sequential instruction while waiting for other students to respond (Koegel & Rincover, 1974). To offset this potential, combining choral and sequential response based instruction has been recommended (Kamps et al., 1992; Quill et al., 1989; Taubman et al., 2001). All three methods offer multiple opportunities for the students to respond and are effective methods for delivering discrete trial teaching with a group (Taubman et al., 2001).
**Consistent feedback.** Descriptions of discrete trial teaching offered earlier in the chapter address the systematic method of presenting each discrete trial in rapid succession. The format of the discrete trial (i.e., instruction, response, consequence) remains the same during group discrete trial teaching. Each student is given consistent feedback for all instructional opportunities. In addition, students receive consistent, systematic reinforcement for correct responding correctly and receive informational feedback (e.g., “no,” “good try”) for responding incorrectly. Importantly, when the students do receive corrective feedback, teachers also include prompts to assist the student in responding correctly. During group instruction the students are able to frequently practice skills with corrective feedback. More research is needed to evaluate the effects of consistent feedback provided in group instructional settings on skill acquisition and observational learning.

**Group discrete trial research.** As mentioned previously, Taubman et al. (2001) conducted a study in which they systematically evaluated the use of group discrete trial teaching with a group of students with developmental delays, including autism, using a single-subject research design. The group consisted of eight students between the ages of three and five. Group discrete trial teaching was described in terms of the instruction, response requirement, and consequence and the form of delivery (e.g., choral, sequential, or overlapping). Group instruction was conducted by a special education teacher during regularly-scheduled group time in their special education preschool classroom. The dependent variable was the percent of correct responses to trials conducted for three different instructional tasks: (a) imitation, (b) pre-mathematics, and (c) language. A
multiple-baseline design across tasks was used to assess the effectiveness of the group discrete trial method. Data were taken on each student’s responses and then averaged to obtain one score for the group per session.

Group discrete trial teaching served as the independent variable. Each instructional method followed the traditional discrete trial format including (a) an instruction or S, (b) a response requirement, and (c) a consequence. During an instructional session, the three methods of delivery, choral, sequential, and overlapping, were used randomly across all three instructional tasks. Prompts and brief inter-trial intervals (i.e., a three second pause between trials) were also used to ensure success and maintain a consistent pace.

Using a multiple-baseline design across tasks, the researchers demonstrated that group discrete trials were an effective method for teaching targeted skills to the students with autism (Taubman et al., 2001). Stability of baseline conditions prior to intervention demonstrated experimental control and a functional relationship between skills learned as a result of group discrete trials. Contributing to the ample research on discrete trials utilized in a one-to-one fashion, the Taubman et al. (2001) study presents evidence that the structured, fast-paced, predictable nature of the intervention can be adapted to group instruction. Furthermore, combining the findings from discrete trial teaching research (e.g., Lovaas, 1987; Smith et al., 1997) with group instruction research (e.g., Chiara et al., 1995; Kamps et al., 1992; Rincover & Koegel, 1977) allows teachers opportunities to provide instruction to more students at one time (Collins et al., 1990) and provides students with increased opportunities to learn in group settings.
Procedural Integrity

In addition to evaluating the effectiveness of group discrete trials with students with autism, it is essential to determine if the procedures are practical for teachers to implement correctly. Numerous studies have been conducted to determine the procedural integrity of behavioral interventions (e.g., discrete trials, time-delay, naturalistic teaching, preference assessments; Bolton & Mayer, 2008; Grow et al., 2009; Lerman, Vorndran, Addison, & Kuhn, 2004; McBride & Schwartz, 2003). However, procedural integrity measures are not consistently presented in the literature for group instruction (Handleman & Harris, 1983; Rincover & Koegel, 1977; Taubman et al., 2001). Some research on group instruction has shown that teachers and paraprofessionals can be taught to implement procedures with integrity (Chiara et al., 1995; Ledford et al., 2008; McDonnell et al., 2006). Important aspects of procedural integrity include measuring the teacher’s ability to follow the procedures consistently, assessing student performance as a result of the teacher’s behavior, and providing ongoing feedback regarding teacher performance (Lerman et al., 2004). High degrees of treatment integrity suggest that the procedures are not only effective but practical. More research is needed that measures a teacher’s ability to follow group discrete trial teaching procedures with integrity while collecting data.

Complexity of the procedures. Unfortunately, the characteristics that make discrete trial teaching an appropriate teaching model for students with autism also make it difficult to apply in inclusion settings (e.g., regular education classrooms, small group instruction; Lerman et al., 2004). Integrating students with autism into whole group
instruction settings found in integrated classrooms poses several challenges for teachers. First, teachers may not understand how to systematically modify lessons for students with autism (Lerman et al., 2004). Second, teachers may be overwhelmed by the number of skills that require direct teaching. Third, teachers who know of behavioral strategies, such as discrete trial teaching, may not know how to implement the procedures according to the prescribed protocol (i.e., established procedures recognized in the literature; McBride & Schwartz, 2003). And most important, fourth, even if a teacher is able to implement instruction effectively little is known about the teacher’s ability to also manage collecting data while instructing. Though interventions for teaching students with autism in group settings have demonstrated effectiveness, little research has been conducted to determine if those interventions are feasible for teachers to carry out. Therefore, it is important to analyze the feasibility of group discrete trial teaching in terms of the teacher’s ability to follow the procedures with integrity.

**Required skills.** Research shows that a teacher’s ability to have a high degree of treatment integrity in implementing behavioral intervention depends largely on the type and intensity of training received (Lerman et al., 2004; McBride & Schwartz, 2003). Therefore, it is important to determine how much training is necessary for teachers and paraprofessionals to use interventions with the same level of effectiveness as demonstrated in the literature. First, Lerman and colleagues (2004) found that the complexity of behavioral interventions affected the treatment integrity scores in relation to the level of training provided to the teacher. For example, teachers were able to perform preference assessments—a procedure with few steps—with a high degree of
integrity after a lecture that included handouts. They were not able to implement direct teaching—a procedure with many steps—with more than 80% integrity following a similar lecture format. After assessing integrity of implementation following the lecture and handout format, Lerman and colleagues were able to demonstrate that advanced training, which included opportunities to perform the skills and receive feedback, resulted in high degrees of treatment integrity. Second, research further suggests that practice of behavioral interventions influences treatment integrity (Bolton & Mayer, 2008; Lerman et al., 2004). Several studies have demonstrated that after teachers were taught behavioral interventions, given feedback based on their abilities, and then began using the skills in-situ, performance scores increased over time (e.g., increased from 50% in baseline to 70% after training and increased to 90% after implementing the procedure for several sessions; Bolton & Mayer, 2008).

Knowing the complexity of group instruction that is necessary to teach students with autism, and recognizing the level of training needed to implement behavior interventions, it is important to analyze the integrity in which teachers can implement group discrete trial teaching in the classroom. Teachers need to be able to have a high degree of treatment integrity in their instructional practices because when teachers do not implement procedures with integrity student learning may be impacted (Grow et al., 2009). Because addressing the complex needs of students with autism often requires a teacher who is well-versed in behavioral strategies and knowledgeable about the learning challenges faced by these students (Lerman et al., 2004) it is important to assess how much training is necessary to effectively implement group discrete trial teaching.
**Student Benefits**

Group discrete trial teaching offers students an opportunity to actively participate and learn in a group setting (Taubman et al., 2001). The consistent format of each discrete trial provides students with clear behavioral expectations that are easily transferred from a structured one-to-one setting (Smith, 2001). In addition to acquiring new skills that are typically learned in one-to-one, the structured direct teaching format provides observational opportunities for teachers to evaluate such as turn taking, and other group behaviors such as hand raising (Taubman et al., 2001, Wolery, Ault, Gast, Doyle, & Griffen, 1991). Additionally, the instructional setting more closely matches the natural environment, which improves generalization effects (Soluaga et al., 2008; Taubman et al., 2001).

**Skill attainment.** Extensive research demonstrates that students with autism can learn skills across all domains in a one-to-one setting (e.g., Howard et al., 2005; Lovaas, 1987). However, natural settings are often not set up to support the learning challenges faced by students with autism (e.g., distractions, expectations for observational learning and sustained attention). Group discrete trial teaching can be conducted in classrooms and provides students with autism, key discrete trial learning components that meet their learning needs. Increasing the teacher’s use of these strategies during group instruction provides students with increased opportunities to learn while participating in instruction with peers (Leaf et al., 2008).

**Observational learning.** In addition to learning new skills that are directly taught, group discrete trial teaching offers learning trials that are repetitive and consistent,
allowing other students increased opportunities to learn, through observation, information directly taught to their peers. Because observational learning tends to be difficult for students with autism (Ledford et al., 2008), the consistent feedback delivered to peers allows the student with autism to repeatedly hear the correct answer delivered repeatedly (Schoen & Ogden, 1995). The structured group format focuses on immediate corrective feedback that increases the likelihood that if observational learning does occur the acquired information will be correct.

**Incidental learning.** In addition to learning skills which are directly taught to other students, group discrete trial teaching provides students with autism access to additional information that is not present when taught one-to-one and that can enhance their opportunities for observational learning. Though it has been established that students with autism do not acquire skills automatically, they can be taught how to acquire information from their environment (e.g., using group discrete trial teaching; Leaf et al., 2008). While sitting in the group, the students have the opportunity to learn incidental information, such as group reinforcement schedules, taking turns, and responding in unison. Additionally, participating in a group allows the student opportunities for social interactions (Leaf et al., 2008).

**Teacher Benefits**

Group discrete trial teaching allows the teacher to easily assess acquisition, maintenance, and generalization of skills with several students at one time. The group format creates an intensive setting for implementation and generalization of
Individualized Education Plan (IEP) goals that has demonstrated promising results for practicality of use by classroom teachers (Taubman et al., 2001).

**Individualized group lessons.** Teachers are able to plan group lessons with imbedded individualized objectives that can be measured and documented because of the discrete behavior being taught (Smith, 2001). Structured delivery of instruction allows the teacher to individualize lessons for each student within the group to meet IEP objectives in a consistent way. For example, the presentation of an instruction based on the acquisition of colors for one student can serve as an observational opportunity for another student, and also serve as the presentation of practice trials for the maintenance and generalization of colors for additional students.

**Data collection.** Teachers are required to collect data on each student’s goals and objectives for the school year according to each student’s IEP. Because students with autism face learning challenges across a variety of skill areas (Kanner, 1943), they may require goals and objectives across skills (e.g., language, self-help, academic, gross motor) resulting in IEPs with multiple goals and objectives. Group discrete trial teaching increases the teacher’s opportunities to collect data on individual performance (Taubman et al., 2001). The fast-paced lessons utilized in group discrete trial teaching allow teachers to target more IEP goals in a short time (e.g., 20 minutes) for all students (Leaf et al., 2008), providing multiple opportunities for data collection. However, more research is necessary to determine if data collection is feasible while conducting the group instruction.
Intensity of instruction. In addition to providing the teacher with data collection opportunities, the active responding component increases active student responding. The teacher spends more time actively teaching and assessing the students, which follows the NRC recommendation of intensity (2001). Additionally, the teacher is able to work on more goals with more students than when working with each student individually (Reid & Favell, 1984).

Generalization. As mentioned in the descriptions of IBI, generalization is among the important considerations when choosing the setting for intervention (NRC, 2001). Specific consideration is given to the way in which students acquire information and then subsequently use the information outside of the instructional setting. Again, because children with autism lack the ability to learn from the environment (Spence et al., 2004) and have difficulty generalizing learned information to new situations teachers need to design instruction that fosters generalization. Programming and planning for generalization can be difficult for teachers within the time constraints of the classroom (e.g., teaching skills one-to-one, varying the location, varying the stimuli). Evidence supports that discrete trial teaching, used during group instruction, provides teachers with a method for generalizing skills learned in one-to-one instructional settings (Kamps et al., 1992; Rincover & Koegel, 1977). Skills taught using very specific language and materials can be practiced in the natural environment with new materials, naturalized language, and with peers (Cowan & Allen, 2007; Leaf et al., 2008). Increased opportunities for student responding within small group instruction allows the teacher more time to address the same goals repetitively. Increased repetition results in increased
opportunities for learning, increased rates of acquisition, and increased time presenting
generalized stimuli and generalized instruction.

Summary

Many factors support implementation of IBI, specifically group discrete trial
teaching, in the classroom with evidence to support benefits for the student and the
teacher. As recommended by the NRC (2001), students with autism require systematic
teaching with careful monitoring to assess the need for change in instructional goals and
procedures. This means schools must have well-trained teachers who are prepared to
teach students with autism. Teachers with knowledge of not only behavioral
interventions but specifics on the characteristics of autism are imperative to a student’s
success. Moreover, it is essential that teachers have access to EBP that have
demonstrated practicality and are practical to use with students in group settings, which
requires more research which replicates the findings for group discrete trial teaching.

Purpose

Group discrete trial teaching has been shown to be effective in teaching students
with autism in a group setting; however, more research is needed to understand the
effectiveness of the instruction with students of varying levels and abilities. Additionally,
it is important to determine if the method is feasible for teachers to implement with
integrity while collecting data. A teacher’s ability to implement the procedures and
collect data will determine future use of the intervention. The present study sought to
assess the effectiveness of group discrete trial teaching for students with autism in the
classroom. The study was designed to systematically replicate the findings of Taubman et al. (2001) and answer the following questions.

**Research Questions**

1. Will group discrete trial teaching be an effective method for instructing students with autism?
2. Will a teacher be able to implement group discrete trial teaching with integrity?
3. Will students indirectly learn information that is targeted for other students when instructed using discrete trial teaching?

**Research Design**

The current study employed a single-subject design method to demonstrate the effectiveness of group discrete trial teaching. A single-subject research design method was chosen instead of between-group research design because it allowed for establishing a relationship between dependent and independent variables within subjects and permitted an individual focus that makes the designs particularly appropriate for evaluating diverse populations, such as students with autism (Tankersley, McGoey, Dalton, Rumrill, & Balan, 2006). Though students with autism, by diagnostic criteria, share similar characteristics, they present with varied symptomology and ability levels (American Psychiatric Association, 2000; Kanner, 1943), thereby making group research methods difficult to implement and interpret. The single-subject design provides a representation of each subject’s performance while presenting precise measures of variability that can be accounted for quickly (Cooper et al., 2007). The comparison of
one subject’s (i.e., an individual or a group treated as one unit) behavior across multiple phases allows the researcher to make systematic changes in the dependent variable based on the subject’s performance as opposed to averaging large group performance which may not detect individual needs (Tankersley et al., 2006). The current study used the multiple phases of a multiple-baseline research design to compare treatment effects across skills for individuals as opposed to using a comparison group design where changes in group behaviors would be observed (Baer et al., 1968; Cooper et al., 2007).

The multiple-baseline single-subject research design was chosen as opposed to a reversal design (e.g., a design in which the intervention is implemented and then withdrawn) because of learning that was expected to occur as a result of the intervention (Kazdin, 1973). Additionally, the multiple phases of the multiple baseline design allowed the researcher to establish a functional relationship between the intervention and the outcome. The researcher sought to demonstrate that behaviors would remain stable in baseline until intervention was initiated for each skill. Changes in the behavior immediately following the introduction of intervention would establish experimental control. The multiple-baseline design eliminates the need for withdrawing the intervention by replicating the experimental effects across skills, people, or settings (Kazdin, 1982).

**Conclusion**

Single-subject research methods provide a model for demonstrating treatment effectiveness for children with autism in practical settings (Chiara et al., 1995; Horner et al., 2005; Kelley et al., 2003; Ledford et al., 2008; McDonnell et al., 2006; Odom et al.,
2003; Soluaga et al., 2008; Taubman et al., 2001). Numerous literature reviews (Cowan & Allen, 2007; Delprato, 2001; Horner, Carr, Strain, Todd, & Reed, 2002) validate the effects of behavioral interventions with children with autism. Though validated as effective, there remains an urgent need to prepare teachers to use behavioral interventions when teaching students with autism in inclusion settings (Lerman et al., 2004).

Therefore, it is imperative that research be conducted which supports the practical use of behavioral interventions in the classroom. Group discrete trial teaching has the potential to provide teachers and schools with an EBP for teaching students with autism; however, additional research is needed to support effective use of discrete trials in a group format. Chapter 2 of this paper provides a detailed description of the methods utilized to systematically replicate the procedures used by Taubman et al. (2001) in an attempt to provide the field of ABA data to support group discrete trials as an EBP.
CHAPTER II

METHOD

Participants

The study focused on five kindergarten students in a special education resource classroom in a rural public school district. In addition to the five participants, there were five students enrolled in the classroom—one preschool student and four first grade students—who were also included in general education classes for portions of the day. The classroom of students was selected based on the enrollment of the combination of students diagnosed on the autism spectrum and diagnosed with multiple disabilities. All of the students who participated in the study were diagnosed with autism except for two students who did not have a formal autism diagnosis but were included because they were students in the classroom and presented with characteristics the school viewed as consistent with autism (see Table 6). The students with autism were selected as participants based on their enrollment in the special education classroom, their current participation in small group instruction in the target classroom, and their diagnosis of autism. The other two students were chosen based on their regular inclusion in small group instruction with the three students with autism. All five of the kindergarten students in the study were included in regular kindergarten classes for at least 50% of their day and attended the special education classroom for small group instruction. They had minimal exposure to structured ABA procedures such as discrete trials or choral responding. Based on present level reports in each students’ individualized education
Table 6

*Student Characteristics*

<table>
<thead>
<tr>
<th>Student</th>
<th>Age</th>
<th>IEP Determination of Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mason</td>
<td>6.3</td>
<td>Other Health Impairments</td>
</tr>
<tr>
<td>Luke</td>
<td>7.2</td>
<td>Autism</td>
</tr>
<tr>
<td>Robby</td>
<td>7.4</td>
<td>Autism</td>
</tr>
<tr>
<td>Sarah</td>
<td>5.9</td>
<td>Autism</td>
</tr>
<tr>
<td>Alex</td>
<td>5.10</td>
<td>Multiple Disabilities</td>
</tr>
</tbody>
</table>

plan all the students were able to communicate verbally and were able to exhibit
classroom behaviors such as waiting, sitting in a chair, hand-raising, and following
simple instructions. None of the students required behavior intervention plans (BIP) as a
part of their individualized education plan.

Four paraprofessionals were assigned to the special education classroom but they
were not assigned to individual students. Typically, two students were paired with one
paraprofessional during inclusion periods (e.g., one paraprofessional would assist two
second grade students who were included in the same regular education classroom).
Instructional assistants provided assistance in modifying academic work, prompting the
student to follow the teacher’s directions, and facilitating social interactions.

The classroom teacher was a special education teacher licensed in the state of
Ohio to teach students with severe multiple disabilities. The teacher had been teaching
kindergarteners with special needs in the school district for 10 years and had received prior in-service training on basic behavioral strategies. Two of the paraprofessionals regularly assigned to the kindergarten students in the classroom also participated in the study. Both paraprofessionals had been working with the teacher for at least three years. To avoid disruption in data collection because of absences, both paraprofessionals were trained to be data collectors throughout the study and to be instructors during generalization.

Setting

The study was conducted in a special education resource classroom in a rural public school district. All phases took place in the students’ natural environment, which was a large classroom consisting of five main areas: (a) a large table for group work; (b) a play area with mats, a play kitchen, games, a swing, and pretend play materials (e.g., baby dolls, dress-up clothes); (c) a circle time area that included a rug, dry erase technical board (e.g., computerized board with a touch screen), and a calendar on another dry erase board; (d) a computer station with four computers sectioned off by a dry erase board; and (e) a teacher area that included a desk, computer, and cabinets. The teacher conducted the intervention during regularly scheduled kindergarten group lessons referred to as circle time. When the students arrived in the special education classroom, they were instructed to prepare for circle time by getting a chair and bringing it to the rug. Three adults were present during circle time instruction: (a) the teacher sat in a chair approximately five feet in front of the students who were seated in a row, (b) a paraprofessional stood approximately eight feet in front of the students at the dry erase
board to mark tallies, and (c) the researcher or the other paraprofessional sat
approximately five feet in front of the students, but off to the side of the rug to collect
data. During circle time, the participants were the only students present in the classroom
during the majority of sessions. On occasion, a peer would be brought to the classroom
for individual instruction, but this only occurred three times during the course of the
study, and when it did occur, the peer did not participate in the circle time activities.

**Dependent Variables**

The students attended circle time activities for approximately 20 minutes, four
afternoons per week. During circle time, the students participated in activities from a
range of instructional areas such as math (e.g., counting the days from a calendar),
reading (e.g., rhyming), and language (e.g., vocabulary). Therefore, the dependent
variable was the performance on six instructional skills grouped in sets of two: (a) Set
1—Holiday and Math (time and money), (b) Set 2—Season and Individual target, and (c)
Set 3—Addition and Number targets. The specific instructional skills varied for each
student, but the dependent variable was the same for all students (see Table 7). In
addition, to measure if students were learning through observation, two students were
chosen to answer three probe questions that were targeted for other students. The
dependent variable was only measured during circle time.

The teacher chose three areas of focus for targeted instructional skills: language,
math, and personal information. Skills within these areas were assigned based on
students’ initial lack of accuracy on a pre-assessment conducted by the teacher. The
teacher conducted the assessment during individual sessions with each student. Six
Table 7

*Skills Targeted Per Student*

<table>
<thead>
<tr>
<th>Skill</th>
<th>Mason</th>
<th>Luke</th>
<th>Robby</th>
<th>Sarah</th>
<th>Alex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skill 1: Holiday</strong></td>
<td>What is (Halloween, 4th of July, Valentines Day)? A holiday</td>
<td>Same for all students</td>
<td>Same for all students</td>
<td>Same for all students</td>
<td>Same for all students</td>
</tr>
<tr>
<td><strong>Skill 2: Math</strong></td>
<td>What is noon? 12 o’clock</td>
<td>How many quarters in a dollar? 4</td>
<td>What time is it? 4:30</td>
<td>How many months in a year? 12</td>
<td>Which coin is copper? A penny</td>
</tr>
<tr>
<td>(time and money)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Skill 3: Season</strong></td>
<td>What is (winter, spring, summer, fall)? A season</td>
<td>Same for all students</td>
<td>Same for all students</td>
<td>Same for all students</td>
<td>Same for all students</td>
</tr>
<tr>
<td><strong>Skill 4: Individual Targets</strong></td>
<td>What country do you live in? United States</td>
<td>What rhymes with (g/b/s)/et? let, bet, get</td>
<td>What is your address? 35 W. Juniper Lane</td>
<td>When is your birthday day? April 24th</td>
<td>Tell me a word that starts with “f”. Fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Skill 5: Addition</strong></td>
<td>8+4=12</td>
<td>8+7=15</td>
<td>9+5=14</td>
<td>5+8=13</td>
<td>7+3=10</td>
</tr>
<tr>
<td><strong>Skill 6: Number Targets</strong></td>
<td>Where is the star (teacher points to a star in a row of 8 stars)? 6th</td>
<td>What is a dozen? 12</td>
<td>Tell me a number less then 50.</td>
<td>Tell me a number between 10-15. (10-15)</td>
<td>Put in order (7,8,9)</td>
</tr>
</tbody>
</table>

questions were chosen for each student. During baseline, if a student answered a targeted question correctly, a new question was selected to demonstrate that group discrete trial teaching was effective in teaching unknown information. One question from each set was chosen as a probe question for each of the two probe students.
A predetermined response was selected for each of the questions that required a verbal response. One question required the student to manipulate numbers into numerical order. Verbal responses were scored as follows: (a) a correct response was scored if the student provided the full verbal response, (b) an incorrect response was scored if the student answered with any other response, and (c) a no response was scored if the student did not answer within four seconds of the instruction. The manipulation task was scored as follows: (a) a correct response was scored if the student arranged the numbers in the correct sequence, (b) an incorrect if the student arranged the numbers in an incorrect sequence, or (c) a no response if the student did not respond within four seconds of the instruction. Following are the specific response requirements for all six skills.

1. Set 1—Holiday and Math
   a. Holiday—The targeted skill was a language task in which the students were instructed to chorally identify items in the category of holidays, specifically by identifying the fact that Valentine’s Day, the Fourth of July, and Halloween are all classified as holidays.
   b. Math—This skill was a math concept related to time or money selected for each student. During instruction, the teacher identified each student by name then delivered the individualized math question.

2. Set 2—Season and Individual Targets
   a. Season—This skill was a language task in which the students were instructed to chorally identify items in the category of seasons,
specifically by identify the fact that Winter, Spring, Summer, and Fall are all classified as seasons.

b. Individual Target—These skills involved targets related to personal information for each student. The teacher called each student by name and delivered the individualized question.

3. Set 3—Addition and Number Targets

a. Addition—This skill involved a task in which an addition problem was presented to each student. The student was required to state the single digit sum when presented with an addition flashcard.

b. Number Targets—These skills involved a target in which individualized concepts related to numbers (e.g., ordinal numbers, sequencing) were delivered to each student. The teacher called each student by name and delivered the individualized question. Although four of the five students were asked a number question requiring a verbal response, one student was given a manipulation task, in which he was presented with a board and set of numbers and instructed to put the numbers in a sequence (i.e., 7, 8, 9).

In addition to measuring student acquisition of the six instructional skills, the researcher utilized a probe method to assess if two of the students were learning information that was being taught to the other students during instruction. To assess the acquisition of skills that were not directly taught, the researcher chose two of the participants, Alex and Robby, to answer an additional question per skill set. To select
probe students the teacher asked each student questions that were targeted for the other students. Each of the two probe students were selected because he missed at least one question per skill set that was targeted for another student (see Table 8).

Table 8

Skills Targeted for Each Probe Student

<table>
<thead>
<tr>
<th>Skill</th>
<th>Probe 1 Alex</th>
<th>Probe 2 Robby</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 1: Math (time &amp; money)</td>
<td>What is noon? 12 o’clock</td>
<td>Which coin is copper? A penny</td>
</tr>
<tr>
<td>Set 2: Individual</td>
<td>What rhymes with (g/b/s)et? let, bet, get?</td>
<td>What country do you live in? The United States</td>
</tr>
<tr>
<td>Set 3: Number target</td>
<td>Where is the star (teacher points to a star in a row of 8 stars)? 6th</td>
<td>What is a dozen? 12</td>
</tr>
</tbody>
</table>

Independent Variable

The independent variable was group discrete trial teaching implemented during circle time activities. The components of the approach were replicated from the original study conducted by Taubman et al. (2001) and descriptions from manuals such as Leaf et al. (1999). The discrete trial included: (a) a discriminative stimulus ($S^D$), also referred to as the instruction or question, (b) a prompted trial following an incorrect trial, and (c) a consequence. A two to three second inter-trial interval separated each trial to keep the
pace of the lesson consistent. Each discrete trial component is described in the following sections.

**Instruction**

The instructional phrase was selected based on the individual skill to be targeted. The only language that was used in the trial was that language necessary for the student to understand the question. Minimizing the number of words spoken ensured that the instruction was clear and concise. For example, when presenting an addition fact, the question was “What is (number) plus (number)?” as the teacher held up a card with the equation written on it, as opposed to “Add up these two numbers and tell me what they equal.” Two different methods for delivering instruction were employed: (a) sequential and (b) choral responding, and they are discussed in the following sections.

**Sequential.** The sequential method of instruction allows one student to be targeted at a time, with one student responding before the next student is given an instruction. The teacher would deliver the instruction, wait four seconds for the response, then deliver the informational “no” or a reinforcing consequence (e.g., praise, token, skittle). If the student was incorrect or did not respond, the instruction was repeated and paired with the least intrusive prompt to ensure a correct response (levels of prompting are addressed later with error correction procedures). The prompted trial was then followed by another independent trial, to allow the student an opportunity to attempt an independent response before moving on to the next participant. If the student had difficulty with the prompting strategy or did not obtain a correct response to the prompted trial, the teacher delivered two additional consecutive prompted trials before shifting
instruction to the next participant. The prompting procedure ensured a rapid, consistent pace for the group while giving the individual student an opportunity to practice the skill. This strategy is unlike a one-to-one teaching situation where, ideally, the student would be continuously prompted until a correct, independent trial was achieved before the teacher moved to the next skill or target. The teacher documented the level of prompting on the data sheet to track which prompt she should implement the following day.

**Choral.** The choral responding method allowed all the students to respond to the instruction in unison. The teacher cued the students to respond together with the following statement: “Class, when I snap my fingers I want to hear everyone. Let’s practice,” and then delivered a practice instruction, followed by a snap. The practice trial was only needed during the first three sessions of baseline. Once the practice phase was faded, the teacher would begin the choral trial by saying, “Everyone get ready,” then deliver the instruction followed by a snap. If less than three of the students responded within four seconds, the trial was ended using an informative “no” consequence. The teacher then delivered another trial paired with a verbal prompt (e.g., partial or whole word) to assist specific students who did not respond or who responded incorrectly. The teacher recorded the students’ responses. If all the students responded correctly with the prompting procedure, a third choral trial was delivered without a prompt to ensure at least three of the students were able to demonstrate correct and independent responding. The procedure allowed prompt fading based on student performance—the teacher was able to observe which students were incorrect and deliver the least intrusive prompts for those students. If the prompting procedure was not effective (i.e., with a prompt more then
three students answered incorrectly) two subsequent prompted trials were delivered. The two prompted trials were delivered to ensure the students practiced correct responses as opposed to moving to another skill after an incorrect response. The teacher then delivered the next question in the sequence.

**Prompts**

Prompts were employed to assist the students in producing the correct responses. Students were provided an initial, unassisted trial. If an incorrect response or no response occurred after four seconds, the trial was ended and another trial paired with a prompt was provided. Responses to verbal tasks were prompted using (a) initial sound cues, (b) full verbal models, and (c) textual cues (i.e., the answer was written on a cue card). Responses to receptive tasks were prompted using point cues (i.e., the teacher pointed to the correct answer). Data were taken on the prompting strategies used during each discrete trial to determine the least intrusive prompt to be used on subsequent trials.

The teacher used a system of most-to-least prompting to assist the students in responding correctly. If the first time an instruction was introduced a student or students responded incorrectly, the teacher delivered the most intrusive prompt (e.g., a full verbal prompt). The teacher monitored the students to determine if the prompt yielded success. Based on the students’ response to the prompt the teacher faded the prompt each time it was needed (e.g., a faded prompt sequence in the case in which the response requirement was *a holiday* would be: (a) full verbal—*a holiday*, (b) partial verbal—*a hol*, and (c) initial sound cue—*a h*). The teacher could fluctuate between most-to-least intrusive prompts according to each response. For example, if a student did not respond to a
partial verbal prompt then the teacher would move back to a full-verbal prompt on the next trial.

**Consequence**

A student’s response was coded based on the behavior that occurred following the instruction: (a) a correct response, (b) an incorrect response, or (c) an absence of a response within four seconds. For each type of response, a consequence was administered.

**Correct responding.** During the first four sessions of intervention for skill Set 1, if the student responded correctly, a positive consequence was delivered paired with praise. Starting with Session 8, before each session the teacher asked the students what they wanted to work for from the following list of choices: (a) stickers, (b) candy, (c) cookies, or (d) toys. The students received their choice after each correct response. On Session 10, the teacher began to deliver the reinforcer after all students had the opportunity to answer one question as opposed to after each individual response. Modifying the reinforcer schedule increased the pace of the lesson. On Session 14, the reinforcement system was changed again to a token economy with tally marks delivered as tokens on a continuous schedule of reinforcement for correct responding. The teacher and researcher decided to institute a token economy based on the students’ positive response to continuous reinforcement. Further, the teacher reported that the students had previous experience with tokens. Students did not receive tallies for prompted trials but the teacher did praise the students’ attempts at the correct response (e.g., “Great try!”). Tally marks were made on the dry erase board by the paraprofessional rather than by the
teacher. Having the paraprofessional deliver the tally marks increased the pace of the lesson. At the end of each lesson, the students counted their tally marks and were able to select a backup reinforcer from a bin containing the student’s preselected items. Because reinforcement was being used as a part of group discrete trial teaching and not as an isolated method for increasing behaviors, reinforcers were delivered to all students regardless of the number of tallies earned.

**Incorrect responding.** If the student responded incorrectly or did not respond to the instruction the consequence was an informational *no, try again,* or *good try* delivered by the teacher. The consequence was delivered in a calm voice that varied from a voice used for praise, signaling to the student that the answer provided was incorrect and the trial was over.

**Error Correction Procedures**

If a student responded incorrectly or did not respond within four seconds, the teacher marked an *I* for incorrect or *NR* for a non-response (see Appendix K for a visual description of error correction procedures). Next, the teacher delivered another trial by pairing the instruction with a prompt and marking a *P* on the data sheet. Even though a prompt was delivered to ensure a successful response, when calculating the final percentage of correct responses, a trial that was marked with a *P* was scored as an incorrect trial. Trials were marked as incorrect because the researcher calculated acquisition of skills by evaluating an increase in the percentage of independent correct responding that occurred during unprompted trials. The teacher then delivered another trial, allowing the student to respond independently. If the students responded correctly,
the teacher circled C, delivered a positive consequence (e.g., praise), and transitioned to the next student. If the student responded incorrectly or did not respond to the trial following the prompted trial the teacher circled I or NR and then delivered an additional two prompted trials before moving on to the next student.

At this point in the error correction procedure, instead of continuing to prompt the student until the student responded independently, the researcher established a rule of delivering only two more prompted trials. Typically, when implementing discrete trial teaching the objective is to end on a correct independent trial (Leaf et al., 2008). In one-to-one situations the teacher has the ability to continue with an elaborate prompting sequence until the student responds correctly. The level of prompting necessary to achieve an independent response varies by student and by skill (e.g., to reach independence one student may need two prompted trials whereas another student may need a series of 15 trials with faded prompts). Establishing a rule to limit the number of prompts delivered to an individual student during group instruction, maintained a consistent pace for all the students. The researcher was interested in determining effective strategies for adapting discrete trial teaching, which is proven effective in one-to-one instructional settings (Chiara et al., 1995; Cohen et al., 2006; Lovaas, 1987), to a group instructional setting. In a group setting it is important to keep a consistent pace (Leaf et al., 2008) so that all the students in the group maintain focus, which necessitates rules for adapting prompting strategies and responding requirements.
Data

All sessions were video recorded to assist in accurate and reliable data collection; however, data were taken in-vivo by the teacher, who served as the primary observer. The second data collector varied daily between one of the paraprofessionals or the researcher depending on each person’s daily schedule. The teacher’s data were graphed each day to determine procedures for the following day. Both the teacher and the second data collector had data sheets with a clipboard. The data sheet included the question and answer for each student (see Appendix G). To collect data, the teacher indicated each student’s response per trial by circling (a) C for a correct response, (b) I for an incorrect response, (c) P for a prompted response, and (d) NR (non-response) for the absence of a response. The number of opportunities to respond varied each session based on the students’ responses. For example, all students had the opportunity to answer each question one time. If a student responded incorrectly the trial was ended and a prompted trial was delivered, followed by an independent trial. The error correction procedure resulted in a varied number of trials per student each session. At the end of each session, to determine the group’s percentage of correct responding to each skill, the teacher added the number of correct trials and divided by the total number of trials delivered per skill and then multiplied by 100.

Interobserver Agreement (IOA)

As mentioned previously, the teacher collected the primary data for this study while the researcher and two paraprofessionals rotated as the second data collector. Prior to baseline, the researcher met with the teacher and two paraprofessionals, referred to as
data collectors, and trained them on the instructional procedures using a procedural script and role-play scenarios. The observers were taught that the start of a trial was signaled by the question posed by the teacher, cueing the observer to circle the student’s response with (a) a C if the student responded correctly independently, (b) an I if the student responded incorrectly, (c) a P if the student were prompted, and (d) a NR if the student did not respond. Each data collector had opportunities to practice delivering the instruction to the researcher. Next, the data collectors practiced scoring videos of children responding to tasks during group discrete trial teaching. This was done to ensure that all three data collectors understood the scoring procedures and were able to score accurately. The researcher worked with the data collectors until they were accurately scoring the video. To check for accuracy, the researcher instructed them to score an additional video segment independently. Next, the data collectors viewed and scored in-vivo probe activities, in which the researcher utilized group discrete trial teaching with a group of kindergarten students (Taubman et al., 2001). After each observation session the researcher reviewed the data collectors’ results against the researcher’s coding of the session and provided feedback on response definitions, until the observers reached 85% agreement.

To obtain interobserver agreement (IOA) during the study, the researcher or one paraprofessional scored 89% of sessions (see Table 9). At the end of each session the teacher and the data collector scored her respective data by counting the number of correct trials and dividing by the total number of trials (correct + incorrect + prompted + no response; and multiplying by 100) to arrive at a percent correct for each instructional
skill for each student. Interobserver agreement (IOA) was collected for 89% of sessions during the entire study (see Table 9). To obtain IOA the two sets of data were compared using trial-by-trial interobserver agreement which is the number of trial agreements divided by the total number of trials and multiplied by 100 (Cooper et al., 2007).

Table 9

*IOA-Percentage of Sessions Conducted Per Condition*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 and 2</td>
</tr>
<tr>
<td>Baseline</td>
<td>66%</td>
</tr>
<tr>
<td>Intervention</td>
<td>91%</td>
</tr>
</tbody>
</table>

**Procedural Integrity**

The teacher was trained using procedural scripts and role-playing as described earlier. The skills for each student were listed on the data sheet to assist the transition from student to student with minimal interruption (see Appendix G). Because the students in the current study demonstrated high levels of compliant behaviors (e.g., following directions), the paraprofessionals were not needed to assist by prompting the students or managing behavior. The teacher was considered trained when she achieved 80% or higher on the procedure script across at least two role-play situations.

To evaluate procedural integrity, the researcher and a college student scored 92% of the total sessions for integrity according to the procedural script (see Table 10). The
<table>
<thead>
<tr>
<th>Condition</th>
<th>Skills</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>100%</td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>Intervention</td>
<td>97%</td>
<td>96%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

college student was a junior Special Education major and had practiced scoring procedural integrity using the same procedures described earlier for the data collectors. The researcher and college students combined scored 47% of the sessions in vivo and 53% of the sessions via video recording. The researcher and college student marked a check on the script if the teacher implemented the step correctly. The procedural checklist included steps for delivering the discrete trials using the choral and sequential procedures. Therefore, when assessing the teacher’s delivery of the discrete trials during each session, the researcher and college student observed one discrete trial delivered using the sequential method and one delivered using the choral method. The number of correctly implemented steps in the script was divided by the total number of steps and multiplied by 100 to obtain an overall percent score for procedural integrity. The researcher delivered feedback to the teacher regarding any treatment errors before the next session.
Baseline

Skill sets. During all phases the teacher sat in an adult-sized chair approximately five feet in front of the students who were seated in a row in child-sized chairs. During the lesson, each instructional skill was presented one time per session to the students without the use of prompting strategies, corrective feedback, or reinforcement. Each skill was presented in the same sequential order: Skill 1, Skill 2, Skill 3, and so forth.

Two skills, Holiday and Season, were taught using choral responding and were always delivered first and third. The remainder of the skills, Math, Individual targets, Addition, and Number targets, were taught using the sequential method and were also always taught in order; however, the order in which the individual questions within the skill set were delivered to each student was varied. For example, Skill 2 (see Table 7) was always presented second; however; the order in which each student was presented with a question was randomized daily.

Skills targeted for probe students. During baseline Alex and Robby were presented with an additional instructional skill originally assigned to different students. Only skills targeted sequentially (not through choral responding) were used as probe skills. When delivering the probe question, the teacher followed the same strategies that were in place for each instructional skill set. When delivering instruction to the probe students prompting strategies were not employed for baseline or intervention phases; however, during intervention, praise was delivered contingent upon correct responses and a verbal statement such as “Good try” was delivered contingent upon incorrect responses.
Experimental Control and Internal Validity

To demonstrate experimental control, a multiple baseline design across behaviors was employed. Students were scored individually and then data were aggregated for each skill (e.g., Skill 1) to obtain a mean percentage of correct responding per session. During instruction, the teacher marked responses as correct, incorrect, prompt, or no response. Responses that were scored as incorrect, prompted, or no response were all counted as incorrect trials. As mentioned earlier the researcher was only interested in determining an accurate percentage of correct responses. After each session the total number of correct responses per skill for each student was divided by the total number of trials delivered. The data across each skill were then aggregated for a mean score per task per session.

The intervention was implemented for instructional skills—Holiday and Math (Time and Money)—after documentation of a stable baseline, while the remaining instructional skills continued in the baseline condition. After the demonstration of an ascending trend with Holiday and Math (Time and Money), and all students reaching a score of 80% or higher across two sessions, intervention commenced for the next two instructional skills—Season and Individualized targets. Once the second set of skills reached 80% or higher across both skills and all students, intervention was then implemented with the final two instructional skills—Addition and Number targets. To avoid maturation effects, the researcher graphed and analyzed the data after each session in order to move each set of skills into intervention at a rapid pace.
**External Validity**

An effective research study controls for external validity by demonstrating that study results can be reproduced under varying conditions (Cooper et al., 2007). To address external validity the researcher sought to establish within-subject replication effects (Chard et al., 2009; Horner et al., 2005). The independent variable was implemented across instructional skills to ensure the students were able to learn targets in a variety of skill areas using multiple stimuli and instructions. Further, once all six instructional skills were mastered, a second and third instructor presented the lesson to assess for generalization across people. To establish group discrete trial teaching as a reliable instructional procedure, the study sought to demonstrate the functional relationship between group discrete trial teaching and the acquisition of skills. Additionally, the researcher attempted to replicate the findings of Taubman et al. (2001) by demonstrating that group discrete trial teaching would be effective when taught under varied conditions from the original study (i.e., systematic replication). Additionally, to further support the external validity of group discrete trial teaching as an EBP, the researcher offered a thorough description of the method and procedures to ensure that future researchers will be able to replicate the study.

**Social Validity**

To ensure the study met social validity quality indicators the researcher considered the following: (a) the importance of the dependent variable, (b) the magnitude of change, (c) the cost-effectiveness and practicality of the intervention, and (d) the nature of the intervention within a natural setting (Chard et al., 2009; Horner et al., 2005).
The teacher, staff, and parents were provided a survey before and after implementation of the study, asking each to rate his or her perceptions of ABA strategies. They were given a 10-question survey that asked questions such as “Do you feel the strategies will be beneficial for all students in the class?” and “Do you feel the behaviors targeted will have an impact on each student’s success?”

**Generalization**

Generalization was assessed (a) across people, (b) response order, and (c) setting. To assess whether the students were able to respond to the questions under varied conditions, generalization sessions occurred one-time per week after acquisition sessions had concluded. One student had difficulty with generalization procedures and required two extra individualized sessions to generalize the skills.

**Across people.** The first two generalization sessions were conducted by two different people to assess whether the students would maintain high-levels of correct responding. The same two paraprofessionals who were trained to take data instructed one lesson per day.

**Random order.** The third generalization session was conducted to determine if the order of presentation would affect the students’ responding. The special education teacher delivered the instruction using the same procedures as in the original intervention phase except each question was delivered in a randomized sequence. The sequence was determined by shuffling the numbers one through six before the session. Randomizing the presentation of the instructional skills was employed to ensure that the students had not just memorized a sequence of responses.
One-to-one with and without distracters. To further assess if the students had generalized the skills, the students were instructed by the teacher individually at a table in the classroom. Individualized sessions were conducted with the teacher at a table. The teacher used the same procedures used during intervention sessions with the group with the exception of choral responding. During the first session the teacher delivered instruction using the same sequence as used during group instruction. The following session, the teacher embedded the targeted skills within other instruction. For example, while teaching reading concepts the teacher would intersperse instructional skills between reading tasks. Though the sessions were conducted individually, data for all students were aggregated. For example, for the first skill holiday, the teacher combined all the students’ correct responses and divided the number of correct responses by the combined number of response opportunities.

Maintenance

To assess whether the students had maintained their skills, two maintenance sessions were conducted. Once the intervention phase was completed, the first maintenance session was conducted after a six-day break from school for Spring Break. Then to continue to measure maintenance, generalization sessions were conducted one time per week for five weeks as opposed to daily. Four weeks after generalization was completed (i.e., nine weeks after treatment was concluded), a second maintenance check was conducted by the teacher. Procedures during maintenance sessions were identical to the intervention sessions. The instructional skills were delivered in the same order and
the students received tallies for correct responding. All scoring procedures were the same as in the intervention phase.
CHAPTER III

RESULTS

Chapter 3 presents results for (a) group discrete trial teaching, (b) generalization measures, (c) maintenance, (d) social validity measures, (e) interobserver agreement, and (f) procedural integrity in relation to the group discrete trial teaching procedures.

Group Discrete Trial Teaching

The results of the group discrete trial teaching analysis are shown in Figure 1. The mean percentage correct for all students across all six skills per session is presented. Results are described in relation to mean levels of correct responding across students and skills. To reach a level of mastery for each skill a student had to respond with 80% accuracy or higher across two consecutive sessions. Based on the mastery criteria each of the students mastered each targeted skill across all skill sets.

The following students were absent during the study: (a) Mason, Sessions 7 and 8; (b) Luke, Sessions 23 and 30; (c) Sarah, Sessions 26 and 27; and (d) Robby, Sessions 10, 15, and 32. The absences may have affected the group mean slightly; however, all means were calculated based on the total number of trials delivered on that day. After Session 25, Mason left the school district; therefore, his scores are aggregated with the rest of the scores through Session 25.
Figure 1. Percentage of correct responding during baseline and intervention phases across skill sets for all students. The graph also includes results for each probe skill.
Skill Set 1

As illustrated in Figure 1, for the holiday and math skills (i.e., time or money) there was a substantial increase from mean 0% and 0%, respectively to intervention mean 86% and 87.6%, respectively. Scores in baselines for both skills were low and stable. When the teacher implemented group discrete trial teaching there was an immediate increase in correct responding with an ascending trend and no overlapping data points. As intervention was implemented for skill set 1, it was important to evaluate the extent to which there were changes in the continuing baseline levels of skill sets 2 and 3—the goal being that the skill sets not involved in intervention remain unchanged in their performance so that a relationship between the intervention and skill performance could be established. The results showed that while still in baseline, the second set of skills—season and individualized targets—continued with their low level of performance and had a variable data path mean of 1.8% and 3.6%, respectively. Student responding to skills in the last set varied also with stable low-levels of responding to addition mean 0% and slight variability to number targets mean 1.3%. Therefore the skills in sets 2 and 3 did not respond when intervention was implemented to skill set 1.

Skill Set 2

Student correct responding to the second set of skills, seasons, and individual targets increased from means of 1.8% and 3.6%, respectively, during baseline, to means of 78.5% and 84.7%, respectively, during intervention. Scores in baseline for both skills were slightly variable with a descending trend. Once intervention commenced correct responding scores increased immediately with an ascending trend and no overlapping
data points. The remaining skill set in baseline, skill set 3, remained consistently low and stable with mean 0% for both skills as intervention was continued with skill set 1 and initiated with skill set 2. Again, this lack of change provides evidence that the independent variable, rather than other explanations, was related to the change in skill performance in skill set 2 noted.

**Skill Set 3**

Consistent with student responding to intervention with the first two sets, skill set three—addition and number targets—increased from a mean of 0% and 1.3% respectively during baseline to mean 58.2% and 74.5%, respectively, during intervention. Scores in baseline were low and stable. Again, once intervention commenced results demonstrated an immediate increase in student correct responding with an ascending trend and no overlapping data points.

**Skills Targeted for Probe Students**

The results of the two probe students, Alex and Robby, are also illustrated in Figure 1. Because of Mason’s absences, probe skills for Alex and Robby were affected on days 8 (Alex only), 28, and 31. On those days each of the students were asked the probe skill, but they did not hear the model question delivered to Mason. The results demonstrate an increase from baseline across all probes skills indicating the students learned skills through observation.

**Probe skill set one—time and money.** As illustrated in Figure 1, scores increased from a neutral baseline with mean 0% to 85.4% during intervention. Once intervention commenced correct responding scores increased immediately with an
ascending trend and no overlapping data points. The other two skills in baseline remained stable with mean 0% correct responding.

**Probe skill set two—individual target.** The results for the probe skill in set two demonstrate an increase from mean 0% during baseline to mean 44% during intervention. Low-scores are a result of consistent incorrect responding with no corrective feedback for Robby. As a result of Mason’s absence, Robby was not exposed to the correct answer model; therefore, he maintained the incorrect response for the remainder of the sessions resulting in a descending trend. However, Alex consistently responded with 100% accuracy to the second probe skill reaching mastery criteria. Skills in set 3 which were still in baseline phase remained stable with mean 0% correct responding and did not react to the implementation of intervention for probe skill set 2.

**Probe skill set three—number target.** The results for the probe skill in the third set demonstrate an increase from mean 0% during baseline to mean 88% during intervention. Once intervention commenced correct responding scores increased immediately with an ascending trend and no overlapping data points.

**Generalization**

The following paragraphs present the results for generalization probes conducted (a) across people, (b) order of presentation, and (c) one-to-one with and without distractions.

**Across people.** The results for the generalization phase across multiple teachers are described in the next section and illustrated in Table 11.
Table 11

*Generalization and Maintenance Scores for All Students*

<table>
<thead>
<tr>
<th>Generalization</th>
<th>Skills</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Set one holiday &amp; math (money &amp; time)</td>
<td>66.5%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Set two season &amp; individual</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Set three addition &amp; numbers</td>
<td>100%</td>
<td>100%</td>
<td>60%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Note.* The two numbers indicate percent correct for each skill within the set.

**Skill sets.** As illustrated in Figure 1, for holiday and math (i.e., time and money) skills, all of the students maintained high-rates of responding across multiple generalization probes. The first generalization probe, across people, resulted in a mean of 66.5% and 100% respectively. The skills in set 2 also maintained high-rates of correct responding with the students responding with a mean of 100% for both skills. The results for the third set of skills remained high with minimal variability. When exposed to different teachers both skills remained at a mean of 100% correct responding.

**Skills targeted for probe students.** As illustrated in Figure 1 for the first probe skill, scores remained at mean 100% correct responding. The second probe skill resulted in variable data, due to Mason’s withdrawal from school. Robby continuously produced the incorrect answer without a correct model and without corrective feedback. When skills were assessed across people, the result was a mean of 50% (scores ranged from 0%
to 100%) correct responding. Scores for probe three also remained at a mean of 100% correct responding during the first generalization condition. Results illustrate that students learned information by observing instruction directly taught to other students.

**Random order.** The next generalization phase was conducted to determine if the order of presentation would effect correct responding. To ensure that students were not responding to a pattern of presentation, the order in which the stimuli were presented was randomized and rates of responding were assessed.

**Skill sets.** The results of randomized order of presentation for skills holiday and math resulted in a mean of 100% and 100%, respectively. As intervention was introduced to the first set of skills, the second and third sets remained in baseline conditions as skill responding was assessed. The second set of skills, season and individual, also maintained high-rates of correct responding with a mean of 100% for both skills and the results for the third set of skills, addition and number targets, remained high with minimal variability. The students continued to respond at a mean of 100% correct responding when the order of presentation was randomized.

**Skills targeted for probe students.** This section describes the results of the presentation of skills in a randomized order on the three probe questions. Both students consistently responded with a mean of 100% to the first probe skill. The results for the second probe skill during generalization phases resulted in variable data with a mean of 50% correct responding. Decreased scores seem to be due to Mason’s withdrawal from school as without a model or corrective feedback, Robby continuously produced the incorrect answer. However, Alex consistently scored 100%. Similarly, for the third
probe skill, both students’ scores remained at a mean of 100% correct responding.

Results illustrate that students learned information by observing instruction directly taught to other students.

**One-to-one with and without distracters.** This section presents the results of the next two generalization sessions conducted to determine if the students would continue to correctly respond in one-to-one settings with and without distractions present. For skill attainment to be meaningful, students should be able to present the skill in a natural environment. This generalization task assessed the extent to which students could produce the skill with distracters that can be found in natural learning environments.

**Skill sets.** When the teacher delivered the instruction for skill set one, holiday and math, interspersed with distracter tasks, the students responded with a mean of 66% and 100%, respectively. The 66% was a result of Robby responding incorrectly on the first trial requiring a prompted trial and follow-up trial. The students maintained high-rates of correct responding for the second set of skills, with a mean of 100%. The students continued to respond correctly to the third set of skills, with a mean of 66% correct responding and a mean of 100% correct responding. Similar to skill set one, Robby responded incorrectly to the addition skill on the first trial and required a prompted and follow-up trial, resulting in reduced scores.

**Skills targeted for probe students.** Both probe students’ scores remained consistent when asked the probe skill in a one-to-one setting (sessions 36 and 37). Although they no longer heard the question delivered to the peer before responding, both students’ scores remained at a mean of 100% with no variability. For the second probe
skill, the teacher and researcher decided not to deliver the probe skill to Robby in order to minimize practice of the incorrect answer. The second probe skill, then, was only delivered to Alex resulting in 100% correct responding. Consistent with other skills, both students’ scores remained at a mean of 100% correct responding for the third probe skill (see Table 12).

Table 12

*Generalization Scores for Probe Skills*

<table>
<thead>
<tr>
<th>Generalization</th>
<th>Set one</th>
<th>Set two</th>
<th>Set three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Across People</td>
<td>100%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>Random Order</td>
<td>100%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>One-to-one (2 sessions)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Maintenance**

The first maintenance session occurred on Session 32 after a spring break from school that lasted six school days. The final maintenance session occurred on Session 38 after 21 school days had passed without the students being exposed to the intervention or generalization phases. Robby was absent for both sessions.

**Skill sets.** As illustrated in Figure 1 and presented in Table 11, all students maintained a mean of 100% correct responding during both maintenance checks across
the first two skill sets. Student correct responding to the addition skill was a mean of 60% during the first maintenance check and a mean of 100% on the second maintenance check. The reduced score of mean 60% was due to one student responding incorrectly to the first trial and requiring a prompted trial. The mean for the number targets during both maintenance checks was 100%.

**Skills targeted for probe students.** Robby was absent during both maintenance checks so probe scores are only representative of Alex’s scores. Robby consistently scored 100% across both maintenance checks for all three probe skills, demonstrating mastery of information learned by observing instruction occurring for peers.

**Interobserver Agreement**

The teacher and one observer documented data during 89% of the total sessions conducted during the study. The mean IOA was 95.7% (range 93–100; see Table 13).

Table 13

**IOA Analysis**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Skills</th>
<th>1 and 2</th>
<th>3 and 4</th>
<th>5 and 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>98%</td>
<td>90%</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>96%</td>
<td>99%</td>
<td>99%</td>
<td></td>
</tr>
</tbody>
</table>
Procedural Integrity

Procedural integrity assessments were conducted during 97% of the total sessions (see Table 10). The researcher provided feedback regarding the assessment after each session. The teacher and teacher’s assistants’ scores resulted in a mean of 98% (see Table 14).

Table 14

Procedural Integrity Analysis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 and 2</td>
</tr>
<tr>
<td>Baseline</td>
<td>97%</td>
</tr>
<tr>
<td>Intervention</td>
<td>98%</td>
</tr>
</tbody>
</table>

Note. Scores higher than 80% indicate the teacher is following the procedures with integrity.

Social Validity Measures

The results of the surveys conducted prior to and after the intervention are illustrated in Table 15. The teacher’s and assistants’ mean ratings are listed for each question they were asked to rate. Overall, the teacher and assistants stated that this intervention was beneficial and effective for the students. Only one parent completed and returned both the pre- and post-survey. The parent reported that her child learned the skills and was able to demonstrate skills home.
Table 15

*Results of Teacher and Assistant Surveys*

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean Pre</th>
<th>Mean Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Behavioral teaching, specifically discrete trial teaching, is very important for a child with autism?</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>2. The student will exhibit inappropriate behavior when the instructional strategy is used.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. The student will benefit from the instructional strategy.</td>
<td>4.3</td>
<td>4.7</td>
</tr>
<tr>
<td>4. The instructional strategy will increase student attention during circle time.</td>
<td>4</td>
<td>4.7</td>
</tr>
<tr>
<td>5. I will use the strategy after the study is completed.</td>
<td>4</td>
<td>4.3</td>
</tr>
<tr>
<td>6. I feel confident in using discrete trial teaching.</td>
<td>3</td>
<td>3.7</td>
</tr>
<tr>
<td>7. I feel confident in training others to use the discrete trial teaching.</td>
<td>1.3</td>
<td>2.3</td>
</tr>
<tr>
<td>8. The instructional method is cost effective.</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

*Note.* Questions were rated on a scale from one, *disagree*, to five, *strongly agree.*
CHAPTER IV
DISCUSSION

Years of research provide documented evidence for the use of ABA methods in teaching students with autism (Cohen et al., 2006; Lovaas, 1987; McEachin et al., 1993; Sallows & Graupner, 2005; Smith et al., 2000). In particular, intensive behavioral intervention (IBI), a comprehensive program built on the principles of ABA, has been identified as an evidence-based practice for teaching students with autism (NRC, 2001). An important component of IBI is the method in which instruction is delivered; specifically, an IBI program employs discrete trial teaching, which is most often delivered in a one-to-one setting (Lovaas, 1987; Smith, 2001). However, the one-to-one format for discrete trial teaching is not always practical in a classroom setting. The purpose of the current study was to assess if group instruction utilizing discrete trials could be an effective teaching practice for students with autism. In addition to systematically replicating the findings from Taubman et al. (2001), this study was designed to increase the external validity of the instructional format by further investigating whether group discrete trial teaching is an evidence-based practice (Chard et al., 2009). To determine if group discrete trial teaching was a viable option for teachers, the study was designed to answer three questions:

1. Will group discrete trial teaching be an effective method for instructing students with autism?
2. Will a teacher be able to implement group discrete trial teaching with integrity?

3. Will students indirectly learn information that is targeted for other students when instructed using discrete trial teaching?

The next section summarizes the findings and provides implications for practice and research.

**Effectiveness of Group Discrete Trial Teaching**

The current study was conducted to systematically replicate the findings of Taubman et al. (2001) and to further demonstrate the effectiveness of group discrete trial teaching. A multiple-baseline across instructional tasks design was used to illustrate the effect of group discrete trial teaching on the acquisition of skills. The study incorporated choral and sequential responding to replicate methods used by Taubman et al. Results indicated an immediate increase in performance at the onset of intervention across all targeted skills for all students. Stability of scores during baseline sessions for skills in sets two and three (i.e., season and individual target, and addition and number targets) appear to indicate learning was a direct result of the prompting and corrective feedback delivered during the intervention phase for skill Set 1 (i.e., holiday and math [time and money]). An ascending trend for skills in Set 1 was replicated when intervention commenced for skills in Set 2 (i.e., season and individual target), and Set 3 (i.e., addition and number targets). Students’ responses to intervention across both sets of skills were immediate with an ascending trend. Further, the students maintained mastery criteria across all six skills during maintenance sessions and continued to correctly respond
during generalization sessions in which teaching components were varied (e.g., different teachers, randomized order of presentation).

**Reinforcement Effects**

As described earlier, during the study the researcher and teacher collaborated and made modifications to the schedule of reinforcement. First, the teacher delivered only descriptive praise, then she delivered tangible reinforcers paired with praise, and then tokens (i.e., tally marks drawn on a dry erase board) paired with praise. Adjusting the reinforcement schedule did not impact student responding. The percentage of correct responding remained stable during the sessions before and after the changes from praise to tangible reinforcers, and then from tangible to delayed reinforcement with tokens. However, it should be noted that reinforcement procedures may have increased the likelihood that probe students retained probe skills. Even though probe students were not given corrective feedback, tallies were delivered to all students for all correct responses in the probe sessions. As a result, one might question if the students’ probe skills were learned as a result of observational learning or as a result of a reinforcement contingency. However, data appear to indicate that the probe students exactly replicated the target students’ response for each skill, even when the response was incorrect. It would be beneficial to conduct further analysis on observational learning during group instruction to determine the effects of reinforcement for correct responding.

**Treatment Integrity Factors**

According to recommendations made by NRC (2001) and mandates from national policy (Individual with Disabilities Education Act, 2004) teachers should select EBPs
when instructing students with autism. It is important for the use and sustainability of EBP that researchers identify practices that are not only effective but practical for teachers to implement. In fact, an underlying component of using an EBP is that teachers deliver the intervention as it was planned (Grow et al., 2009; NRC, 2001). The findings from the current study demonstrated that the teacher was able to adhere to the training protocol with minimal corrective feedback. Over the course of the study, feedback for errors in delivery of the discrete trial teaching procedure was minimal. Feedback was only necessary during 14% (i.e., 5 out of 37 sessions) of sessions and was not necessary after Session 12. The most consistent feedback necessary was for exceeding inter-trial intervals because of reinforcement procedures and not because of a lack of ability to follow the protocol. Specifically, feedback was associated with the delivery of tangibles (e.g., pieces of candy) as reinforcers, which extended the inter-trial intervals to approximately 5 to 12 seconds. Delivering a tangible reinforcer proved to be inefficient and drastically impacted the pace of the lesson; however, modifying reinforcement procedures increased treatment integrity scores. The teacher in this study was able to adjust the reinforcement delivery to meet the procedural expectations, demonstrating that one to two seconds is a reasonable expectation when a paraprofessional is also present to deliver the token reinforcement. Group discrete trial teaching offers teachers a consistent model for delivering instruction that could be implemented within an existing curriculum with integrity.
Teacher Training

Numerous studies have been conducted to evaluate the level of training teachers and paraprofessionals need to implement EBPs (e.g., Bolton & Mayer, 2008; Grow et al., 2009; Lerman et al., 2004). The teacher who participated in the study was tenured with 10 years of experience teaching students with autism. She received previous introductory training on ABA procedures, including reinforcement procedures and discrete trials taught in a one-to-one format. She also had experience practicing discrete trial teaching with a student in her class. The staff in her classroom had also received previous training in basic ABA procedures but had not implemented discrete trials in a one-to-one format. The teacher’s level of prior training in ABA procedures may have positively impacted treatment integrity measures during this study. Comparable integrity results may not have been observed with a teacher with less training in behavioral interventions; however, others have found that minimal experience (e.g., an undergraduate course in behavior management) prior to training did not impact teacher’s or paraprofessionals’ ability to implement behavioral interventions with integrity (Bolton & Mayer, 2008; Lerman et al., 2004). Although the teacher in the current study had substantial experience in behavioral interventions, she required some performance feedback when the procedures became more complex (e.g., switching from continuous reinforcement to a token system for correct responses; Lerman et al., 2004). These findings suggest that the teacher’s ability to conduct discrete trial teaching in one-to-one settings may have increased her accuracy for implementing group discrete trial teaching; however, ongoing performance feedback was still necessary when more complex skills are involved
(Lerman et al., 2004). Further investigation should be conducted to evaluate efficient levels of training necessary to use group discrete trial teaching, specifically as it relates to the teacher’s present level of experience.

**Practice Opportunities**

As previously discussed, after Session 12 the teacher did not require performance feedback to deliver the group discrete trial teaching procedures accurately. It may be that the “practice” of delivering the trials increased the precision of accuracy of the procedure (e.g., Bolton & Mayer, 2008). The need for practice opportunities seems to be evident when the first paraprofessional implemented the procedure during generalization. Although the paraprofessional was able to observe at least 50% of the sessions and participated in the initial training, she did not get the opportunity to practice implementing the group discrete trial teaching again until she conducted a generalization session. When students responded incorrectly to the first question, she was unable to implement the error correction procedure with integrity. Low procedural integrity scores that increase over time are consistent with previous research indicating that teachers were able to moderately increase integrity scores when intervention commenced but integrity scores did not reach 80% or higher for several sessions (Bolton & Mayer, 2008). The paraprofessional’s ability to demonstrate the procedures accurately may have been effected by several variables. First, the students had been performing without the need for the correction procedure for several sessions before generalization; therefore, the paraprofessional had not observed the correction procedure for at least two weeks. Second, prompting procedures for incorrect trials may be more challenging to implement
with integrity due to the increased steps required (Lerman et al., 2004). Third, the paraprofessional had minimal experience teaching students in a group format. Future studies should be conducted to assess each of these variables.

**Feasibility**

To further investigate the feasibility of group discrete trial teaching, the researcher measured the teacher’s ability to accurately collect data while implementing instructional procedures. Interobserver agreement of student responding was conducted for 89% of all sessions conducted with a mean 95.7% agreement between the teacher’s data and the second data collector’s data. High mean percentages of IOA demonstrate that the teacher was able to collect data accurately while implementing instruction. Specifically, the teacher was able to effectively implement multi-step error correction procedures with proficiency and praise group and individual performance while collecting data. The combination of high IOA and high procedural integrity measures, verify that collecting data is not only feasible but can be done accurately without threats to the integrity of the procedure. It is important to acknowledge that procedural integrity measures are not consistently reported in the research for group discrete trial teaching (Taubman et al., 2001). These findings add to the literature on treatment integrity of EBPs by demonstrating the teacher’s ability to implement group discrete trial teaching in the classroom. Even in a group instructional setting, the behaviors demonstrated by the students are discrete and measurable, allowing for continuous measurement of skills. As such, the outcomes of the study appear to suggest that teachers are then able to collect data during instruction, analyze that data to ensure the instruction is meaningful, and
modify instruction according to student needs (Yell et al., 2005). Importantly, collecting data during instruction aligns with compliance standards for No Child Left Behind (NCLB; Yell et al., 2005).

**Observational Learning**

Assessing students with autism observational learning in group settings provides important information for including these students in group instruction. Because students with autism often lack the ability to observe the natural environment and to naturally acquire information to use again in the future (Spence et al., 2004), teachers cannot expect observational learning to occur naturally during group instruction. However, these results suggest that students with autism may be able to acquire skills targeted for other students when taught using group discrete trial teaching. Developing learning environments that foster observational learning (e.g., group discrete trial teaching) may enhance inclusion opportunities for students with autism.

In the current study, the researcher sought to determine whether students would learn information through indirect exposure during systematic group instruction. Specifically, the researcher defined observational learning as present if “probe” students acquired information directly taught to other students (Browder et al., 2001). The data indicated that both students selected to answer probe skills acquired skills taught directly to other students. For example, during baseline when asked a question that was not directly taught, both probe students consistently repeated the incorrect responses provided by the original student or responded that he did not know the answer. Once intervention commenced, both probe students began responding accurately despite the
fact the teacher did not provide either of them with corrective feedback to error responses. It is, however, noteworthy that as a consequence the teacher provided a tally mark when they responded correctly. These data suggest the probe students began to respond correctly after observing their peers receive corrective feedback and reinforcement for correct answers. Although it is unclear if the students were learning the information or just imitating the correct answer, it is clear that they were retaining information in the moment via observation. Furthermore, the probe skills were further assessed during two generalization sessions that were conducted in a one-to-one setting. During one-to-one sessions probe students continued to respond correctly without hearing the original student’s response. Correct responding during generalization sessions after being taught in a small group setting using group discrete trial teaching also suggests observational learning.

These preliminary findings provide evidence that students with autism may be able to benefit—beyond what is directly taught—from being included in group instructional settings. However, it is important to recognize that the characteristics of group discrete trial teaching (i.e., structured delivery, active responding, corrective feedback, positive reinforcement) are essential to meeting the needs of students with autism in a group instructional setting. Specifically, the information the students observe must be correct; therefore, the direct corrective feedback is critical to the process (Delgado & Greer, 2009). More research is needed to better understand the process.
Incidental Learning

It is important to acknowledge the additional benefits of inclusion of students in group learning settings. Typical students acquire information during all their waking moments (Lovaas, 2008), some of which is incidental information, that is, information that is not directly taught (e.g., sitting quietly, waiting for a turn, copying from the board; Ledford et al., 2008). Though incidental learning was not formally measured through data collection, anecdotal reports of the sessions suggested the students were able to participate in concepts that had not yet been taught. For example, the students had not been introduced to tally marks or how to count tally marks before this study. After each session, the teacher asked the students to count their tally marks before they received their reinforcer. Initially, the students needed assistance in counting the tally marks (e.g., the teacher pointed to each tally as the student counted) and by the end of the study the students were able to count their tallies with no assistance (e.g., stand at the board and count the tallies independently; Ledford et al., 2008). In addition, the teacher reported that the students began to praise each other for correct responding after observing the teacher use praise in this format. She reported that although she had used praise in the past, the students had not engaged in this behavior until it was used during group discrete trial teaching. Production of praise statements suggested that students were learning socially appropriate behaviors in addition to gaining an ability to identify when other students were correct. This may have been a result of the consistent format of the group discrete trial teaching (Delgado & Greer, 2009). The students were learning the three-term-contingency: when an instruction is presented, reinforcement will be available for
correct responding (Ghezzi, 2007; Leaf et al., 1999). Future research should investigate the effectiveness of group discrete trial teaching on the acquisition of incidental skills, skills that are not directly taught for students with autism.

**Single-Subject Research Design**

The researcher sought to contribute to the EBP literature by adhering to recommendations for single-subject design research made by Chard et al. (2009). Specifically, the researcher developed the current study to systematically replicate the independent variable methodology of Taubman et al. (2001). A study that replicates procedures of past research strengthens the reliability, generality, and external validity of the original study by demonstrating effectiveness under varied conditions (Cooper et al., 2007). To strengthen the external validity of group discrete trial teaching the researcher systematically replicated the protocol. The next section addresses the components of the study that were systematically varied from the procedures implemented by Taubman et al. (2001).

**Procedural Variations**

Limited research is available regarding variations in group discrete trial teaching. The present study replicated the original work of Taubman et al. (2001) by systematically changing the following variables: (a) instead of presenting the questions in a varied format whereby each question was initiated randomly using a different method referred to as overlapping, sequential, and choral, the present study consistently presented each question using the same method; (b) delivery of discrete trials was limited to choral and sequential methods as opposed to including overlapping trials (see Taubman et al., 2001);
and (c) participants were in kindergarten as opposed to preschool. The increase in correct responding to all questions, across students, indicates some generality across age groups of students with disabilities. In addition, replicating the results of the study demonstrated the feasibility and practicality of implementation by teachers in a classroom setting.

**Aggregating Data**

The use of single-subject research design is an established method for comparing an individual’s behavior under varying conditions to determine experimental control (Kazdin, 1982); as such, results are typically presented based on within-subject replication of behavior change (Cooper et al., 2007; Kazdin, 1982). In the current study, treatment decisions were made based on aggregated data across the group’s performance on each skill, as opposed to being based on individual performance (Taubman et al., 2001; Wrobel & Resnick, 1970). The researcher aggregated the data to determine if group discrete trial teaching was effective for the entire group and because it would have been impossible to make changes based on individual scores on responses made during choral instruction. When comparing the group’s combined results to individual responding results, scores remained consistent and stable. Because the participants maintained stable responding, aggregating the data did not affect decisions for the initiation of the intervention. However, researchers should take caution when considering aggregating data, especially when the study includes students who display high degrees of individual variability. Variability may lead to initiating intervention before individual students demonstrate a stable baseline (Wrobel & Resnick, 1970). Additionally, variability of responding may lead to harmful treatment effects for students.
who have stable responding but remain in baseline too long due to variable group scores. Further analysis should be conducted to determine criteria for phase changes based on aggregated group data. Alternatively, it would be beneficial to assess the impact of transitioning a student to the generalization phase as a part of a group before individual mastery criteria have been met.

**Generalization**

The current study programmed for generalization by documenting whether procedural variations would yield the same results for each student. To establish mastery, a student should be able to demonstrate a skill under various conditions (e.g., one-to-one, in small group, in large group; Ledford et al., 2008). Ultimately the goal is for a student to be able to perform a skill in the natural environment. For children with autism, deficits in generalization of skills are an underlying characteristic of the disorder; therefore, most students with autism will require multi-step teaching strategies to ensure a skill is generalized (Anderson et al., 2006; Wolery & Schuster, 1997).

In the current study, once students reached mastery criteria for each skill set under the original conditions, generalization sessions were conducted. Results indicated that students were able to maintain correct responding across people, settings, and stimuli. These findings are similar to Chiara et al. (1995) who reported students with developmental disabilities maintained correct responding when presented with variations in procedures (e.g., varied stimuli, varied settings) during generalization probes. More research is needed to replicate these findings. Additional variation methods for
evaluating generalization could include: (a) varying the instruction, (b) varying the response requirement, and (c) manipulating schedules of reinforcement.

**Varying the Instruction**

Students with autism require explicit instructions that are clear and concise (Leaf et al., 2008). Using discrete trial teaching enhances a student’s ability to pick out the critical information and respond appropriately (Leaf et al., 2008). When using discrete trial teaching, one method for delivering the instruction is to utilize one instruction or phrase until mastery criteria is met. Once the student masters a skill using one specific instruction, the phrase is modified to include more natural language. The current study employed one set of instructions across the entire study. For example, the instruction “What coin is copper?” was used every time the response requirement was “a penny.” Further research should be conducted to determine whether the students would continue to respond at a mastery level if the instruction were varied. For example, if the instruction were changed to “Tell me the name of the copper coin,” would the student be able to respond, “A penny”? Furthermore, would the teacher be able to accommodate variations in instruction across students? In the current study, student responding was consistent and all the students demonstrated mastery criteria during the generalization phase. Examining the effects of varying the instruction in the group format would yield critical information regarding individualized instruction within a group setting. Teaching a student to respond to varied instructions allows him access to those natural environments. Before a student can independently demonstrate a skill set in the natural
environment he or she should be able to perform response variations in the teaching environment.

**Maintaining Acquired Skills**

Students with autism need to perform skills in the natural environment to promote skill maintenance (Cohen et al., 2006). The independent demonstration of a behavior in a natural environment depends largely on the consequences maintaining the behavior. Therefore, the natural environment must include enough stimuli (i.e., opportunities) to motivate a student with autism to engage in learning opportunities (Lovaas, 2008) and enough opportunities to respond to maintain the behavior. We know that students with autism have difficulty learning in a general setting and that they require intensive direct instruction to learn skills. We also know that a basic tenet of behavior analysis is that behavior is learned and is maintained by the environment; therefore when developing a teaching model, it is imperative to include variables for maintaining behaviors. In the current study, initially students received immediate reinforcement after each correct response on a continuous schedule and later they received generalized reinforcement (tally marks) on a continuous schedule (Smith, 2001). The teacher used the same schedule of reinforcement across all students. Varying the reinforcement schedules may strengthen the students’ correct responding behaviors and avoid satiation. Further research should be conducted that assesses the impact of the reinforcement schedule on group discrete trial teaching.
Implications for Practice

Many children with autism lack the ability to learn from their environment and require systematic instruction to acquire even the most basic skills (Varni, Lovaas, Koegel, & Everett, 1979). Moreover, students with autism face learning difficulties across all domains (e.g., social interactions, communication, restricted interest)—it is a pervasive developmental disability (Spence et al., 2004). Students who have typical development acquire information from their environment approximately 16 hours a day (Lovaas, 2008). To match the intensity of learning for students with autism, educators need to implement strategies to optimize learning. The results of this study indicate that group discrete trial teaching provides a systematic method for providing intensive instruction throughout the school day.

Evidence-Based Practice

With federal mandates initiating a movement toward inclusion for all students (Yell et al., 2005), many students with disabilities are being included in regular education classrooms for much, if not all, of their school day. Subsequently, the movement of students who receive special education services into regular education classrooms places new demands on regular education teachers. Regular education and special education teachers have to arrange learning environments that prepare students with autism for learning in group settings (Yell et al., 2005). Students with autism need to have a combination of readiness skills along with the ability to acquire skills in a group to be successful in an inclusion setting. This means to effectively meet federal mandates,
teachers need to develop lessons that allow students with autism to engage in behaviors that demonstrate learning in group settings.

Applied behavior analysis is referenced by national organizations (NRC1, 2001), is employed in the workplace (Scherrer & Wilder, 2008), and is a part of everyday behavioral strategies in classrooms (Coleman-Martin & Heller, 2004). Based on treatment recommendations for students with autism, behavioral treatments are not only effective but necessary (NRC, 2001). Historically, educators embrace unsupported information (e.g., information passed from generation to generation, fads), which can lead to wasted time and resources while missing out on effective interventions (Mostert & Crockett, 1999). This may result in teachers using eclectic approaches for students with autism that are not shown to be effective (Chasson, Harris, & Neely, 2007).

Alternatively, through teaching educators to recognize criteria for quality research and to adopt evidence-based practices we may help reduce wasted resources. For example, a cost comparison by Chasson et al. (2007) revealed that schools are potentially losing money by not adapting IBI for students with autism. An evaluation of the cost per child savings, subsequent to receiving IBI for three years, revealed that schools would experience a 72% reduction in cost over the next 15 years, with a savings of $84,300 per child. Further analysis of the total number of students who would not be included in regular education after IBI treatment revealed the cost to serve students would be significantly offset by the amount saved on students who were successfully included (Chasson et al., 2007).
Despite estimated savings and the publication of thousands of articles demonstrating the effectiveness of behavioral techniques for teaching students in special education, it is unclear how many of these techniques are actually being implemented in classrooms (Cook & Schirmer, 2006). Although progress toward implementation of effective practices in classrooms is slow, applied behavior analysis has made generous strides toward demonstrating evidence-based practices. Further investigation into the reluctance of special education and regular education teachers to utilize behavioral interventions in a classrooms setting should be conducted to determine strategies for effectively bridging the research to practice gap.

**Conclusion**

Identifying an intervention, which can be used to increase learning opportunities in a group setting, will benefit students with autism as they enter classroom settings. Because students with autism do not demonstrate substantial skill acquisition from typical instruction (Eikeseth et al., 2002; Howard et al., 2005), implementation of focused direct instruction is imperative. It is of the utmost importance that teaching procedures that are replicable and generalizable be conducted to contribute to the identification of evidence-based practices for students with autism (NRC, 2001). Discrete trials implemented in a group setting may be an effective intervention for this population. The current study focused on the effectiveness of group discrete trial teaching for students with autism and the feasibility of implementing the procedures in everyday practice.

As more students with autism are integrated into classroom settings, the need for effective instructional strategies becomes critical. Due to deficits in joint attention,
students with autism miss out on educational opportunities that are present in the natural environment. Additionally, the natural environment is not set up in a way that supports the learning challenges of a student with autism. Traditional methods of teaching (e.g., lecture style) rely on the student’s ability to acquire information by sitting for a duration of time and attending to the teacher (Delgado & Greer, 2009). Group discrete trial teaching modifies traditional learning environments by providing students with autism multiple opportunities to respond (Taubman et al., 2001). The three-part learning trial is consistent and reliable, which is important for students with autism who display a desire for sameness (American Psychiatric Association, 2000). The findings of the current study are promising. The investigation clearly demonstrated that students could acquire information through the use of group discrete trial instruction, a teacher could implement the procedure effectively and accurately while collecting data, and importantly students could learn information taught to other students through observational learning. Furthermore, students were able to generalize the skills they learned across settings, teachers, and variations in delivery modes. Overall, the study supported the use of group discrete trial teaching for instructing teaching students with autism in group settings. Further research is needed to replicate these findings in support of EBPs.
APPENDIX A

RECRUITMENT SCRIPT
Recruitment Script

Parents

(Group Discrete Trial Teaching)

Procedure for recruiting parents to allow their children to participate in the study.

1. Hello, Mr./Mrs. [name].

2. My name is Jennifer Sweeney, and I am conducting a study as a special education student at Kent State University. I am interested in investigating effective teaching methods for children with autism and other developmental disabilities. I would like to have your child participate in the group instructional strategy that I will be teaching your (son/daughter’s) teacher. Your son/daughter’s teacher is going to use the teaching method to teach three skills such as a counting skill, a language skill, and a reading skill. The instruction will take place during small group instruction in the child’s regularly scheduled classroom. We will be video taping each session.

3. If you are interested in having your child participate in the study I will ask you to read and sign a consent form. The consent form will explain your child’s participation in detail.

4. Are you interested in allowing your child to participate?

5. Do you have any questions before we start? (clarify if necessary)
APPENDIX B

LETTER TO THE SCHOOL
October 23, 2008

Dear Superintendent and Special Education Director,

I would like to do a research study on increasing learning in group settings for students who are diagnosed with autism or with developmental disabilities. Specifically, we would like to use a teaching style to teach your students academic skills (e.g., counting skills, sight words, pronouns) and determine whether the method helps students learn the goals quicker, remember the information for an extended period of time, and use the information with other people. We would like to do this study because students with autism and developmental disabilities often have difficulty learning information in group settings. The results of this study may allow us to understand effective ways to teach children new skills.

The project will be conducted in Mrs. Smith’s classroom with several of her kindergarten students. I will teach Mrs. Smith how to use discrete trials with the group of students to teach three different learning tasks. This study will last for approximately 6-7 months during the school year. The teachers, paraprofessionals and parents will be asked to complete a survey pertaining to the study. The survey will provide me with information regarding your perceptions of the study procedures.

The identity and data for each student will be kept confidential and all material will be kept in a locked filing cabinet in Dr. Tankersley’s office. Each parent will be asked to sign a consent form that will describe the procedures. All participants have the right to withdraw from the study at any time.

If you want to know more about this project, please call me at (330-606-3633) or my advisors, Dr. Melody Tankersley, or Dr. Lyle Barton at 330-672-2294. The project is pending approval from Kent State University until XXX School District provides a letter approving the research be conducted. If you have questions about Kent State University's rules for research, please call Dr. John West, Vice President of Research, Division of Research and Graduate Studies (Tel. 330.672.2704).

Sincerely,

Jen Sweeney, MA, BCBA
Special Education Doctoral Candidate
APPENDIX C

PARENT LETTER AND CONSENT FORM
Dear Parents/Guardians,

I would like to do a research study on increasing learning in group settings for students who are diagnosed with autism or with developmental disabilities. Specifically, we would like to use a teaching style to teach your child academic skills (e.g., counting skills, sight words, pronouns) and determine whether the method helps students learn the goals quicker, remember the information for an extended period of time, and use the information with other people. We would like to do this study because students with autism and developmental disabilities often have difficulty learning information in group settings. The results of this study may allow us to understand effective ways to teach children new skills.

I would like you to let your child take part in this project. If you decide to do this, your child will be presented three different tasks during regular circle time activities. Your child will be asked to engage in tasks such as counting, language, and reading. Your child’s teacher will present the group or an individual within the group with a series of discrete trials, which include an instruction or question, a 3-4 second opportunity to respond, and feedback based on the individual or group response. On each day discrete trials are implemented, your child will work with the teacher for no more than the allotted circle time activities set by the teacher. This study will last for approximately 6 months during the school year. You will also be asked to complete a survey pertaining to the study. The survey will provide me with information regarding your perceptions of the study procedures.

If your child displays any discomfort throughout the course of this study (e.g., resisting, stopping), the session will end. Your child’s identity will not be revealed to anyone not directly involved in conducting the research, or by means of publication, documentation, computer storage, or any other form of report developed from this research. Taking part in this project is entirely up to you and no one will hold it against you if you decide not to do it. If you decide to allow your child to take part in this study, you may withdraw your consent at any time.

To advance the knowledge of interventions for children with autism it is important to this study that your child’s disability be verified by diagnostic reports or school records. By signing this consent you would be agreeing to provide the teacher and myself these documents. The documents would only be used to verify the disability and would not be used to identify your child in any way.

If you want to know more about this project, please call me at (330-606-3633) or my advisors, Dr. Melody Tankersley, or Dr. Lyle Barton at 330-672-2294. The project has been approved by Kent State University. If you have questions about Kent State University’s rules for research, please call Dr. John West, Vice President of Research, Division of Research and Graduate Studies (Tel. 330.672.2704).

You will get a copy of this consent form.

Sincerely,
Jen Sweeney, MA, BCBA
Special Education Doctoral Candidate

Parent Consent Form – Group Discrete Trial Teaching
I agree to let my child, ____________________________, take part in this project. I know what he will have to do and he can stop at any time. I further agree to allow my child’s classroom teacher and the researcher access to diagnostic reports and school records for the purpose of verifying my child’s disability. I also agree to complete a survey regarding my perceptions of the study.

______________________________
Signature

_________________________
Date
APPENDIX D

CONSENT FORM TEACHERS
Dear Teacher,

I would like to do a research study on increasing learning in group settings for students who are diagnosed with autism or with developmental disabilities. Specifically, we would like to use a teaching style to teach your students academic skills (e.g., counting skills, sight words, pronouns) and determine whether the method helps students learn the goals quicker, remember the information for an extended period of time, and use the information with other people. We would like to do this study because students with autism and developmental disabilities often have difficulty learning information in group settings. The results of this study may allow us to understand effective ways to teach children new skills.

I would like to take part in this project. If you decide to do this, you will be taught a teaching style in which you will present three different tasks during regular circle time activities. You will engage your students in tasks such as counting, language, and reading. You will present the group or an individual within the group with a series of discrete trials, which include an instruction or question, a 3-4 second opportunity to respond, and feedback based on the individual or group response. On each day that the discrete trials are implemented, you will work with the students for no more than the allotted circle time activities set in your normal schedule. This study will last for approximately 6 months during the school year. You will also be asked to complete a survey pertaining to the study. The survey will provide me with information regarding your perceptions of the study procedures.

If at anytime you are uncomfortable with the teaching style you may discontinue the intervention. Your identity will not be revealed to anyone not directly involved in conducting the research, or by means of publication, documentation, computer storage, or any other form of report developed from this research. Taking part in this project is entirely up to you and no one will hold it against you if you decide not to do it. If you decide to take part in this study, you may withdraw your consent at any time.

If you want to know more about this project, please call me at (330-606-3633) or my advisors, Dr. Melody Tankersley, or Dr. Lyle Barton at 330-672-2294. The project has been approved by Kent State University. If you have questions about Kent State University’s rules for research, please call Dr. John West, Vice President of Research, Division of Research and Graduate Studies (Tel. 330.672.2704). You will get a copy of this consent form.

Sincerely,

Jen Sweeney, MA, BCBA
Special Education Doctoral Candidate

I, ______________(name) agree to take part in this project and agree to complete a survey. I know what I will have to do and I can stop at any time.

_________________________________________  ____________
Signature                                      Date
APPENDIX E

CONSENT FORM PARAPROFESSIONALS
Date

Dear Paraprofessional,

I would like to do a research study on increasing learning in group settings for students who are diagnosed with autism or with developmental disabilities. Specifically, we would like to use a teaching style to teach students academic skills (e.g., counting skills, sight words, pronouns) and determine whether the method helps students learn the goals quicker, remember the information for an extended period of time, and use the information with other people. We would like to do this study because students with autism and developmental disabilities often have difficulty learning information in group settings. The results of this study may allow us to understand effective ways to teach children new skills.

I would like you take part in this project. If you decide to do this, you will be taught a teaching style in which you will assist the student to respond to three different tasks during regular circle time activities. The teacher will present the group or an individual within the group with a series of discrete trials, which include an instruction or question, a 3-4 second opportunity to respond, and feedback based on the individual or group response. You will prompt the students in responding to discrete trials as needed. The researcher and teacher will inform you which prompts should be used (e.g., pointing to the correct answer, verbally helping the child with the answer). On each day that discrete trials are implemented, you will work with the students for no more than the allotted circle time activities set in the normal schedule. This study will last for approximately 6 months during the school year. You will also be asked to complete a survey pertaining to the study. The survey will provide me with information regarding your perceptions of the study procedures.

If at anytime you are uncomfortable with the teaching style you may discontinue the intervention. Your identity will not be revealed to anyone not directly involved in conducting the research, or by means of publication, documentation, computer storage, or any other form of report developed from this research. Taking part in this project is entirely up to you and no one will hold it against you if you decide not to do it. If you decide to take part in this study, you may withdraw your consent at any time.

If you want to know more about this project, please call me at (330-606-3633) or my advisors, Dr. Melody Tankersley, or Dr. Lyle Barton at 330-672-2294. The project has been approved by Kent State University. If you have questions about Kent State University's rules for research, please call Dr. John West, Vice President of Research, Division of Research and Graduate Studies (Tel. 330.672.2704).

You will get a copy of this consent form.

Sincerely,

Jen Sweeney, MA, BCBA
Special Education Doctoral Candidate

I, ______________________ (name) agree to take part in this project and agree to complete a survey. I know what I will have to do and I can stop at any time.

____________________________________
Signature

Date
AUDIO/VIDEOTAPE/PHOTOGRAPH CONSENT FORM

I agree to be video taped during instruction during circle time activities that occur in the classroom each day.

___________________________________________  _____________________________________
Signature                                      Date

I have been told that I have the right to see the video tapes before they are used. I have decided that I:

_____want to see the tapes  _____do not want to see the tapes

Sign now below if you do not want to see the tapes. If you want to see the tapes, you will be asked to sign after seeing them.

Jennifer Sweeney and other researchers approved by Kent State University may / may not use the tapes. The original tapes or copies may be used for:

_____this research project  _____teacher education  _____presentation at professional meetings

___________________________________________  _____________________________________
Signature                                      Date

Address:
APPENDIX G

DATA SHEET: TRIAL-BY-TRIAL RECORDING
# Data Sheet: Trial-By-Trial Recording

<table>
<thead>
<tr>
<th>Task 1</th>
<th>Mason</th>
<th>Luke</th>
<th>Robby</th>
<th>Sarah</th>
<th>Alex</th>
<th>Total %</th>
<th>Probe 1 Alex</th>
<th>Probe 2 Robby</th>
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<td><strong>Holiday</strong></td>
<td>What is _____?</td>
<td>Halloween, fourth, valentines</td>
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<td>2 Math</td>
<td>*What is noon? 12 o'clock</td>
<td>How many quarters in a $? 4</td>
<td>What time is it? 4:30</td>
<td>How many months in a year?</td>
<td>~Which coin is copper?</td>
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<th>Score</th>
<th>Mason</th>
<th>Luke</th>
<th>Robby</th>
<th>Sarah</th>
<th>Alex</th>
<th>Total %</th>
<th>Probe 1Alex</th>
<th>Probe 2Robby</th>
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<td>9+5=14</td>
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<td>7x3=10</td>
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<tr>
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<th>Task 6</th>
<th>*Where is the star? 6th</th>
<th>~What is a dozen?</th>
<th>Tell me a # less than 50</th>
<th>Tell me a # between 10-15</th>
<th>Put in order (7,8,9)</th>
<th>*Where is the star? 6th</th>
<th>~What is a dozen?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>2</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>3</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>4</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>5</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>6</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>7</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
<tr>
<td>8</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
<td>C I NR P</td>
</tr>
</tbody>
</table>

Key: C = correct | I = incorrect | P = prompt | NR = no response
Additional Notes: Specific answers (e.g., Sarah’s Birthday: April 24th)
### Sequential Responding

<table>
<thead>
<tr>
<th>Sequence for Independent Correct Response</th>
<th>YES</th>
<th>NO</th>
<th>Sequence for Incorrect Response</th>
<th>Yes</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use attention-getting cues</td>
<td></td>
<td></td>
<td>1. Use attention-getting cues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Assure that the child has attended.</td>
<td></td>
<td></td>
<td>2. Assure that the child has attended.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Make 2nd attempt for attention.</td>
<td></td>
<td></td>
<td>3. Make 2nd attempt for attention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Deliver the SD.</td>
<td></td>
<td></td>
<td>4. Deliver the SD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Child responds correctly within 3-4 seconds deliver praise or reinforce.</td>
<td></td>
<td></td>
<td>5. Wait 3-4 seconds if no response from child deliver informational “no”.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Deliver the SD to the next child.</td>
<td></td>
<td></td>
<td>7. Deliver feedback.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8. Deliver next SD for same item to get independent trial.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9. <strong>If response correct:</strong> Deliver feedback.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>If response incorrect:</strong> Deliver two additional prompted trials.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10. Intertrial-1-2 seconds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11. Deliver SD to next child.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Feedback:**

Procedural Checklist

141
Choral Responding

<table>
<thead>
<tr>
<th>Sequence for independent correct responding</th>
<th>YES</th>
<th>NO</th>
<th>Sequence for Incorrect responding</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use attention-getting cues</td>
<td></td>
<td></td>
<td>1. Use attention-getting cues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Assure that children have attended.</td>
<td></td>
<td></td>
<td>2. Assure that the children have attended.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Make 2nd attempt for attention.</td>
<td></td>
<td></td>
<td>3. Make 2nd attempt for attention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Deliver the SD.</td>
<td></td>
<td></td>
<td>4. Deliver the SD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. All children respond in unison within 3-4 seconds deliver praise or reinforce (at least 3 out of 5 children).</td>
<td></td>
<td></td>
<td>5. Wait 3-4 seconds if no response from more than 3 children deliver informational “no”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Deliver the next SD to the group.</td>
<td></td>
<td></td>
<td>7. Deliver feedback.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Deliver next SD for same item to get independent trial.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Deliver individualized trial to a student who was incorrect.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Feedback:

*Must have a minimum of 80% across two sequences.*
APPENDIX I

PARENT SURVEY
PARENT SURVEY

CONFIDENTIAL

This survey is confidential. Please answer all questions to the best of your knowledge and then return the survey in the envelope that was provided.
Thank you for your cooperation!

Rate the following statements according to the following scale by circling the number or circling Don’t Know for each question:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Don’t Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissatisfied</td>
<td>Disagree Strongly</td>
<td>Don’t Know</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disagree Somewhat</td>
<td>Neutral</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agree Somewhat</td>
<td>Agree Strongly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extremely Satisfied</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Overall, how satisfied are you with the service(s) your child received?
   1 2 3 4 5 Don’t Know

2. Behavioral teaching, specifically discrete trial teaching, is very important for a child with autism?
   1 2 3 4 5 Don’t Know

3. My child benefited from the instructional strategy.
   1 2 3 4 5 Don’t Know

4. The instructional strategy will increase student attention during circle time.
   1 2 3 4 5 Don’t Know

5. I feel the teaching methods used with my son/daughter were effective.
   1 2 3 4 5 Don’t Know

Please write any additional comments:

_____________________________________________________________________________________
_____________________________________________________________________________________

Please seal your survey in the envelope provided and return it to the researcher.
Thank you for your time!
APPENDIX J

TEACHER AND PARAPROFESSIONAL SURVEY
TEACHER AND PARAPROFESSIONAL SURVEY

CONFIDENTIAL

This survey is confidential. In the upper right hand corner, please write a three digit code that you will write again on the post survey. Please remember the code in order for the scores on the surveys to be compared. Please answer all questions to the best of your knowledge and then return the survey in the envelope that was provided. Thank you for cooperation!

Rate the following statements according to the following scale:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>disagree</td>
<td>disagree</td>
<td>neutral</td>
<td>agree</td>
<td>agree</td>
</tr>
<tr>
<td>strongly</td>
<td>somewhat</td>
<td>somewhat</td>
<td>strongly</td>
<td></td>
</tr>
</tbody>
</table>

1. Behavioral teaching, specifically discrete trial teaching, is very important for a child with autism?
   1 2 3 4 5

2. The student will exhibit inappropriate behavior when the instructional strategy is used.
   1 2 3 4 5

3. The student will benefit from the instructional strategy.
   1 2 3 4 5

4. The instructional strategy will increase student attention during circle time.
   1 2 3 4 5

5. I will use the strategy after the study is completed?
   1 2 3 4 5

6. I feel confident in using discrete trial teaching
   1 2 3 4 5

7. I feel confident in training others to use the discrete trial teaching.
   1 2 3 4 5

8. The instructional method is cost effective.
   1 2 3 4 5

Please write any additional comments: __________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Please seal your survey in the envelope provided and return it to the researcher.
Thank you for your time!
APPENDIX K

DISCRETE TRIAL TEACHING PROCEDURAL FLOWCHART
REFERENCES
REFERENCES


programs for students with Autism Spectrum Disorders (pp. 1-9). New York: DRL Books.


