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Evaluating the Efficacy of Group Equivalence-Based Instruction Using Observational Learning

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EVALUATING THE EFFICACY OF GROUP EQUIVALENCE BASED INSTRUCTION USING OBSERVATIONAL LEARNING

by

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Submitted in Partial Fulfillment of the Requirements for the
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TITLE: EVALUATING THE EFFICACY OF GROUP EQUIVALENCE BASED INSTRUCTION USING OBSERVATIONAL LEARNING

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The current study investigated the effect of observational learning during equivalence based instruction (EBI). Two boys (Tim and Nate) ages 11 and 12 with Autism Spectrum Disorder participated in the study. Participants received small-group EBI training with an embedded observational learning component twice weekly for six weeks. Both participants were given a trained and observation set containing three classes (Class A, Class B and Class C) consisting of four class members. Participants served as both learners and observers during each training session. Each participant was trained on match-to-sample tasks with relations A-B and B-C and tested for class formation across the trained and observation set. Results showed that Tim was able to derive the untrained A-C and C-A relation at 100% correct on both the trained and observation set of stimuli. After the initial training, Nate averaged at 40% and 55% on the trained and observation set of stimuli, indicating that he was unable to derive the untrained relations. Two remedial training sessions were conducted, where Nate was re-exposed to the A-B and B-C training. After the remedial training, Nate averaged at 85% and 67.5%, indicating strong class formation on the trained set of stimuli, and moderate class formation on the observation set. The current study demonstrated the utility of observational learning during EBI. Limitations and implications for clinical practices are discussed.

Keywords: Equivalence-based instruction, Observational learning, Autism Spectrum Disorder, PEAK-Equivalen

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DEDICATION

To my husband and five children who will never read it.

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CHAPTER 1

INTRODUCTION

Autism Prevalence Rates

There seems to be a gulf between the technology of special education instruction for those with Autism and other developmental disabilities, and current research findings regarding most efficacious methods of instruction. Additionally, research in other fields beyond Behavior Analysis in the last few decades has indicated that worldwide there has been an increase in children being diagnosed with Autism Spectrum Disorder (ASD) (Koegel, Koegel, Ashbaugh, & Bradshaw, 2014; National Autism Center, 2009). According to the Centers for Disease Control and Prevention 1 in 59 children are diagnosed with Autism each year (CDC, 2019). There is great debate as to what has caused this dramatic increase in prevalence rates with experts claiming increased inclusion in the DSM criteria, or environmental factors playing a major role. This said however, the rise in the epidemiology rates of Autism have led to greater interest in diagnosing Autism from an early age. Resulting from this interest, in recent years reliable detection of Autism occurs as early as 2 years of age (Corsello, 2005).

While research regarding the most efficacious models and forms of instruction in education settings is still being conducted, what has resulted in the biggest gains in IQ and quality of life for those with developmental disabilities results from Early Intensive Behavioral Intervention (EIBI) (Corsello, 2005; Lovaas, 1987; Reichow, 2012; Reichow & Wolery, 2009). The earliest findings supporting EIBI resulted from Lovaas (1987) at University of California Los Angeles, where almost half of the children participating with developmental disabilities achieved IQ scores above 85. These participants went on to be placed in general education classrooms and maintained academic gains as years passed. A review of five meta-analyses of

EIBI by Reichow (2012) showed that four out of five meta-analyses revealed positive gains in IQ and adaptive behavior for children with ASD. The two components that make EIBI most effective are early behavioral education, and the overall level of intensity and comprehensiveness of the model of instruction selected (Corsello, 2005).

Discrete Trial Training

In terms of EIBI, one of the most effective methods of treating children with Autism and developmental disabilities is Discreet Trial Training (DTT) (Crockett, Fleming, Doepke, & Stevens, 2007; Taubman, Brierley, Wishner, Baker, McEachin, & Leaf, 2001). DTT has been shown to provide a properly structured platform for children with developmental disabilities to effectively learn new skills, especially when used from an early age (Lerman, Valentino, & LeBlanc, 2016). DTT is typically administered in a one-on-one, table-top setting with an instructor or therapist providing repeated opportunities for a response from the participant, and once a response has been indicated some form of corrective feedback is typically delivered (Leaf et al., 2013). In Applied Behavior Analysis (ABA), DTT is structured around the critical components of a discriminative stimulus, specific prompt sequence, and a target skill followed by reinforcement. The beginning of the next trial in the series is immediately followed by the completion of the previous trial in the sequence (Lerman et al., 2016). In recent years, DTT has been extended from a clinic setting with trained professionals implementing direct therapy, to parents implementing this at home to good effect (Crockett et al., 2007).

Another area in which DTT is currently being utilized is within group settings. Although the paradigm of one-on-one instruction could ensure that the learning environment is free from distractions, as well as allowing opportunities for each learner to be provided with as many learning trials as possible during each session (Taubman et al., 2001), due to the necessity of teaching strategies for those dealing with disabilities, group designs have begun to be researched more frequently (Leaf et al., 2013). DTT within a group setting allows for a larger number of students to learn similar concepts. This maximizes the efficiency of each teacher's time, and also allows for inclusion and interaction between those with and without developmental disabilities in educational settings (Ledford, Lane, Elam, & Wolery, 2012). Recent studies have shown that group-based DTT instruction has been used to teach money skills, tolerance to delays, language and reading skills, as well as a variety of other vocational tasks (Kamps, Walker, Maher, & Rotholz, 1992; Schoen & Ogden, 1995; Taubman et al., 2001).

According to Leaf et al. (2013), student responses can be programmed in group formats using DTT methods. Two common responses programmed in group DTT include choral responding and sequential responding. An example of a choral response would be all students responding to a basic motor movement that can be visibly seen by the instructor at once. Sequential responding is a more naturalistic approach that mimics an in-class education setting where each student or participant is asked a question, or series of questions before moving to the next child.

Both forms of responding have advantages and disadvantages, but overall preliminary studies have revealed group DTT methods to be just as effective as one-on-one instructional methods. In one such study involving a direct comparison between both group and one-on-one instructional methods, participants with Autism were found to acquire the same number of target responses, as well as demonstrate similar levels of maintenance, and overall quicker acquisition of target skills in the group condition (Leaf et al., 2013). Another advantage attributed to the success of group DTT methods stems from observational learning (Leaf et al., 2013; Ledford et al., 2012).

Observational Learning

Bandura (1977) first coined the term observational learning as being part of a mentalistic process of an individual seeing a model engage in a behavior and because of information gleaned from the actions of that model, the individual is more likely to engage in that behavior. Behavior analytically, Castro and Rehfeldt (2016) use the term observational learning to describe the process by which an individual learns a new skill or behavior simply by observing another individual engaging in that skill or behavior and receiving reinforcement. The individual observing then engages in that same skill or behavior without any training or reinforcement provided directly. Skill-acquisition becomes efficient when learners can build large repertoires without direct instruction. Observational learning is conceptualized as being derived from processes like rule-governed behavior, generalized imitation and conditioned reinforcement (Fryling, Johnston, & Hayes, 2011). For instance, a learner observes another peer in class receive praise for throwing away trash. The learner might be more likely to engage in this same response in the future, without being directly reinforced.

Observational learning has been used with individuals with developmental disabilities with promising results. For example, Egel, Richman, & Koegel (1981) successfully taught individuals with developmental disabilities to properly administer CPR by observing skills demonstrated by a typically developing peer. Results showed that individuals with developmental disabilities can learn skills as complex as CPR successfully. In addition Werts, Caldwell and Wolery (1996) demonstrated that observational learning can be used to teach various academic skills to individuals with disabilities. In this study, three individuals with developmental disabilites learned functional skills using behavioral chains. The functional skills were customized to each of the individuals based on preferences and individual needs and modeled by typically developing peers. Peers would narrate each step of the behavior chain while modeling the behavior being described. These skills included using a calculator for an addition problem, sharpening a pencil and spelling the individual's name using letter tiles. Results showed that each of the three individuals with developmental disabilities were able to successfully learn these behavior skill chains by observing peers.

Despite its promises, children with Autism or other developmental disabilities do show difficulties with observational learning procedures (Taylor, DeQuinzio, & Stine, 2012). The pre-requisite skills of sitting, attending to specific modeled responses and motor movements are not always present for those with developmental disabilities. This said however, previous research suggests that, these attending deficits may be mitigated by teaching individuals with developmental disabilities to engage in a monitoring response or observation response during instruction.

Taylor et al. (2012) states that an observation response can consist of a prompt to all students to attend to the student being directly trained, or some type of motor or vocal utterance that mimics a peer's response. This prompt ensures that the observational learner can discriminate between commands, and is physically and visually oriented to the target participant. It also ensures that the learner can engage in any pre-requisite motor skills that are possibly needed to acquire the new skill. The observation response cannot however guarantee that the observer is hearing and retaining the correct response, but the chances that the observer is attending increases when observing practices are encouraged.

Previous research by Taylor et al. (2012) compared observation responses to regular observation trials. In this study, researchers used sight words for training reading skills to individuals with developmental disabilities in a classroom setting. The observation response was the observer repeating a spoken sight word read by a peer. Only the peer received tokens for the target behavior of reading the sight words correctly, but the observer was given praise by the instructor and provided tokens contingent upon other skills like sitting quietly and keeping hands still. Results showed that acquisition of sight words occurred for the observing participant that did not receive any direct training on sight words. In a different setting, the observer did not need to engage in an observation response. Although participants demonstrated skill acqusition, the pace of acquisition was slower than the condition requiring an observation response.

Equivalence Based Instruction

Equivalence relations were first demonstrated empirically in a study teaching a child with developmental disabilities to conditionally discriminate pictures of objects when presented with auditory names, and auditory names when presented with visual words (Sidman, 1971). After initial training, the child was then able to match visual words to pictures and oral names to written visual words (i.e. read). This early technology provided a basis for efficient instruction for those with developmental disabilities, since interventions using Equivalence Based Instruction (EBI) may only need to directly teach a marginal number of relations to produce a robust set of derived relations (Stanley et al., 2018).

Consider the following example, an A-B relation between a picture of a food (A) and the auditory name of a food (B) might be taught directly. Next, An A-C relation between the picture of a food (A) and a written expression of the word for that food (C) may be taught directly. After this training the participant would be able to derive the B-C relation of auditory name of a food (B) to the written word for that type of food (C) without direct training. In this example only two direct relations were trained (A-B, A-C), but four derived relations emerged. The emerged relations were B-C along with C-B and the symmetrical relations of B-A, C-A. The number of derived relations increases exponentially as the number of directly taught relations increases.

Dixon, Stanley, Belisle, Galliford, Alholail, and Schmick (2017) demonstrated this increase in derived relations by using four stimulus classes and directly teaching three relations to two children with Autism (eg. A-B, B-C, C-D). The stimuli classes used were vocal names of countries (A), location of country on map (B), flags of each country (C), and continent of each country (D). Each time a new relation was taught the remaining relations were probed for the emergence of derived relations. While three relations were directly taught, there are nine possible relations that may emerge with this design. This study showed that numerous stimulus relations were derived by increasing the stimulus class categories. After initial training, both children were able to derive untaught relations after the direct training of three relations. Participants in this study were also able to generalize location of a country on a paper map to location of country on a computerized map. This study highlights the utility of EBI in that relevant, age-appropriate classroom skills may be taught to children with developmental disabilities using derived relational responding procedures.

Stimulus equivalence procedures have also been used with arbitrary stimuli to make sure skills demonstrated during test for class formation are result of derivation, not prior relation based on direct contingency. In some of these studies, foreign languages, Greek symbols and novel shapes or patterns have all been used as arbitrary symbols (eg. Ramirez, Rehfeldt, & Ninness, 2009; Sidman, & Tailby, 1982). Such variation makes EBI procedures flexible enough for teaching skills to individuals at different skill levels (Ramirez et al., 2009), as well as being able to adapt to the procedures that include olfactory and tactile training for those with developmental disabilities.

For example, Belisle, Stanley, Alholail, Galliford, and Dixon (2019) incooperated equivalence based instructional methods to teach socially significant skills necessary for independent functioning. In this study the researchers showed that through Multiple Exemplar Training (MET), individuals with developmental disabilities could generalize the stimulus properties of wet/dry and hard/soft to novel stimuli that hadn't previously been trained. Results showed that each of the participants with developmental disabilities successfully generalized these properties with novel stimuli.

Despite the efficiency of EBI in one-to-one instructional settings, EBI has rarely been applied to multiple participants at once (Zinn, Newland, & Ritchie, 2015). As Tullis, Frampton, Delfs, Greene, & Reed (2019) pointed out, EBI is just starting to emerge in research using group instruction procedures. As implied by its name, group instruction involves at least two learners present at the same time (Collins, 2012). Research surrounding small group instruction is geared toward increasing the number of learners and amount of material taught with the fewest number of instructors possible (Ledford et al., 2012). This technology of EBI, if applied to a group setting allows maximum efficiency for instructors in the education setting (Collins, 2012). Although research surrounding EBI in group settings is limited, evidence has shown favorable outcomes under specific conditions and methodological considertions (Rehfeldt et al., 2003).

One of the few studies evaluating the effects EBI procedures in a group setting was conducted by MacDonald, Dixon, and LeBlanc (1986). This study attempted to train four adults with developmental disabilities to produce full stimulus class derivation after being directly trained on one relation using arbitrary line formations. Once a single participant was able to master a matching-to-sample procedure using two arbitrary stimli (A1-B1), that participant was required to observe a peer being directly trained in another relation using arbitrary line formations that shared a stimulus class (A1-C1). Symmetrical relations (B1-A1, C1-A1) were demonstrated in this early study, however only one of the four participants demonstrated true stimulus equivalence after training and observation. While researchers failed to show equivalence relations with all participants, the results of this study showed that embedding an observational component within a stimulus equivalence paradigm can be both successful and efficient. Additionally, Rehefeldt et al. (2003) demonstrated the use of EBI with three children with developmental disabilities. This study also required an observation response of eye contact before every trial to maximize attending (Rehfeldt et al., 2003).

Equivalence Based Instruction with Observational Learning

Tullis et al. (2019) combined Small group instruction with EBI using two groups of three children. This study also utilized an observation response from participants and an observational learning component by measuring a secondary target response never directly taught. Before every training trial, all participants in each group were expected to engage in an observation response that required interaction with the stimuli in some manner (e.g., blow the stimulus card a kiss). One group was trained on historical figures and the second group was trained on cartoon characters.

Participants were trained to match dictated names to pictures of historical figures or cartoons. Participants were also trained to provide the vocal response of naming the historical figure or cartoon when provided with a picture. After a participant correctly identified the target character or figure during training, the instructor gave a secondary fact about that character or figure (e.g., Benjamin Franklin discovered electricity, Mulan is friends with Mushu).The participant was never directly trained on this secondary fact and the researcher stated this fact without requiring a response from participants. Emergence of this secondary target response was tested after direct training and participants were able to state the secondary fact when shown a picture of the historical figure or cartoon. Overall results suggest the acquisition and derivation of the secondary observation target response was successful for some participants (Tullis et al., 2019).

Another example of the efficiency of observational learning in EBI has been shown using two siblings in a study by Ramirez, Rehfeldt, and Ninness (2009). In this study only one sibling was directly taught symmetry relations (A-B) of a picture of an object to the vocal Spanish name for that object. Three separate types of stimuli sets were used in this study, and after teaching one sibling these conditional discriminations (i.e. matching to sample) and mastery was reached, the observing sibling was then tested to see if the A-B relation had also been acquired via simple observation. Results showed that after training, both siblings were able to master A-B relations along with the emergence of the symmetrical relation of B-A. Maintenance of these new language skills were monitored for both children after one month, and it was found that both siblings still retained these relations. This study shows how efficient observational learning methods can be when teaching complex skills like language.

Besides the consideration of implementing an observation response, studies have shown other procedural variations required for derived relations to emerge based on observational learning in a group setting. For example, Rehfeldt Latimore and Stromer (2003) examined observational learning by teaching three separate stimulus classes to the peer and observer. Each participant was given a different superordinant class (i.e. modes of transportation, occupations, and appliances). Participants were directly taught to identify a picture from a dictated word (A-B), match a written word with a dictated word (A-C) and then tested for emergence of matching written words to pictures (B-C). Symmetrical relations of (B-A), (C-A) and (C-B) were also probed.

While results of this study by Rehfeldt et al. (2003) showed that each participant could individually learn a full stimulus class that was directly taught, the observational component of the study was unsuccessful until researchers taught separate stimulus classes to each participant that shared the similarity of being within the same superordinate class.This means that each class taught whether to an observer or peer had to have a commonality with every other stimulus class being taught (e.g. occupations, types of food, animals). When researchers redesigned the stimulus classes to share the same superordinate class for these participants, the results from the observational learning component showed that each participant demonstrated emergence of relations not directly taught. The implications from Rehfeldt et al (2003) suggest the methodological importance of a shared superordinate class when designing stimuli classes within the current study.

Current Treatment Packages and Technology

In terms of treatment packages, there exists a wide array of comprehensive treatment models (CTM) designed to target skill deficits for adults and children with Autism and developmental disabilities (Odom, Boyd, Hall, & Hume, 2010). CTMs are packaged or "branded" intervention strategies or curriculums designed for the applied setting for prolonged periods of time (Odom et al., 2010). Examples of CTMs include the Denver Model, TEACCH model and Lovaas model (Lovaas, 1987; Mesibov, Shea & Schopler, 2005; Odom et al., 2010; Rogers & Dawson, 2010). Recently a new CTM entitled *Promoting the Emergence of Advanced Knowledge Relational Training System* (PEAK) has emerged with multiple studies demonstrating its effectiveness in EIBI for those with autism and developmental disabilities because of its use of derived relational responding based on relational frame theory (Dixon, 2015; Dixon, Belisle, & Stanley, 2018a; Dixon, Carman, Tyler, Whiting, Enoch, & Daar, 2014a; Dixon, Whiting, Rowsey & Belisle, 2014b; Dixon, Wiggins & Belisle, 2018c; Stanley et al., 2018; McKeel, Dixon, Daar, Rowsey, & Szekely, 2015). Through the use of EBI and learning based upon derived relational responding, studies have shown socially significant outcomes such as improvement on intelligence, executive functioning and adaptive behavior (Dixon et al., 2014b; Dixon et al., 2018a; McKeel et al., 2018).

The purpose of the current study was to evaluate the efficacy of EBI methods in group instruction with individuals with developmental disabilities. In education settings for those with developmental disabilities usually there are not enough resources or instructors to consistently implement one-to-one instruction (Leaf et al., 2013; Ledford et al., 2012). By using a group instruction format and increasing the number of learners per instructor, this instructional paradigm will increase the overall social validity and clinical significance in educational settings (Collins, 2012; Ledford et al., 2012; Leaf et al., 2013; Stanley et al., 2018).

Researchers in the current study embedded an observational learning component evaluating both trained and untrained relations. In this study, training occurred simultaneously for both participants, but separate stimulus classes within the same superordinate class were used for each participant (Rehfeldt et al., 2003). Participants simply sat and observed while a peer received feedback during half of the trials within every training session. Participants were shown all sets of stimuli, but not allowed to respond during any of the observational trials. This means that half of each session was solely observational learning for both participants.

The current study hypothesized that using a small group EBI procedure would yield full equivalence class formations on all stimulus sets for both participants. Participants were exposed to reinforcement contingencies and corrective feedback on the trained stimuli set, while not receiving any feedback during observations. A multiple probe across participant design was used to evaluate the emergence of two equivelance classes (the trained set and the observion set) separately between two participants.

CHAPTER 2

METHOD

Participants and Setting

Two children diagnosed with Autism spectrum disorder participated in this study. Both participants attended a clinic for language, cognitive, and social skill development at a Midwestern University. Tim was 11 and Nate was 12 years of age. Both participants received therapy twice every week for one hour each. Participants were selected based off the *PEAK Comprehensive Assessment* (PCA) which indicated both participants were within the same skill levels. PCA scores are used by clinicians at the clinic to assess the overall level of demonstrated knowledge and performance on PEAK related skills from each module. Scores from the PCA serve as the basis for pre-assessments during intake, programming by case managers, and post-assessments upon termination of services from the clinic.

All sessions were conducted in one of the designated therapy rooms of the clinic on campus. Each therapy room had a single table and four chairs for the two participants. Two participants, the researcher and an additional collector of IOA were present during sessions. Two 30-minute sessions were conducted during the participants' scheduled therapy session each week. During each session both participants were present during all of the training phases, but only one participant was allowed in the room during baseline and probes.

Materials

The program utilized for this study was based from 10 P Metonymical Tacts taken from the Equivalence module of the PEAK curriculum.Three stimuli classes were trained during this study with eight members per class. These consisted of pictures of a type of cloud (A), the sight word of that type of cloud (B) and pictures of an arbitrary symbol for that stimuli (C). See

Appendix A for stimuli used. All members of each class belonged to the same superordinate stimuli class (Rehfeldt et al., 2003). These class members were further divided into two sets, class members one to four as set one, and class members five to eight as set two. For each participant, one set of stimuli was used during teaching trials while the other set was used during observation trials. The (A) and (C) stimuli were printed on 3x3 inch laminated cards. PEAK Equivalence data sheets were used to record scores for each trial conducted with participants. A battery operated button was also used during these trials. See Appendix B, C and D for these materials. The purpose of this button served as an observation response for participants. The participants were required to press this button before each trial delivered by the researcher.The participants were told that using the button indicated readiness to either observe the trial or participate in the task demand.

Procedure

Independent Variable. The PEAK Equivalence: Metonymical Tacts-10P program was selected for this study. The stimuli sets chosen for this program were adapted to the type of science instruction that is taught to neurotypical children during the same age range (Malleus, Kikas, & Marken, 2017). This type of science instruction typically is taught between fourth and fifth grade and focuses on the water cycle and cloud formation (Malleus et al., 2017). The Metonymical Tacts- 10P program was altered slightly by substituting an arbitrary class symbol for stimulus class C to ensure no prior learning history had been established. This was also selected to illustrate that the emergence of derived relations are not dependent upon specific stimuli, but instead can be adapted based on curriculum needs. The current study sought to target educationally relevant material using the PEAK curriculum and small group instruction that both participants would contact during typical instruction.

Dependent Variable. The dependent variable in this study was the PEAK score for each trial block (10 trials). Participants could score a 0 or 10 on each of the trials per block. The PEAK score was calculated by adding the number of correct responses (scored 10) for each trial block (e.g. 8 correct out of 10 total trials = 80% for trial block score). During each trial block one participant was exposed to 10 trials of observation. Researchers referred to this participant as the observer. The second participant was required to respond to the task demand. Researchers referred to the responding participant as the learner. During this time only the learner's responding was scored.

Experimental Design and Procedure. A multiple-probe across participants design was used in this study. In baseline four relations were tested (i.e. A-B, B-C, A-C, and C-A). Out of the four relations only two were directly trained for both participants. Probes were conducted during each training phase to assess for derived relations. The probes tested the same four relations as during baseline. The two relations directly trained were A-B and B-C. For example, the picture of a type of cloud (A) was matched to its sight word (B) and the the sight word (B) was matched to an arbitrary symbol that didn't share any characteristics related to that cloud formation (C). The sequence of conditions within this study were as follows: (a) baseline condition, (b) A-B training phase, (c) probe, (d) B-C training, and (e) testing for class formation. Baseline tested both set one and two in regards to each of the four relations examined for both participants. Following mastery of A-B relations for participant one with stimuli in set one (A_{1234}-B_{1234}) and A-B realtions for participant two with stimuli in set two (A_{5678}-B_{5678}), probes were conducted on both sets of stimuli to examine learning via direct contingency and via observation. If a participant was unable to maintain the directly trained relation during probes, both participants were exposed to additional training on the same relation with their respective set of stimuli before moving on to the next step. Testing for class formation consisted of researchers testing the same four relations as during baseline and probe sessions.

Baseline, Probes and Test for Class Formation. During the initial baseline each of the four relations were tested in two separate trial blocks of 10. There were 20 total trials for each of the four relations tested. During the two trial blocks used to probe the A-B relation, one trial block was used for testing stimuli in set one (i.e., A_{1234}-B_{1234}) while the second block tested the A_{5678}-B_{5678} stimuli set. The same procedure was used for the remaining three relations probed (i.e. B_{1234}-C_{1234}, B_{5678}-C_{5678}, A_{1234}-C_{1234}, A_{5678}-C_{5678}, C_{1234}-A_{1234} and C_{5678}-A_{5678}). This arragement allowed for stimuli in teaching trails and observation trials to be kept separate. During baseline and test probes following training sessions participants were given no praise, tokens or feedback for correct or incorrect responses. No prompting procedures were in place during test probes.

Role as Learner and Observer. The learner in each session responds to the task demand during teaching trials when the SD is delivered for the corresponding stimuli set (i.e. sample and comparison stimuli). The observer is required to listen to the SD and watch the learner's response without responding or aiding the learner during these observation trials. Each participant rotates between these two roles, participant one (Nate) used set one during his teaching trials and used set two during his observation trials. Participant two (Tim) used set two during his teacing trials and used set one during his observation trials.

Switching Role between Learner and Observer. Both participants were in the room during all sessions, except during baseline or probes. Participants alternated roles as the learner and the observer on average after three trials. For example, participant one served as the learner while participant two served as the observer for three trials. The SD was delivered to each participant, but only the learner was allowed to respond to the task demand. During this time the observer watched the learner's responses as well as error correction procedures implemented by the researcher.This continued for three trials before participants alternated roles. Alternating roles occurred when the researcher read the following script to designate which participants served as the learner and observer: "You will watch and listen as [name of learner] completes his work. Please pay attention, do not talk, point, or help him it is [name of learner]'s turn". Participant's responses were only recorded during teaching trials when a participant served as the learner.

A-B Training. During A-B training trials, the sample stimli were $A_{12345678}$, and the comparison stimuli were $B_{12345678}$. At the beginning of each trial the researcher first placed three comparison stimuli on the table, one of which was the correct answer. The researcher then presented the sample stimulus and said: "look at this and press the button." Both participants were required to engage in the observation response by pressing the button (Taylor et al., 2012). After the observation response was performed by each participant the researcher prompted the observer to watch the learner. The researcher then delivered the SD: "put with same" handed the sample stimuli (a picture of specific cloud formation) to the learner. The researcher required the learner to match the picture of the cloud formation to its sight word. Responses were scored as either correct or incorrect using the PEAK Equivalence data sheet. The percentage of correct answers were scored for each trial using these data sheets. If the participant gave the incorrect response an error correction procedure was implemented. When the participant answered the question incorrectly the researcher replied "no that is incorrect" and provided corrective feedback in the form of first modeling the correct response and then re-presenting the task with a gestural prompt. If the participant engaged in the correct response, the researcher reinforced the participant with priase. If the participant still chose incorrectly, the researcher once again stated that the answer was incorrect, modeled the correct response, re-presented the task and immediately provided a full physical prompt. After the full physical prompt the researcher moved on to the next trial. Both participants ended the A-B training phase together when mastery was achieved. The mastery criteria for A-B trainig was set at scoring 90% or above across three consecutive sessions. Particpants moved on to the next part when both participants reached the mastery criteria.

B-C Training. The B-C training followed the same paradigm in A-B training, with the exception that the sample stimuli was $B_{12345678}$ and the comparison stimuli was $C_{12345678}$. The researcher used the same error correction procedure. Both participants ended the B-C training phase together when Nate reached mastery on the B_{1234}-C_{1234} relationship and Tim reached mastery on the B_{5678}-C-$_{5678}$ relationship.

Interobserval Agreement. IOA was taken by a second researcher during this study. IOA was taken during 90% of sessions run during the baseline and train trials. IOA was calculated by taking the total number of disagreements and dividing that number by the total sum of the disagreements plus agreements and multiplying that number by 100. An agreement during this study was defined as both researchers achieving the same score per every trial block used for scoring during baseline, training and test probe sessions. IOA during this study was 100% across 77 trial blocks.

Procedural Integrity. Procedural integrity data was taken in addition to IOA by a second observer. Procedural integrity data consisted of the rater filling out a data sheet that could be marked yes or no for seven separate components on each trial (see Appendix E for detail). The observer scored if the script was read correctly by the researcher, if the observation response was prompted, if the SD was delivered clearly and if appropriate feedback was given based on whether participants served as the observer or learner. The observer also scored whether the error correction procedure was delivered correctly and whether only one participant was present during baseline and probe sessions. Procedural integrity data was taken for 90% of all sessions. Overall procedural integrity data indicated that the researcher performed EBI procedures accurately at 100% across 9 out of 10 sessions.

CHAPTER 3

RESULTS

Baseline

Tim. During baseline Tim's scores ranged from 20% to 60% with an average of 38.89% across all 9 trial blocks. There were a total of 80 trials ran during baseline, or 20 trials per relation, with 10 trials ran for both the observation and the train set (i.e. 10 trials per A_{1234}-B_{1234} and 10 trials per A_{5678}-B_{5678}). Tim received an additional 10 trials when he scored 60% during the C-A probe with his trained set of stimuli. This score was the only trial block during baseline scored above 50%. This occurred during the C_{5678}-A_{5678} set when the participant was being tested on matching pictures of stimuli (A) to arbitrary symbols (C). Due to the arbitrary nature of the stimuli it is unlikely that the participant ever contacted this specific set of stimuli, it was highly likely that Tim's score was reached by chance. Nevertheless, researchers decided to re-test this relation before moving on to training. Results of the re-test showed Tim scoring a 40%, which confirms that the high score was likely due to chance

Nate. Nate's score during baseline ranged from 10%-50% with an average of 27.50% across all 8 trials. No additional probes were needed as the highest score only reached 50% on a single trial, which suggests scores equal to that of chance.

A-B Training

Results of visual inspection of A-B training for both participants suggest a rapid change in level and trend immediately following the transition between baseline and training (Figure 1). As shown in Figure 1, Tim reached mastery by the 4th trail block of A-B training, while Nate required 5 trial blocks total to reach mastery. Overall variability in data was low in this condition. Both participants reached mastery within a few trial blocks and remained at a high level of scores until mastery of A-B was achieved. Training to mastery of the A-B relation only required two training sessions with both participants

Probe

Following mastery of the A-B training set by both participants, all relations were probed as in baseline. A total of 80 trials were conducted on each participant. Figure 1 shows that both Tim and Nate scored at or above mastery on the A-B relationship with the directly trained set of stimuli. Tim scored 90% and Nate scored 100%. Tim however showed an increasing score from baseline on each of the relations including relations not yet trained. Tim scored a 100%, 70% and 90% on the remaining untrained relations (B_{5678}-C_{5678}, A_{5678}-C_{5678} and C_{5678}-A_{5678}). The lowest score during the probe session was 70% during A_{5678}-$C_{5678.}$ Figure 1 also illustrates a more expected effect with Nate on his trained set, with scores on the untrained relations remaining at similar levels as baseline. Nate scored a 10%, 40% and 50% on the remaining relations (B_{1234}-C_{1234}, A_{1234}-C_{1234}, and C_{1234}-A_{1234}).

Results of the observation set for both participants also reflect unexpected results. Tim's acquisition of the training set occurred at a quicker rate than Nate's. Tim also worked at a faster rate compared with Nate during training sessions. Tim reached 90% after a single trial block of A-B training (Figure 2), while Nate scored much lower the first two trial blocks before finally reaching 90% (Figure 2). Researchers expected Tim to score higher on the observation set because the trained set was acquired with more fluency and at a quicker pace, however Figure 2 shows that Nate was able to master the observation set along with the trained set, while Tim only scored a 60% on the observation set. The remaining three untrained relations of the observation set for both participants were 60% and below.

B-C Training

Tim reached mastery with the first three trial blocks (Figure 1). Tim's scores remained at an almost perfectly stable level the remainder of training, however Nate showed more variability during each trial block (Figure 1). For example, the score on the first trial block reached 80%, but there was a major change in level during the next few trial blocks (Figure 1). Nate scored 30% on one trial followed by a 90% and eventually scoring a 70% on the 6^{th} trial block during B-C training. This amount of variability makes it difficult to determine if the skill is being acquired. The variability of the data suspended the B-C training into three separate sessions. Regardless of this, Tim's scores remained at a high level across all sessions suggesting maintenance of B-C training. Following one week of absence Nick also scored a 90%, 100% and 100% upon returning to B-C training which suggests that the relation might have been acquired at an earlier session.

Test for Class Formation

Results of the test for class formation show that the instruction successfully established a robust three-member equivelance class for Tim. Tim was directly trained on A_{5678}-B_{5678} and B_{5678}-C_{5678} relations. Figure 1 also shows that derivation occurred on the untrained relations of A_{5678}-C_{5678} and C_{5678}-A_{5678}, as Tim scored 90% correct on the A-C relation and 100% correct on B-C, A-C, and C-A relation. Figure 2 also shows that the class formation based on observational learning was successful. Tim served as the observer for the relations of A_{1234}-B_{1234} and B_{1234}-C_{1234}. Tim scored a 70% and 100% on these observed relations (Figure 2). Tim's scores also showed that derivation occurred on the untrained relations of the observation set (A_{1234}-C_{1234} and C_{1234}-A_{1234}). The scores for these two relations were both 100% (Figure 2).

Nate scored a 100% and 90% on his trained set of A_{1234}-B_{1234} and B_{1234}-C_{1234}. Figure 1 shows that Nate was unable to derive the untrained relations A_{1234}-C_{1234} and C_{1234}-A_{1234} as scores on these two relations were 50% and 30% which were similar to scores during baseline (Figure 1). Scores on the observation set indicate that Nate was able to master the A_{5678}-B_{5678} relation with 90% (Figure 2). This suggests that some observational learning was taking place. Nate scored a 70%, 40% and 70% on the remaining three relations of the observation set (B_{5678}-C_{5678}, A_{5678}-C_{5678} and C_{5678}-A_{5678}). The scores on the B_{5678}-C_{5678} and C_{5678}-A_{5678} relations of the observation set indicate an increasing trend compared to baselines scores of 50% and 20% (Figure 2). While derivation was unsuccessful and observational learning did not appear to occur fully in every relation, the increase in performance on these relations during the test for class formation compared with baseline scores prompted researchers to conduct a remedial training for this participant.

Remedial Training

The increasing trend in Nick's data prompted researchers to conduct two brief remedial training sessions consisting of a trial block of A-B and B-C trainings (conducted in the same fashion as in the A-B and B-C training phase) followed by a C-A and A-C probe. Nick's scores on the A-C and C-A relation using the trained set of stimuli raised significantly from 50% and 30% to 80% and 90%. This increase in level prompted a second training of A-B and B-C and scores remained at 100% and 80% on the trained set (Figure 1). These results show that with additional training, a three-member equivelance class was established for Nick among stimuli used in direct training.

Results also showed an overall improvement of Nick's performance on the observational set. After the first remedial training session, his performance on the A-C and C-A relation among the observational set changed from 40% and 70% to 70 % and 50%. After the second remedial training, Nick scored 60% on the A-C realtion and 90% on the C-A realtion. Overall, Nick averaged 65% and 70% during the A-C and C-A relation using stimuli in the observational set. This improved performance compared to his baseline condition indicated a three-member equivalence class among stimuli used in observation set with moderate strength.

Percentage Non-Overlapping Data

Nate's percentage of non-overlapping data (PND) was 75% in the trained set and 75% in the observation set. This indicates a little to moderate effect of treatment. Tim percentage of non-overlapping data was 100% in the trained set and 75% in the observation set. This indicates a strong effect of treatment in the trained relations set, but a weak effect in the observation set. While Nate's PND scores were moderate for both the trained and observations sets, Tim's PND for the trained set is promising for further research into group-based EBI procedures.

CHAPTER 4

DISCUSSION

The purpose of the current study was to examine group equivalence-based instruction (EBI) using the PEAK curriculum on participants with developmental disabilities. There were two participants diagnosed with ASD. Overall results suggest that a group-based EBI can successfully produce equivalence classes during a short amount of time and sessions. This study also showed that a curriculum intended for single subject use can be adapted to use with multiple participants successfully.

Furthermore, results also showed strong evidence of successful class formation based on observational learning in one participant (Tim). Derivation of the observation set occurred at 100% accuracy. For this participant, only two relations (A_{5678}-B_{5678} and B_{5678}-C_{5678}) were directly taught, but by participating in a group-based EBI, mastery of all relations was demonstrated. This participant demonstrated that skill acquisition can occur without direct contingency and that observational learning can be extended in settings that involve equivelance based instructions.

In an applied setting this kind of procedure would potentially result in an increase in mastered relations, especially with teachers using this instruction on three to four children at a time. The possible amount of relations gleaned from this current study was eight for both participants, but in a group of four children the number of mastered relations possible increases to 16 for each participant. When this number is combined with the total number of groups receiving EBI instruction the number of relations per classroom increases exponentially. Researching equivalence-based programs that serve as many participants as possible would best serve the applied interest of behavior analysis in terms of educating those with developmental disabilities (Baer et al., 1986).

Results of the second participant (Nate) were less promising for the observational component of the study, however derivation of the trained set for this participant was shown. While this participant did not reach mastery of the observation set there was an overall increase during remedial training, which suggested mastery might have been achieved with further training. There were other factors that might have mitigated this participant's lower scores. For instance, researchers repeatedly had to retrieve the participant from the hallway and require the trial to be completed before a break was given during the remedial training, which might have accounted for this participant not reaching mastery of all sets. Since the length of the remedial training was twice the amount compared to a regular session, researchers had to repeatedly redirect this participant to remain seated during sessions. In addition, researchers were unclear during some observation trials whether this participant was attending to the learner's sample stimuli and the feedback given to the learner by the researcher, which is essential for observational learning.

Due to issues of inattention, researchers anticipated a lower score for this participant's observation set after A-B training, but this participant managed to master the observation set for this relation. Unfortunately, this trend did not continue during the test for class formation, nor did the participant initially derive the trained relations expected. Nate also exhibited issues of adhering to the observation response during the A-B training trials. For example, during A-B training this participant would sometimes perform the observation response with eyes closed or ignore the sample stimulus in favor of repeatedly hitting the button chosen for the observation response. Overall, this participant did manage to successfully derive some of the relations using this group EBI design, which is promising for future research.

The current study was designed based from findings of previous research on Early Intensive Behavioral Interventions (Corsello, 2005; Lovaas, 1987; Reichow, 2012; Reichow & Wolery, 2009). Available research on EIBI suggests that using discrete trial training (DTT) provides learners with the most opportunities for acquiring new skills and has shown success when implemented in a group format so that time, resources, and optimal learning can be maximized (Leaf et al., 2013). EIBI research also suggests using components of observational learning within group DTT so that each clinician does not have to devote additional time for one-on-one instruction (Castro & Rehfeldt, 2016). Observational learning can be combined with EBI in order to further maximize the amount of relations taught at one time (Stanley et al., 2018). With the demand for teaching individuals with disabilities coupled with the success shown from studies using EBI and observational learning further research to increase the impact of this technology is needed.

With the robust amount of relations that emerge with the use of EBI (Stanley et al., 2018) and the flexibility the procedures provide, there is a need to expand methods into group procedures (Rehfeldt et al., 2003). The results of this study highlight the need for research into group EBI for those with developmental disabilities, as in the applied settings of schools and clinics there are not enough staff or aids to implement DTT on a one-to-one basis, nor are there enough hours to devote to each child needing services (Kamps, et al., 1992; Schoen & Ogden, 1995; Taubman et al., 2001). While findings with single individuals using EBI have emerged over the years with success (Dixon et al., 2017; Ramirez et al., 2009; Sidman, 1971; Sidman, & Tailby, 1982; Stanley et al., 2018), very few studies have sought to implement EBI and observational learning with multiple learners (Leaf et al., 2013; Ledford et al., 2012; Zinn et al., 2015).

The current study is one of the first studies exploring group EBI procedures using an observational learning component. This study also utilized the PEAK curriculum which has never been implemented in a group setting. The findings of the current study illustrate how efficient it is to only teach a few relations to multiple participants at once, and how quickly untrained relations emerge (Collins, 2012). While this study was a first of its kind in many respects the results of each participant should be interpreted with caution. It is not yet known how other studies using group EBI will compare in terms of efficiency of instruction and overall treatment effectiveness. Previous research supports the use of observational learning with individuals with disabilities, but these studies have also highlighted many methodological concerns working with this population which may make the current study's results hard to replicate (Taylor et al., 2012). It remains to be seen if individuals with developmental disabilities can consistently engage in observational learning in order to learn and derive new relations.

This study also demonstrated that stimuli typically taught in a classroom (Malleus et al., 2017) can be used successfully in EBI procedures. Both participants were able to derive the directly trained set, after additional remedial sessions (see Figure 1). Due to the arbitrary symbols chosen for stimulus set C there is also evidence that this type of EBI program can be adapted to meet other curriculum needs. For instance, instead of arbitrary symbols for stimulus set C, functions of cloud formations or emotions related to types of clouds could have been substituted. Working with individuals with developmental disabilities can be challenging and having a flexible curriculum that can be adapted based on individual needs is essential (Werts et al., 1996). While this study provides an example of a flexible curriculum it has yet to be determined if all EBI stimuli can be adapted into skills typically taught in the classroom .

Limitations

Regardless of the overall promise of this design, there were shortcomings with its implementation. As the study was conducted during participant's regular clinical session, the inconsistency of exposure to intervention could have had unwanted effects on treatment outcome. For example, researchers were provided with only half an hour twice a week and were subject to absences that were not made up due to illness, tardiness and scheduling conflicts. In addition, both participants had to be present in order to conduct training of one set and observation of a second set. An entire session was unable to be utilized if only one participant was present, which happened twice during training. This sometimes resulted in an entire week with both participants receiving no instruction. For example, participants received B-C training twice one week, but the next week due to a campus closing and an unexpected illness, both participants did not receive any instruction on the B-C set until the following week. An entire week without receiving training might have increased the variability in Nick's B-C training scores since the missed sessions occurred during this period.

Having two 30-minute sessions per week also does not mimic a naturalistic classroom setting. In a classroom, students would be taught a concept like cloud formation to mastery within a few days of back-to-back instruction. It is not determined how comparable results of this study would generalize to a classroom setting. In this study, researchers had to work around scheduling conflicts and parent demands, which resulted in limited session times available that were spread out over a series of six weeks. The length of the study, the amount of time between sessions and the limited amount of training time available per session might have affected Nate's inability to derive all relations, as data suggested that further training might have increased scores in the observation set.

Previous research by Rehfeldt et al. (2003) suggests that individuals with disabilities sometimes require special considerations with observational learning procedures and that derived relations can be delayed. For instance, in this study emergence of the observation set required repeated training sessions and procedural variations. While the directly trained set was derived by all participants, the observation set was not fully derived by each participant, but scores had increased much like the current study suggesting that further training might have led to emergence. The current study is in line with this finding, as the trend in data after repeated trainings for Nate on A-B and B-C led to increases in the probes for A-C and C-A on the observation set. This leads researchers to believe that Nate might have been exhibiting delayed emergence.

Regardless of whether emergence would have occurred with this participant, a limitation of this design is that the effect of observational learning seems less robust compared with the result of direct contingency. For Nate, skill acquisition occurred at a lower speed compared with Tim even after additional remedial training. Nate performed worse during test for class formation when using the observational set, compared with the directly trained set. According to the data in Figures 1 and 2, scores for the trained set of B_{1234}-C_{1234} reached 90% during test for class formation, but only reached 70% in the observation set (B_{5678}-C_{5678}). After remedial training scores on the trained set reached mastery at 90% in the C-A relation and 100% in the A-C relation (Figure 1). The highest scores achieved after remedial training in the observation set were 70% for the A-C relation and 90% for the C-A relation, which showed an increase from baseline, but overall resulted in Nate failing to achieve mastery of the observation set (Figure 2).

Another issue was experimental control demonstrated during this study. During baseline each of the scores for both participants reflected no previous experience with each of the relations in the observation and trained set. After A-B training it was expected that the trained and observed A-B set would be the only scores to reach mastery, but Tim's trained set showed emergence of the remaining three relations not yet trained. It was expected that these remaining three relations fall within baseline levels. However, as shown in in the data, Tim scored 100%, 70% and 90% on these remaining relations (Figure 1). Due to the arbitrary nature of members in class C, Tim's high performance on the untrained B-C, A-C and C-A relations were likely to be the result of luck. This participant guessed the correct relationship between name of cloud formations (B) and arbitrary corresponding symbols (C) and these arbitrary symbols (C) to pictures of cloud formations (A) to 100% and 90% accuracy (Figure 1).

That being said, the pattern of this responding makes it difficult to determine if the treatment is solely responsible for the improvement in scores for Tim. This phenomenon of emergence of untrained relations based on self-generated rules was also observed in a study by Dixon, Speelman, Rowsey, and Belisle (2016). In this study participants were taught rule-following in the form of the children's game Twister. Participants were taught that a known anatomical term (i.e. head) was synonymous with another term (i.e. dome), and that the second term was also synonymous with a third term (i.e. cranium). Participants were then trained on these terms and used the terms to play the game. Although the biggest improvement in participants' response occurred after specific training with that term, they noticed that two of the three participants were able to perform slightly better in the subsequent untrained term once the previous term was mastered. In the current study, it is unlikely that Tim's improved performance on the A-C and C-A relations during the probe after the A-B training was due to prior learning history because of the arbitrary nature of the stimuli chosen for class C. Therefore, it is more likely that similiar effects of self-generated rules were observed. That is, Tim was able to guess the correct B-C relations by chance, or by constructing a set of rules in which adhere to the relation chosen by the researcher. The improvement on A-C and C-A probes could be the result of derivation based on the trained/observed rule during A-B and the self-generated rule of B-C. Tim's performance in B-C training confirms this hypothesis, as his performance was unable to maintain at 100% correct.

Another limitation in the current study is the observation response. Previous literature supports its use in increasing attending with individuals with disabilities during EBI procedures (Taylor et al., 2012; Tullis et al, 2019). While research supports its use, the observation response does not guarantee that an individual is attending during training. In this study, researchers placed the sample stimulus next to the battery-operated button that participants were required to press. Pressing the button was described as the participants being willing to engage in either observation or the task demand. An issue witnessed repeatedly by researchers was that participants could still engage in the observation response of button-pressing without ever having the button or sample stimulus within the participant's line of sight. Researchers also noticed participants focusing more on the act of pressing the button versus gazing at the intended sample stimulus. While the observation response sometimes resulted in the participants engaging with the sample stimulus and attending to the task demand, or attending to the learner performing the task demand, this design was not foolproof.

Although Previous research has shown EBI procedures to be effective for teaching new skills to those with developmental disabilities (Dixon et al., 2018a; Dixon et al., 2014a; Dixon et al., 2014b; Dixon et al., 2018b; Stanley et al., 2018; McKeel et al., 2015), the procedure used in the current study poses additional challenges. While research shows EBI procedures to be highly effective, only a small number of studies have evaluated EBI used with novel clinicians like teachers, staff and parents in home settings (Dixon et al., 2018b; Stanley et al., 2018). Early studies have revealed that EBI procedures can be used by novel clinicians in a one-on-one setting with fidelity, however group EBI being administered by teachers in a naturalistic setting has not been evaluated. Furthermore, there were multiple steps within the procedure in the current study, with multiple sets of stimuli constantly rotating. Despite the researcher in this study having experience implementing EBI procedures in an EIBI setting, repeated practice was needed to achieve fluency to be able to deliver the training. This leads to concern for teachers, parents and aids that have no previous experience running EBI procedures. It begs the question of whether these novel clinicians could keep stimuli sets organized, apply an observation response, reinforce each participant appropriately and score with fidelity without prior knowledge of basic behavioral principals, a knowledge of the PEAK curriculum and the general purpose of an EBI procedure. Also, the current study examined only two participants, but in a clinical setting ideally three or four students would be involved per every instructor in a group EBI procedure. This would increase the number of stimulus members in each of the classes, which would make keeping observation and training sets separate and scoring participants that much more daunting for clinicians without any prior training.

With these considerations in mind future research should focus on implementing group EBI in naturalistic settings with novel clinicians like teachers and parents. Procedural fidelity should be assessed, and IOA taken to make sure scoring and protocol is consistent across all practitioners. Results from EBI groups should be assessed in order to determine if participant's scores are affected by differences of the clinicians implementing procedures. Research should assess whether these procedures can be mastered without any additional training from researchers, followed by assessments that compare clinicians receiving some form of behavioral skills training from researchers to see if there is significant difference in administration. It would also be relevant to measure social validity across each of the clinicians to assess if the intervention is believed to be making a difference. Social validity measures should also be taken on how convenient and easy to administer group EBI procedures are in a classroom or home setting.

While this study shows that EBI can be run with more than one participant with some success, there needs to be studies evaluating its use after increasing the number of participants per researcher or clinician. The current study only used two participants with a single researcher present. For this group EBI procedure to be effective in applied settings the ratio of participants-to-instructors needs to increase as classroom settings have few instructors present compared with the number of students needing instruction. Further research should evaluate the range of participants that allows for optimal relations to be taught and examine what occurs when this range of participants-to-clinician is exceeded.

Future research should also investigate various types of programs that can be implemented using this EBI design. Further research should test the boundaries of what skills can be adapted from traditional DTT tasks to group contexts using EBI instruction. The use of arbitrary symbols in the current study highlights the flexibility of a group-based EBI design. Future research should strive to adapt available EBI curricula into programs utilized in group settings. Ultimately while these considerations are needed in future research, the goal should be to increase learning efficiency, decrease time for instruction and resources needed, while also keeping the clinician’s preferences and skill-levels in mind. Multiple studies are needed to evaluate the overall effectiveness of group EBI before its applied use, however the need for its use as an EIBI tool of instruction is more apparent from the results of this study and hopefully as a result of future studies of its use.

EXHIBITS

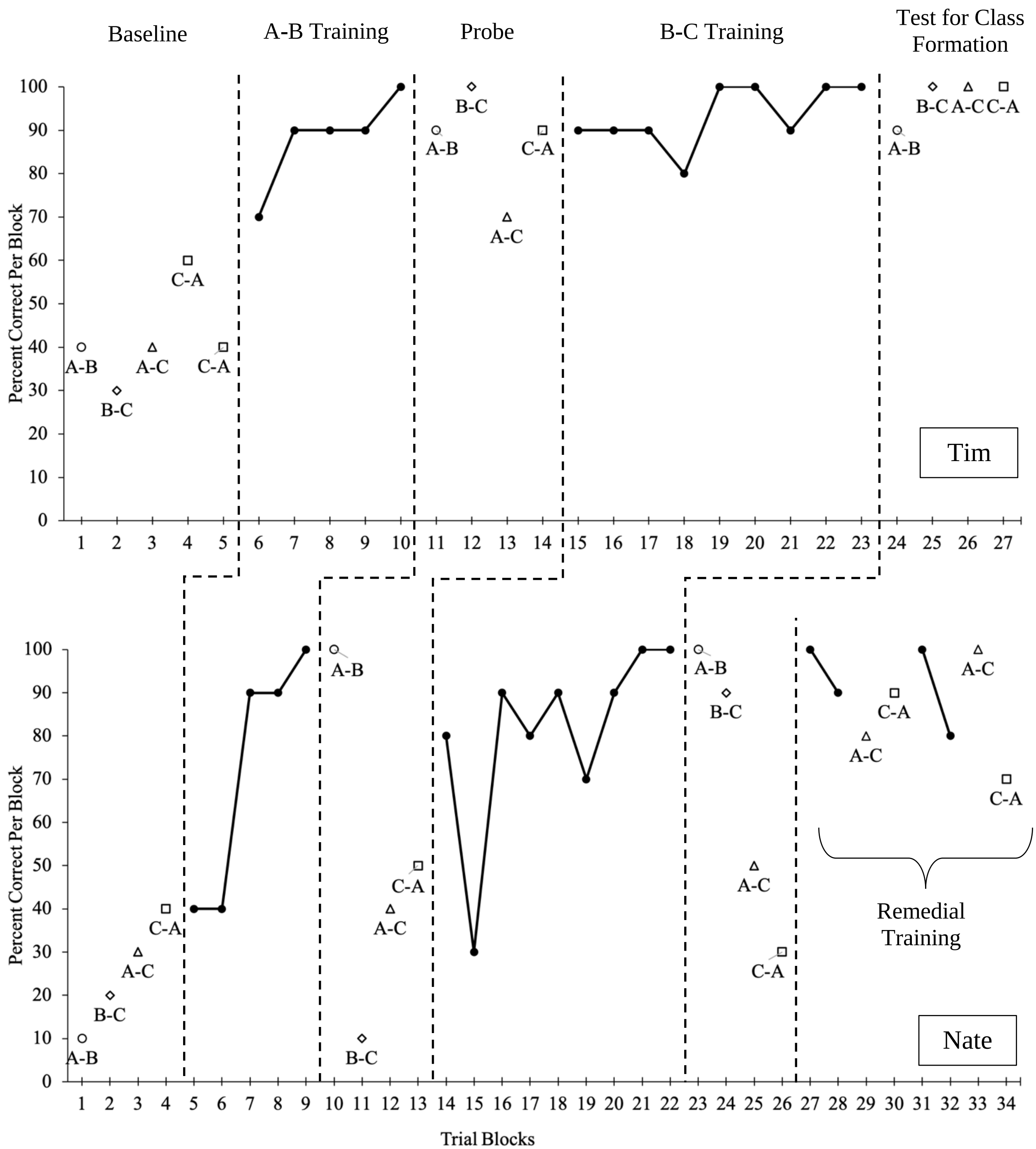

Figure 1. Participants' scores on each trial block during trained set

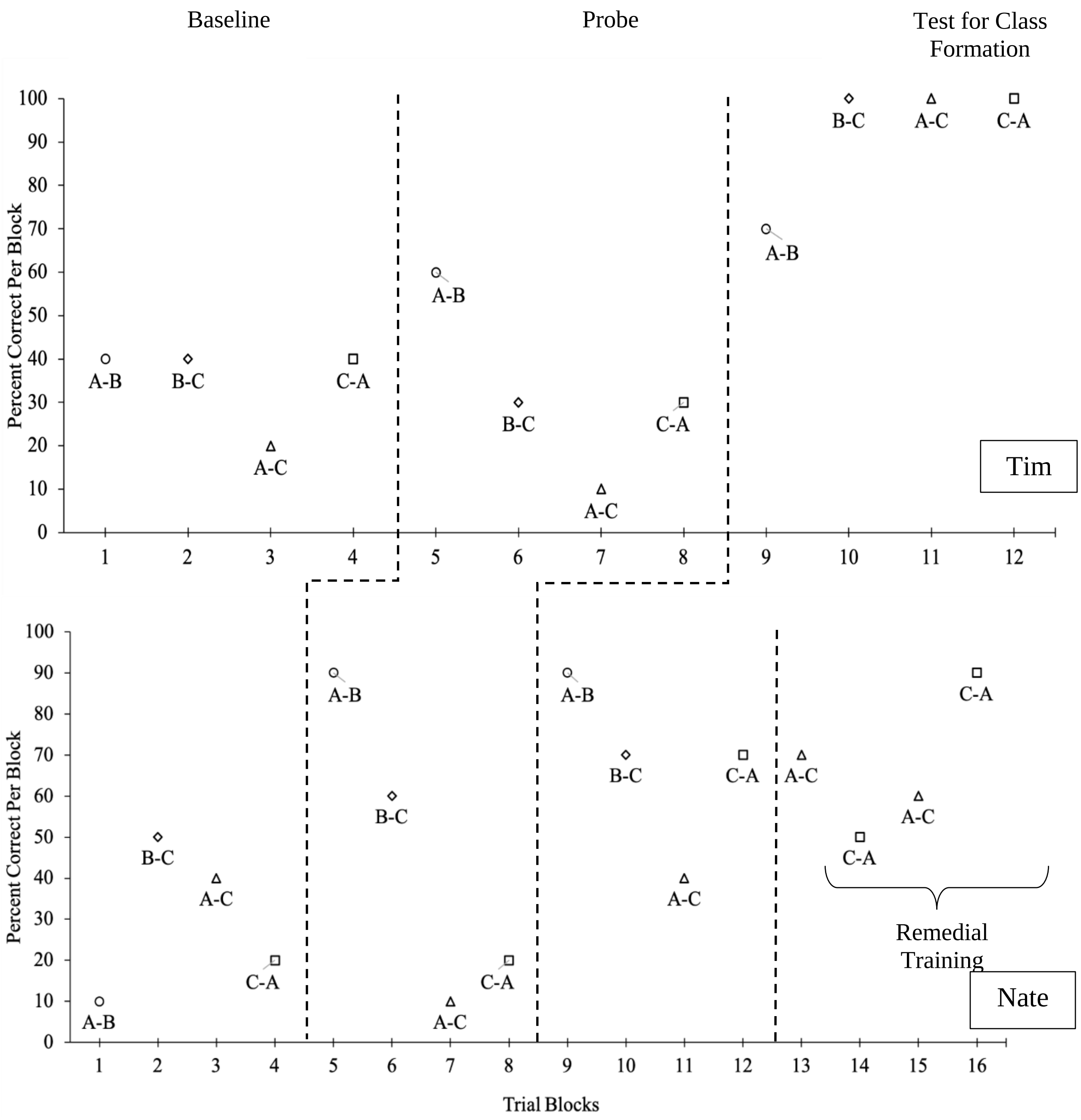

Figure 2. Participants' scores on each trial block during observation set

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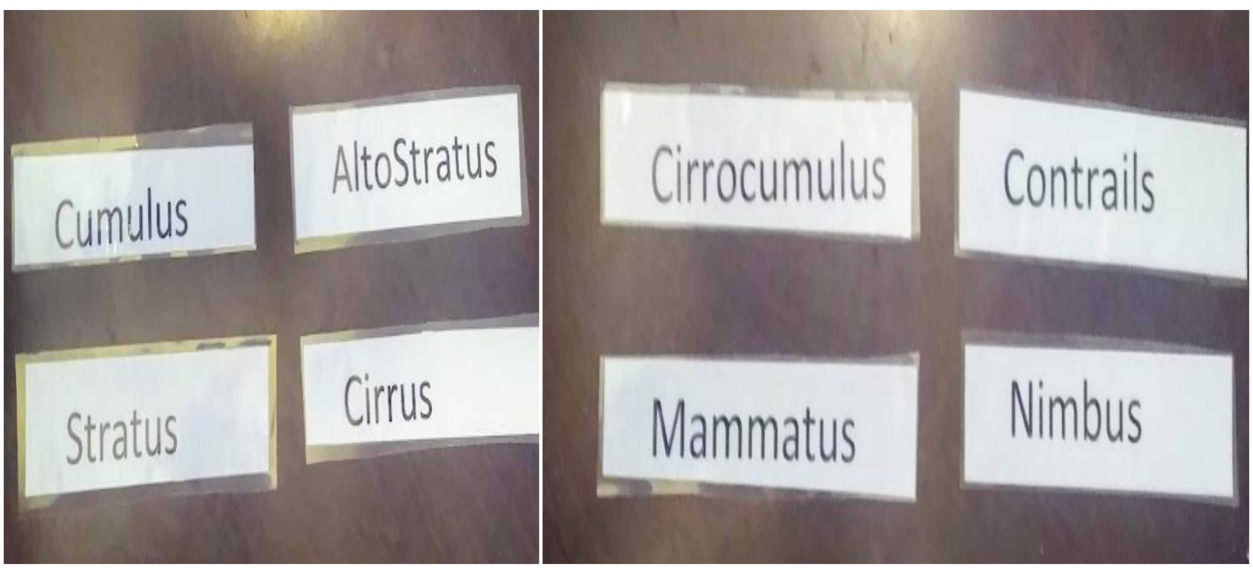
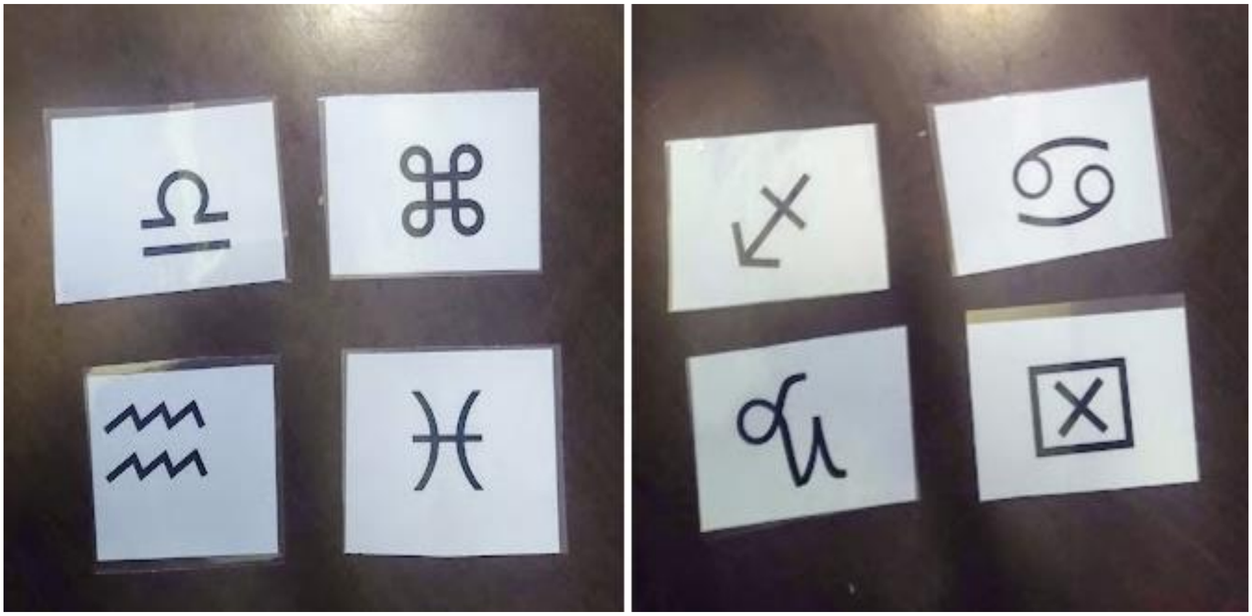
APPENDIX A

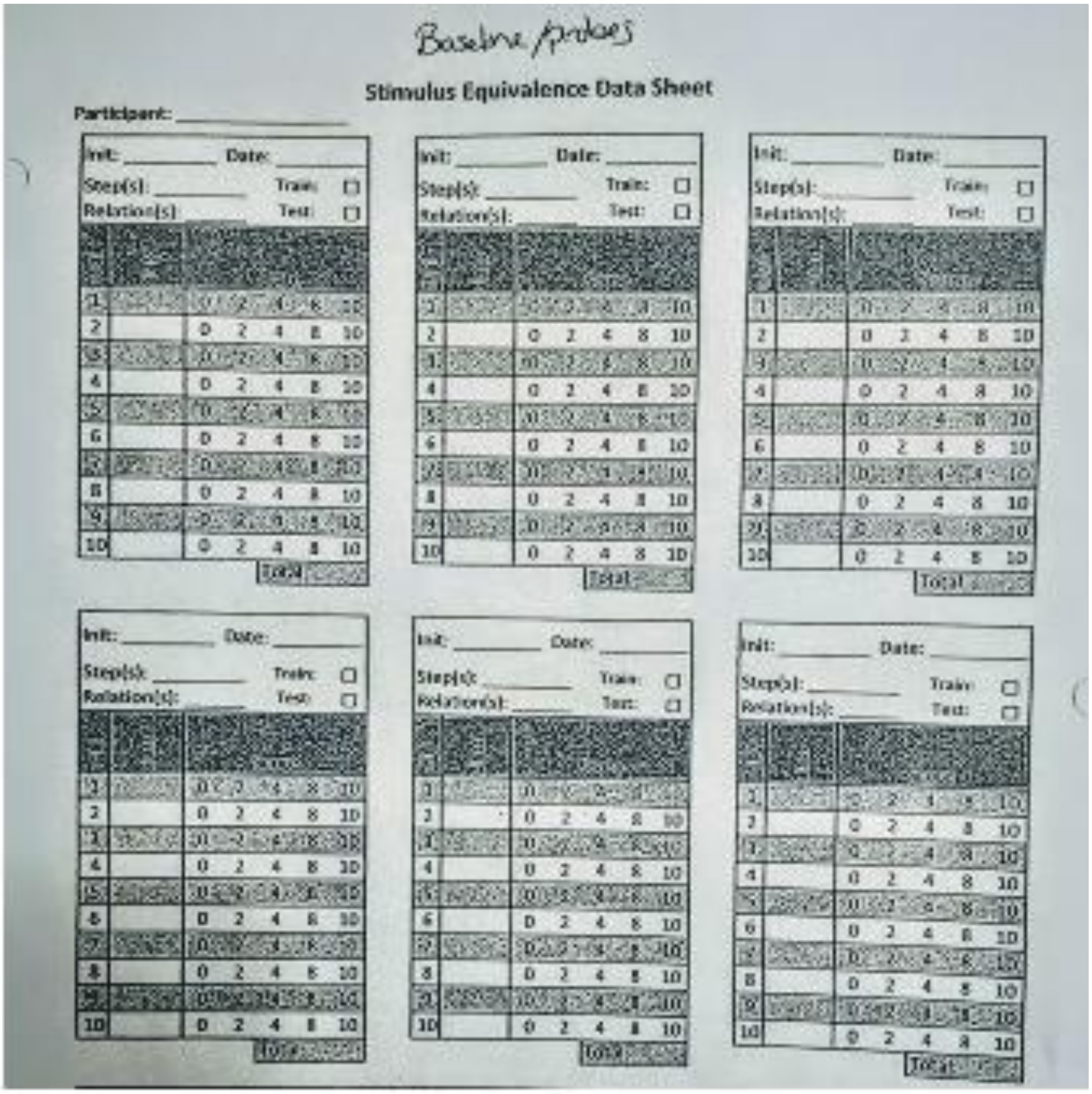
STIMULI A-C





APPENDIX B

BASELINE/PROBE SCORING SHEET



Baseline probes

Stimulus Equivalence Data Sheet

Participant: ____________

Init: ________ **Date:** ________
Step(s): ________ **Train:** ☐
Relation(s): ________ **Test:** ☐

[illegible]	[illegible]	[illegible]
1		0 2 4 8 10
2		0 2 4 8 10
3		0 2 4 8 10
4		0 2 4 8 10
5		0 2 4 8 10
6		0 2 4 8 10
7		0 2 4 8 10
8		0 2 4 8 10
9		0 2 4 8 10
10		0 2 4 8 10
	Total	

Init: ________ **Date:** ________
Step(s): ________ **Train:** ☐
Relation(s): ________ **Test:** ☐

[illegible]	[illegible]	[illegible]
1		0 2 4 8 10
2		0 2 4 8 10
3		0 2 4 8 10
4		0 2 4 8 10
5		0 2 4 8 10
6		0 2 4 8 10
7		0 2 4 8 10
8		0 2 4 8 10
9		0 2 4 8 10
10		0 2 4 8 10
	Total	

Init: ________ **Date:** ________
Step(s): ________ **Train:** ☐
Relation(s): ________ **Test:** ☐

[illegible]	[illegible]	[illegible]
1		0 2 4 8 10
2		0 2 4 8 10
3		0 2 4 8 10
4		0 2 4 8 10
5		0 2 4 8 10
6		0 2 4 8 10
7		0 2 4 8 10
8		0 2 4 8 10
9		0 2 4 8 10
10		0 2 4 8 10
	Total	

Init: ________ **Date:** ________
Step(s): ________ **Train:** ☐
Relation(s): ________ **Test:** ☐

[illegible]	[illegible]	[illegible]
1		0 2 4 8 10
2		0 2 4 8 10
3		0 2 4 8 10
4		0 2 4 8 10
5		0 2 4 8 10
6		0 2 4 8 10
7		0 2 4 8 10
8		0 2 4 8 10
9		0 2 4 8 10
10		0 2 4 8 10
	Total	

Init: ________ **Date:** ________
Step(s): ________ **Train:** ☐
Relation(s): ________ **Test:** ☐

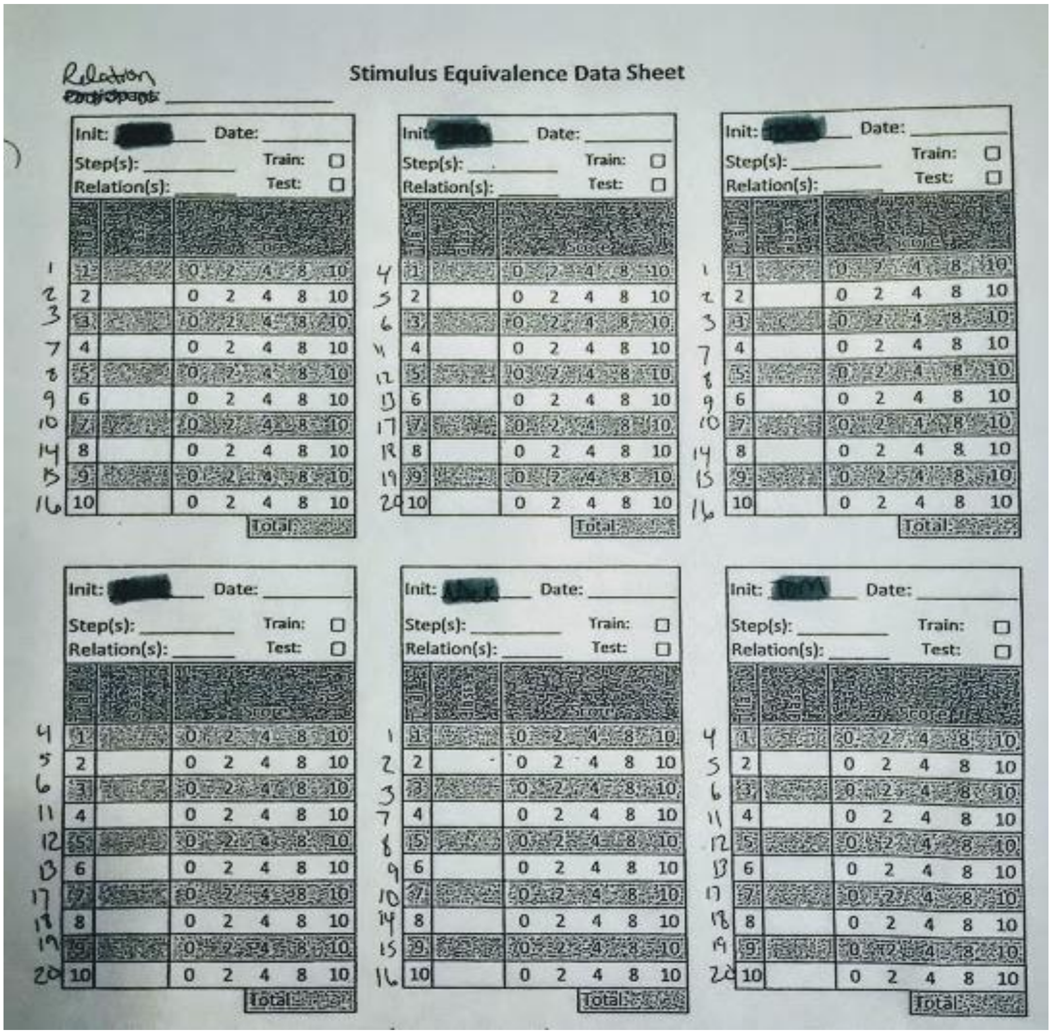
[illegible]	[illegible]	[illegible]
1		0 2 4 8 10
2		0 2 4 8 10
3		0 2 4 8 10
4		0 2 4 8 10
5		0 2 4 8 10
6		0 2 4 8 10
7		0 2 4 8 10
8		0 2 4 8 10
9		0 2 4 8 10
10		0 2 4 8 10
	Total	

Init: ________ **Date:** ________
Step(s): ________ **Train:** ☐
Relation(s): ________ **Test:** ☐

[illegible]	[illegible]	[illegible]
1		0 2 4 8 10
2		0 2 4 8 10
3		0 2 4 8 10
4		0 2 4 8 10
5		0 2 4 8 10
6		0 2 4 8 10
7		0 2 4 8 10
8		0 2 4 8 10
9		0 2 4 8 10
10		0 2 4 8 10
	Total	

APPENDIX C

STIMULUS EQUIVALENCE DATA SHEET



Stimulus Equivalence Data Sheet

Relation
Participant: ______________

Init: [redacted] Date: ________
Step(s): ________ Train: ☐
Relation(s): ______ Test: ☐

1	1		0 2 4 8 10
2	2		0 2 4 8 10
3	3		0 2 4 8 10
7	4		0 2 4 8 10
8	5		0 2 4 8 10
9	6		0 2 4 8 10
10	7		0 2 4 8 10
14	8		0 2 4 8 10
15	9		0 2 4 8 10
16	10		0 2 4 8 10
			Total:

Init: [redacted] Date: ________
Step(s): ________ Train: ☐
Relation(s): ______ Test: ☐

4	1		0 2 4 8 10
5	2		0 2 4 8 10
6	3		0 2 4 8 10
11	4		0 2 4 8 10
12	5		0 2 4 8 10
13	6		0 2 4 8 10
17	7		0 2 4 8 10
18	8		0 2 4 8 10
19	9		0 2 4 8 10
20	10		0 2 4 8 10
			Total:

Init: [redacted] Date: ________
Step(s): ________ Train: ☐
Relation(s): ______ Test: ☐

1	1		0 2 4 8 10
2	2		0 2 4 8 10
3	3		0 2 4 8 10
7	4		0 2 4 8 10
8	5		0 2 4 8 10
9	6		0 2 4 8 10
10	7		0 2 4 8 10
14	8		0 2 4 8 10
15	9		0 2 4 8 10
16	10		0 2 4 8 10
			Total:

Init: [redacted] Date: ________
Step(s): ________ Train: ☐
Relation(s): ______ Test: ☐

4	1		0 2 4 8 10
5	2		0 2 4 8 10
6	3		0 2 4 8 10
11	4		0 2 4 8 10
12	5		0 2 4 8 10
13	6		0 2 4 8 10
17	7		0 2 4 8 10
18	8		0 2 4 8 10
19	9		0 2 4 8 10
20	10		0 2 4 8 10
			Total:

Init: [redacted] Date: ________
Step(s): ________ Train: ☐
Relation(s): ______ Test: ☐

1	1		0 2 4 8 10
2	2		0 2 4 8 10
3	3		0 2 4 8 10
7	4		0 2 4 8 10
8	5		0 2 4 8 10
9	6		0 2 4 8 10
10	7		0 2 4 8 10
14	8		0 2 4 8 10
15	9		0 2 4 8 10
16	10		0 2 4 8 10
			Total:

Init: [redacted] Date: ________
Step(s): ________ Train: ☐
Relation(s): ______ Test: ☐

4	1		0 2 4 8 10
5	2		0 2 4 8 10
6	3		0 2 4 8 10
11	4		0 2 4 8 10
12	5		0 2 4 8 10
13	6		0 2 4 8 10
17	7		0 2 4 8 10
18	8		0 2 4 8 10
19	9		0 2 4 8 10
20	10		0 2 4 8 10
			Total:

APPENDIX D

BATTERY OPERATED BUTTON

APPENDIX E

PROCEDURAL INTEGRITY FORM

	Yes	No
Therapist Delivers script: "You will watch and listen as _____ completes his work. Please pay attention, do not talk, point, or help him it is _____ turn." On an average of 3 schedule once participants switch roles		
Therapist requires observation response: Look at this (sample stimuli) and press button" after each presentation of sample stimuli		
Therapist delivers clear SD "put with same" on each trial		
Therapist follows prompting procedure of LTM correctly -modeled correct response -repeat SD w/model prompt -hand-over-hand		
Therapist does not provide reinforcement to the participant who is the **observer**		
Therapist provides appropriate reinforcement to participant who is the **learner**		
During Baseline/Probes only 1 participant is present		

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Bachelor of Arts, Psychology, December 2017

Thesis Paper Title:
Evaluating the Efficacy of Group Equivalence Based Instruction Using Observational Learning

Major Professor: Mark R. Dixon